Municipal tax restrictions and economic efficiency: an analysis of Australian local councils

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ABSTRACT
This paper analyses the impact of rate capping policy on local council efficiency. It also examines a set of exogenous factors associated with local government efficiency. A semi-parametric framework based on data envelopment analysis is applied to construct an efficient frontier for Victorian local governments. Findings indicate that rate capping policy had no significant effect on the overall economic efficiency of Victorian local governments. Furthermore, the policy appears to have an adverse effect on the efficiency of metropolitan councils during the study period. The heterogeneity of local governments needs to be considered when setting rate caps.

KEYWORDS
municipal performance; data envelopment analysis; double-bootstrap; rate capping; municipal tax

INTRODUCTION
The notion that public sector organizations are inherently inefficient was a critical force driving the emergence of the new public management (NPM) reforms in the 1980s. To reconfigure the state governance along more cost-efficient lines, NPM protagonists recommended that the public sector be opened up to greater private sector influence (Hood, 1991, 1995). Subsequently, many developed countries across the world adopted NPM reforms. These changes and reforms are designed to achieve greater efficiency and to encourage the adoption of new processes and technologies. Economic regulation, through imposing restrictions on municipal taxation or rate capping,\textsuperscript{1} is one of the policy levers that higher levels of governments use to enhance efficiency in local councils. Past studies have attempted to bring forth and connect insights across economic and political spheres in a systematic manner to understand municipal taxation (Afonso & Fernandes, 2006; Charlot et al., 2015; Foreman-Peck & Zhou, 2020; Guillamón & Cuadrado-Ballesteros, 2021; Rutherford & Tormá, 2010). Many European countries, including Germany, Greece, Denmark, Sweden and Austria, have implemented fiscal cooperation on municipal taxation to reduce tax competition (Charlot et al., 2015). The United States has widespread restrictions on municipal tax rates (Anderson, 2006). Despite its importance, the effect of rate capping policy on the efficiency of local government has received less attention in the literature.

Rate capping is not new and has been implemented in many developed countries to regulate local governments. The rate capping policy affects three distinctive areas of local government: (1) the local government revenue, (2) cost shifting or property tax revenue offsets by increasing other revenue streams and (3) changes to input mix of the local government service provision (Kitchen et al., 2019a). The US and Canadian experiences reveal that imposing restrictions on property taxes has reduced the local government revenue (Clemens et al., 2003) and created a greater reliance on user fees and charges (Kitchen et al., 2019a). However, the effect of tax restrictions on local government input mix changes, which is the core subject of this paper, are inconclusive. Some studies found that local governments respond to rate capping by a proportionate reduction in their administrative costs, while other studies found a proportionate reduction to their service costs (Kitchen et al., 2019a).

Economic regulation of local government generally involves two main objectives. First, in terms of economic efficiency, optimal regulation should strive to achieve (1) allocative efficiency, where local community preferences

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\textsuperscript{1}Supplemental data for this article can be accessed at https://doi.org/10.1080/00343404.2022.2030054.
should be reflected in the range of local services; and (2) productive efficiency, where local services should be delivered at least-cost (Drew & Dollery, 2015). Second, regulation should address equity objectives to ensure essential local services are provided to all households at reasonable prices. However, there is no clear evidence that rate capping is the best possible way to achieve these economic goals or about the impact of rate capping on the performance of local governments (Productivity Commission, 2017).

This paper focuses on the effect of rate capping on local government efficiency in Australia. Many empirical studies have focused on assessing the efficiency of local governments from multiple points of view and contexts (Benito-Lopez et al., 2011, 2015; Fogarty & Mugera, 2013; Worthington & Dollery, 2000, 2001). For example, Guillamón and Cuadrado-Ballesteros (2021) found that increased transparency enhances economic efficiency in Spanish municipalities. In an Australian study, Drew and Dollery (2015) found that rate capping in New South Wales (NSW) local councils did not increase municipal/local council efficiency. The authors also drew a similar conclusion on another comparative study between NSW and South Australia (Dollery & McQuestin, 2017). Drew and Dollery (2015) is the only study that directly addressed the Victorian local government rate capping policy. However, it was an ex-ante evaluation prior to the introduction of the rate capping policy in Victoria.

