AN EMPIRICAL EVALUATION OF THE RELATIVE EFFICIENCY OF *ROADS TO RECOVERY* EXPENDITURE IN NEW SOUTH WALES LOCAL GOVERNMENT, 2005/06

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ABSTRACT: The Roads to Recovery local roads infrastructure funding program represents the most important Commonwealth local government finance initiative in the history of Australian fiscal federalism, not only because of its sheer size, but also because it funds individual local councils directly, thereby bypassing state and territory governments. Despite its significance, almost no scholarly attention has been directed at critically examining the operation of the program. In order to address this unfortunate neglect, this paper attempts to evaluate the relative efficiency of individual council expenditure under the Roads to Recovery program for New South Wales local government in the financial year 2005/06. Our results show that only a comparatively small proportion of councils expended funds relatively efficiently.

1. INTRODUCTION

Local government plays a vital role in contemporary Australian life by providing essential local services to almost all Australians. While its functions are limited compared with many other local government systems in other advanced countries, over the past several decades Australian local government has significantly expanded its range of activities from an historical emphasis on 'services to property' to a more recent 'services to people' focus (Dollery, Wallis and Allan, 2006). However, this evolution of responsibilities has occurred at the expense of traditional service provision, with local government diverting funds from infrastructure spending to finance its growing range of 'human services'. Escalating financial pressure and limited spending on local assets has resulted in an 'infrastructure crisis', particularly in the area of local roads maintenance and renewal (Dollery, Byrnes and Crase, 2007a).

In an effort to address this financial crisis, the Commonwealth government has provided funds directly to local councils, particularly through the Roads to Recovery (R2R) program. This initiative was first established as a response to the deterioration of many local roads, with renewal far beyond the financial capability of many local authorities (Dollery, Pape and Byrnes, 2006). Despite

the program's sheer scale, its sizeable impact on local government and its landmark distribution process, there has been almost no academic attention devoted towards an evaluation of the program, with a few notable exceptions. While the program appears to have ameliorated the financial pressures faced by local government, the extent of its effectiveness in economic terms is as yet unknown.

The present paper seeks to at least begin to remedy this neglect by examining the relative efficiency with which R2R funds have been expended amongst a limited sample of local authorities. It should be stressed that data inadequacies and other unavoidable factors necessarily mean that our empirical analysis should be seen as an initial first tentative step to a more thorough examination of the R2R program. With these caveats in mind, we thus examined expenditure of R2R funding by local councils in New South Wales during the fiscal year 2005/06, employing the relative efficiency technique known as Data Envelopment Analysis (DEA).

The paper itself consists of five main parts. A synoptic review of the R2R program is provided in section 2, while the relevant extant empirical literature is briefly summarised in section 3. Methodological considerations are addressed in section 4. The results obtained are presented in section 5. T he paper ends with some brief concluding remarks on the implications of this analysis in section 6.

2. AUSTRALIAN LOCAL GOVERNMENT AND THE *ROADS TO RECOVERY* PROGRAM

Local government is both dynamic and diverse, with characteristics like demographic composition, population, spatial area, and typography varying widely not only within given state local government jurisdictions, but also across Australia itself (Worthington and Dollery, 2001). While local government traditionally focused exclusively on 'services to property', caricatured in the phrase 'roads, rates and rubbish', several factors have led to a marked expansion in the responsibilities assumed by local government, most of which were forced on councils by higher tiers of government, but some of which have been self-inflicted (Dollery, Wallis and Allan, 2006). These additional responsibilities have obliged councils to channel expenditure away from traditional services, such as roads, in order to offer more extensive 'human services'. Furthermore, this has occurred at a time when local government is facing diminishing funding from state and federal governments, coupled with an already low revenue base. Moreover, local government's financial situation has been further compounded with the emergence of an infrastructure and asset crisis due a deficiency in expenditure on maintenance and renewal (Dollery, Byrnes and Crase, 2007b). In response, the Commonwealth government has initiated the *Roads to Recovery* funding in order to address the specific deficiency in local road funding.

Of all the infrastructure responsibilities of local government, the maintenance of local roads is one of its most capital-intensive activities. Much local government infrastructure consists of local and regional roads. The Australian local road network is estimated to be worth almost $80 billion and accounts for approximately 20 percent of aggregate local government expenditure

(Department of Transport and Regional Services 'DOTARS' 2006a, p. 78). While many local authorities receive annual grants from their respective state governments, PricewaterhouseCoopers ('PwC' 2006, p. 70) has observed that state funding has been rendered inadequate due to rising input costs, with roads needing more costly resurfacing in particular.

