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Do preferences for BRT and LRT change as a voter, citizen, tax payer, or self-interested resident?

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TITLE: **Do preferences for BRT and LRT change as a voter, citizen, tax payer, or self-interested resident?**

ABSTRACT: Interest in modal preferences remains a topic of high interest as governments make infrastructure decisions that often favour one mode over the other. An informative input into the infrastructure selection process should be the preferences of residents, since they can guide buy in to support political and bureaucratic choice making. Cost-benefit analysis (CBA) uses the self-interest preferences of individuals as the relevant interpretation of ‘individual preferences count’, which in aggregate represent the benefit to society of candidate investments. However, the CBA benefit calculations can be rather restrictive with other preference metrics often being identified and used in various ways to inform the debate on infrastructure support. In this paper we assess how the preferences for bus rapid transit (BRT) and light rail transit (LRT) change with different roles the residents may play: a citizen or altruistic resident, a self-interested resident, a tax-payer, and as a voter. We use data collected in five countries to investigate preference differences and also to establish whether there is replicability of the findings across geographical jurisdictions. The findings suggest that there are, in general, noticeable differences in preference revelation across the metrics; however there are also both similarities and differences in the role of specific attribute drivers (as represented by willingness to pay, and magnitude of support for a specific mode) within and between preference metrics across countries.

KEY WORDS: ***Bus rapid transit, light rail transit, citizen vs private preferences, cross culture contrasts, five countries, community preference model, mixed logit, willingness to pay***

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Introduction

When seeking to understand individual preferences for specific investments, the position that respondents take (e.g., a personal or a citizen perspective) when responding to questions on transport infrastructure scenarios, plays a fundamental role in determining the resulting preference expression and hence arguments that can be mounted for support (or not) of particular investments. This is of great interest in the highly emotional debate on the role of bus-based and rail-based corridor investments (Hensher, 2007; Kain, 1988), the focus of this paper. The transport literature in the main focusses on revealing individual preferences aligned with a self-interest person utility gain preference paradigm (some exceptions being, for example, Daniels and Hensher 2000 and Mouter et al., 2017) although the latter is focussed on safety more broadly); in contrast other literatures, notably in environmental and agricultural sciences and political science, also focus on the view of individuals acting as non-self-interested citizens who judge opportunities from the viewpoint of the good of the community, regardless of what this might mean for their own private preferences in terms of direct use and/or non-use benefit.

To the best of our knowledge, there are no studies on a comparison of preferences of a sample of residents who respond to a choice experiment focussed on valuing the merits of public transport infrastructure, namely, bus rapid transit (BRT) and light rail transit (LRT), acting as self-interested residents and separately as an altruistic citizen, tax payer or voter. Central to the many studies identifying and comparing preferences aligned with different decision paradigms is the resulting willingness to pay (WTP) estimates for attributes that individually contribute to preference revelation for alternative investments (for example, Blamey et al. 1995; Ovaskainen and Kniivilä 2005; Svensson and Johansson 2010; Mouter et al. 2017) and how the preferences shift when levels of the drivers defining support for alternative infrastructure investments change.

In this study we use context and framing of a series of questions to identify responses under different decision paradigms on preferences for various BRT and LRT offerings when answering a stated choice experiment with an interest of seeing, in particular, the extent (if any) of a chasm between citizen or altruistic and self-interest motives. If we can identify differences in preferences when a respondent evaluates infrastructure alternatives from different choice perspectives: as a citizen or altruistic resident, self-interested resident, tax-payer, and voter, then this raises important questions as to the appropriate estimates of WTP to use in predicting popular support for specific transport investments, and what might be the chosen metric for cost-benefit analysis of capturing benefits. In cost-benefit analysis, we have always assumed that aggregated individual preferences represent societal value; however what does 'individual' actually mean in terms of the relevant choice making paradigm, and does it matter what perspective is used in assessing project options? We argue herein that even if the consumer (self interest) preference metric is used in formal cost-benefit analysis (CBA), that a complementary assessment method, referred to here as the resident or community preference support model (Hensher et al. 2015b), provides important ancillary evidence to complement the CBA output and in many ways offers up a more powerful representation of the direct community support for specific projects. Politically, this is a very appealing paradigm.

Previous studies on comparing support for BRT and LRT transport infrastructure systems conducted by the authors have focused exclusively on understanding individual private (or self-interest) preferences for public transport investments in Australia (Hensher et al. 2015a, 2015b) and in five countries (Hensher et al. 2018). In investigating the range of choice response paradigms, estimated using advance non-linear in parameter choice models, we include actual experience of different modes as a conditioning agent on the utility function represented by the attributes of each alternative. Unlike previous studies such as Hensher and Ho (2016), where such conditioning is not differentiated across attributes, this study hypothesises actual experience to have a different influence on different subsets of attributes. Specifically, separate parameters are identified for each type of actual experience separating the effect on: (1) investment characteristics, (2) system characteristics, and (3) the cost of the investment. This treatment is compared with the homogeneity assumption to see how preferences might change.

Literature Background

Different definitions of consumers and citizens have been proposed in the literature. Sagoff (1988) argued that as a consumer, an individual pursues their own goals, while as a citizen an individual is concerned with public interest rather than their own self interest. Therefore, the same person might have two distinct and conflicting preferences associated with different roles. Other studies propose that the fundamental difference between citizen and consumer preferences is that they involve different budget constraints – consumers are subject to their own budget constraint, but as citizens they are subject to the government's budget (Mouter and Chorus, 2016; Mouter et al., 2017). The identification of roles have been studied through different preference responses, although it has been argued that response as a particular type of preference role can be encouraged by an adequate framing and orientation of the questions (Ajzen et al., 1996; Russell et al., 2003).

Nyborg (2000) discussed the effect that two different points of view – personal or social preference – has on environmental evaluation. Nybourg argues that in contingent valuation environmental studies, altruism or moral commitment plays an important role in decision-making. He studied two respondents' roles: as consumers or *Homo Economicus*, and as citizens or *Homo Politicus.* He presented a model that distinguished between these two types of roles, emphasizing the relevance of making sure all respondents answer from the same preference perspective, otherwise there might be problems in the results.

Blamey et al. (1995) used contingent valuation to obtain the WTP estimates for the forests in stripped areas in Australia. Respondents were asked attitudinal questions to determine their opinion towards environmental preservation. The results showed that responses are dominated by citizen judgement; so they argued that in pure public goods it may be inappropriate to use contingent valuation models in cost-benefit studies unless the modeller is able to extract information on consumer preferences (self-interested decisions). Curtis and McConnell (2002) studied contingent valuation of the control of deer in the USA through the framing and orientation of questions. They compared the results using two points of view; one altruistic or as citizens, and one as respondents concerned about their own private benefit. They asked three questions, where the first reached to the 'citizen' perspective, the second was the contingent valuation question providing a solution for deer control, and the third asked if they would change their response when thinking only of their own personal benefit. Curtis and McConnel compared the answers to the second and third questions to see if respondents changed their mind, but the results showed no difference in the WTP estimates between them.

Several other studies have looked at contingent valuation and the role of respondents' point of view on the results. Ovaskainen and Kniivilä (2005) study consumer and citizen preferences in contingent valuation towards the sustained preservation of conservation areas in Finland. They used questions with different framing and orientation to encourage a consumer and a citizen role. Their results showed that when acting as citizens, the WTP mean and median were substantially higher than when acting as consumers. Tienhaara et al. (2015) use contingent valuation to study consumer and citizen roles in valuing a conservation programme of agricultural genetic resources and a native breed product. To analyse the different roles, they presented two types of decision contexts, one as a product purchasing decision and another one as a taxpayer's decision about a new policy. However, they were not able to compare the WTP from these decisions because the questions were essentially different. Nevertheless, the results showed that income only affected the WTP for the product but not for the conservation programme. The WTP for the conservation programme was motivated by existence and use motives, but both did not affect the WTP for the product.

Svensson and Johansson (2010) carried out a road safety study to find the WTP estimates for risk reductions in Sweden. Individuals were asked to value a private and public good and to answer questions about their attitudes towards traffic safety and their preferences for private and public goods in general. Their results showed that the private risk reduction was three times higher compared to a public risk reduction. The authors related these results to the way respondents said they thought other peoples' valuation of risk reduction were lower than their own and, according to Johannesson et al. (1996), private WTP might be higher to public WTP when respondents are purely altruistic and believe that safety will reduce welfare for other individuals.

Mouter et al. (2017) investigated whether individual behaviour derived from a stated (hypothetical) preference experiment is a good indicator of how those same individuals would behave as citizens when trading-off safety and travel time in Netherlands. They used five choice experiments where they varied the context (consumer or citizen), the type of decision (route choice or road project), the cost attribute (if it was included or not), and the opportunity to take into account other households' choices. When using the citizen context experiments, they did not include scenarios in which the respondents would act as third party decision-makers (i.e., they are not affected by the decision). Their results showed that individuals in their role of citizens assigned significantly more value to safety than travel time when compared to consumer choices. Mouter and Chorus (2016) carried out a similar study to compare the citizen and consumer value of travel time. They find that the WTP from previously collected tax money for travel time savings created by a government policy was significantly higher than the WTP for travel time savings by choosing a different route (with their after tax income).

In cost-benefit analysis, the most important input is the monetary value of the good or service in question, e.g., the value of travel time savings in transport projects or the value of statistical life in safety projects. Some of the previous studies discuss the importance that the perspective (e.g., citizen and consumer) might have in cost-benefit analysis, although this is not discussed with great detail (Svensson and Johansson, 2010; Mouter and Chorus, 2016; Mouter et al., 2017). Other studies have focused on the altruism component of WTP, which is directly related to the citizen role of respondents, and have stated that this preference metric should not be used in a cost-benefit analysis (Bergstrom, 1982; Milgrom, 1993; Diamond and Hausman, 1994; Blamey et al., 1995).

In summary, the existing evidence is not clear cut as to the impact of the perspective on the willingness to pay. Moreover, there are no transport studies that have investigated the role of perspective in the evaluation of benefits, yet the infrastructure spend of transport is often the largest commitment of funding that governments make in their quest to improve sustainability. This study is thus timely as governments prepare to invest particularly in urban transport infrastructure where preferences between modes, and preferences affected by perspective, have no evidence base.

The Choice Experiment

The data used in this study were collected as part of an ongoing project to study BRT and LRT preferences and imaging in order to understand individual and societal preferences for BRT and LRT infrastructure schemes. The evidence can be used as one source of support data to assist government in prioritising investments in new public transport infrastructure. The data were collected in 19 cities in five countries during 2014 and 2015: Australia, France, Portugal, U.K. and U.S. The stated choice experiment presented BRT and LRT future scenarios with attributes describing the investment, the service levels, the features of the system, and the general characteristics of the investment. The attributes and their levels are presented in Table 1. Individuals were asked for their socio-demographic characteristics and their use of bus, train and rail during the last month. At the end of the experiment, respondents indicated which attributes they considered irrelevant (i.e., those they did not attend to) which are used to incorporate the attribute-non-attendance heuristic in the models.

The survey was designed using *Ngene*[1] (Choice Metrics 2012) with 24 rows (i.e., choice tasks) and blocked into 12 blocks so that each respondent is assigned a block with two choice tasks. A set of conditions were employed to ensure that peak-hour level of service is no worse than the off-peak level of service. This condition provided the only relatively high correlation between design attributes ($r = 0.46$) with all other correlations being low ($-0.2 < r < 0.2$). Hensher et al. (2015a) explain how the prior values were determined for generating the efficient design in Australia, and these same designs were implemented subsequently in the other four countries (see also Hensher et al. 2018, 2015b).

[1] Full details of the Ngene syntax, and efficiency outputs for this application, is given in Hensher, Rose, and Greene (2015, Chapter 6.6.3 Design 3: D-Efficient Choice Design).