Accordingly, this paper will analyse the impact of rate capping on the efficiency of the local councils in the state of Victoria, Australia. This paper makes three distinct contributions to the literature. First, to the best of our knowledge, this is the first attempt to examine the efficiency impact of Victorian rate capping policy using a robust efficiency analysis. Second, it provides a disaggregated analysis by various council groups, which will be of interest to the various councils, policymakers and to the community in general. Third, a set of exogenous variables with a probability to influence efficiency is analysed by council groups using bootstrap methods, which provide robust estimations compared with conventional analyses.

The remainder of the paper is structured as follows. The next section provides a context to the research study by outlining the institutional background and the Victorian rate capping policy. The third section briefly reviews the literature on rate capping policy and economic efficiency and develops the hypotheses for the study. The fourth section outlines the empirical methodology used. It also outlines the model specifications, data and selection of variables. This is followed by the results and discussion section. Policy implications of the findings, limitations of the present study and recommendations for future research are highlighted in the concluding section.

**RATe CAPping POLICY IN VICTORIA**

Australia’s constitution establishes a federal system of government in which power is divided between various levels of government: the Commonwealth, state/territory and local government. Constitutionally, the state and territory governments are responsible for the functioning of local governments (Drew, 2018), which provide infrastructure and property services, recreational facilities, community services, cultural facilities, some limited health services and other locally based services. Local councils are funded primarily from taxation in the form of rates on properties (38.6%), user charges (33%), grants from the Australian government and state (or territory) governments (9%), and other revenue such as investment and business income (19.4%) (Drew, 2018). There are 79 councils within the state of Victoria and their responsibilities have expanded rapidly over the past decades as their communities demand responsible representation and high-quality infrastructure and services. Councils’ statutory responsibilities have also continued to grow since the current Act became law in 1989. Councils manage over A$89 billion of public infrastructure and delivery services valued in excess of A$7 billion every year (The State of Victoria, 2017).

Arguably, the Victorian local governments have been subjected to more changes than any other local government within Australia (Kloot & Martin, 2007). Consequently, many new reforms, practices and processes have been instituted in Victoria (Kloot & Martin, 2000). In 2015, the Andrews government in the state of Victoria embarked on the most significant reform agenda in local government since the generational reforms of the 1990s. Council governance legislation has been reformed to set clear limits on councillor conduct and sharper triggers for intervention. Accordingly, the Government of Victoria implemented a rate capping scheme under its Fair Go Rating policy which commenced in the beginning of the 2016–17 financial year. The reforms also included a new performance reporting framework, the Local Government Performance Reporting Framework (LGPRF) which has improved the transparency of local government performance. The framework requires local governments to report on a broad range of indicators, release data publicly, allowing easy comparisons across similar local governments in Victoria (Productivity Commission, 2017). Accordingly, each year, the Minister for Local Government sets the maximum amount by which the Victorian local councils can increase municipal rates without seeking advance approval from the economic regulator.

The main rationale cited for rate capping is that it restricts the spatial monopoly power of local governments to raise property taxes (Temple, 1996). This is somewhat similar to the NSW initiative, the only Australian state that has employed rate pegging for over 30 years, where the policy is designed to limit increases in property taxes that can be levied by the local councils in the state (Dollery & Wijeweera, 2010). The genesis of rate pegging can be found as early as 1976—while the mechanics of the process may have adjusted periodically, the basic principle has remained unchanged (Dollery & Wijeweera, 2010). Rate pegging is a subset of a larger category of public sector regulation dealing with state-imposed limitations on the expenditure and taxation by local government, including property taxation (Temple, 1996). This type of regulation
should seek to secure allocative efficiency, where the mix of local services provided must coincide with local community preferences and productive efficiency, where local services must be produced in the most cost-effective and equitable manner (Dollery & Wijeweera, 2010).

The main benefit of rate capping is that, unsurprisingly, it reduces gross taxation imposts on local government rate payers (Dollery & Drew, 2016). Other cited benefits to rate capping, more controversial and not supported by empirical evidence include: enhanced governance (although others have argued that a rate cap provides a default option and hence has a negative effect on governance); limiting the provision of non-core services (which may also have significant equity implications for the most vulnerable in our society); and improvement to technical efficiency, defined as conversion of inputs into outputs, which is not supported by the empirical evidence (Dollery & Drew, 2016).