In addition, according to the Independent Inquiry into Local Government or 'Allan Report' (LGI, 2006, p. 14) many locally-managed roads are now reaching or have reached the end of their useful economic life. A large number of local authorities have neglected the need for infrastructure renewal, instead using scarce funds to finance their ever-increasing range of human services. Most local government assets, like roads, drainage and public buildings, were originally financed by higher tiers of government. However, with many of these assets over a century old and in dire need of upgrading or even replacement, local governments now face the massive financial responsibility of major infrastructure renewal. In this regard, the Allan Report (LGI, 2006, p. 115) has argued that 'current revenue mechanisms available to local government were not designed to meet the financial burden of "second generation" infrastructure renewal.' In addition, local government's expansion into new fields and the undertaking of a wider range of responsibilities, especially the shift in service provision from a focus on 'services to property' to an emphasis on 'services to people' has also caused an expansion of councils' asset base, contributing to the heightened financial pressures experienced by local government (LGI 2006, p. 115).

Approximately 80 percent of Australia's public road network (or 649,000 km) is classified as 'local' and administered by local government (DOTARS 2006a, p. 78). According to DOTARS (2006a, p. 78), 'local roads are important to national transport safety, efficiency and overall economic performance' since 'they provide basic access from farms, factories and homes to schools, hospitals, work, shopping and to families and friends'. In particular, the mining, grain, horticulture and plantation industries are heavily dependent on local roads. Hence, the continued deterioration of local roads will adversely affect the efficiency and cost of transport, both locally and throughout Australia (DOTARS 2006a, p. 78).

The Australian Local Government Association (ALGA) realised that a deficiency existed in the level of road funding needed to maintain an adequate level of service and thus began holding an annual road congress commencing in March 2000. In response to the concerns raised at the inaugural national roads congress, the (then) Commonwealth government announced a new road expenditure plan known as *Roads to Recovery* in November 2000. The Commonwealth government decided that the *Roads to Recovery* Program should operate under simple administrative arrangements in order that councils minimise administrative costs and devote funding to road works. Moreover, by allowing local decision making, a flexible system was ensured with local councils prioritising projects according to their own circumstances (DOTARS 2006b, p. 9). Although the Commonwealth government has previously provided funding to local government, particularly through Financial Assistance Grants

(FAGs), the *Roads to Recovery* Program is unique because grants are provided directly to local authorities from the federal government, thereby bypassing state and territory governments (Dollery, Pape and Byrnes, 2006, p. 4-5).

3. EMPIRICAL ANALYSIS OF LOCAL GOVERNMENT SERVICE PROVISION

Whilst efficiency analysis within the private sector and the broader public sector has been widespread, it is only comparatively recently that efficiency measurement techniques have been utilised in the local public sector. In particular, Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA) have emerged as two popular techniques for estimating the efficiency of local government in the provision of local public services (see, for instance, Dollery, Crase and Johnson (2006), Dollery and Wallis (2001) and Worthington and Dollery (2000a; 2000b) for surveys of this empirical literature).

Several international studies have been undertaken on the analysis of the efficiency of road maintenance programs. For example, Rouse, Putterill and Ryan (1997) used DEA to examine the efficiency of highway maintenance performed by New Zealand local authorities and expanded on earlier work in this area by incorporating quality measures.[1] T his study provided initial insight into local authority efficiency by partitioning measures across efficiency, effectiveness and economy. However, another study by Rouse and Putterill (2005) demonstrated much more substantive evidence of significant scale economies in pre-amalgamation New Zealand local government. Nevertheless, the authors conceded that diseconomies of scale could not be solely attributed to the earlier 'fragmentation' of New Zealand local government into many more local authorities.

In an analogous exercise, Deller and a number of collaborators (Deller and Nelson (1991); Deller (1992), Deller, Nelson and Walzer (1992) and Deller and Halstead (1994)) employed both DEA and SFA to investigate the relative efficiency of municipal road services in various American states. Both production and cost frontiers were estimated and a number of quality-adjusted outputs were modelled. While initially this work supported the proposition that scale economies existed in local government, with increases in jurisdictional size leading to a rise in efficiency (see, for instance, Deller and Nelson, 1991), later studies implied that managerial inefficiencies may be incorrectly attributed to size economies and that consolidation may in fact be inappropriate.

DEA and SFA techniques have also been applied in the context of Australian local government, with this literature critically examined in detail by Dollery, Crase and Johnson (2006), Dollery and Wallis (2001), as well as Worthington and Dollery (2000a; 2000b). However, at the time of writing these techniques

[1] Quality was estimated via the 'roughness's of highways' and 'general maintenance expenditure'. Since general maintenance incorporated a variety of outputs, an index of surface defects was also employed, which calculated the dollar amount per metre of general maintenance expenditure required to rectify surface defects.

have not been applied to Australian road maintenance and road renewal. Furthermore, despite the sizeable investment made by the *Roads to Recovery* program, Dollery, Pape and Byrnes (2006) contend that very little academic attention has been devoted towards an evaluation of the program. Thus, this study aims to at least partly remedy this negligence and contribute to the modest base of Australian research into local public sector efficiency analysis.