Table 1. Predefined attributes and attribute levels for the choice experiment

Note: The attributes and attribute levels are exactly the same across all cities. We only change the cost unit ($AU - $US – EU) and length unit (kms – miles)[2]

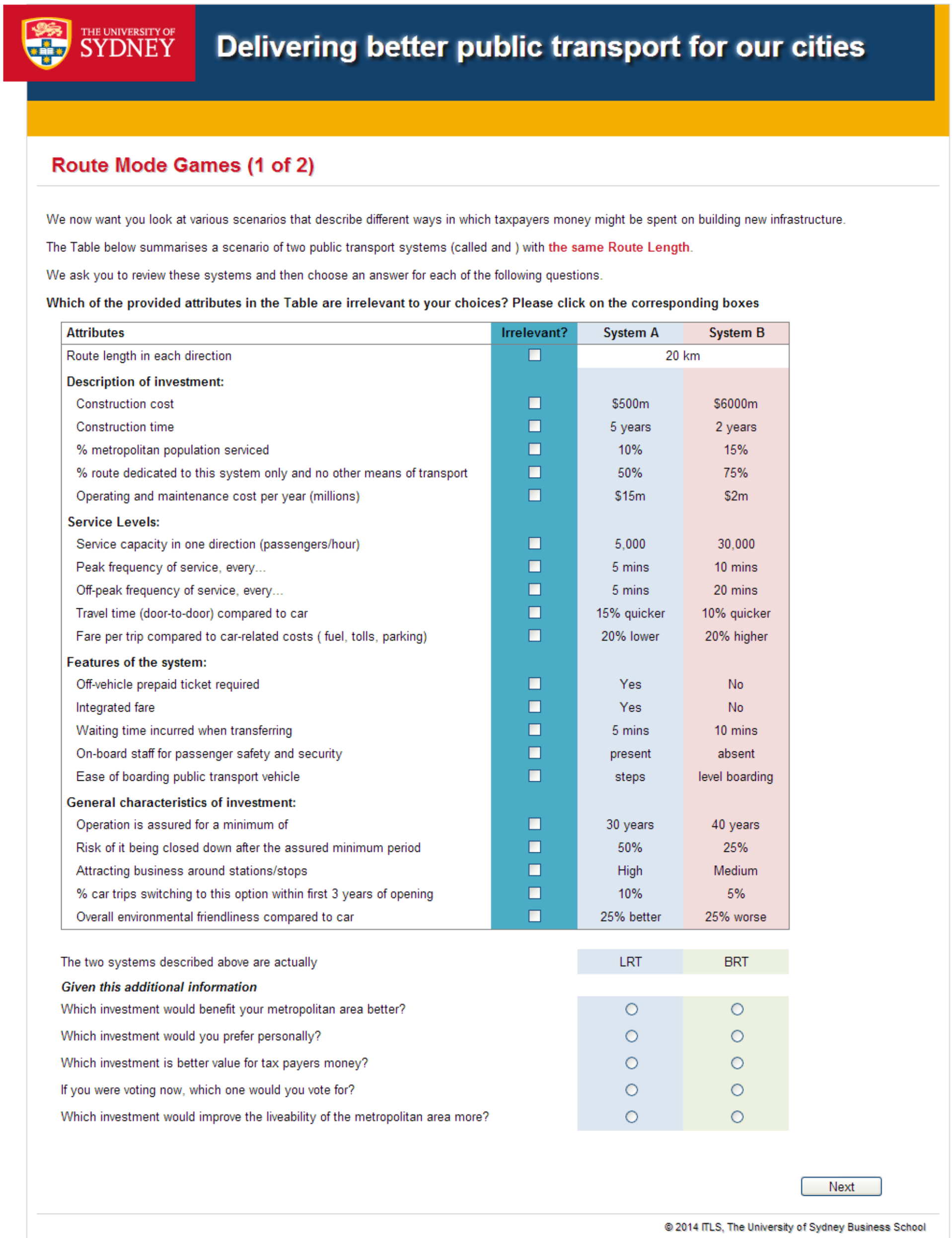
Attributes	Attribute level	# levels
Route length (same for both systems in each choice scenario)	10,20,30 kms or miles	3
Description of investment		
Construction cost of project	0.5, 1, 3, 6 bn$	4
Construction time	1,2,5,10	4
% metropolitan population serviced	5,10,15,20	4
% route dedicated to this system only and no other means of transport	25,50,75,100	4
Operating and maintenance cost per year (millions)	2,5,10,15 m$	4
Service Levels:		
Service capacity in one direction (passengers/hour)	5k, 15k, 30k	3
Peak headway of service, every...	5,10,15 mins	3
Off-peak headway of service, every...	5,10,15,20 mins	4
Travel time (door-to-door) compared to car	-10,10, 15, 25 %	4
Fare per trip compared to car-related costs (fuel, tolls, parking)	±20, ±10%	4
Features of the system:		
Off-vehicle prepaid ticket required	Yes , No	2
Integrated fare	Yes, No	2
Waiting time incurred when transferring	1, 5,10,15 mins	4
On-board staff for passenger safety and security	present, absent	2
Ease of boarding public transport vehicle	level boarding, steps	2
General characteristics of investment:		
Operation is assured for a minimum of	10,20,30,40,50,60 years	6
Risk of it being closed down after the assured minimum period	0,25,50,100%	4
Attracting business around stations/stops	low, medium, high	3
% car trips switching to this option within first 3 years of opening	0,5,10,20 %	4
Overall environmental friendliness compared to car	±25, -10,±5, 0 %	6
The two systems described above are actually “ “	BRT, LRT	2

The labelled experiment considered a fixed route length and varied the other attribute levels – an illustrative example of the experiment is presented in Figure 1. As can be seen, the survey asked respondents five different choice response questions:

1. Which investment would benefit your metropolitan area better? –referred to as ‘Metro’ and represents an altruistic resident or citizen decision
2. Which investment would you prefer personally? –referred to as ‘Prefer’ and represents the self-interested resident decision
3. Which investment is better value for tax payers’ money? –referred to as ‘Value’ and represents the tax-payer decision
4. If you were voting now, which one would you vote for? –referred to as ‘Vote’ and represents the voter decision
5. Which investment would improve the liveability of the metropolitan area more? –referred to as ‘Live’ and represents an altruistic resident or citizen decision (similar to 1)

[2] Regarding costs, Australia and UK presented the levels shown in AUD$, Portugal and France in EUR$, and US in US$. In the case of the length, US presented the route length as miles and the rest of the countries in kilometres.

In this study each of the five responses will be analysed separately as alternative metrics for preference revelation.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Delivering better public transport for our cities

Route Mode Games (1 of 2)

We now want you look at various scenarios that describe different ways in which taxpayers money might be spent on building new infrastructure.

The Table below summarises a scenario of two public transport systems (called and) with the same Route Length.

We ask you to review these systems and then choose an answer for each of the following questions.

Which of the provided attributes in the Table are irrelevant to your choices? Please click on the corresponding boxes

Attributes	Irrelevant?	System A	System B
Route length in each direction	☐	20 km	
Description of investment:			
Construction cost	☐	$500m	$6000m
Construction time	☐	5 years	2 years
% metropolitan population serviced	☐	10%	15%
% route dedicated to this system only and no other means of transport	☐	50%	75%
Operating and maintenance cost per year (millions)	☐	$15m	$2m
Service Levels:			
Service capacity in one direction (passengers/hour)	☐	5,000	30,000
Peak frequency of service, every...	☐	5 mins	10 mins
Off-peak frequency of service, every...	☐	5 mins	20 mins
Travel time (door-to-door) compared to car	☐	15% quicker	10% quicker
Fare per trip compared to car-related costs (fuel, tolls, parking)	☐	20% lower	20% higher
Features of the system:			
Off-vehicle prepaid ticket required	☐	Yes	No
Integrated fare	☐	Yes	No
Waiting time incurred when transferring	☐	5 mins	10 mins
On-board staff for passenger safety and security	☐	present	absent
Ease of boarding public transport vehicle	☐	steps	level boarding
General characteristics of investment:			
Operation is assured for a minimum of	☐	30 years	40 years
Risk of it being closed down after the assured minimum period	☐	50%	25%
Attracting business around stations/stops	☐	High	Medium
% car trips switching to this option within first 3 years of opening	☐	10%	5%
Overall environmental friendliness compared to car	☐	25% better	25% worse

The two systems described above are actually	LRT	BRT
Given this additional information		
Which investment would benefit your metropolitan area better?	○	○
Which investment would you prefer personally?	○	○
Which investment is better value for tax payers money?	○	○
If you were voting now, which one would you vote for?	○	○
Which investment would improve the liveability of the metropolitan area more?	○	○

Next

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Figure 1: An Illustrative choice screen

Preference Model Estimation

The models estimated are non-linear multinomial logit models. The attributes included as explanatory variables refer to the investment characteristics, system characteristics, socio-demographic characteristics of the respondents, and their actual experience of different modes. Actual experience has been shown to significantly influence preferences on particular modes. Traditional studies typically include actual experience as an additive exogenous variable (Hensher, 1976; Goodwin, 1977; Cantillo et al., 2007). However, more recent studies have shown a significant improvement in model performance when using experience to condition the overall utility function (Hensher & Ho, 2016).

This approach is referred to as Heteroscedastic MNL Model, *HMNL* (Swait & Adamowicz, 2001; Hensher & Rose, 2012).

This study uses a *HMNL*, but considers also that actual experience might have a different influence on the investment attributes, system attributes and on the cost. This approach has not, to the best of our knowledge, been used before. Actual experience is defined in two ways - as the frequency of use per mode in the last month (bus, train and metro), and as a dummy variable that indicates if a sampled respondent has used public transport in the last month given the system availability of their city. The only dummy variable that was statistically significant occurred where a resident has used public transport in the last month and has both BRT and LRT available in their city[3], $dummy_{usePT\_BRTLRT}$, interacting in the LRT alternative.

The utility function for the BRT alternative is written as equation (1).

$$\begin{aligned} U_{BRT}^{HMNL} &= (1+\varphi_{fr_{bus},BRTinv}\cdot freq_{bus}+\varphi_{freq_{metro},BRTinv}\cdot freq_{metro}+\varphi_{freq_{train},BRTinv}\cdot freq_{train}) \\ &\cdot\left[ASC_{BRT}+\theta_{x_{inv1}}\cdot x_{inv1,BRT}+\ldots\right] \\ &+(1+\varphi_{fr_{bus},BRTsys}\cdot freq_{bus}+\varphi_{freq_{metro},BRTsys}\cdot freq_{metro}+\varphi_{freq_{train},BRTsys}\cdot freq_{train}) \\ &\cdot\left[\theta_{x_{sys1}}\cdot x_{sys1,BRT}+\ldots+\theta_{Z_1}\cdot Z_1+\ldots\right] \\ &+(1+\varphi_{fr_{bus},BRTcst}\cdot freq_{bus}+\varphi_{freq_{metro},BRTcst}\cdot freq_{metro}+\varphi_{freq_{train},BRTcst}\cdot freq_{train}) \\ &\cdot\left[\theta_{x_{scst1}}\cdot x_{cst,BRT}\right] \end{aligned} \tag{1}$$

$\varphi_{fr_m,BRTinv}$, $\varphi_{fr_m,BRTsys}$ and $\varphi_{fr_m,BRTcst}$ represent the actual experience associated with the frequency of use of mode *m* in the last month conditioning the investment, system and cost attributes, respectively*;* $x_{inv1,BRT}$, $x_{sys1,BRT}$ and $x_{cst,BRT}$ represent attribute 1 of the investment attributes, of the system attributes and the cost attribute, respectively; Z represent the socio-demographics of individuals; θ are the associated parameters; and ASC_{BRT} and ASC_{LRT} are the alternative specific constants, where the LRT is the base (i.e., equal to zero). As noted, the *ASC* is conditioned together with the investment attributes and the *Z* with the system attributes. This was the functional form used in this research, but the results are equivalent when grouping the *ASC* and *Z* differently. The LRT alternative has an equivalent utility expression, but includes $dummy_{usePT\_BRTLRT}$ as an individual effect conditioning the different attributes (equation 2).

$$\begin{aligned} U_{LRT}^{HMNL} &= (1+\varphi_{freq_{bus},inv}\cdot freq_{bus}+\varphi_{freq_{metro},inv}\cdot freq_{metro}+\varphi_{freq_{train},inv}\cdot freq_{train} \\ &+\varphi_{usePT\_BRTLRT,inv}\cdot dummy_{usePT\_BRTLRT}) \\ &\cdot\left[ASC_{LRT}+\theta_{x_{inv1}}\cdot x_{inv1,LRT}+\ldots\right]+\ldots \end{aligned} \tag{2}$$

The interpretation of the experience parameters associated with subsets of attributes which are jointly estimated, compared to a common experience parameter for all the attributes, needs clarification. For example, a positive $\varphi_{fr_m,BRTinv}$ parameter and $\varphi_{fr_m,BRTsys}=\varphi_{fr_m,BRTcst}=0$ would suggest that the utility component encapsulating investment characteristics of the BRT alternative increases in magnitude when the frequency of use of mode *m* increases, relative to the other two

[3] 65% of the sample use public transport. 30% have BRT and LRT available. And 58% of the people that have BRT and LRT available, use public transport.

utility components associated with construction cost and system. In terms of the willingness to pay estimates (WTP), this implies that those who use mode *m* more frequently are willing to pay more for an improvement of the investment characteristics. Additionally, if experience through use does not change preference for LRT (i.e., experience parameters associated with LRT all equal to zero) and given the investment utility component is in the negative domain, a positive $\varphi_{fr_m,BRTinv}$ parameter, resulting in an experience scaling factor larger than 1, would increase the dis-utility of BRT relative to LRT. This suggests that greater experience with mode *m* results in less support for BRT. Since experience with a mode can increase or decrease the support towards that mode, we do not expect, *a priori*, a particular sign for these experience parameters. This way of including experience provides two interpretations: one that relates to the WTP estimates and another that refers to the overall support towards a particular transport infrastructure option. The effect on the WTP estimates is behaviourally straightforward; although, the directional effect on the overall support for BRT and LRT cannot be unambiguously determined by analysing the experience parameter estimates separately; this will be obtained through the scenario simulations set out in a later section.

