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# H Referee reports on modelling

To improve the quality of the modelling, the Productivity Commission asked two independent experts to act as referees and provide input to the modelling process. The referees were asked to comment on the appropriateness of the assumptions and modelling techniques, and to advise on any possible improvements. Each referee provided useful insights to improve the modelling at a workshop held prior to the release of the draft report and again before the final report. In addition, each referee provided a written report on the modelling.

This appendix contains reports from Dr Peter Abelson (Managing Director of Applied Economics) and Associate Professor Joe Hirschberg (Department of Economics, University of Melbourne).

## H.1 Report from Peter Abelson

The full terms of reference for this inquiry into the revenue raising capacity of local government in Australia require the Productivity Commission to examine the capacity of various types of council to raise revenue, to explain how this capacity may change over time, to explain the impact of the various revenue sources on individuals, organisations and businesses, and to examine the impacts of State regulatory limits on revenue raising capacity.

This review focuses, as requested, on the first of these issues, namely the capacity of various types of council to raise revenue as discussed in chapters 4 and 5 and appendix C of the report.

The Productivity Commission treats this issue in two parts: the **capacity** of a local council to raise revenue, which it calls fiscal capacity, and the **willingness** of a council to raise revenue. This is an important and reasonable distinction which is followed in this review.

### Fiscal capacity in concept

The report asserts (page 52) that ‘... a comprehensive measure of the income of a person (or household or business) is the best indicator of their ability to pay taxes

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and charges ... It is a natural extension of this concept to suggest that the aggregate income of a community is an indicator of that community's ability to pay for government services.'

As the report notes (page 55): 'Ultimately, it is the incomes of individuals in local communities that constrain the choices they face between consuming public or private sector goods and services.'

This is a fundamental point of the report. It is perhaps worth noting two possible caveats on this core principle.

First, there is an assumption that local councils are not revenue constrained by limited tax instruments. For example if local councils were required to raise all their revenue by a uniform poll tax on all adults, the revenue they could raise would be severely constrained by the amount that they could levy on the lowest income individuals in the community. However there is no such constraint in Australia. Australian councils can raise as much revenue as they wish via their tax on land values. While these land values are not perfectly correlated with incomes, the tax base does not constrain the total revenue that can be raised.

Second, tax competition may constrain the amount of tax that an individual council can raise as high tax rates without a commensurate improvement in services could cause households or firms (or capital) to emigrate. However, providing higher taxes fund improved (and desired) services, they should not create emigration. In any case, tax competition does not appear to be a major constraint on raising local government revenue in Australia.

Accordingly I concur with the report, in line with a very large body of technical literature (some of which is cited in the report) that aggregate disposable community income (inclusive of local business income) is the appropriate measure of the fiscal capacity of a community.

## **Fiscal capacity measurement**

The report assesses the aggregate income in each community as the sum of after-tax personal incomes, rents from the ownership of dwellings net of expenses (including imputed rents), and the after-tax operating surpluses of local businesses pro-rated on local employment.

This represents quite a comprehensive assessment of income. The median Australian council is estimated to have a fiscal capacity of \$20,700 per person. Although these estimates do not include most welfare payments, low incomes under

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the tax threshold, and unrealised capital gains, this does not detract significantly from the results.

### **Willingness to raise local council revenue**

In 2005-06, total local government taxes were only 1.5 per cent of household disposable income in Australia. Prima facie in these circumstances it is hard to believe that there is a binding financial constraint on the ability of councils to raise more revenue. Rather councils, at least those that are not rate regulated as in New South Wales, set the tax rate so as to collect the revenue that they deem their communities are willing to pay for local public services.

However local communities have different amounts of local income and councils raise varying amounts of own revenue. These differences may be taken to imply that some councils are working harder to raise own revenue than others are. After any determining factors have been taken into account, such as differences in income, the remaining differentials between low and high revenue councils may indicate the extent to which low revenue raising councils could increase their revenues.

As described in appendix C of the report, there are three main ways of estimating these own-revenue raising differentials.

*Ordinary least squares (OLS) regression.* In this case actual own-revenue raised by councils is regressed against various determining variables. A revenue effort index is obtained by comparing the actual revenue ratio (revenue/fiscal capacity) of a council with the revenue ratio predicted by the own-revenue equation. If the revenue effort index is below one, a council is not exploiting its fiscal capacity. This method presumes that all unexplained difference is due to revenue effort.

*Data envelopment analysis (DEA).* Using DEA all councils are assumed to be able to meet the highest standards in their group of councils for each type of council (e.g. for councils in different geographical locations). Thus DEA analysis sets a higher target than the mean predicted by an OLS regression.

*Stochastic frontier analysis (SFA).* Here again actual own-revenue raised by councils is regressed against various determining variables. However SFA attempts to distinguish between the unexplained variance that is determined by unobserved variables and the random error terms. Once the former is estimated, the highest possible target is lower than in DEA, but higher than the predicted revenue equation.

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The report adopts the SFA method. This is based on the regression results described in table 5.4. This shows that own-source revenue is positively and significantly related to personal and business income per capita, to road km per person, the provision of water supply, the number of properties per person, and the population growth rate. It is negatively related to population size. Allowing for these factors, own-revenue raised is higher in urban than in rural areas. The results are all plausible and have expected signs and significance.

The report then estimates that own-source revenue raised averages about 12 per cent below the stochastic frontier for each local council (the frontier depends in each case on the characteristics of the council area). This is equivalent to about \$140 per person per annum or \$370 per household.