4. MEASURING THE TECHNICAL EFFICIENCY OF *ROADS TO RECOVERY*

In economic analysis, technical efficiency or productive efficiency refers to the how much output is produced from a defined quantity of input factors. Technical efficiency should be contrasted with allocative efficiency which refers to how input factors are allocated between the production of alternative types of output. Relative measures of technical efficiency shed light on the comparative performance of different councils rather than their absolute levels of technical efficiency. Relative efficiency can be affected by many variables, including scale. Thus large-scale production may be characterised by economies of scale (i.e. the greater the level of output, the higher the level of technical efficiency).

DEA has been chosen for this analysis for three main reasons. First, DEA has previously been used to examine highway maintenance by Rouse, Putterill and Ryan (1997) and Rouse and Putterill (2005) for New Zealand local authorities and by Cook, Kazakov and Roll (1993) to investigate the efficiency of highway maintenance patrols in Ontario. Second, DEA easily accommodates multiple inputs and outputs. Third, DEA is non-parametric, allowing the data itself to construct the production frontier. Consequently, unlike SFA, it is not necessary to make assumptions regarding the form of the production frontier. However, since DEA is entirely deterministic, the model does not account for external influences and statistical noise, necessitating a second step in the analysis to account for those effects.

DEA models can be input or output-oriented. An input-oriented approach aims to minimise input use, while leaving output constant, while an output-oriented model suggests that the organisation aims to maximise outputs, given a fixed quantity of inputs (Coelli et al. 2005, p. 54). In the case of *Roads to Recovery*, since the life-time allocation of *Roads to Recovery* funding for local councils (the input) is fixed, we argue the model should be output-oriented. Figure 1 illustrates technical and allocative efficiency in an output-oriented context. Two outputs q_1 and q_2 are produced, using one input x_1. Assuming constant returns to scale, the curve *ZZ'* represents an organisation's production possibilities curve, with point *A* indicating an inefficient organisation.

The Farrell (1957) measure of output-oriented technical (in)efficiency (TE) can be calculated by the ratio:

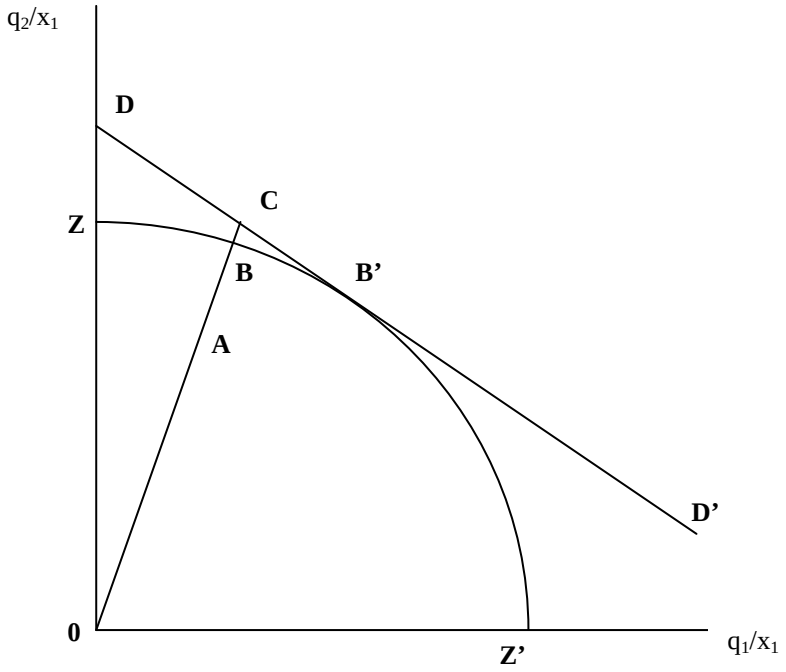
$$TE = OA/OB = d_o(x,q)$$

where $d_o(x,q)$ is an output distance function with input matrix x and output matrix q. The distance *AB* represents technical inefficiency or the amount by which outputs could be increased without requiring extra input. If the requisite

price information is available, then an isorevenue line can be constructed, represented by *DD'*. Thus, allocative efficiency (AE) can be measured by the ratio:

$$AE = OB/OC$$

Overall economic or revenue efficiency can be calculated as the product of both technical and allocative efficiency:



Source: Coelli et al. (2005:55).