Some parameters were estimated as country-specific, where the results indicated that the preferences towards those attributes were significantly different across countries. Only the most significant country-specific parameters were included given the primary focus of this research is to understand how preferences change when individuals are responding as altruistic residents, self-interested residents, tax-payers or voters, and how experience with each transit system through usage impacts preferences.

A secondary objective of this research is to verify whether the heteroscedastic conditioning (HC) of the utility function might be better parameterised as experience that varies across different groups of attributes that describe the transit system, the investment, and the construction cost. To this end, we compared the results of the HMNL model with those of a simple MNL model in which experience is included as an additive component of the utility function, as in equations (3) and (4), and those of a generic HMNL model, in which experience is assumed to have the same influence on all attributes, as in equations (5) and (6):

$$\begin{aligned} U_{BRT}^{MNL} = & ASC_{BRT} + \left[\theta_{x_{inv1}} \cdot x_{inv1,BRT} + \ldots\right] + \left[\theta_{x_{sys1}} \cdot x_{sys1,BRT} + \ldots\right] + \left[\theta_{Z_1} \cdot Z_1 + \right] \\ & + \left[\theta_{x_{scst1}} \cdot x_{cst,BRT}\right] + \varphi_{fr_{bus},BRT} \cdot freq_{bus} + \varphi_{freq_{metro},BRT} \cdot freq_{metro} + \varphi_{freq_{train},BRT} \cdot freq_{train} \end{aligned} \quad (3)$$

$$U_{LRT}^{MNL} = ASC_{LRT} + \left[\theta_{x_{inv1}} \cdot x_{inv1,LRT} + \ldots\right] + \varphi_{usePT\_BRTLRT} \cdot dummy_{usePT\_BRTLRT} \quad (4)$$

$$\begin{aligned} U_{BRT}^{HMNL0} = & (1 + \varphi_{fr_{bus},BRT} \cdot freq_{bus} + \varphi_{freq_{metro},BRT} \cdot freq_{metro} + \varphi_{freq_{train},BRT} \cdot freq_{train}) \\ & \cdot \left[ASC_{BRT} + \theta_{x_{inv1}} \cdot x_{inv1,BRT} + \ldots + \theta_{x_{sys1}} \cdot x_{sys1,BRT} + \ldots + \theta_{Z_1} \cdot Z_1 + \ldots + \theta_{x_{scst1}} \cdot x_{cst,BRT}\right] \end{aligned} \quad (5)$$

$$\begin{aligned} U_{LRT}^{HMNL0} = & (1 + \varphi_{freq_{bus}} \cdot freq_{bus} + \varphi_{freq_{metro}} \cdot freq_{metro} + \varphi_{freq_{train}} \cdot freq_{train} \\ & + \varphi_{usePT\_BRTLRT} \cdot dummy_{usePT\_BRTLRT}) \\ & \cdot \left[ASC_{LRT} + \theta_{x_{inv1}} \cdot x_{inv1,LRT} + \ldots + \theta_{x_{sys1}} \cdot x_{sys1,LRT} + \ldots + \theta_{x_{scst1}} \cdot x_{cst,LRT}\right] \end{aligned} \quad (6)$$

In the MNL model, variables describing usage experience are specified in only one of the utility functions for model identification (for the frequency use of the different modes we have chosen BRT, and for $dummy_{usePT\_BRTLRT}$ we have chosen LRT).

Empirical Findings

The final *HMNL* estimates for five different models, all of which take into account stated attribute-non-attendance[4], are presented in Table 2. These models are 'Prefer' (personal preference model), 'Metros' (associated with benefits in the Metropolitan area), Value (as tax payers), 'Vote' (which one would you vote for) and 'Live' (improving the liveability of the metropolitan area). Most of the parameters are statistically significant with behaviourally plausible signs. Each model utilises the observations from the five countries allowing for some country-specific parameters, which are highlighted in italics in the first column. The monetary items were all converted to the currency value of $AUD as of June 2014. Gender was the only socio-demographic characteristic that was found to be statistically significant in any of the models, and is present in the personal preference model ('Prefer') and the model associated with benefits in the metropolitan area ('Metro'). In both these models, female respondents were more inclined towards the BRT alternative (often associated with safety in the presence of a driver).

There are significant differences in the drivers associated with choosing BRT versus LRT for a given preference metric, and in the responses between the five metrics. Table 3 summarises the drivers for each system and each response, represented with an 'X'. The total number of investment and system attributes is smaller for the 'Value (as tax payers)' model. This suggests that less attributes describing a project are relevant if respondents are looking at the decision from a tax-payer point of view (maybe a value for money bias?), relative to looking at project options as self-interested residents or as voters. When evaluating the BRT alternative, the business attracted to the station/stop, the waiting time and staff presence on board are not statistically significant in any of the models. The other BRT characteristics are significant in the 'Live' model (improving the liveability of the metropolitan area), and almost all attributes are significant in the voter preference model, except for the off-peak headway. From a self-interested resident perspective (i.e., 'Prefer') the other system characteristics are all statistically significant, except for the percent right of way and risk of the investment being closed. Other characteristics, such as the level boarding, are only significant from a vote for the project perspective.

Focusing on the LRT alternative, the results show that the capacity, off-peak headway, and level boarding are never statistically significant. From a self-interested resident perspective, almost all of the other attributes are significant, except for the annual operating and maintenance costs, the operation period assured, and the percentage car that switched to this mode. From a voter perspective, the percent right of way, annual operating and maintenance costs, operation period assured and the off-vehicle prepaid ticket required, are not statistically significant, with all of the other LRT characteristics being significant. Overall, we see that for both modes what interests people in is much more wide ranging when they wear the self-interested hat than when they wear other hats.

[4] As described in the 'Choice Experiment' section, questions on attribute non-attendance (ANA) was asked at the end of the experiment, where respondents indicated which attributes they did not consider (i.e., those they did not attend to). For more information on ANA refer to Hensher et al. (2015c).

Table 2: Parameter Estimates Results for the HMNL Models (t-values in parenthesis)

	Prefer		Metro		Value		Vote		Live	
	BRT	**LRT**	**BRT**	**LRT**	**BRT**	**LRT**	**BRT**	**LRT**	**BRT**	**LRT**
Constant	-0.127 (-2.30)	-	-0.006 (-0.07)	-	0.020 (0.26)	-	-0.012 (-0.24)	-	-0.010 (-0.22)	-
Investment Characteristics										
Construction cost ($m)	-	-	-	-	-	-	-	-	-0.014 (-1.44)	-
Construction cost ($m), **squared**	-0.003 (-2.61)	-0.006 (-3.51)	-0.004 (-3.58)	-0.003 (-2.12)	-0.007 (-5.37)	-0.011 (-7.05)	-0.004 (-3.28)	-0.005 (-3.24)	-	-0.003 (-2.18)
Construction time (year) - *Common*	-0.015 (-2.72)	-	-0.011 (-1.37)	-0.023 (-2.71)	-	-0.010 (-1.96)	-0.016 (-2.75)	-0.023 (-2.81)	-0.014 (-2.71)	-
Australia specific	-	-0.024 (-2.36)	-	-	-	-	-	-	-	-
U.K. specific	-	-0.049 (-3.69)	-	-	-	-	-	-	-	-
Percent metro population serviced (%)	0.006 (2.37)	0.008 (2.24)	0.008 (2.04)	0.011 (3.00)	0.013 (3.46)	-	0.005 (1.63)	0.014 (3.81)	0.007 (2.21)	0.005 (1.75)
Percent right of way	-	0.002 (2.73)	0.002 (3.12)	-	-	0.001 (2.35)	0.001 (1.82)	-	0.001 (1.87)	0.001 (2.40)
Annual operating and maintenance cost ($m)	-0.006 (-1.93)	-	-	-0.009 (-2.19)	-0.014 (-3.54)	-	-0.010 (-3.14)	-	-0.006 (-2.18)	-
Operation period assured (year)	0.002 (1.86)	-	-	0.004 (3.50)	0.005 (4.41)	-	0.002 (2.40)	-	0.002 (2.14)	-
Risk of being closed after assured period (%) - *Common*	-	-	-0.002 (-3.01)	-	-0.001 (-2.06)	-	-0.001 (-1.54)	-	-0.001 (-1.73)	-
Portugal specific	-	-0.005 (-3.24)	-	-0.002 (-1.84)	-	-	-	-0.006 (-4.13)	-	-
Environmental friendliness (% better/worse vs. car) - *Common*	-	0.008 (4.11)	-	0.010 (5.44)	-	0.007 (4.32)	-	0.011 (5.62)	-	0.006 (3.54)
Portugal specific	0.009 (2.77)	-	-	-	-	-	0.011 (3.39)	-	0.007 (2.55)	-
Percent car switched to this mode (%) - *Common*	-	-	0.008 (2.49)	-	-	0.005 (1.96)	-	-	-	-
France specific	0.007 (1.85)	-	-	-	0.028 (4.16)	-	0.019 (3.34)	-	0.013 (2.67)	-
High level of business attracted to station/stop (1/0)	-	0.148 (2.83)	-	0.188 (3.47)	-	0.133 (3.08)	-	0.147 (2.51)	-	0.111 (2.77)
System Characteristics										
One-way service capacity ('1000 passengers) - *Common*	0.004 (1.88)	-	-	-	-	-	-	-	-	-
Australia specific	-	-	0.008 (2.67)	-	-	-	0.006 (2.19)	-	0.009 (2.52)	-
Off-peak headway (mins) - *Common*	-	-	-0.010 (-2.57)	-	-0.011 (-2.95)	-	-	-	-	-
Australia specific	-0.006 (-1.73)	-	-	-	-	-	-	-	-0.019 (-3.59)	-
Travel time compared to car (% quicker/slower)	0.002 (2.02)	0.002 (2.02)	0.004 (3.43)	0.004 (3.43)	-	-	0.003 (3.48)	0.003 (3.48)	0.003 (2.84)	0.003 (2.84)
Travel cost compared to car (% cheaper/dearer)	-0.003 (-4.49)	-0.003 (-4.49)	-0.003 (-4.03)	-0.003 (-4.03)	-0.004 (-4.99)	-0.004 (-4.99)	-0.003 (-4.59)	-0.003 (-4.59)	-0.003 (-3.41)	-0.003 (-3.41)
Off-vehicle prepaid ticket required (1/0) - *Common*	-0.123 (-2.48)	0.132 (2.16)	-	-	-	-	-	-	-	0.100 (2.03)
France specific	-	-	-	-	-	-	-0.323 (-2.59)	-	-0.293 (-2.67)	-
Integrated fare availability (1/0) - *Common*	0.112 (2.47)	-	-	-	-	-	-	0.121 (2.86)	-	-
Australia specific	-	-	-	0.230 (2.92)	0.129 (1.56)	-	-	-	0.261 (3.00)	-

	Prefer		Metro		Value		Vote		Live	
	BRT	**LRT**	**BRT**	**LRT**	**BRT**	**LRT**	**BRT**	**LRT**	**BRT**	**LRT**
Waiting time if transfer (mins) - *Common*	-	-0.023 (-4.58)	-	-0.010 (-2.04)	-	-	-	-0.012 (-2.61)	-	-0.026 (-5.19)
U.S. specific	-	-	-	-	-	-0.015 (-2.10)	-	-	-	-
Portugal specific	-	-	-	-	-	-0.034 (-3.26)	-	-	-	-
Staff presence on board (1/0)	-	0.184 (3.78)	-	0.164 (3.30)	-	0.183 (3.36)	-	0.180 (3.61)	-	0.194 (4.03)
Level boarding (vs. step boarding)	-	-	-	-	-	-	0.070 (1.45)	-	-	-
Socioeconomic Characteristics										
Female (1/0)	0.096 (2.63)	-	0.085 (1.78)	-	-	-	-	-	-	-
Experience										
Frequency bus conditioning investment characteristics	-	-0.023 (-1.91)	-	-0.030 (-2.63)	-	-	0.076 (2.45)	-0.027 (-2.88)	0.091 (2.10)	-
Frequency rail conditioning investment characteristics	0.159 (1.91)	-	-	-	-	-	-	-	-	-
Frequency metro conditioning n investment characteristics	0.062 (1.62)	-	-	0.028 (1.95)	-	0.073 (2.46)	-	-	-	0.035 (1.74)
Frequency bus conditioning system characteristics	-	-	-	-0.039 (-1.99)	-	-0.029 (-2.19)	-	-	-0.058 (-2.32)	-
Frequency rail conditioning system characteristics	0.100 (1.58)	-	-	-	-	-	-	-	-	-
Frequency metro conditioning system characteristics	0.039 (1.44)	-	-	0.045 (1.98)	-	-	-	0.036 (1.71)	0.057 (1.92)	-
Frequency bus conditioning cost	-	-0.038 (-1.95)	-	-	-0.043 (-3.49)	-0.021 (-2.30)	-	-	-	-
Dummy UsedPT_BRTLRT conditioning investment characteristics	-	0.843 (2.09)	-	-	-	-	-	-	-	1.340 (2.32)
Dummy UsedPT_BRTLRT conditioning cost	-	1.300 (1.70)	-	-	-	-	-	-	-	-
Summary Statistics										
Log-likelihood at zero	-5136.59		-5141.51		-5143.11		-5140.87		-5138.74	
Log-likelihood at convergence	-4986.23		-5030.70		-4987.69		-5004.00		-5014.40	
McFadden Pseudo R^2	0.029		0.022		0.030		0.027		0.024	
Info. Criterion AIC	-1.353		-1.363		-1.351		-1.356		-1.359	
Sample Size (number of observations)	7420		7420		7420		7420		7420	