LITERATURE REVIEW: LOCAL GOVERNMENT EFFICIENCY

The primary goal of local public economics and finance is to align local government revenue with the preferences of local residents in delivering a range of services efficiently. Most local governments heavily rely on municipal rates revenue to deliver services (Alm et al., 2011). To this end, local governments make decisions about the best possible mode of delivery of their services. For example, they must decide whether to deliver a particular service by themselves (public) or outsource it to a private entity or partner with private actors (public–private partnership). These decisions are largely driven by technical efficiency considerations such as economies of scale and scope (Kitchen et al., 2019b).

The efficiency of tax allocation among various tiers of government is debated widely. Tax collected in aggregate (say, income tax collected by the federal government) needs to be redistributed through large intergovernmental transfers since expenditures are decentralized (Kitchen et al., 2019a). In the United States, explicit rate limits on property taxation are widespread. For example, limitations on property tax revenues, property tax rates and property assessments have a direct impact on individual property tax payments (Anderson, 2006). Anderson (2006) also indicates that a desire by local residents to constrain local government expenditures is the primary motivation for these limitations. Another common motivation identified by the same study is that property tax limits provide a form of insurance against unexpected increases in individual property tax liability. While a desire by local residents to constrain local government expenditures may exist, the need for insurance explains the presence of limitations in the absence of such desires (Anderson, 2006).

There are other studies evaluating the impact of municipal rates and local tax rates on the economic efficiency of local government and the evidence appears to be mixed. For example, De Borger and Kerstens (1996) and Athanassopoulos and Triantis (1998) found that local governments that had higher tax revenue are the most inefficient in the management of their resources. Conversely, van den Eekaut et al. (1993) found that high local tax rates have a positive impact on efficiency. Balaguer-Coll et al. (2019) found that the level of taxes and grant revenues negatively affect municipal efficiency indicating that municipalities lack incentives for efficient management when funds are easier to generate.

In undertaking an analysis of 84 empirical studies on local government efficiency from a global point of view, Narbón-Perpiñá and De Witte (2018a) identified that there are differences in the local government’s efficiency analysis across countries. However, the authors indicate that this does not necessarily mean that local governments in one country are more efficient than others, as this depends on the input and output variables selected and the methods used. The selection of variables depends on the availability of data and the specific services and facilities that local governments must provide in each country (Narbón-Perpiñá & De Witte, 2018a). Also, the number of output variables included in different studies varied drastically. Some studies aggregate various municipal services in a global index, while others evaluate a set of specific local services (Narbón-Perpiñá & De Witte, 2018b). Furthermore, the efficiency measures use cross-sectional data and the use cross-sectional efficiency techniques makes it difficult to explain the heterogeneity among local governments and to determine how municipal outputs affect efficiency (Narbón-Perpiñá & De Witte, 2018a).

These studies, however, have not quantified the impact of methodological choices on the variability of efficiency scores in local government which Aiello and Bonanno (2019) addresses. In their study covering 54 published papers between 1996 and 2016, and applying meta-regression analysis, they identify how methodological choices bring about different efficiency outcomes. This provides insights into estimating efficiencies and testing the sensitivity of findings in the choice of study design (Aiello & Bonanno, 2019), which our study takes into consideration. Thus, the conclusions and policy implications from the various studies on local government efficiencies are not necessarily applicable to other jurisdictions since they are country specific, and differ in terms of variables and methodologies used (Aiello & Bonanno, 2019; Narbón-Perpiñá & De Witte, 2018b).

Within Australia, several studies have addressed various aspects of local government efficiency: council amalgamation (Dollery & Crase, 2004; Drew et al., 2015; Nakazawa, 2013, 2014); economies of scale (Andrews & Boyne, 2009; Byrnes & Dollery, 2002; Drew et al., 2015); waste management (Worthington & Dollery, 2001); water supply (Woodbury & Dollery, 2004); and road maintenance (Kalb, 2014; Wheat, 2017). There are also links between economic efficiency and the ability of citizens to monitor local government performance and pressure local government representatives (Hayes et al., 1998). On the one hand, there is substantial evidence that larger populations make local councils more efficient (Balaguer-Coll et al., 2002; Drew et al., 2015) although
this may be attributed to scale economies. On the other hand, communities in smaller councils can be more effective in monitoring, influencing their representatives and keeping their local government accountable than communities in more dense and populous municipalities. Based on NSW local government experience, Drew et al. (2015) did not find conclusive evidence to support that rate capping enhances economic efficiency of NSW councils. Based on the above literature, we hypothesize that rate capping will not enhance the efficiency of Victorian local governments.