Figure 1. Output-Oriented Technical and Allocative Efficiency.

The output-oriented constant returns to scale model for *N* organisations using a vector of inputs *x* to produce a vector of outputs *y*, can be calculated by solving the following linear programming problem (Zhu 2003, p. 9):

$$\max \phi - \varepsilon\left(\sum_{i=1}^{m} s_i^- + \sum_{r=1}^{s} s_r^+\right)$$

subject to

$$\sum_{j=1}^{n} \lambda_j x_{ij} + s_i^+ = x_{io} \qquad i = 1, 2, \ldots, m;$$

$$\sum_{j=1}^{n} \lambda_j y_{rj} - s_r^+ = \phi y_{ro} \qquad r = 1, 2, \ldots, s;$$

$$\lambda_j \geq 0 \qquad j = 1, 2, \ldots, n.$$

Adding the convexity constraint $\sum_{i=1}^{n} \lambda_j = 1$ yields the variable returns to scale model.

These linear programming problems are calculated in two stages. First, relative efficiency scores are calculated by ignoring the slacks. Then ϕ^* is fixed in order to optimise the slacks.

While environmental variables can be included directly into a DEA model, this requires an assumption on whether the included variables will have a positive or negative influence. Given that this may not be readily apparent on a theoretical, empirical or practical basis, a second-stage is often undertaken on results obtained from DEA, which incorporates other explanatory variables.

Since Logit and Tobit models are specifically intended for analysis where data has been censored or truncated at a numeric value, they have often been embraced in place of ordinary least squares (OLS) regression models. However, the application of Tobit models to this task has recently faced criticism by Hoff (2007). Although arguing that Tobit is 'misspecified,' Hoff (2007) concedes that the Tobit model still provides 'sensible' results and is relatively robust in comparison to other more technically accurate techniques. Thus, Tobit will still be used for the second-stage of analysis, while being mindful of the reservations of this model.

The standard Tobit model can be specified as a latent regression of the form (Greene 2002, E21-1)

$$y_i^* = \beta' x_i + \varepsilon_i, \varepsilon \sim N[0, \sigma^2]$$

The observed dependent variable is subject to censoring such that:

$$\text{if } y_i^* \leq L_i, \text{ then } y_i = L_i \text{ (lower-tail censoring)}$$

$$\text{if } y_i^* \geq U_i, \text{ then } y_i = U_i \text{ (upper-tail censoring)}$$

In this case, the DEA scores obtained are the observed dependent variable to be regressed against a number of explanatory variables, with the upper and lower tails censored such that $L_i = 0$ and $U_i = 1$.

An Australian National Audit Office (ANAO) Report on the *R2R* program up until 30 June 2005 revealed a number of deficiencies with policy implementation. One issue related to data collection, collation and reporting by local councils. The ANAO Report suggested that this stemmed from the aim of the program to minimise the administrative burden on councils, so as to ensure that funds were not being unnecessarily diverted to administration of the program. As a result, reporting measurements were not stringently enforced or thoroughly scrutinised. Thus, while the archive data for projects completed before 30 June 2005 provided a comprehensive summary of the first instalment of the program, there are several problems with the reported information which prevent it from being used in this efficiency study.

First, a quantifying measure, like kilometres of road repaired, is not recorded.

This prevents the calculation of averages and similar magnitudes. Second, a common understanding between councils about what constituted eligible works under the *Roads to Recovery* program appeared not to exist. While the Department of Transport and Regional Services (DOTARS) (the Commonwealth government department responsible for the administration of the funding) addressed specific questions raised by councils, the *Administrative Guidelines* (which provided information on the requirements of the program) were not updated to clarify common problems. Thus, according to ANAO (2005, p. 104-5), a shared understanding between councils was often lacking. This introduced the problem of comparing 'apples with oranges' into the data set.

Third, it was common for recipient councils to incorrectly report the total estimated expenditure of a project. This was starkly apparent after a comparison of councils' estimated cost and their total allocation for the first instalment of the *Roads to Recovery* program. The results showed vast differences in the figures for several councils with numerous councils' costs well exceeding their allocations and *vice versa*. A common reason for this problem was councils failing to state if the cost of a project was to be jointly funded from another source. In addition, the structural reform of councils through amalgamation appeared to further compound the problem, with some works schedules being reported twice. For example, all the projects undertaken by the Shire of Windouran, were subsequently also reported by the Shire of Conargo, with which Windouran was amalgamated. Such inaccuracies led to disparity between the total allocation of funds between councils and the total expenditure reported.