Table 3: Drivers summary for the HMNL models (X = significant)

	BRT					LRT				
	Prefer	**Metro**	**Value**	**Vote**	**Live**	**Prefer**	**Metro**	**Value**	**Vote**	**Live**
Investment Characteristics										
Construction cost ($m)	X	X	X	X	X	X	X	X	X	X
Construction time (year)	X	X	-	X	X	X (A, UK)	X	X	X	-
Percent metro population serviced (%)	X	X	X	X	X	X	X	-	X	X
Percent right of way	-	X	-	X	X	X	-	X	-	X
Annual operating and maintenance cost ($m)	X	-	X	X	X	-	X	-	-	-
Operation period assured (year)	X	-	X	X	X	-	X	-	-	-
Risk of being closed after assured period (%)	-	X	X	X	X	X (P)	X (P)	-	X (P)	-
Environmental friendliness (% better/worse vs. car)	X (P)	-	-	X (P)	X (P)	X	X	X	X	X
Percent car switched to this mode (%)	X (F)	X	X (F)	X (F)	X (F)	-	-	X	-	-
High level of business attracted to station/stop (1/0)	-	-	-	-	-	X	X	X	X	X
System Characteristics										
One-way service capacity ('1000 passengers)	X	X (A)	-	X (A)	X (A)	-	-	-	-	-
Off-peak headway (mins)	X (A)	X	X	-	X (A)	-	-	-	-	-
Travel time compared to car (% quicker/slower)	X	X	-	X	X	X	X	-	X	X
Travel cost compared to car (% cheaper/dearer)	X	X	X	X	X	X	X	X	X	X
Off-vehicle prepaid ticket required (1/0)	X	-	-	X (F)	X (F)	X	-	-	-	X
Integrated fare availability (1/0)	X	-	X (A)	-	X (A)	-	X (A)	-	X	-
Waiting time if transfer (mins)	-	-	-	-	-	X	X	X (US, P)	X	X
Staff presence on board (1/0)	-	-	-	-	-	X	X	X	X	X
Level boarding (vs. step boarding)	-	-	-	X	-	-	-	-	-	-
Total number of investment and system drivers	**13**	**10**	**9**	**14**	**15**	**12**	**13**	**9**	**11**	**10**

*The parenthesis represent country-specific drivers. A = Australia, P = Portugal, F = France, US = U.S., UK = U.K.

Table 4: Experience influence in the HMNL models

Experience	**Prefer**	**Metro**	**Value**	**Vote**	**Live**
Frequency bus conditioning investment characteristics	X	X	-	X	X
Frequency rail conditioning investment characteristics	X	-	-	-	-
Frequency metro conditioning investment characteristics	X	X	X	-	X
Frequency bus conditioning system characteristics	-	X	X	-	X
Frequency rail conditioning system characteristics	X	-	-	-	-
Frequency metro conditioning system characteristics	X	X	-	X	X
Frequency bus conditioning cost	X	-	X	-	-
Dummy UsedPT_BRTLRT conditioning investment characteristics	X	-	-	-	X
Dummy UsedPT_BRTLRT conditioning cost	X	-	-	-	-
Total number of significant experience parameters	**8**	**4**	**3**	**2**	**5**

The results suggest that actual experience varies in influence across the respondent perspectives. Table 4 presents a summary of the findings for the different models. The table does not differentiate the influence on the BRT or LRT alternative, because if an experience parameter is included in either one of the alternatives, it would also be influencing the choice probability of both alternatives. Almost all the actual experience variables are statistically significant when evaluating the choice options from a self-interested resident perspective but not the other preference metrics. From a voter perspective, only two of the nine parameters are statistically significant; one conditioning investment characteristics and one conditioning system characteristics.

Next, models obtained using the HMNL form (i.e., conditioning the utility function by actual experience and considering specific parameters for different subsets of the attributes as shown in Table 2) are compared to the simpler MNL form where actual experience is included as an additive exogenous variable and to the HMNL0 form where, as with HMNL, actual experience is used to condition the utility function but where the actual experience parameters are generic. Table 9 and Table 10 in Appendix A summarise the parameter estimates for these MNL and HMNL0 models, respectively.

Since the HMNL models are not nested versions of the HMNL0 and MNL models (due to differing sets of attributes being statistically significant), the AIC (Akaike, 1974) and Vuong statistic (Vuong, 1989) is used to compare goodness of fit. The AIC indicator measures the overall fit of the model taking into account the log-likelihood of the model while penalising the number of parameters estimated. The comparison of the AICs is presented in Table 5. The results show that there is a considerable improvement in the 'Metro', 'Value', 'Vote' and 'Live' models when using the HMNL model instead of the MNL model, while for the 'Metro' model there is almost no statistical difference. When comparing the HMNL with the HMNL0 models, there is a statistically significant improvement in the AIC indicator in the 'Value', 'Vote' and 'Live' model, while in the 'Prefer' and 'Metro' models the AIC improvement is statistically insignificant.

Table 5: AIC comparison for the HMNL versus MNL models

AIC Comparison	Prefer	Metro	Value	Vote	Live
MNL Model	-1.355	-1.364	-1.353	-1.358	-1.362
HMNL0 Model	-1.353	-1.363	-1.354	-1.357	-1.363
HMNL Model	-1.353	-1.363	-1.351	-1.356	-1.359
Difference HMNL - MNL	**0.002**	**0.000**	**0.002**	**0.002**	**0.003**
Difference HMNL - HMNL0	**0.000**	**0.000**	**0.003**	**0.001**	**0.003**

Although the AIC indicator is a good general indicator, the Vuong statistic is much more informative as it considers model performance at an individual level. The Vuong statistic is calculated using the log-likelihood difference between the HMNL model and the MNL or HMNL0 model for each individual. The test is such that if the Vuong statistic is greater than the critical t-test value, the test favours the first model, HMNL; and if it is lower it favours the second model, MNL or HMNL0. The results are presented in Table 6. The results show that there is a significant improvement in the HMNL models versus the MNL models for the 'Prefer', 'Value', 'Vote' and 'Live' models, although the confidence level changes. The greatest improvement is found in the 'Live' model, followed by the 'Prefer' model, then the 'Value' model and finally the 'Vote' model. The improvement in the 'Metro' model is not statistically significant (considering a minimum of 75% confidence level). For the HMNL models compared to the HMNL0 models, the Vuong test favours the HMNL in the 'Prefer', 'Value' and 'Live' model with 75%, 95% and 99% confidence level. The 'Metro' and 'Vote' models appear statistically similar in terms of their performance. These results suggest that consideration of specific experience as conditioning a subset of the attributes (HMNL) is an behaviourally encouraging approach and is superior or, at least, equivalent to the exogenous additive consideration of overt experience (MNL) and to the conditioning of the whole utility function with common parameters (HMNL0) in all the models estimated. The difference was particularly relevant when considering the perspective of a self-interested resident ('Prefer), a tax-payer ('Value'), and an altruistic resident looking after the liveability of the metropolitan area ('Live').

Table 6: Vuong test results for the HMNL versus MNL models

Vuong Test		Prefer	Metro	Value	Vote	Live
HMNL vs MNL	Mean	0.0017	0.0003	0.0015	0.0010	0.0019
	Standard deviation	0.0789	0.0563	0.0763	0.0666	0.0736
	Sample Size	7420	7420	7420	7420	7420
	Vuong Statistic	**1.825**	**0.508**	**1.698**	**1.283**	**2.257**
	Result	**Favours HMNL with 90% confidence level**	**No statistically significant improvement**	**Favours HMNL with 90% confidence level**	**Favours HMNL with 80% confidence level**	**Favours HMNL with 95% confidence level**
HMNL vs HMNL0	Mean	0.0005	0.0000	0.0016	0.0007	0.0023
	Standard deviation	0.0345	0.0141	0.0679	0.0645	0.0725
	Sample Size	7420	7420	7420	7420	7420
	Vuong Statistic	**1.236**	**0.154**	**2.081**	**0.905**	**2.690**
	Result	**Favours HMNL with 75% confidence level**	**No statistically significant improvement**	**Favours HMNL with 95% confidence level**	**No statistically significant improvement**	**Favours HMNL with 99% confidence level**

These model results show important differences in preferences towards the BRT and LRT systems between countries and preference metrics. The absolute parameter estimates presented are not directly comparable (because of scale differences in choice models (see Hensher et al. 2015c), and so in the following section willingness to pay estimates (WTP) are presented which are an important behavioural outcome in choice studies as well as offering a direct comparison between the behavioural responsiveness to each attribute in each model.

Willingness to Pay Estimate Contrasts

One of the most informative behavioural outputs is the comparison of the WTP estimates from different preference metric perspectives. The WTP estimates for the HMNL models for each model and country are summarised in Appendix B, and Table 7 presents the average WTP for each model pooled across all countries. The WTP estimates were calculated as an average across the sample, based on the attribute levels presented in the stated choice experiment and the experience of each individual[5]. The results show that all the WTP estimates are statistically significant at the 95% confidence level. There are noticeable differences across the five preference metrics for many of the attributes.

The interpretation of the WTP estimates in Table 7 (and Figure 2) is defined as how much someone is willing to support a change in construction cost in return for a change in a characteristic of the offered infrastructure. For example, an individual acting as a self interested utility maximiser is willing to

[5] As the models are non-linear in terms of experience and construction cost, individual WTP estimates are highly dependent on the cost attribute levels and individual experience. Therefore, the results presented are equivalent to a WTP that is calculated using the average of the cost attribute level and of the experience levels.

support a $2.43m increase in the construction cost of BRT if it can be delivered one year earlier. The equivalent value is $2.84m for LRT. Residents are willing to support a higher construction cost if integrated ticketing is introduced for BRT under three metrics and for LRT under two metrics. The range is the equivalent construction cost of $32.86m for LRT (metro) to $7.87m construction cost for BRT (value). Introducing level boarding in BRT is equivalent to support of $38.98 construction cost from the perspective of self-interest preferences. Across all the attributes we see mean WTP estimates for the majority of the support drivers in the range of $200,000 to $2.5m, with BRT sometimes representing a higher WTP and LRT otherwise.

A particularly interesting finding is the lack of support for the position that BRT will have a high level of business attracted to the station/stop (value uplift and potential capture), in contrast to LRT where it is a sizeable WTP equivalent in construction cost on all five preference metrics (ranging from $8.2m to $22.15m). Clearly this perception, embodied in a viewpoint that BRT is inherently less permanent, is also potentially fuelled by a lack of many examples of actual development around BRT stations in contrast to LRT/rail stations: it is a perception that will require a lot of work to alter. By contrast, BRT offers a WTP (albeit lower) for increases in service capacity defined per 1,000 passenger capacity in the range of $0.52m to $0.83m for all preference metrics except value to tax-payers, in contrast to LRT where this driver did not attract any support on all five metrics.

For the BRT alternative, the construction time WTP is larger from the perspective of a self-interested resident ('Prefer' model) and smaller from the perspective of an altruistic resident looking after the benefits to the metropolitan area ('Metro' model). For the LRT alternative, the construction time WTP is also larger from the perspective of a self-interested resident and closely followed by the 'Metro' model, while it is smaller from the perspective of a tax payer. The off-vehicle prepaid ticket WTP is interesting, being negative for BRT and positive for LRT from the perspective of a self-interested resident and of an altruistic resident looking after the liveability of the metropolitan area. This means that the situation of some respondents, under the 'Prefer' metric, worsens when having the requirement of an off-vehicle prepaid ticket in BRT, but improves (i.e., they see value in having it) in LRT. From the perspective of a voter, the WTP to not have an off-vehicle prepaid ticket requirement is very high in BRT and is not significant in LRT. This may be interpreted as some statement to support having electronic ticketing (swipe card) on BRT.

Many conclusions can be drawn from Table 7, but one of the most important findings is that the highest WTP associated with each support driver varies across all five preference metrics for BRT, whereas for LRT the altruistic resident looking after the benefits to the metropolitan area ('Metro' model) displays the highest WTP for the majority of support drivers. LRT is clearly seen as a popular proposition for metropolitan areas; however the evidence below (Figure 2 and Appendix Figure 4) related to the support for *increases* in the percentage right of way (dedicated to the BRT or LRT system) suggests that BRT and LRT garner similar support leading to the view that improved service level, regardless of whether they are provided by BRT or LRT, is a key consideration for associating support with either of the two modes.