A difficulty with the SFA method is that the results emerge from a statistical black box. The report does not provide any evidence that can readily be used to validate the results. However the results do pass the common sense test. If all councils raised own-source revenue as vigorously as the most vigorous in their group (after allowing for all possible determining factors), a 12 per cent increase in own-revenue raised appears realistic.

## **Conclusions**

The report uses an appropriate measure of fiscal capacity. It also devotes considerable resources to estimating after-tax community incomes inclusive of business income. It is clear from these data that there is essentially no fiscal constraint on local councils.

Rather, except where there is rate regulation, the own-revenue that councils raise is essentially a political decision. Analysing these decisions, the report estimates that bringing the lower revenue-raising councils in line with the highest revenue-raising councils would increase councils' own-revenue by about 12 per cent. This conclusion appears realistic.

## **H.2 Report from Joe Hirschberg**

The majority of the literature concerning municipal government efficiency is oriented to the provision of specific services such as: rubbish collection, parks and the libraries. However this study goes beyond this traditional literature to consider the overall operation of local government. The techniques used in this analysis are current methods in the area of efficiency measurement and the cross government comparisons of revenue raising activities. To date, there are no other analyses to

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which it can be compared directly and it stands as research that could be submitted to an international journal in the field of public finance.

The premise that a national comparison of local governments can be made between different types of jurisdictions is fraught with numerous difficulties. The primary difficulty is that the local governments in Australia vary quite widely in their capacities and the demands on their services. In order to make inter-council comparisons it is necessary to account for these differences so that the comparisons do not merely reveal the systematic variations as one find between the bush and the capital city and between the councils that can draw on a wealthy population and a strong business base and those that cannot. The basic method applied in the wide literature that accomplishes such comparison is the use of conditioned averages which are available via use of regression techniques.

In the interpretation of the results of regression techniques one must keep in mind the old adage — GIGO (garbage in garbage out). Thus no matter how sophisticated the methods used for analysis, the quality of the data used is elemental to the quality of the conclusions drawn from the results. In this case the Commission researchers have compiled a unique data series that combines information from a number of sources.

Once a sufficient data series are assembled the application of regression methods requires a number of modelling decisions. The decision to use the log of revenue raised per capita as the measure of revenue raising capacity is based on a desire to use a single measure to facilitate interpretation.

The choice of conditioning information is driven, in part, by what information is available and their relationship to the log of revenue per capita. Given the differences between the States and Territories and the differences between the classes of urban and rural councils, it is reasonable to allow the mean log revenue raised per capita to vary by state and city type. Although, this means that it is more difficult to establish whether certain characteristics of these councils, that only vary by state and council type have an influence on the revenue raising process, can be discovered. The additional information as to the kilometres of roads per capita, properties per capita, the log of total population of the council, and whether the council is also responsible for local water supply are all factors that will influence the level of services required by the residents of the particular council and thus indirectly influence the revenue raised. Other characteristics of the council areas could have been included and it appears that a detailed 'specification search' was conducted in which only a subset of potential variables were used. Some attempt should be made to include some results of these alternative models so that the reader could satisfy their curiosity as to whether other characteristics are of value or not in the results that are given in the body of the report. In particular, the inclusion

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of demographic variables as well as growth values of income, the proportion of the population employed full time, and the average vintage of the housing would be of interest.

In addition to the physical characteristics of the community the two other regressors are the log of personal income per capita and the log of business income per capita. It is most crucial that these two factors be included in the model separately because the estimates of these incomes are generated using different sources.

A characteristic of the regression estimated is the linear nature of the relationship between the log revenue per capita and all the regressors. By taking the logs of the values used in this analysis the variability of these values is reduced. However, there is a significant literature on the question of economies of scale in the production of specific municipal services. A recurring question in regard to Australian local governments is whether councils are of sufficient size to achieve economies of scale. An answer to this question in regard to the revenue raising process could be found if the impact of size was allowed to vary within the specification chosen.

The estimation methodology employed in this study is referred to as stochastic frontier analysis (SFA). This class of models has the ability to model not only the conditioned mean of the dependent variable (here log of revenue per capita) but it also allows the distribution of the dependent variable to be asymmetric. This generalization allows the computation of the degree to which each council is off the most productive frontier. The main alternative technique for the estimation of efficiency measures is the data envelopment analysis (DEA). DEA would provide similar results however frontier of efficiency would be determined by only a few councils instead of the entire set of councils. In other words, if only 5 councils were on this frontier all the other council's data will have no influence on the location of the frontier. In contrast the SFA will use all the information in the data to construct the frontier. In the current application SFA has the advantage that it can accommodate the presence of outliers in the data caused by the highly variable quality of the data and the large variation in the size of the councils included together. In addition, this method allows the researchers to include auxiliary variables to explain the general accuracy of the model (the symmetric component of the errors) and the efficiency of each council (the asymmetric component of the errors).

Aside from the concern that this analysis does not account for the measurement of the presence of economies of scale, another area where this analysis would benefit is from the possible inclusion of the location of the councils with respect to each other. Other than the possibility that the errors by council are not independent of each other (that they are subject to spatial autocorrelation), there is also the

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possibility of the presence of spill-over effects that may influence the demand for services by adjacent councils since for the most part many services are not excluded to residents of adjacent councils — it would be of interest to determine if such ‘free riding’ does occur.

In conclusion, this report represents an application of a number of methods to a unique data series. The methodology applied is sound and demonstrates the ability to adapt a model first used for international comparisons to a national study and to improve upon that analysis by modelling the revenue raising by utilizing an efficiency framework that accounts for the difficulties encountered in the data.