After the ANAO (2005) audit of the first *Roads to Recovery* program, program procedures were tightened to improve reporting requirements and limit funding conditions (DOTARS 2006b, p. 19). As a result, the later *AusLink Roads to Recovery* Program has an increased emphasis on council accountability and reporting. Due to the strengthened reporting requirements, council work schedules had to provide a location for the work undertaken, including chainage and cross roads where work was to be undertaken on a section of road, a detailed description of the problem and the solution to be applied, as well as starting and completion dates and the estimated cost. The main advantage of this data set is that local councils reported both the length and width of the road to be rectified, thus providing a quantitative measure. Consequently, the data set that will be analysed in this study incorporates all *R2R* projects completed by NSW councils between 1 July 2005 and 30 June 2006.

However, despite tightened reporting requirements, there were still councils which failed to provide correct work schedules. Thus, of the 151 New South Wales councils that completed projects in 2005/06, 51 have been omitted from our analysis because the width and length of the work to be undertaken has not been provided. A further nine councils were excluded because their estimated total cost of completed projects exceeded their total funding allocation for the year. The exclusion of around one third of the total universe of New South Wales councils is most unfortunate. However, it is obviously not possible to include councils in our sample which have not provided adequate data and there was thus no alternative but to reduce the number of councils included in our

empirical analysis, despite the implications this may have for sample bias.

The appendix at the end of the paper lists the excluded councils with their respective NSW Department of Local Government classification number. Those marked with an asterisk were excluded from the analysis because of incorrect reporting, all other councils were excluded due to a lack of data.

The input employed in this study is the total allocated funding each local council received in the time period under review. *Roads to Recovery* funds are distributed according to an allocation formula based on population, road length and bridge length. In the financial year 2005/06, each local council received double their annual allocation as a consequence of the Commonwealth government providing a further $307.5 million in funding as a supplement to the *Roads to Recovery* program. The conditions attached to the Supplementary Funding were similar to that of the current AusLink program.

Output is measured by two variables. The first is area of work undertaken, measured in metres squared. Part 3.1 of the *Notes on Administration* (DOTARS 2006b, p. 7) outlines eligible projects under the *AusLink Roads to Recovery* program and states that in addition to the normal meaning, the term 'roads', according to the *AusLink Act*, includes each of the following when in association with a road:

- 'traffic signs and control equipment;
- street lighting equipment;
- vehicular ferries;
- bridges or tunnels, including pedestrian bridges or tunnels; and
- bicycle paths.'

The second output measure is the total cost of all *Roads to Recovery* Projects completed by the council. A transformation of this data series was required since we are using an output-oriented model which suggests that the firm aims to maximise outputs given a fixed quantity of inputs. However, because we assumed local councils would seek to minimise rather than maximise total cost, it was first necessary to transform the data such that when the vector is maximised within the DEA model, this will be analogous to minimising total cost. Zhu (2003, p. 106-07) provides a transformation procedure which is followed here. It is assumed that the estimated cost of all completed projects reflects the actual spending by councils on *Roads to Recovery* projects.

5. DISCUSSION OF RESULTS

Table 1 presents the summary statistics of the input and outputs included in the DEA analysis. On average a council was expected to receive $1,118,421 in total funding (including supplementary funding) during financial year 2005/06. However, there is also a large standard deviation. On average councils completed 49,365 metres squared of *Roads to Recovery* works. However, again the range and standard deviation suggest high dispersion within the data. The descriptive statistics also show that on average the estimated cost of a project was $78,189. However, due to the positive skewness score, this estimate may have been inflated by usually high values. Thus the median, which has been

calculated as $40,000, may provide a more reasonable evaluation of the representative council. The data is again highly dispersed with a wide range and a large standard deviation.

Table 1. Descriptive Statistics of Outputs and Input.

Variable	Mean	Standard Deviation	Minimum	Maximum
Funding (x_1)	1,118,421	580,210.5	125,658	3,214,616
Area (y_1)	49,365	112498.4	184	1,062,720
Total Cost (y_2)	78,189	102,677	2,900	903,727

Using the specified DEA methodology, an output-oriented model was employed to calculate the technical efficiency of New South Wales councils' use of *R2R* funding. In order to account for possible scale effects, the output-oriented model was estimated under the variable returns to scale assumption.

Four councils were considered to be 'fully' technically efficient; Burwood Council, Bankstown City Council, Snowy River Shire Council and Walgett Shire Council. In contrast to these 'best-performing' councils, three councils performed relatively poorly, obtaining efficiency scores of less than 0.2. These were Lake Macquarie City Council (0.1420), Inverell Shire Council (0.1661) and Wagga Wagga City Council (0.1885). In theoretical terms, this implies that these latter councils could increase output by at least 81 percent while leaving input constant. More generally, the results reported in Table 2 indicate that the average technical efficiency of councils was 0.75, implying that the average council could have increased its output by 25 percent, with the given level of input. However, while this interpretation is conventionally correct, the composite nature of the outputs makes direct interpretation difficult. Furthermore, some councils may appear more inefficient than they actually are since data availability has restricted the projects to be included in the analysis. Consequently, some local authorities may still have projects yet to be completed and thus may attain lower efficiency scores.