An important message, given this evidence, is that if the mean WTP estimates are used to calculate the benefits of LRT over BRT, we would be inflating the benefits obtained when using the 'Metro' (altruistic) estimates instead of the self-interest preference WTP. Economic theory embedded in cost-benefit analysis (as discussed in an earlier section) would warn against this since there is a confounding effect across resident preferences that leads to some amount of double counting of benefits. So here we must conclude that there are differences in WTP (as the basis if benefit determination) that sends a warning about using preference metrics in cost-benefit assessment that are aligned with an altruist citizen perspective in contrast to a private individual personal interest perspective. More importantly, such evidence has greater value when presented in the context of a complementary assessment tool, the community preference support model (Hensher et al. 2015b). This dual assessment framework is a powerful way of representing multiple preference perspectives on residents and is something that should appeal and be useful to exploit by the political and bureaucratic decision process.

Table 7: Willingness to pay estimates ($m construction cost/unit of attribute change) '-' = not statistically significant

		BRT					LRT				
WTP higher construction cost (AUD$m) to…		Prefer	Metro	Value	Vote	Live	Prefer	Metro	Value	Vote	Live
Investment Characteristics	Reduce the construction time by one year	$2.43	$0.94	-	$2.03	$1.48	$2.84	$2.67	$0.61	$1.58	-
	Increase the population serviced by 1%	$1.06	$0.70	$0.78	$0.59	$0.70	$0.57	$1.35	-	$0.97	$0.84
	Increase the percentage right of way by 1%	-	$0.20	-	$0.12	$0.10	$0.11	-	$0.08	-	$0.20
	Reduce the annual operating costs by one million $	$0.98	-	$0.82	$1.29	$0.61	-	$1.06	-	-	-
	Increase the operation period assured by 1 year	$0.27	-	$0.32	$0.32	$0.23	-	$0.49	-	-	-
	Decrease by 1% the risk of being closed after assured period	-	$0.18	$0.08	$0.10	$0.09	$0.28	$0.25	-	$0.33	-
	Increase the environmental friendliness by 1% compared to car	$1.69	-	-	$1.37	$0.94	$0.52	$1.22	$0.41	$0.79	$0.95
	Increase by 1% the cars switched to this mode	$1.09	$0.71	$1.61	$1.92	$1.39	-	-	$0.30	-	-
	Have a high level of business attracted to the station/stop	-	-	-	-	-	$9.95	$22.15	$8.20	$10.21	$18.80
System Characteristics	Increase the service capacity by 1,000 passengers	$0.52	$0.83	-	$0.68	$0.70	-	-	-	-	-
	Reduce the headway in off-peak hours by 1 minute	$1.09	$0.84	$0.66	-	$1.41	-	-	-	-	-
	Increase the travel time compared to the car by 1% quicker	$0.28	$0.32	-	$0.33	$0.22	$0.13	$0.44	-	$0.32	$0.38
	Reduce the travel cost compared to the car by 1%	$0.49	$0.29	$0.25	$0.33	$0.20	$0.23	$0.41	$0.13	$0.32	$0.34
	Require off-vehicle prepaid ticket	-$18.25	-	-	-$24.93	-$23.01	$9.30	-	-	-	$12.39
	Have integrated fare availability	$16.57	-	$7.87	-	$19.68	-	$32.86	-	$11.22	-
	Reduce the waiting time if transfer by 1 minute	-	-	-	-	-	$1.61	$1.22	$0.53	$1.14	$3.20
	Have staff presence on-board	-	-	-	-	-	$13.24	$19.87	$5.52	$16.64	$24.18
	Have level boarding	$38.98	-	$7.79	$6.73	-	-	-	-	-	-

Six statistically significant attributes appear more frequently across all preference metrics: construction time, percentage of metro population served, percent right of way, travel time compared to car, travel cost compared to car, and environmental friendliness. Next these drivers are considered graphically at a country level and across the five preference metrics, as presented in Figure 2.

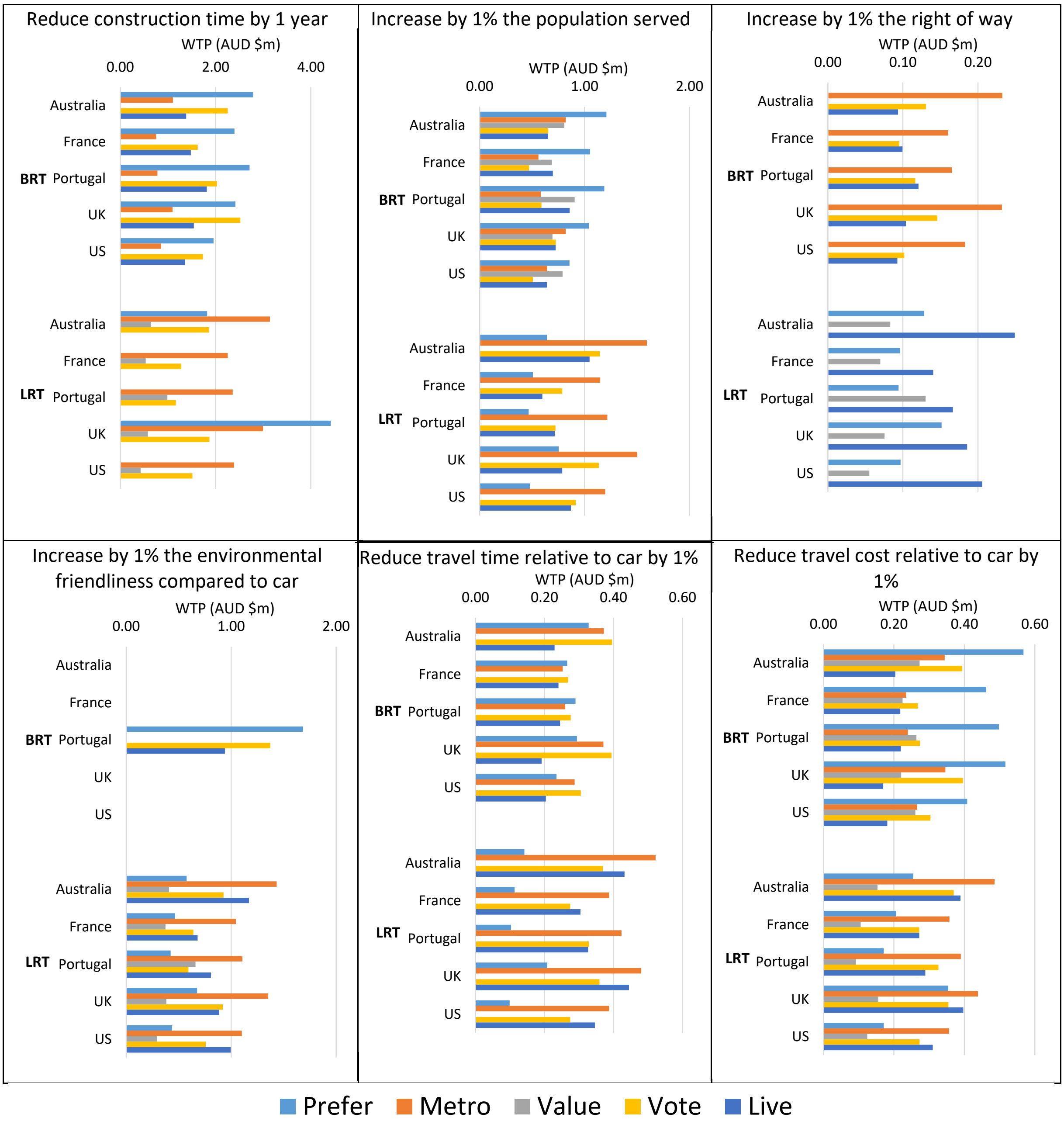

Figure 2: Graphical mean WTP comparison between countries and preference metrics

These graphs reinforce the above discussion around Table 7 of significant differences in the mean WTP estimates both within and between countries on each preference metric, suggesting that utilising evidence from one country for a given preference rule in another country is not defensible. The equivalent graph, where the findings are sorted by preference metric, in contrast to country, is given in Appendix C (Figure 4), and provides further evidence on the clear and noticeable differences between each country on each preference metric for BRT and LRT.

Simulation – Community Preferences between Preference Metrics and Countries

As identified above, a community preference model can provide complementary information in a format where the changes in the support towards BRT associated with changes in the characteristics of the investments, systems or resident modal experience are analysed. The base scenario for the simulations is defined in terms of the average attribute levels from the preference experiment. The levels of support towards BRT in the base scenario for each country and each preference response are summarised in Table 8. With the French residents supporting BRT on its value for money ('Value') being the only exception, all modal support shares for BRT are less than 50%, lying between 43.76% to 49.28%. This suggests that on balance there is evidence that BRT and LRT have relatively balanced support and that the particular levels of the key drivers can tip the balance either way. This is a very important finding suggesting that BRT is by no means a failed option in the competitive stakes with LRT. It is only a matter of identifying the salient influences that can give BRT an advantage from the perspective of resident support. We investigate a number of such drivers in this section and, although necessarily selective in the scenarios investigated, the choice has in part been based on the WTP evidence above.

Table 8: Support towards BRT in base scenario

Support in base scenario towards BRT	Prefer	Metro	Value	Vote	Live
Australia	47.52%	46.97%	49.24%	44.96%	44.96%
France	47.44%	46.42%	51.57%	46.17%	46.17%
Portugal	47.82%	49.03%	49.28%	44.78%	44.78%
U.K.	49.57%	47.29%	46.70%	46.12%	46.12%
U.S.	43.76%	47.21%	48.90%	48.90%	47.51%

Figure 3 presents fourteen different scenarios focusing on the six attributes that were statistically significant in most models (i.e., construction time, percentage of metro population services, percent dedicated right of way, travel time compared to car, travel cost compared to car, and environmental friendliness). The graphs show important differences in the levels of support for BRT when varying specific characteristics. For example, in all countries, if the LRT construction cost is twice of the BRT construction cost, all else being equal, the level of support towards BRT increases by 2% to 7% across the five preference metrics (with the highest increase in BRT support associated with the value-for-money choice). By contrast, if the BRT construction cost is double that of the LRT system, the level of support towards BRT decreases dramatically from the voter perspective (almost 10 percent), and for the other four preference metrics it varies from 2.5% to 4%.

For construction time (to opening), which has country-specific parameter estimates, when the LRT construction time is twice as long as that for the construction of a BRT system, the level of support towards BRT in the two countries where it is statistically significant increases by 5% in the U.K. and 3% in Australia from a self-interested resident perspective. For the catchment area, as defined by the percent of the population served, a 50% increase in the population served by LRT leads to a decrease of up to 2% in the support for BRT across all countries studied with the greatest decrease observed in the liveability model (all countries) and personal self-interest model (in Australia, France and Portugal). The percentage difference does vary across countries although the differences in general are very small. If BRT serves more people, the increase in its level of support will not be significant from a tax-payer perspective ('Value' model), but it will from the other four preference perspectives. Hensher et al. (2018) provides strong evidence that, if we start with a given budget to build either BRT or LRT system, BRT will deliver greater patronage and hence a higher benefit-cost ratio, because every dollar of construction cost can support a much larger catchment area.

Figure 3 presents a number of other scenarios where there are to varying degrees, noticeable switches away from or towards BRT compared to LRT. The greatest percent changes are associated with construction cost, construction time, environmental friendliness (the sustainability concern), and the extent of getting car users to switch to public transport, be it LRT or BRT. The latter challenge may be more aligned with road pricing reform associated with the car than with anything under the control of the public transport provider and regulator.

The influence of experience through usage was investigated and showed in general a rather lukewarm sensitivity of support for both BRT and LRT, with some exceptions. Specifically, if the frequency of bus use doubles, the support towards BRT would increase quite marginally except in France from the perspective of a voter '(Vote') and an altruistic resident looking after the liveability of the metropolitan area ('Metro'). The directional impact within a modal experience context varies since it is clear that all experience cannot be assumed to be a positive and may in some cases be a negative as shown in this study.

Finally, with regards to the current availability of both BRT and LRT systems, if all the cities would have both systems available, this would only affect the support in Australia and the U.S. (given they currently are the only countries in our sample that had cities with both systems available). Interestingly, from a self-interested resident perspective ('Prefer'), the simulated scenarios with changes in the availability of both BRT and LRT systems, suggest an increase in the support towards BRT in Australia (1.5%); however this is more than offset from a voter perspective ('Vote'), where we see a decrease in the support towards BRT in the U.S. (1%) and Australia (3%).

The evidence of actual accumulated experience in using various transport modes and the availability of both BRT and LRT does not dominate what matters in promoting the virtues of BRT and LRT. The findings suggest that inherent characteristics of BRT and LRT service and delivery plans together with how they impact on the amount of car traffic should be the focus of promoting BRT over LRT, LRT over BRT, and public transport in general. This is an encouraging finding that suggests that there is a chance that new BRT initiatives can still succeed over LRT without having to demonstrate a priori its advantage in the local setting.