Past studies found a link between economic efficiency and the ability of citizens to monitor local government performance and pressure local government representatives (Hayes et al., 1998). On the one hand, there is substantial evidence that larger populations make local councils more efficient (Balaguér-Coll et al., 2002; Drew et al., 2015) although this may be attributed to scale economies. On the other hand, communities in smaller councils can be more effective in monitoring, in the ability of citizens to monitor local government and the closer scrutiny of local government groups. Therefore, the closer scrutiny of accountable than communities in more dense and populous municipalities. Therefore, the closer scrutiny of accountable than communities in more dense and populous municipalities.

Theoretical setting

Assume a setting where \( K \) local governments that use \( m \) inputs and \( n \) outputs. Let \( x^k = (x^k_1, \ldots, x^k_m) \in \mathbb{R}^m_+ \) be the inputs that are used and \( y^k = (y^k_1, \ldots, y^k_n) \in \mathbb{R}^n_+ \) be the outputs produced by local government \( k \), \( k = 1, \ldots, K \). The matrix notation of production plans for local governments can be expressed as \( x = (x^1, x^2, \ldots, x^K) \) and \( y = (y^1, y^2, \ldots, y^K) \). The production technology set can be expressed as \( T = \{ (x, y) \in \mathbb{R}^m_+ \times \mathbb{R}^n_+ \mid x \text{ can produce } y \} \). Since the exact technology used by each local government is not known, DEA can solve this problem by estimating the technology \( T \) with \( T^* \) using historical or cross-sectional data, which can be regarded as the empirical reference technology. This technology is constructed through the minimal extrapolation principle. This principle specifies \( T^* \) as the smallest subset of \( \mathbb{R}^m_+ \times \mathbb{R}^n_+ \) that contains the data \( (x^k, y^k), k = 1, \ldots, K \) and satisfies certain technological orientations such as returns to scale (CRS, VRS, etc.) as discussed in the previous section.

Define \( T^* \) as:

\[
T^*(y) = \{ (x, y) \in \mathbb{R}^m_+ \times \mathbb{R}^n_+ \mid \exists \lambda \in \Lambda^K(y) : x \geq \sum_{k=1}^{K} \lambda^k x^k, \ y \leq \sum_{k=1}^{K} \lambda^k y^k \} \tag{1}
\]

where \( \Lambda^K(y) \) is the technological assumption about the technically feasible production function. In order to define input efficiency, we rely on the Farrell input efficiency definition (Farrell, 1957), which is expressed as \( E = \min \{ E > 0 | (Ex, y) \in T \} \). This measure provides the input efficiency of a production plan \( (x, y) \) relative to the technology. By combining the ideas of Farrell input efficiency and the minimal extrapolation principle, we specify the below mathematical programme to be solved in order to derive efficiency indices for Victorian local governments:

\[
E^* = E(x^*, y^*) ; \ T^* = \min \{ E \in \mathbb{R}_+ | (Ex, y^*) \in T^* \} \tag{2}
\]
By inserting $T^*(\gamma)$ for $T^*$, the above expression can be rewritten as:

$$\min_{E, \lambda_1, \ldots, \lambda_K} E$$

subject to:

$$Ex^\gamma \geq \sum_{k=1}^{K} \lambda_k x^k,$$

$$y^\gamma \leq \sum_{k=1}^{K} \lambda_k y^k,$$

$$\lambda \in \Lambda^\gamma(\gamma).$$

(3)

The above linear programming problem must be solved for each local government in the sample to obtain efficiency measure $E$. This measure in turn is the weighted distance from the best-practice frontier and is known as Farrell distance function, where a value of 1 indicates full efficiency and any value lower than 1 implies that local government is inefficient.

Since the conventional DEA is a deterministic approach, it is prone to data noise and outliers and does not easily allow for hypothesis testing. Two-stage approaches based on deterministic DEA and Tobit regressions ignore the data generating processes leading to erroneous results (Gearhart & Michieka, 2018; Narbón-Perpiñá et al., 2020; Simar & Wilson, 2007, 2011). Simar and Wilson (2007) proposed two algorithms to overcome the above deficiency and to compute robust efficiency scores and make statistical inferences using a bootstrap procedure. In this study, we use the second algorithm proposed by Simar and Wilson (2007).