Table 2. Descriptive Statistics of Councils' Technical Efficiency.

Mean	0.7479
Median	0.7991
Standard Deviation	0.2110
Minimum	0.1420
Maximum	1.0000

The distribution of relative efficiency scores is presented in Figure 2. Over 25 per cent of councils in the sample were either technically efficient or close to technically efficient. In contrast, less than 5 percent of councils obtained a technical efficiency score of 0.2 or lower. Thus, Figure 2 suggests that most local authorities would not need to increase their output levels by a substantial amount in order to become technically efficient. Based on this evidence, the use

of *R2R* funding by local councils appears to have been relatively efficient.

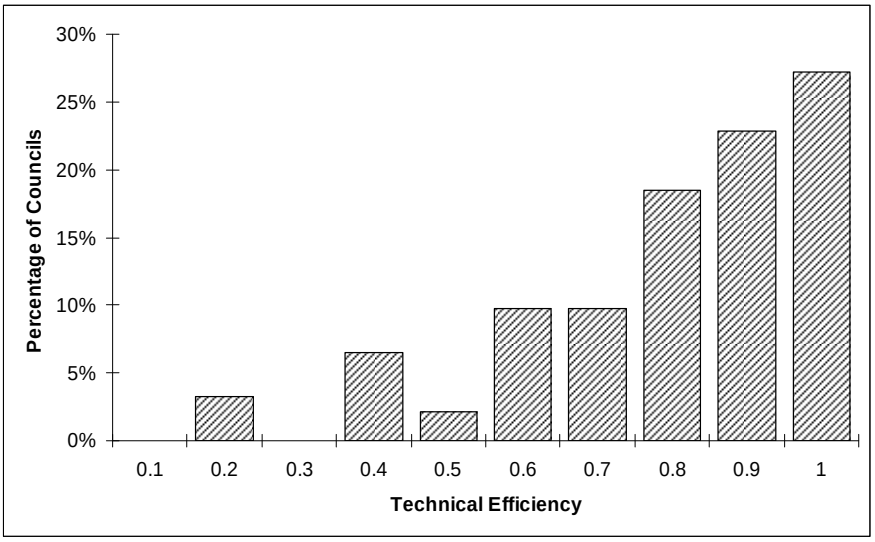


Figure 2. Distribution of Local Councils' Technical Efficiencies.

In order to test if there was a significant difference in the relative efficiency between urban and rural councils a Wilcoxon Rank Sum Test was performed, following Levine et al. (1999, p. 402-04). Two alternative hypotheses were proposed:

$H_o : M_1 = M_2$ (No difference in medians of urban and rural councils)

$H_1 : M_1 \neq M_2$ (Medians were different)

The test statistic T_1 is normally distributed with a mean of:

$$\mu_{T_1} = \frac{n_1(n+1)}{2}$$

and standard deviation of T_{test} equal to:

$$\sigma_{T_1} = \sqrt{\frac{n_1 n_2 (n+1)}{12}}$$

Thus, the standardized Z test statistic is given by:

$$Z = \frac{T_1 - \mu_{T_1}}{\sigma_{T_1}}$$

The results of the Wilcoxon Rank Sum test are presented in Table 3. At the 0.05 level of significance, the results indicate that the null hypothesis should not

be rejected. Thus, there is no significant difference between the median technical efficiencies of the two council types. This result suggests that councils in rural and regional New South Wales were equally efficient on average at administering *R2R* funds.

Table 3. Wilcoxon Rank Sum Test Results.

Rural Sample	
Sample Size	43
Sum of Ranks	2058
Urban Sample	
Sample Size	49
Sum of Ranks	2220
Intermediate Calculations	
Total Sample Size n	92
*T*1 Test Statistic	2058
*T*1 Mean	1999.50
Standard Error of *T*1	127.79
Z Test Statistic	0.4578
Two-Tailed Test	
Lower Critical Value	-1.9600
Upper Critical Value	1.9600
p-value	0.6471

In order to measure the extent to which the calculated DEA scores were a function of so-called 'external' variables, a second stage Tobit analysis of the DEA results was undertaken, the results of which are reported below.

While council type is an important consideration, there are also other exogenous factors that may have influenced the technical efficiency of local authorities. This study has identified two other variables which may potentially have an impact on technical efficiency. These are:

- The type of work – condensed into four main categories (general maintenance, major works, bridges and other);
- Local council area – measured in kilometres squared.