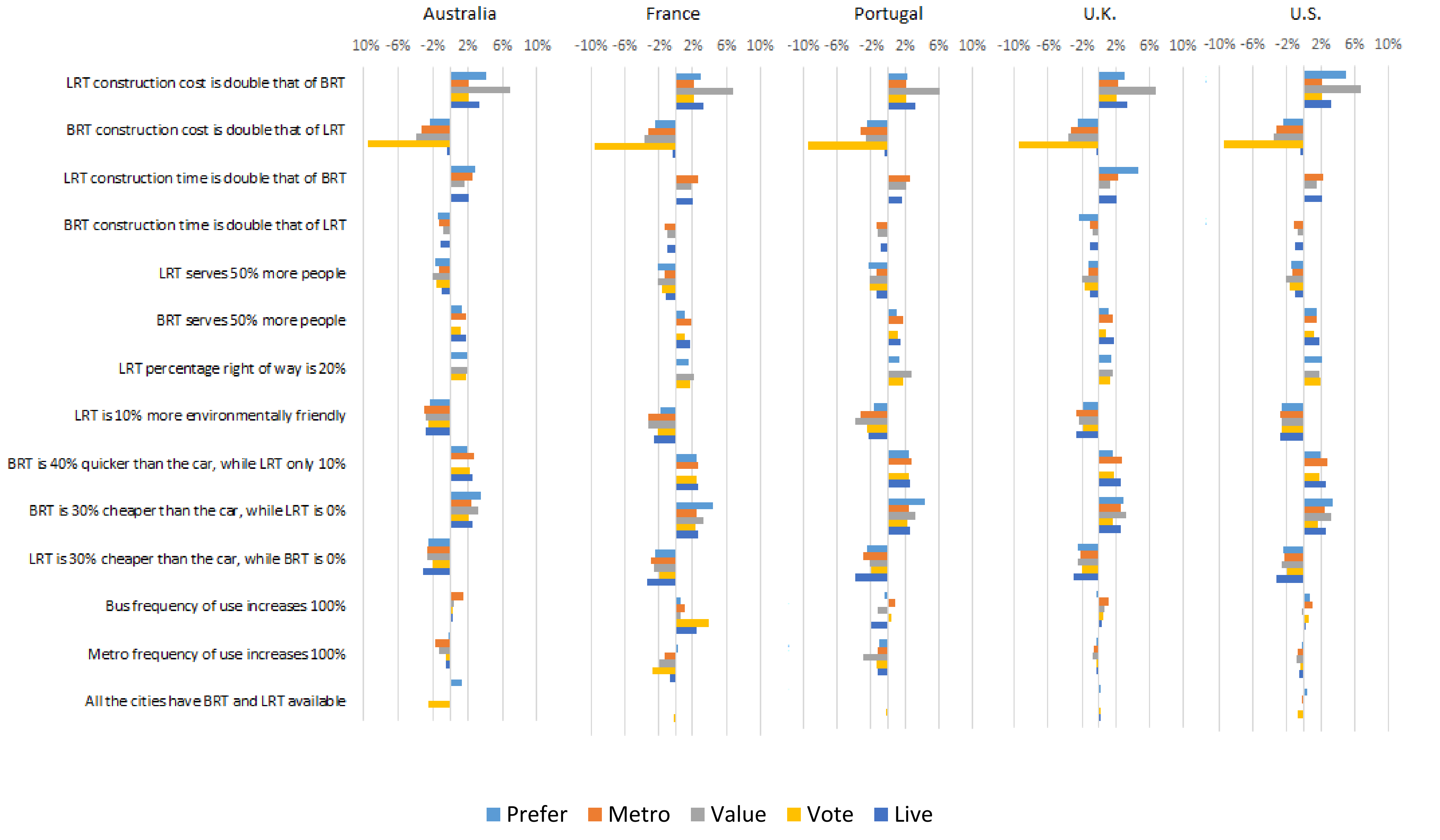

Figure 3: Support towards BRT in different simulation scenarios

Discussion and conclusions

The focus of this paper is on whether there are significant differences or similarities in the key behavioural outputs associated with five measures of preference revelation when comparing a BRT system with an LRT system in five countries. The five preference perspectives are encouraged by the framing and context of a series of choice response questions in a stated choice experiment which relate to a self-interested resident, a tax-payer, a voter, an altruistic resident concerned about the benefits to the metropolitan area, and an altruistic resident concerned about the liveability of the metropolitan area.

Through estimation of a series of non-linear logit models in which the parameter estimates associated with each attribute representing a BRT and an LRT offer are conditioned by actual experience through usage of different public transport modes, we obtained empirical evidence which suggests both notable differences and similarities between countries and/or between supporting attributes. The results suggest that experience with a specific transit system through usage influences its preferences, and these influences appear to vary, at the mean parameter estimates, across subsets of attributes. However, the influence of experience on preferences for BRT or LRT is small, with the simulated results indicating that a level of support for BRT above 50 percent was not likely to be achieved through greater experience of the community at large with a BRT system, except in France and only when respondents were asked to wear the tax-payer's hat or the metropolitan livability hat. This is an important finding since it takes the pressure off the much promoted position that until you experience a mode you are unlikely to obtain sufficient community support for it.

The WTP evidence suggests that different measures of preference revelation produce noticeable differences in the levels of WTP, including different subsets of statistically significant WTP estimates. Construction cost provides a good example to portray the significant differences in the WTP estimates between countries and preference perspectives. In particular, for the U.K. only, residents under a self-interest preference metric are willing to pay a significant sum in equivalent construction cost to shorten the construction time of LRT, which also applies to BRT in all countries; however it is significantly low from a tax-payer perspective for LRT and not significant at all for BRT. Another interesting example associated with system characteristics is the WTP to reduce public transport travel cost compared to the car. The results suggest that for BRT the WTP is significantly higher from a self-interested resident than from a voter perspective, for every country. However, the WTP to reduce the LRT travel cost compared to the car is significantly higher from a voter perspective than a self-interested resident perspective for every country except for the U.K. where they are relatively similar.

Thus different preference revelation perspectives engender very different WTP responses between modes and countries, suggesting that replication as a basis of transferability of evidence is potentially problematic. There is clear evidence of preference heterogeneity between countries between modal support drivers and between modes.

The scenario simulations associated with a resident (or community) preference model support a view of significantly different responses to changes in the levels of the support drivers from different preference perspectives. Given that the levels of sample support in the base scenario were equivalent to BRT and LRT (around 50% each – see Table 8), small percentage changes in modal support could make a necessary difference when comparing the projects, tipping the balance over 50 percent for a specific modal infrastructure initiative. The selected scenario assessments show some high sensitivities in the levels of support for one mode over the other and switch more generally to public transport. The greatest percent changes are associated with construction cost, construction time, environmental friendliness, and the extent to which the transit system attracting car users.

Historically, cost benefit analysis has used self-interest or private consumer preference as the representation of the benefits associated with projects and initiatives, and to avoid any risk of double counting and other possible sources of confoundment, this should remain the appropriate metric to capture societal preferences in CBA. However, determining (and marketing) the appeal of particular modal infrastructure in a context where there are strong emotional biases towards one mode (e.g., LRT) and against another mode (e.g., BRT as perceived to be a boring bus), often contaminates the opportunity to at least get both modes on the cost-benefit agenda at the project generation stage. Too often we see rail-based solutions being assessed as a number of rail projects with bus not even on the radar. This paper makes the case (with evidence) to parallel a formal economic cost-benefit analysis with a complementary support tool that incorporates the preferences of residents as expressed in a number of other ways such as have been presented in this paper. Applying the levels of the drivers identified as significant in this paper, that are being evaluated under a project specification in a CBA, will obtain an index of resident support for each mode. This has the intent, amongst other reasons, of drawing to the attention of politicians, their advisers and the government bureaucracy, that the voice of the residents has a number of interpretations that have buy in appeal and will highly likely lead to a positive electoral outcome, regardless of the CBA finding.

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Appendix A

Table 9: Parameter Estimates Results for the MNL Models

	Prefer		Metro		Value		Vote		Live	
	BRT	**LRT**	**BRT**	**LRT**	**BRT**	**LRT**	**BRT**	**LRT**	**BRT**	**LRT**
General										
Constant	-0.105 (-1.13)	-	-0.024 (-0.25)	-	0.064 (0.78)	-	-0.046 (-0.52)	-	0.026 (0.30)	-
Investment Characteristics										
Construction cost ($m)	-	-	-	-	-	-	-	-	-0.017 (-1.66)	-
Construction cost ($m), **squared**	-0.004 (-2.86)	-0.005 (-3.62)	-0.005 (-3.72)	-0.003 (-1.71)	-0.006 (-4.55)	-0.010 (-6.67)	-0.004 (-3.01)	-0.005 (-3.20)	-	-0.003 (-1.91)
Construction time (year) - *Common*	-0.021 (-2.79)	-	-0.009 (-1.07)	-0.025 (-3.01)	-	-0.019 (-2.71)	-0.021 (-2.50)	-0.018 (-2.20)	-0.020 (-2.85)	-
Australia specific	-	-0.030 (-2.41)	-	-	-	-	-	-	-	-
U.K. specific	-	-0.043 (-3.51)	-	-	-	-	-	-	-	-
Percent metro population serviced (%)	0.011 (2.65)	0.008 (2.12)	0.008 (1.89)	0.011 (2.79)	0.013 (3.36)	-	0.008 (2.01)	0.010 (2.55)	0.010 (2.36)	0.010 (2.50)
Percent right of way	-	0.002 (2.38)	0.002 (3.07)	-	-	0.001 (1.92)	0.001 (1.30)	-	0.002 (2.11)	0.001 (1.48)
Annual operating and maintenance cost ($m)	-0.014 (-3.44)	-	-	-0.010 (-2.35)	-0.013 (-3.46)	-	-0.014 (-3.35)	-	-0.007 (-1.84)	-
Operation period assured (year)	0.004 (2.88)	-	-	0.004 (2.91)	0.005 (4.21)	-	0.004 (3.00)	-	0.004 (3.13)	-
Risk of being closed after assured period (%) - *Common*	-	-	-0.002 (-3.18)	-	-0.001 (-2.21)	-	-0.001 (-2.09)	-	-0.002 (-2.87)	-
Portugal specific	-	-0.004 (-2.80)	-	-0.002 (-1.69)	-	-	-	-0.005 (-3.55)	-	-
Environmental friendliness (% better/worse vs. car) - *Common*	-	0.009 (4.85)	-	0.010 (5.53)	-	0.008 (4.62)	-	0.011 (5.52)	-	0.009 (4.78)
Portugal specific	0.012 (2.40)	-	-	-	-	-	0.011 (2.37)	-	0.007 (1.54)	-
Percent car switched to this mode (%) - *Common*	-	-	0.008 (2.33)	-	-	0.008 (2.25)	-	-	-	-
France specific	0.014 (2.16)	-	-	-	0.025 (3.77)	-	0.023 (3.15)	-	0.017 (2.33)	-
High level of business attracted to station/stop (1/0)	-	0.160 (2.90)	-	0.178 (3.20)	-	0.173 (3.23)	-	0.134 (2.42)	-	0.152 (2.78)
System Characteristics										
One-way service capacity ('1000 passengers) - *Common*	0.005 (1.95)	-	-	-	-	-	-	-	-	-
Australia specific	-	-	0.008 (2.54)	-	-	-	0.006 (2.23)	-	0.011 (2.87)	-
Off-peak headway (mins) - *Common*	-	-	-0.010 (-2.60)	-	-0.011 (-3.03)	-	-	-	-	-
Australia specific	-0.009 (-1.78)	-	-	-	-	-	-	-	-0.017 (-3.19)	-
Travel time compared to car (% quicker/slower)	0.003 (2.31)	0.003 (2.31)	0.004 (3.36)	0.004 (3.36)	-	-	0.004 (3.59)	0.004 (3.59)	0.003 (3.01)	0.003 (3.01)
Travel cost compared to car (% cheaper/dearer)	-0.003 (-4.24)	-0.003 (-4.24)	-0.003 (-3.86)	-0.003 (-3.86)	-0.004 (-5.01)	-0.004 (-5.01)	-0.003 (-4.15)	-0.003 (-4.15)	-0.003 (-3.28)	-0.003 (-3.28)
Off-vehicle prepaid ticket required (1/0) - *Common*	-0.165 (-2.42)	0.149 (2.28)	-	-	-	-	-	-	-	0.102 (2.03)