We follow the notation of Bogetoft and Otto (2011) and let the observations be $(x^1, y^1), \ldots, (x^K, y^K)$ and the corresponding efficiency scores be $E^1, \ldots, E^K$, that is:

$$E^k = \min \{ \theta \in \mathbb{R}_+ \mid (\theta x^k, y^k) \in T \}$$

(4)

where $E^k$ is the efficiency score; and $T$ is the unknown technology set specified by the input–output combinations. The steps and subroutine loops of Simar and Wilson’s (2007) double bootstrap procedure using algorithm 2 are detailed in Appendix A in the supplemental data online.

Data and model specification

Various aspects of council expenditure have been widely used as input variables in past local government efficiency studies (Fogarty & Mugera, 2013; Lopez et al., 2009; Woodbury & Dollery, 2004; Worthington, 1999; Worthington & Dollery, 2002). Some studies have used the number of staff employed or employee costs as an input variable (Drew & Dollery, 2015; Fogarty & Mugera, 2013; Worthington & Dollery, 2000). Most local government efficiency studies have used input variables to reflect municipal expenditure variables including wages and salaries (Balaguér-Coll et al., 2010; Balaguér-Coll et al., 2019), total expenditure (Athanassopoulos & Triantis, 1998; Balaguér-Coll et al., 2002), total per capita expenditure (Afonso & Fernandes, 2006), employee costs (Fogarty & Mugera, 2013), depreciation (Essential Services Commission, 2017). Based on the above literature, the DEA model used in this study comprises four inputs; the total employee costs, material costs, depreciation and other expenditures that are not included in the above-mentioned categories. The employee costs include salaries and on-costs, and other employee benefits such as superannuation and long-service leave. Material costs and services include contract payments, costs of office administration, costs of maintaining building and information services. We used depreciation over capital expenditure in order to minimize potential discrepancies of capital valuation (see Pawsey et al., 2018, for a discussion of the use of fair value and historical costs in capital valuation). Depreciation includes the depreciation relating to all capital assets such as roads, bridges and the drainage system. Other miscellaneous expenses not covered by the above-mentioned cost categories were included in the ‘other’ category. The outputs chosen have been used in recent Australian local government efficiency analysis studies (Essential Services Commission, 2017).

A typical local council delivers a diverse bundle of goods and services. Capturing the range of outputs delivered by councils is a non-trivial task. It is contended that even if council output metrics exist, it is not obvious how to weight each index and combine them into a single composite output index (Andrews & Boyne, 2009). Past studies have used several proxies such as the number of households served or population in its constituency. The former in particular is important as most services such as garbage collection or hard waste collection are delivered at the household level. Low or decreasing levels of expenditure indicate improvements in organizational efficiency (Local Government Victoria, 2019). Australian local governments have a ‘service to property’ orientation (Dollery & Crase, 2004) and therefore the household unit becomes a major metric that represents the volume of services that local government deliver. Therefore, we included the number of households as an output in the DEA specification. The number of households of a local government area is computed by dividing total residential population by the average household size. Maintaining the local road network is a major function of local government and is regarded as the single largest expenditure item for Australian local councils (PricewaterhouseCoopers, 2006). Data regarding roads network included data on sealed (formed and sheeted) and unsealed (natural surface) roads that come under the purview of local governments. However, these data were incomplete and sealed local roads occupy the lion share of council resources in terms of on-costs and engineering overheads and therefore, the length of sealed local roads was chosen for the analysis.

An input orientation was assumed for the DEA model specification. This implies that local councils intend to minimize their inputs (in this case various costs) to deliver the level of outputs required by their communities. This is a plausible assumption because a local government entity has a substantial degree of control over their inputs and...
outputs can be considered as exogenous (Essential Services Commission, 2017; Worthington & Dollery, 2001). Descriptive statistics of all variables used in the analysis are presented in Table 1. The frontier variables were used to construct the DEA frontier while the exogenous variables were used in the subsequent analysis to examine their association with efficiency.

