Victorian Response to Jacobs Urban Transport Consultancy Stage 2 – Final Report

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1. Introduction

Victoria acknowledges the efforts of the consultants from Jacobs and Synergies Economic Consulting in preparing the Stage 2 – Final Report to develop an alternative model that could inform future allocation of GST funds to the States and Territories in terms of urban transport recurrent and infrastructure expenses.

Victoria has examined the proposed methodology and set out responses in the sections that follow.

2. An overview of the proposed methodology

The proposed methodology by the consultants is well developed to inform GST allocation for the urban transport component, including the recurrent and infrastructure expenditure. In undertaking the report, data were collected on 101 significant urban areas (SUAs) level. An urban self-sufficiency index was developed to capture key aspects of extended labour market integration, that is to determine whether a SUA should be considered as a satellite to a capital city.

A recurrent expenditure model has been developed by the consultants to estimate the impact of factors on net per capita expenditure. The consultants estimated a number of models and selected a model which best explains the expenditure variations between SUAs, based on the selection criteria (high R^2, low information criteria, a significant overall F-statistic).

Variables representing impact factors were considered from the demand and supply of urban transport. Due to a relatively small sample of 70 observations (complete datapoints for 70 SUAs), only a limited number of variables were chosen to ensure robust results.

Variables included in the consultants' preferred model are:

- **Population-weighted density**. This is to depict demand and to capture cost, as expenditure in higher density areas may entail greater complexity with regards to infrastructure provision and network management. Although population growth is the primary driver of needs in urban transport, the consultants argue that population-weighted density is less strongly correlated with other explanatory variables, thereby mitigating the risk of multi-collinearity.
- **Distance to work**. This is to represent network complexity. Passenger kilometres are not available for most SUAs, so the average distance to work by SUA obtained from place of usual residence database (Census 2016) is used as a proxy.
- **Mean land slope** to account for topographical complexity partly reflecting cost of provision.

- **Public transport mode used by passengers.** This is to represent availability and congestion. A linear-log functional form for passenger mode numbers by train and bus are incorporated, which implies that per capita expenses increases with passenger volumes at a decreasing rate.

3. Issues

3.1 Definition of urban transport

Victoria notes that no explicit definition is given in the consultancy for urban transport, nor is there one in the 2015 Review[1]. The implicit definition, given the models specified by the consultant, is that urban transport is public transport provided for journeys wholly within a given SUA (and any satellites).

This definition has implications for modes of transport that would be expected to be found in a SUA. For heavy rail, urban transport would only be economically feasible for capital cities where there are high passenger numbers. In other SUAs, it would be expected that heavy rail would be used for transport between SUAs, ie inter-urban transport.

This suggests that there should be five observations for heavy rail (Sydney, Melbourne, Brisbane, Perth and Adelaide). However, the consultant's report states that there are 10 observations. It would be interesting to have the five non-capital city SUAs identified and an assessment made that heavy rail is providing urban transport rather than inter-urban transport. It is important that only urban transport expenses are being used in the models.

Publicly funded ferry transport would be similar to heavy rail, that is it would represent urban transport for capital city SUAs.

Light rail would be for transport wholly within SUAs, although only a handful of SUAs have light rail. Buses would be predominantly for public transport within SUAs, although there would be an inter-urban component of buses. Only expenses relating to urban transport should be considered, although it might be difficult to split the costs between urban and inter-urban bus transport.

3.2 Policy Neutrality

The consultants discussed policy neutrality in some detail in the theoretical section, but do not discuss it in the application of the regression models. The consultants have given the impression, following their comments at the Officer Working Party telepresence, that it is up to the Commission to deal with the policy neutrality issues. Victoria has some suggestions regarding policy neutrality in the next section.

[1] CGC may request data for urban transport related to all Urban Centres and Localities (UCLs) within SUAs.

3.3 Recurrent expenditure model

While Model 1 is the consultants' preferred model for explaining net expenditure per capita on urban transport, it may not be the model that best suits the Commission's purposes. As Victoria understands the Commission's intention, urban transport expenses will be assessed for all SUAs in Australia whether or not urban transport is currently provided in them. In that case the Commission would want to determine the net expense required to provide urban transport in a SUA, based on the average impact of different characteristics on net expenses as given by a regression model. However, a regression model which uses passenger numbers would not be appropriate to determine the net expense of urban transport in a SUA that does not currently have urban transport.

It is assumed that whether or not a SUA has public transport (at least for the ones with smaller populations) is a policy decision and does not reflect the inherent characteristics of the SUA. In determining how much net expenses would be required for urban transport, the existence or not of urban transport in that SUA would be irrelevant to the Commission.

3.4 Infrastructure expenditure model

The consultants argue that the operating cost will be highly correlated with investment cost, thus only one model estimating recurrent expenses is required. First, the contributors for operating cost and investment cost are different to some extent. For example, congestion is a key contributor to bus operating costs while construction cost including land value and terrain will be more important for infrastructure. Using a single expense model that accounts for all key cost factors as the sole basis of the funding allocation mechanism may not be proper, as some contributors to investment may be treated less importantly.