	Prefer		Metro		Value		Vote		Live	
	BRT	**LRT**	**BRT**	**LRT**	**BRT**	**LRT**	**BRT**	**LRT**	**BRT**	**LRT**
France specific	-	-	-	-	-	-	-0.308 (-2.42)	-	-0.311 (-2.41)	-
Integrated fare availability (1/0) - *Common*	0.158 (3.09)	-	-	-	-	-	-	0.113 (2.22)	-	-
Australia specific	-	-	-	0.208 (2.47)	0.143 (1.73)	-	-	-	0.254 (2.84)	-
Waiting time if transfer (mins) - *Common*	-	-0.019 (-3.70)	-	-0.014 (-2.66)	-	-	-	-0.018 (-3.41)	-	-0.024 (-4.75)
U.S. specific	-	-	-	-	-	-0.016 (-2.30)	-	-	-	-
Portugal specific	-	-	-	-	-	-0.026 (-2.89)	-	-	-	-
Staff presence on board (1/0)	-	0.195 (3.91)	-	0.169 (3.42)	-	0.155 (3.15)	-	0.213 (4.30)	-	0.201 (4.09)
Level boarding (vs. step boarding)	-	-	-	-	-	-	0.083 (1.68)	-	-	-
Socioeconomic Characteristics										
Female (1/0)	0.098 (2.05)	-	0.088 (1.85)	-	-	-	-	-	-	-
Experience										
Frequency bus on investment characteristics	0.004 (1.57)	-	0.007 (2.58)	-	-	-	-	-	-	-
Frequency rail on investment characteristics	-	-	-	-	-	-	-	-	-	-
Frequency metro on investment characteristics	-0.006 (-2.00)	-	-0.007 (-2.34)	-	-0.006 (-2.17)	-	-0.006 (-2.13)	-	-	-
Frequency bus on system characteristics	-	0.110 (1.67)	-	0.155 (2.43)	-	0.182 (2.72)	-	0.112 (1.74)	-	0.222 (3.49)
Summary Statistics										
Log-likelihood at zero	-5136.59		-5141.51		-5143.11		-5140.87		-5138.74	
Log-likelihood at convergence	-4998.76		-5033.16		-4998.84		-5011.36		-5028.71	
McFadden Pseudo R^2	0.027		0.021		0.028		0.025		0.021	
Info. Criterion AIC	-1.355		-1.364		-1.353		-1.358		-1.362	
Sample Size (number of observations)	7420		7420		7420		7420		7420	

Table 10: Parameter Estimates Results for the HMNL0 Models

	Prefer		Metro		Value		Vote		Live	
	BRT	**LRT**	**BRT**	**LRT**	**BRT**	**LRT**	**BRT**	**LRT**	**BRT**	**LRT**
General										
Constant	-0.141 (-2.48)	-	0.014 (0.16)	-	0.051 (0.65)	-	-0.099 (-1.44)	-	0.026 (0.31)	-
Investment Characteristics										
Construction cost ($m)	-	-	-	-	-	-	-	-	-0.018 (-1.82)	-
Construction cost ($m), **squared**	-0.001 (-1.50)	-0.008 (-5.37)	-0.004 (-3.68)	-0.003 (-2.08)	-0.006 (-4.75)	-0.009 (-5.45)	-0.003 (-2.36)	-0.006 (-3.88)	-	-0.002 (-1.86)
Construction time (year) - *Common*	-0.017 (-3.08)	-	-0.012 (-1.47)	-0.021 (-2.70)	-	-0.015 (-2.11)	-0.016 (-2.27)	-0.023 (-2.66)	-0.020 (-2.86)	-
Australia specific	-	-0.029 (-2.66)	-	-	-	-	-	-	-	-
U.K. specific	-	-0.053 (-4.10)	-	-	-	-	-	-	-	-
Percent metro population serviced (%)	0.007 (2.62)	0.009 (2.36)	0.008 (2.09)	0.012 (3.17)	0.014 (3.64)	-	0.006 (1.76)	0.012 (2.99)	0.011 (2.71)	0.008 (2.37)
Percent right of way	-	0.002 (2.22)	0.002 (3.18)	-	-	0.002 (2.73)	0.001 (1.83)	-	0.001 (1.96)	0.002 (2.44)
Annual operating and maintenance cost ($m)	-0.008 (-2.53)	-	-	-0.008 (-2.14)	-0.013 (-3.44)	-	-0.013 (-3.54)	-	-0.008 (-1.97)	-
Operation period assured (year)	0.002 (2.18)	-	-	0.004 (3.68)	0.006 (4.55)	-	0.003 (2.44)	-	0.004 (3.42)	-
Risk of being closed after assured period (%) - *Common*	-	-	-0.002 (-2.99)	-	-0.001 (-2.10)	-	-0.001 (-1.82)	-	-0.002 (-2.91)	-
Portugal specific	-	-0.005 (-3.24)	-	-0.002 (-1.87)	-	-	-	-0.006 (-3.82)	-	-
Environmental friendliness (% better/worse vs. car) - *Common*	-	0.009 (4.64)	-	0.010 (5.63)	-	0.008 (4.76)	-	0.011 (5.40)	-	0.008 (4.79)
Portugal specific	0.010 (3.30)	-	-	-	-	-	0.014 (3.62)	-	0.008 (1.73)	-
Percent car switched to this mode (%) - *Common*	-	-	0.008 (2.49)	-	-	0.009 (2.75)	-	-	-	-
France specific	0.008 (2.11)	-	-	-	0.026 (3.94)	-	0.019 (3.30)	-	0.018 (2.53)	-
High level of business attracted to station/stop (1/0)	-	0.159 (2.93)	-	0.190 (3.57)	-	0.187 (3.63)	-	0.144 (2.44)	-	0.145 (2.99)
System Characteristics										
One-way service capacity ('1000 passengers) - *Common*	0.003 (1.67)	-	-	-	-	-	-	-	-	-
Australia specific	-	-	0.008 (2.69)	-	-	-	0.005 (2.24)	-	0.011 (2.95)	-
Off-peak headway (mins) - *Common*	-	-	-0.009 (-2.54)	-	-0.011 (-2.93)	-	-	-	-	-
Australia specific	-0.006 (-1.81)	-	-	-	-	-	-	-	-0.018 (-3.35)	-
Travel time compared to car (% quicker/slower)	0.002 (2.31)	0.002 (2.31)	0.004 (3.52)	0.004 (3.52)	-	-	0.004 (3.37)	0.004 (3.37)	0.003 (3.22)	0.003 (3.22)
Travel cost compared to car (% cheaper/dearer)	-0.003 (-4.63)	-0.003 (-4.63)	-0.003 (-4.20)	-0.003 (-4.20)	-0.004 (-5.31)	-0.004 (-5.31)	-0.004 (-4.43)	-0.004 (-4.43)	-0.003 (-3.22)	-0.003 (-3.22)
Off-vehicle prepaid ticket required (1/0) - *Common*	-0.113 (-2.60)	0.125 (2.16)	-	-	-	-	-	-	-	0.085 (1.90)
France specific	-	-	-	-	-	-	-0.253 (-2.48)	-	-0.296 (-2.31)	-
Integrated fare availability (1/0) - *Common*	0.089 (2.45)	-	-	-	-	-	-	0.112 (2.08)	-	-
Australia specific	-	-	-	0.243 (3.06)	0.130 (1.58)	-	-	-	0.256 (2.86)	-

	Prefer		Metro		Value		Vote		Live	
	BRT	**LRT**	**BRT**	**LRT**	**BRT**	**LRT**	**BRT**	**LRT**	**BRT**	**LRT**
Waiting time if transfer (mins) - *Common*	-	-0.017 (-3.38)	-	-0.011 (-2.18)	-	-	-	-0.017 (-3.13)	-	-0.019 (-4.17)
U.S. specific	-	-	-	-	-	-0.015 (-2.17)	-	-	-	-
Portugal specific	-	-	-	-	-	-0.021 (-2.42)	-	-	-	-
Staff presence on board (1/0)	-	0.192 (3.78)	-	0.176 (3.62)	-	0.182 (3.78)	-	0.232 (4.36)	-	0.183 (4.08)
Level boarding (vs. step boarding)	-	-	-	-	-	-	0.063 (1.47)	-	-	-
Socioeconomic Characteristics										
Female (1/0)	0.087 (2.67)	-	0.085 (1.79)	-	-	-	-	-	-	-
Experience										
Frequency bus	-	-0.020 (-2.50)	-	-0.035 (-4.03)	-	-0.031 (-3.33)	-	-0.019 (-2.70)	-	-
Frequency rail	0.118 (1.97)	-	-	-	-	-	0.093 (2.22)	-	-	-
Frequency metro	0.051 (1.92)	-	-	0.033 (3.04)	-	0.029 (2.10)	-	-	-	-
Dummy UsedPT_BRTLRT	-	0.459 (1.77)	-	-	-	-	-	-	-	0.645 (2.42)
Summary Statistics										
Log-likelihood at zero	-5136.59		-5141.51		-5143.11		-5140.87		-5138.74	
Log-likelihood at convergence	-4989.90		-5030.88		-4999.87		-5009.03		-5031.21	
McFadden Pseudo R^2	0.029		0.022		0.028		0.026		0.021	
Info. Criterion AIC	-1.353		-1.363		-1.354		-1.357		-1.363	
Sample Size (number of observations)	7420		7420		7420		7420		7420	

Appendix B

Table 11: Willingness to pay estimates 'Prefer' model

	WTP higher construction cost (AUD$m) to…	Australia BRT	Australia LRT	France BRT	France LRT	Portugal BRT	Portugal LRT	U.K. BRT	U.K. LRT	U.S. BRT	U.S. LRT
Investment Characteristics	Reduce the construction time by one year	$2.79	$1.82	$2.40	-	$2.71	-	$2.41	$4.42	$1.96	-
	Increase the population serviced by 1%	$1.21	$0.64	$1.05	$0.51	$1.19	$0.47	$1.04	$0.75	$0.86	$0.48
	Increase the percentage right of way by 1%	-	$0.13	-	$0.10	-	$0.09	-	$0.15	-	$0.10
	Reduce the annual operating costs by one million $	$1.12	-	$0.98	-	$1.08	-	$0.99	-	$0.79	-
	Increase the operation period assured by 1 year	$0.32	-	$0.27	-	$0.30	-	$0.27	-	$0.22	-
	Decrease by 1% the risk of being closed after assured period	-	-	-	-	-	$0.28	-	-	-	-
	Increase the environmental friendliness by 1% compared to car	-	$0.58	-	$0.46	$1.69	$0.42	-	$0.68	-	$0.44
	Increase by 1% the cars switched to this mode	-	-	1.09	-	-	-	-	-	-	-
	Have a high level of business attracted to the station/stop	-	11.20	-	8.54	-	8.37	-	12.99	-	8.41
System Characteristics	Increase the service capacity by 1,000 passengers	$0.61	-	$0.49	-	$0.53	-	$0.54	-	$0.44	-
	Reduce the headway in off-peak hours by 1 minute	$1.09	-	-	-	-	-	-	-	-	-
	Increase the travel time compared to the car by 1% quicker	$0.33	$0.14	$0.27	$0.11	$0.29	$0.10	$0.29	$0.21	$0.24	$0.10
	Reduce the travel cost compared to the car by 1%	$0.57	$0.25	$0.46	$0.21	$0.50	$0.17	$0.52	$0.35	$0.41	$0.17
	Require off-vehicle prepaid ticket	-$21.02	$10.06	-$17.00	$8.48	-$18.92	$6.87	-$18.79	$14.38	-$15.38	$6.87
	Have integrated fare availability	$19.27	-	$15.06	-	$17.21	-	$17.32	-	$13.89	-
	Reduce the waiting time if transfer by 1 minute	-	$1.73	-	$1.50	-	$1.23	-	$2.53	-	$1.19
	Have staff presence on-board	-	$13.81	-	$13.71	-	$10.21	-	$19.95	-	$9.74
	Have level boarding	$38.98	-	-	-	-	-	-	-	-	-