The 'general maintenance' category contains works such as sheeting, re-sheeting, resealing and similar common works. 'Major construction' consists of rehabilitation, reconstruction, widening and construction of new roads. 'Bridges' incorporates bridge and causeway work, while 'other' includes traffic improvement, drainage, bicycle and footpaths, planning and all other work.

For the purpose of the Tobit analysis, dummy variables were employed for the work categories to further avoid the problem of collinearity. Since 'major construction' was the most popular work category and performed by 70 percent of councils, this category was excluded to act as the 'base'. Area was kilometres

squared, while council type would also be included as a dummy variable, where 0 indicated urban councils, which were treated as the base. Table 4 summarises the Tobit results.

Table 4. Tobit Coefficient Estimates.

	Coefficient	Standard Error	Probability
Constant	0.7294	0.0344	0.0000
General Works	0.0152	0.0482	0.7517
Bridges	0.2086	0.0471	0.0000
Other	-0.0438	0.2914	0.8805
Area	-2.64E06	2.6E06	0.3098
Rural	0.0545	0.0471	0.2475

From Table 4 it can be seen that when 'major construction' is performed in conjunction with either 'bridges' or 'general works,' technical efficiency is expected to increase. One potential reason for this increase in technical efficiency could be due to the presence of economies of scope. On the other hand, if a council undertakes 'major construction' and 'other' works, technical efficiency is expected to decrease. The results also suggest a negative relationship between technical efficiency and council spatial area; although the magnitude of the coefficient draws into question the economic significance of this result.

An unexpected result relates to council location. If a council is rural as opposed to urban, technical efficiency is expected to increase. This result was unanticipated because rural councils are often perceived as being financially disadvantaged, less 'sustainable' and less administratively and technically proficient than urban local authorities. However, a major concern with these results is that only 'bridges' was considered to be significant at the 0.05 level. Given that there does not seem to be a problem with collinearity or multicollinearity between the variables, it is inferred that this insignificance is attributable to model misspecification or data problems.

Table 5. Tobit Coefficient Estimates Excluding Council Type.

	Coefficient	**Standard Error**	**Probability**
Constant	0.75	0.03	0.00
General Works	0.02	0.05	0.64
Bridges	0.22	0.04	0.00
Other	-0.04	0.31	0.90
Area	0.00	0.00	0.68

Consequently, given that the Wilcoxon Rank Sum test concluded that there was no difference in the median technical efficiencies of urban and rural councils and that the initial Tobit estimation found that council type was an insignificant

variable, the Tobit estimation was repeated, with the dummy variable for rural councils removed from the model to determine if this substantially changes the obtained results. The new calculated coefficients are presented in Table 5 where it can be seen that 'bridges' is still the only significant variable. Generally there has been little other change in the variables. Our model still predicted that if 'major works' is performed along with 'general works' or 'bridges,' technical efficiency will increase. As computed in the first Tobit model, the spatial area of a council will have a negative impact on technical efficiency, in common with local authorities performing 'other' works.

6. CONCLUDING REMARKS

The *Roads to Recovery* program has heralded a new dawn in Australian fiscal federalism since the program circumvents the traditional grants allocation process by bypassing state and territory governments and provides funding direct from the federal government to local government authorities. Moreover, the *Roads to Recovery* program also represents a substantial investment in the local government sector at a time of dire financial need in order to address the 'infrastructure crisis' facing the lowest tier of government. Despite the significance of the *Roads to Recovery* program, not only in terms of the novel manner in which it allocates funds, but also its sheer size, the program has received scant attention in the academic literature. Moreover, examination of the scheme by responsible government agencies has been minimal. A prior cost benefit study by DOTARS/ALGA (2003) has been criticised by ANAO (2005) as not being representative of local authorities as a whole and accordingly ANAO (2005, p. 65) has concluded that the results of the analysis should be used cautiously. To address this deficiency in the literature, this study has attempted to assess how efficiently local government in NSW has used *Roads to Recovery* funding.

Our empirical analysis has focused on local councils which had completed projects during the financial year 2005/06. It was necessary to only include projects that had already been completed so that the final figures would be actual values rather than merely estimates. Furthermore, it was not possible to analyse projects completed prior to July 2005, due to the serious data problems discussed earlier, primarily the absence of a quantitative measure. Moreover, because the *AusLink Roads to Recovery* Program is still in its infancy, it was not possible to make comparisons between council efficiency from one year to another. Thus, it was not possible to analyse efficiency of councils over time. Accordingly, one area of further research could be the analysis of council efficiency over time. However, this line of inquiry would perforce need to be delayed since the next instalment of the program will only be completed by the end of 2008/09 financial year. In addition, a more robust second-stage of analysis could be undertaken to determine the relevant factors affecting how efficiently councils use *Roads to Recovery* funding. However, a major impediment to the incorporation of explanatory variables in this study was the availability of data. As such, the exogenous variables included in this preliminary attempt were severely limited by data considerations. An important issue for all further research will be

improvement in the quality and quantity of available data, particularly on local roads and the *Roads to Recovery* program itself.