Data for the empirical analysis were collated by combining several datasets published separately. The data covered a five-year period from 2014/15 to 2018/19 encompassing three years of post-rate cap observations since the policy was introduced in 2016/17. The bulk of the data for this paper were obtained from the Local Government Performance Reporting Framework (LGPRF) initiative. The data were prepared by Local Government Victoria (LGV) and covered a four-year period from 2014–15 to 2018–19. The framework reports on 41 service performance indicators and is a key aspect of enhancing transparency, accountability and performance of 79 Victorian local councils. The dataset includes data obtained from Council Community Satisfaction Surveys (CSS). Population, household and business numbers were obtained from the Australian Bureau of Statistics (ABS).

The LGPRF classifies Victorian councils into five groups based on the location and population: metropolitan councils, regional councils, interface councils, large shires and small shires. Councils located in Melbourne and Greater Melbourne are in the metropolitan group, whilst the councils in the fringe of the Greater Melbourne area are in the interface group. Regional grouping comprises councils in regional centres and significant rural cities. The LGPRF also notes that the distinction between large and small shires is based on a population cut-off of 15,000.

RESULTS

Efficiency analysis for 2015–19

An efficiency analysis was carried out using the methodology discussed in the methods section. By pooling all councils together across the study period (five years), the analysis compared the performance of councils against a common ‘multi-year’ production frontier, which can be viewed as the ‘best-practice local government frontier’ for Victoria. The underlying assumption in this analysis is that all councils had access to the same technology to deliver their services over the five-year study period. The local government areas (LGAs) are assumed to minimize inputs of overall expenditure and capital expenditures to deliver outputs related to households, businesses and road services. Those councils that are fully efficient will have an efficient score of 1. The average efficiency of the total sample was 0.82 over the five-year period (0.813 in 2015, 0.811 in 2016, 0.814 in 2017, 0.80 in 2018 and 0.851 in 2019). These estimations are comparable with the recent estimates of efficiency in the Victorian local government sector. For example, the Predictive Analytics Group (PAG) efficiency estimation for Victorian local government in 2016 averaged 0.81 (Essential Services Commission, 2017).

Next, robust efficiency scores were estimated using the bootstrap procedure mentioned above in the second

Table 1. Descriptive statistics of the variables used in the analysis, 2015–19 (n = 395).

| Variable                  | Units           | Mean   | SD    | Minimum | Maximum |
|---------------------------|-----------------|--------|-------|---------|---------|
| **Inputs**                |                 |        |       |         |         |
| Employee costs            | A$, millions    | 42.8   | 37.8  | 3.50    | 252.4   |
| Material costs            | A$, millions    | 37.0   | 36.4  | 4.10    | 273.7   |
| Depreciation costs        | A$, millions    | 18.0   | 13.8  | 1.10    | 85.90   |
| Other costs               | A$, millions    | 6.10   | 7.30  | 1.00    | 40.20   |
| **Outputs**               |                 |        |       |         |         |
| Number of households      | Number          | 30,704 | 27,406| 1336    | 114,152 |
| Number of businesses      | Number          | 7482   | 7244  | 326     | 41,572  |
| Length of road network    | km              | 936    | 742   | 42      | 5220    |
| **Exogenous variables**   |                 |        |       |         |         |
| Resident density of roads | Persons/km      | 105    | 125   | 1       | 700     |
| Community satisfaction rating | Score (out of 300) | 167.0  | 20.4  | 117.0   | 224.0   |
| Kerbside garbage collection cost | A$/bin       | 102.7  | 31.8  | 11.5    | 249.9   |
| Residential property tax  | A$/property     | 1566.5 | 343.50| 619.00  | 2758.55 |
| Recycling of municipal waste | %             | 43     | 44    | 15      | 75      |
| Population size           | Persons        | 79,469 | 46,082| 2940    | 353,872 |
| ABS socio-economic disadvantage index | Score (out of 10) | 5.52   | 2.87  | 1.00    | 10.00   |
| Rate capping policy       | Dummy variable |        |       |         |         |

Note: ABS, Australian Bureau of Statistics.
section to account for potential biases arising from measurement errors and statistical noise in the dataset. The bootstrap procedure involved generating 2000 sub-samples from the original dataset to derive robust efficiency indices and their confidence intervals. Unsurprisingly, this yielded efficiency scores slightly lower than the naïve scores that do not account for data uncertainty. These bias-corrected efficiency scores, ordered according to ascending median of each group, are shown in Figure 1. There is a significant variation of efficiency across council groups. The metropolitan group had the highest technical efficiency on average followed by interface, small shires, large shires and regional city council groups. Regional city councils had the lowest median technical efficiency. Figure 1 also shows that the economic efficiency of metropolitan councils has progressively declined. The metropolitan council group recorded the largest decline of bias-corrected efficiency in 2019. Councils that belong to large shires and regional city categories have shown the largest variation in performance in 2019.