Table 12: Willingness to pay estimates 'Metro' model

		Australia		France		Portugal		U.K.		U.S.	
	WTP higher construction cost (AUD$m) to…	**BRT**	**LRT**	**BRT**	**LRT**	**BRT**	**LRT**	**BRT**	**LRT**	**BRT**	**LRT**
Investment Characteristics	Reduce the construction time by one year	$1.10	$3.14	$0.75	$2.26	$0.78	$2.36	$1.10	$3.00	$0.85	$2.39
	Increase the population serviced by 1%	$0.82	$1.59	$0.56	$1.15	$0.58	$1.22	$0.82	$1.50	$0.64	$1.20
	Increase the percentage right of way by 1%	$0.23	-	$0.16	-	$0.17	-	$0.23	-	$0.18	-
	Reduce the annual operating costs by one million $	-	$1.26	-	$0.90	-	$0.96	-	$1.17	-	$0.93
	Increase the operation period assured by 1 year	-	$0.58	-	$0.42	-	$0.44	-	$0.54	-	$0.44
	Decrease by 1% the risk of being closed after assured period	$0.21	-	$0.14	-	$0.15	$0.25	$0.21	-	$0.16	-
	Increase the environmental friendliness by 1% compared to car	-	$1.43	-	$1.05	-	$1.11	-	$1.35	-	$1.10
	Increase by 1% the cars switched to this mode	0.83	-	0.57	-	0.59	-	0.83	-	0.65	-
	Have a high level of business attracted to the station/stop	-	25.94	-	19.12	-	20.02	-	24.62	-	19.73
System Characteristics	Increase the service capacity by 1,000 passengers	$0.83	-	-	-	-	-	-	-	-	-
	Reduce the headway in off-peak hours by 1 minute	$0.99	-	$0.67	-	$0.69	-	$0.98	-	$0.77	-
	Increase the travel time compared to the car by 1% quicker	$0.37	$0.52	$0.25	$0.39	$0.26	$0.42	$0.37	$0.48	$0.29	$0.39
	Reduce the travel cost compared to the car by 1%	$0.34	$0.49	$0.23	$0.36	$0.24	$0.39	$0.35	$0.44	$0.27	$0.36
	Require off-vehicle prepaid ticket	-	-	-	-	-	-	-	-	-	-
	Have integrated fare availability	-	$32.86	-	-	-	-	-	-	-	-
	Reduce the waiting time if transfer by 1 minute	-	$1.45	-	$1.06	-	$1.15	-	$1.32	-	$1.05
	Have staff presence on-board	-	$23.64	-	$16.84	-	$18.91	-	$21.20	-	$17.38
	Have level boarding	-	-	-	-	-	-	-	-	-	-

Table 13: Willingness to pay estimates 'Value' model

	WTP higher construction cost (AUD$m) to…	Australia		France		Portugal		U.K.		U.S.	
		BRT	LRT	BRT	LRT	BRT	LRT	BRT	LRT	BRT	LRT
Investment Characteristics	Reduce the construction time by one year	-	$0.64	-	$0.54	-	$0.99	-	$0.58	-	$0.43
	Increase the population serviced by 1%	$0.81	-	$0.69	-	$0.91	-	$0.69	-	$0.79	-
	Increase the percentage right of way by 1%	-	$0.08	-	$0.07	-	$0.13	-	$0.08	-	$0.06
	Reduce the annual operating costs by one million $	$0.87	-	$0.81	-	$0.97	-	$0.67	-	$0.80	-
	Increase the operation period assured by 1 year	$0.33	-	$0.31	-	$0.38	-	$0.28	-	$0.32	-
	Decrease by 1% the risk of being closed after assured period	$0.09	-	$0.07	-	$0.10	-	$0.08	-	$0.08	-
	Increase the environmental friendliness by 1% compared to car	-	$0.41	-	$0.37	-	$0.66	-	$0.38	-	$0.29
	Increase by 1% the cars switched to this mode	-	0.32	1.61	0.28	-	0.50	-	0.29	-	0.21
	Have a high level of business attracted to the station/stop	-	8.60	-	7.34	-	13.36	-	7.93	-	5.80
System Characteristics	Increase the service capacity by 1,000 passengers	-	-	-	-	-	-	-	-	-	-
	Reduce the headway in off-peak hours by 1 minute	$0.75	-	$0.61	-	$0.73	-	$0.51	-	$0.66	-
	Increase the travel time compared to the car by 1% quicker	-	-	-	-	-	-	-	-	-	-
	Reduce the travel cost compared to the car by 1%	$0.27	$0.15	$0.22	$0.11	$0.26	$0.09	$0.22	$0.16	$0.26	$0.12
	Require off-vehicle prepaid ticket	-	-	-	-	-	-	-	-	-	-
	Have integrated fare availability	$7.87	-	-	-	-	-	-	-	-	-
	Reduce the waiting time if transfer by 1 minute	-	-	-	-	-	$0.70	-	-	-	$0.44
	Have staff presence on-board	-	$6.50	-	$4.41	-	$3.94	-	$6.53	-	$5.28
	Have level boarding	-	-	-	-	-	-	-	-	-	-

Table 14: Willingness to pay estimates 'Vote' model

		Australia		France		Portugal		U.K.		U.S.	
	WTP higher construction cost (AUD$m) to…	**BRT**	**LRT**	**BRT**	**LRT**	**BRT**	**LRT**	**BRT**	**LRT**	**BRT**	**LRT**
Investment Characteristics	Reduce the construction time by one year	$2.25	$1.87	$1.63	$1.28	$2.03	$1.17	$2.52	$1.87	$1.73	$1.51
	Increase the population serviced by 1%	$0.65	$1.15	$0.47	$0.79	$0.59	$0.72	$0.73	$1.14	$0.51	$0.92
	Increase the percentage right of way by 1%	$0.13	-	$0.10	-	$0.12	-	$0.15	-	$0.10	-
	Reduce the annual operating costs by one million $	$1.42	-	$1.03	-	$1.29	-	$1.61	-	$1.11	-
	Increase the operation period assured by 1 year	$0.35	-	$0.25	-	$0.32	-	$0.40	-	$0.27	-
	Decrease by 1% the risk of being closed after assured period	$0.11	-	$0.08	-	$0.10	$0.33	$0.12	-	$0.08	-
	Increase the environmental friendliness by 1% compared to car	-	$0.93	-	$0.64	$1.37	$0.59	-	$0.92	-	$0.76
	Increase by 1% the cars switched to this mode	-	-	1.92	-	-	-	-	-	-	-
	Have a high level of business attracted to the station/stop	-	11.95	-	8.39	-	7.72	-	11.93	-	9.74
System Characteristics	Increase the service capacity by 1,000 passengers	$0.68	-	-	-	-	-	-	-	-	-
	Reduce the headway in off-peak hours by 1 minute	-	-	-	-	-	-	-	-	-	-
	Increase the travel time compared to the car by 1% quicker	$0.40	$0.37	$0.27	$0.27	$0.28	$0.33	$0.39	$0.36	$0.31	$0.27
	Reduce the travel cost compared to the car by 1%	$0.39	$0.37	$0.27	$0.27	$0.27	$0.33	$0.40	$0.35	$0.30	$0.27
	Require off-vehicle prepaid ticket	-	-	-$24.93	-	-	-	-	-	-	-
	Have integrated fare availability	-	$12.78	-	$9.60	-	$11.49	-	$12.61	-	$9.54
	Reduce the waiting time if transfer by 1 minute	-	$1.31	-	$0.97	-	$1.16	-	$1.28	-	$0.96
	Have staff presence on-board	-	$19.33	-	$13.89	-	$16.62	-	$18.63	-	$14.22
	Have level boarding	$7.85	-	$5.33	-	$5.63	-	$7.94	-	$6.20	-

Table 15: Willingness to pay estimates 'Live' model

		Australia		France		Portugal		U.K.		U.S.	
	WTP higher construction cost (AUD$m) to…	**BRT**	**LRT**	**BRT**	**LRT**	**BRT**	**LRT**	**BRT**	**LRT**	**BRT**	**LRT**
Investment Characteristics	Reduce the construction time by one year	$1.39	-	$1.48	-	$1.82	-	$1.54	-	$1.36	-
	Increase the population serviced by 1%	$0.65	$1.05	$0.70	$0.60	$0.86	$0.72	$0.72	$0.79	$0.64	$0.87
	Increase the percentage right of way by 1%	$0.09	$0.25	$0.10	$0.14	$0.12	$0.17	$0.10	$0.19	$0.09	$0.21
	Reduce the annual operating costs by one million $	$0.56	-	$0.60	-	$0.75	-	$0.63	-	$0.56	-
	Increase the operation period assured by 1 year	$0.21	-	$0.23	-	$0.28	-	$0.24	-	$0.21	-
	Decrease by 1% the risk of being closed after assured period	$0.09	-	$0.09	-	$0.12	-	$0.10	-	$0.09	-
	Increase the environmental friendliness by 1% compared to car	-	$1.17	-	$0.68	$0.94	$0.81	-	$0.89	-	$0.99
	Increase by 1% the cars switched to this mode	-	-	1.39	-	-	-	-	-	-	-
	Have a high level of business attracted to the station/stop	-	23.20	-	13.61	-	16.01	-	17.76	-	19.53
System Characteristics	Increase the service capacity by 1,000 passengers	$0.70	-	-	-	-	-	-	-	-	-
	Reduce the headway in off-peak hours by 1 minute	$1.41	-	-	-	-	-	-	-	-	-
	Increase the travel time compared to the car by 1% quicker	$0.23	$0.43	$0.24	$0.30	$0.25	$0.33	$0.19	$0.45	$0.20	$0.35
	Reduce the travel cost compared to the car by 1%	$0.20	$0.39	$0.22	$0.27	$0.22	$0.29	$0.17	$0.40	$0.18	$0.31
	Require off-vehicle prepaid ticket	-	$14.28	-$23.01	$9.97	-	$10.47	-	$14.93	-	$11.10
	Have integrated fare availability	$19.68	-	-	-	-	-	-	-	-	-
	Reduce the waiting time if transfer by 1 minute	-	$3.69	-	$2.58	-	$2.74	-	$3.84	-	$2.91
	Have staff presence on-board	-	$27.93	-	$19.34	-	$20.37	-	$28.50	-	$22.20
	Have level boarding	-	-	-	-	-	-	-	-	-	-

Appendix C

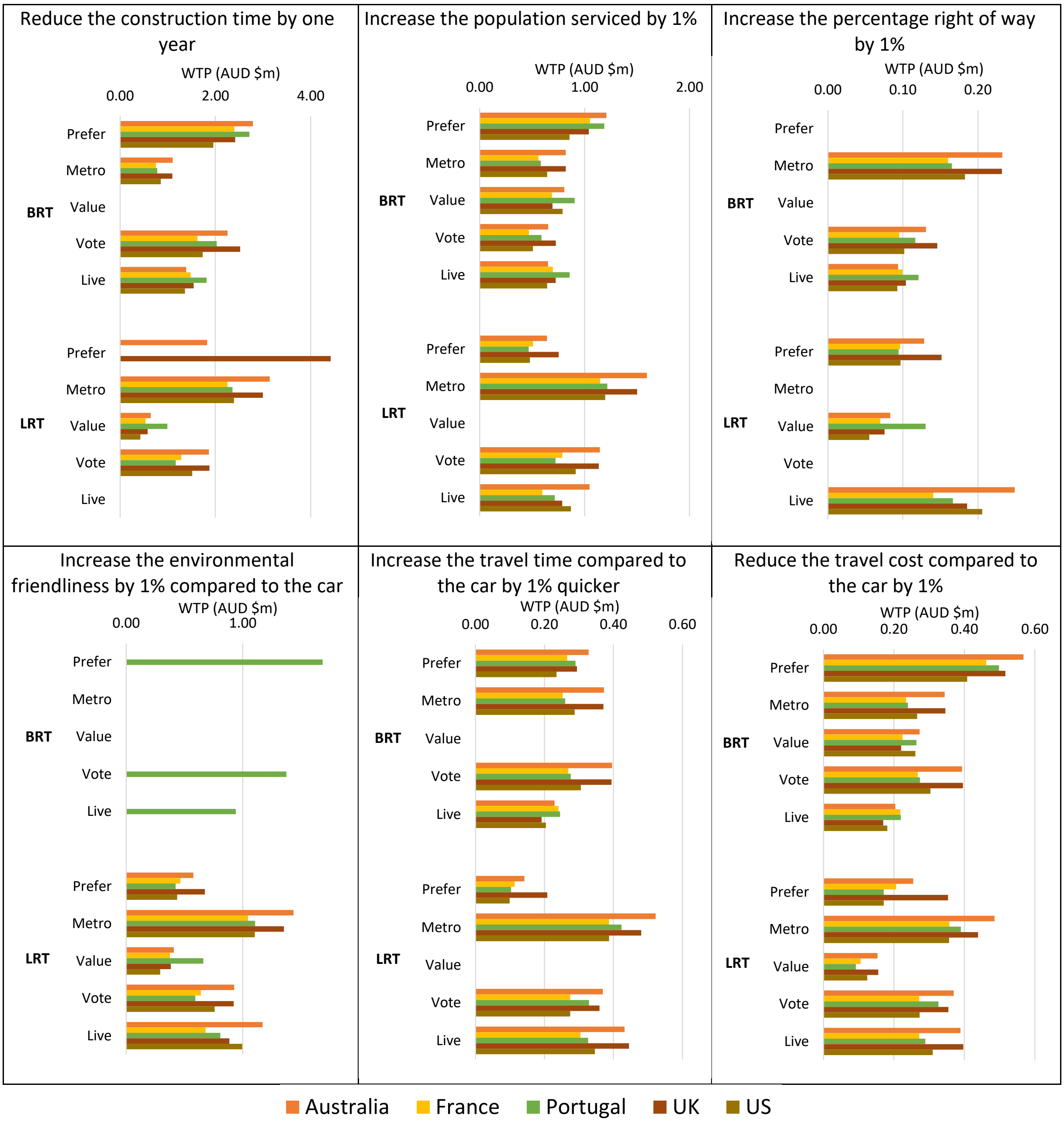

Figure 4: Graphical mean WTP comparison between countries and preference metrics