Moreover, while recurrent and capital expenditures may have been correlated in the past, that would have reflected a service provision that is different to what is faced now, particularly in the fast-growing capital cities.

The consultants could have devoted more effort in examining capital requirements for urban transport, as there are a number of issues not considered.

Rail (heavy and light) is the only form of transport where the infrastructure is the responsibility of the transport provider. Roads used by buses are the responsibility of the roads authorities. Road infrastructure requirements are assessed by the CGC under urban roads and not under the urban transport category. A similar situation is likely for waterways used by ferries, where the infrastructure is the responsibility of a ports authority.

Another issue which is evolving is the step change in heavy rail infrastructure required when capacity beyond a crucial point is reached, as seen in Melbourne's removal of level crossings. Other infrastructure, such as signalling, also needs to be upgraded to provide additional capacity. Extending rail lines and increasing the number of rail lines in large capital cities are extremely expensive. As the infrastructure assessment is to apply from 2020 when these infrastructure projects are in full swing, Victoria considers that it is important that they are recognised in the assessment.

3.5 Economies of Scale

The consultants have allowed for economies of scale, but they have not tested for diseconomies of scale. As larger cities need much more capital per capita to undertake the transport task, Victoria suggests that the consultants test whether diseconomies of scale exist, by adding a quadratic form.

3.6 Other comments

In the consultants preferred Model 1, many key factors are not considered due to data availability or following statistical model selection criteria. For example, employment, a key factor for the need of urban transport especially proving a robust measure of peak demand, is not included. Other demographic or socio-economic status variables such as school enrolment and SEIFA (Socio-Economic Indexes for Areas) are dropped from the model.

While the consultants undertake an assessment of their models in terms of their explanatory power and goodness of fit, they do not appear to provide the same amount of rigour to examine whether the estimated coefficients meet prior expectations.

The estimated constant term for all the models is negative. This term can be regarded as the net expenditure per capita required when there is no demand, congestion, etc. While there may not be observations for low values of these variable, it would be expected that the constant term would be positive. That is, a certain amount of expenditure is required to have an urban transport system before it starts to carry passengers. This is particularly true for capital expenditure with large sunk costs.

Model 4 estimated a negative coefficient on light rail which implies that net per capita expenses would be lower if a SUA had light rail present. As the provision of light rail would be expected to be more expensive than buses this result is counter intuitive and warrants some examination.

A sensitivity analysis is undertaken for Melbourne by adding the model with dummies that have a passenger threshold of 250. Victoria considers that Table E.10 should present the estimated results for models with and without thresholds respectively and explain its implication for Melbourne.

4. Recommendations

4.1 Model selection to keep policy neutrality

It would appear to Victoria that Model 4, which uses dummy variables for transport modes, is the model which best suits the Commission's needs.

If the decision is whether or not to provide public transport and which modes need to be provided in a SUA, a two-stage approach could be used, with the first stage being

estimating the probability, given the characteristics of SUAs that public transport would be provided.

To be able to apply Model 4 coefficients to SUAs where no public transport is currently provided, some rules would be required. It could be assumed that bus transport is provided in all SUAs. Once the population of a SUA exceeds a certain figure (say that for Newcastle-Maitland, the smallest SUA with light rail) then that SUA is assumed to require light rail. Finally, capital city SUAs are assumed to require heavy rail and ferries.

Such an approach would enable the Commission to determine net expenses in a policy neutral way based on the average of what states do.

4.2 Use stepwise regression

Victoria suggests that the choice of predictive variables should be carried out with addition to or subtraction from the set of explanatory variables step by step, based on selection criteria.

4.3 Variables

Care needs to be taken with some variables, such as SEIFA and perhaps slope, due to there being a large variation in these variables within capital city SUAs. An average value for a capital city SUA would mask the degree of variation within that SUA.

4.4 Elasticity

It may be useful to provide estimates of the elasticities, not necessarily the same as the coefficients. The log form in Model 1 only estimates “what is the unit change in net expense per capita resulting from a percentage change in bus and train passengers”. Victoria suggests that a way for elasticity estimates, is to use the log form of dependent variable.

4.5 Other impact factors

It may be worth comparing the impact of key factors on net per capita expense for different transport modes, as the transport modes vary significantly among different SUAs. Some SUAs do not have rail and others may rely more on bus. Adding dummies for the presence of transport modes (in Model 4) can only explain the area difference in net expenses but not how impact factors affect net expenses for bus, train, ferry etc. To do this, the model could add interaction terms between the existence of transport modes and other explanatory variables, or estimate expense model for each transport mode.

More factors need to be considered. The consultants argue that students do not have access to all available transport modes and the choice of public schools is mandated by school catchment areas. However, secondary school students have more freedom to choose schools and are able to travel further. Victoria suggests that secondary school enrolment or number of private school students should be considered.

Visitors and temporary residents including overseas students are one of the factors contributing to traffic burden of big cities such as Sydney and Melbourne. Victoria suggests that overseas visitors and students reflect demand for public transport and should be considered as impact factors.


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