A quick visual examination of Figure 1 suggests that all council groups, except the metropolitan councils, have slightly improved their economic performance, as indicated by increased median efficiency score from 2018 to 2019. The metropolitan councils recorded a marked decline in technical efficiency in 2019. This decline could be due to many reasons including changes to interest rate and exchange rate potentially impacting depreciation costs and loan repayments to overseas capital markets. The small shires group’s median technical efficiency performance (0.843) in 2019 is comparable with that of the interface (0.849) and metropolitan (0.860) groups. This is an impressive performance given that the small shire group had the lowest average population overall (20 times less than the most populace group, interface).

The efficiency scores presented in Figure 1 do not support the claim that ‘bigger is better’ with respect to local government efficiency. The average efficiency performance of comparatively small council group, small shires outstripped the large metropolitan councils. The relative efficiency decline in metropolitan councils may also be due to the changes in interest rate and exchange rate over the study period since they influence debt payments and depreciation costs. Over the study period, the metropolitan council groups had an average population of 141,625. The average population for small shire group was 9639. The core issue here is the economies of scale. It is contended that large councils with large populations may facilitate more council services with relatively low administrative costs and may have access to diverse funding sources (Independent Pricing and Regulatory Tribunal, 1998). The existence of economies of scale has been studied in an Australian local government context. For instance, Byrnes and Dollery (2002) found no evidence of substantial efficiency gains through amalgamation but economies of scope. Dollery and Crase (2004) confirmed that there is limited scope for anticipating substantial

Figure 1. Bias-corrected efficiency by local government area (LGA) group, 2014–15 to 2018–19.
Note: Reg, regional; L-Shire, large shire; S-Shire, small shire; Int, interface; and Metro, metropolitan.
benefits to flow from council amalgamation except possibly in terms of local government capacity and scope economies. The economies of scope attributed to metropolitan councils may also imply different governance capabilities and a different portfolio of outputs. Overall, it appears that the council size has no strict relationship with efficiency performance in Victorian local governments.

Efficiency and rate capping policy
One of the aims of this study was to examine whether the Victorian rate capping policy has improved the economic efficiency of local governments. Bias-corrected efficiency scores were divided into two groups: pre- and post-rate cap periods. Using box plots, Figure 2 compares the efficiency discrepancy in pre- and post-rate capping periods by council group. A visual assessment of box plots suggests that there is a slight improvement in median efficiency in the post-rate cap period for all council groups except the metropolitan group. In the latter group, efficiency has clearly declined in the post-rate cap period. To verify this result, the statistical testing of pre- and post-rate cap efficiency performance was conducted using the Wilcoxon signed rank sum test. The null hypothesis was that median efficiency difference of pre- and post-rate cap periods is significantly different from zero for each group. None of the aforementioned post-cap efficiency improvements was statistically significant. Only the efficiency decline observed in the metropolitan group was statistically significant ($p = 0.094$, $W$-statistic = 1727.0), albeit at a 10% confidence interval level. In essence, this suggests that the rate capping policy has not triggered any significant improvement in economic efficiency. However, it has significantly lowered the efficiency performance of metropolitan councils.

Factors associated with efficiency
We used the double-bootstrap regression procedure mentioned in the methodology section to test a range of exogenous factors that may be influencing technical efficiency scores. Caution should be exercised here as at most the results can only be interpreted as being associated significantly with efficiency rather than implying causality. This analysis was carried out by regressing bias-corrected efficiency scores against a set of exogenous variables. It involved using the double-bootstrap process with 2000 replicates to derive confidence intervals of estimates to identify variables that significantly influence the efficiency in concrete terms.