Our DEA analysis demonstrated that approximately only a quarter of the sample local authorities were technically efficient or close to being technically efficient. On average, councils needed to increase their outputs by at least 25 per cent in order to become technically efficient. Thus, our study provides preliminary evidence that many municipalities have not been using funds efficiently. This is obviously a serious concern from the perspective of public policy.

Although an attempt was also made in this study to try and determine the factors which influence technical efficiency, the results were inconclusive. Thus, the second-stage of analysis will need to be further developed before more definite conclusions can be drawn. The tentative results from the Tobit estimation implied that the model will need to be further developed before it can be conclusively determined which variables influence the technical efficiency of councils. As we have seen, the various exogenous variables employed were included largely due to data availability. In spite of this, only 'bridges' was a found to be a significant explanatory variable. The results obtained indicate that specification error or insufficient data have produced weak results.

This study has highlighted the urgent need for a substantial improvement in the way in which the *Roads to Recovery* program is administered. While the technical efficiency scores obtained for each local council may not be robust, they nonetheless do infer that councils have been generally using the funds inefficiently. In undertaking the analysis, several problems were encountered with data. Limited data has also been a concern in the area of local roads and was also acknowledged by the Commonwealth Grants Commission (2006) which argued that unreliable and inconsistent data impeded its review. In undertaking this efficiency analysis, inadequate and incomplete data has also restricted the scope of this study. Despite these caveats, our study has revealed that in spite of efforts to improve the management of the *AusLink Roads to Recovery* Program there are still shortcomings in the administration of the program.

This tentative conclusion has important implications for federal government policy making. While there is little doubt that the *Roads to Recovery* program has alleviated the financial crisis in Australian local government and thereby contributed to an amelioration of the deterioration of local infrastructure, it appears that scarce funds have been used in a sub-optimal manner and have not maximised their potentially benevolent impact. Commonwealth government policy makers should thus seek to improve the operation of the *Roads to Recovery* program.

ACKNOWLEDGMENTS

The authors would like to thank two anonymous referees for helpful comments on an earlier draft of the paper. Brian Dollery would like to express his gratitude to Professor Okado, Dean of the Faculty of Economics at Yokohama National University, as well as Professor Alec McAulay, Professor

Uemura, and Professor Craig Parsons of the Faculty of Economics Visiting Professor Committee, for their kind hospitality during his period as Visiting Foreign Researcher in the International Graduate School of the Social Sciences in Yokohama in June, 2009.

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APPENDIX : LIST OF EXCLUDED COUNCILS

Council	DLG Group Number	Council	DLG Group Number
Hunters Hill Council	2	Blue Mountains City Council*	7
Kogarah Municipal Council*	2	Liverpool City	7
Manly Council*	2	Bogan Shire Council	9
Mosman Municipal Council	2	Bombala Council	9
Strathfield Municipal	2	Brewarrina Shire	9
Waverley	2	Central Darling Shire	9
Willoughby City Council*	2	Gilgandra Shire Council	9
Canterbury City	3	Harden Shire	9
Ku-ring-gai Council*	3	Murrumbidgee Shire Council*	9
Marrickville Council*	3	Tamworth Regional	9
Randwick City	3	Walcha	9
Byron Shire Council	4	Warren Shire	9
Cessnock City Council	4	Bland Shire	10
Clarence Valley Council	4	Cooma-Monaro Shire Council	10
Coffs Harbour City Council	4	Cootamundra Shire	10
Deniliquin Council	4	Dungog Shire Council	10
Eurobodalla Shire Council	4	Glen Innes Severn	10
Goulburn Mulwarree Council	4	Lachlan Shire	10
Greater Taree City	4	Lockhart Shire	10
Griffith City	4	Narrandera Shire	10
Kiama Municipal Council	4	Temora Shire	10
Maitland City	4	Tenterfield Shire Council*	10
Mid-Western Regional Council	4	Wellington	10
Orange City Council*	4	Cabonne Council	11
Parramatta City Council	4	Greater Hume Shire	11
Port Stephens	4	Gunnedah Shire Council	11
Queanbeyan City Council	4	Nambucca Shire Council	11
Shoalhaven City	5	Upper Hunter Shire Council	11
Camden Council	6	Warrumbungle Shire Council	11
Baulkum Hills	7	Wentworth Shire	11