The selection of variables for this analysis was guided by the literature (Asatryan & De Witte, 2015; Drew et al., 2015; Worthington, 1999; Worthington & Dollery, 2000) and the empirical questions that this paper set out to investigate. The exogenous variables included the resident density of roads (the LGPRF calculates this as population divided by the length of the road network) (Drew et al., 2015), the community satisfaction rating (Wheat, 2017), the direct cost of kerbside garbage collection (Dollery & Worthington, 2000), average property tax or rates (Athanassopoulos & Triantis, 1998; De Borger & Kerstens, 1996; Narbón-Perpiñá et al., 2020), recycling (the proportion of hard waste, recyclables and organic matter diverted from landfill) (Dollery & Worthington, 2000), the ABS socio-economic disadvantage index (Worthington & Dollery, 2000), size of population (Asatryan &

![Figure 2. Box plots of efficiency scores for pre- and post-rate cap by council groups.](image-url)
De Witte, 2015; Balaguer-Coll et al., 2019; Da Cruz & Marques, 2014) and rate policy dummy. Descriptive statistics of these exogenous variables are presented in Table 1.

Two separate sets of analyses were conducted. First, we used the entire dataset of 395 observations, covering five years (2014–15 to 2018–19) to test how the aforementioned exogenous factors would associate with the efficiency of the entire local government sector. The results are summarized in the second column of Table 2 (Overall model). Table 2 warrants a cautionary note when interpreting the results. If a coefficient in Table 2 has a negative sign, it affects efficiency positively and if it has a positive sign, it affects efficiency negatively because the double-bootstrap regression specifies the relationship between inefficiency and explanatory variables. In the second analysis, we repeated the above analysis by council group in order to obtain council group-specific results and these results are summarized in columns 3–7 of Table 2.

The ‘overall’ model with full dataset provides a general picture for the entire Victorian local government sector and we largely focus the discussion on results of this model. All exogenous variables, except rate capping policy and recycling, had a statistically significant association with economic efficiency (robust efficiency scores). Interestingly, the coefficient of rate cap variable was negative indicating that the rate capping policy had a positive association with efficiency although the strength of association is weak and not statistically significant. This confirms the findings of the previous section. Unsurprisingly, the population size had a positive influence on efficiency of local government. The coefficient was highly significant at a 1% confidence interval level. Previous research on Victorian local government also found a positive influence of population size on efficiency (Drew et al., 2015; Essential Services Commission, 2017).

Property tax (municipal rates) showed negative and a statistically significant (at 5% level) association with efficiency. This could be related to the varied capacity of local governments to raise their own revenue as non-metropolitan local governments serving large geographical catchments with low populations might have to charge on average a higher municipal rate than densely populated local government. For example, a small rural council may not be able to raise the same revenue as a metropolitan council from parking fees. Or it could be inefficient local governments charging their rate payers more than their counterparts. This result confirms the findings of De Borger and Kerstens (1996) and Athanasopoulos and Triantis (1998) who found a higher level of inefficiency among the councils with higher tax rates.

The rate capping policy variable did not yield a consistent result across all models. First, the sign of the coefficient (overall model) suggests that, overall, there was a weak but positive association. However, this association was not statistically significant. Therefore, one cannot conclude that the rate capping policy has improved economic efficiency of the sector. That said, rate capping had a significant but negative association with efficiency in metropolitan councils and large shire councils. Out of the six models, the rate capping policy showed a statistically significant negative association with efficiency in only three models: overall, metropolitan and regional models at 1%, and large shires model at 5%. This results somewhat confirms the earlier visual analysis of pre- and post-rate cap efficiency score distributions. This suggests that the policy had a varied effect on council groups.

Although not statistically significant in the overall model, the recycling effort of local councils on average has a negative association with efficiency. Waste management and recycling operations of local governments are complex (differing collection methodologies, for example) and costly and this finding hints that there may be inefficiencies in recycling and waste management processes that may impede efficiency. Conversely, kerbside garbage collection cost showed a positive association with efficiency although this result was not consistent across all council groups. Resident density of roads, which captures the resident density as per unit road network, showed a positive

| Variable                                | Overall         | Metros          | Interface       | Large shires   | Small shires  | Regionals      |
|-----------------------------------------|-----------------|-----------------|-----------------|----------------|---------------|----------------|
| Intercept                               | 1.9233***       | 1.2854***       | −0.6645         | 1.5214**       | 0.5427***     | 1.3171***      |
| Resident density of roads               | −0.0011**       | −0.0003         | 0.0005          | 0.0152**       | −0.0013       | 0.0044***      |
| Satisfaction rating                     | −0.0032**       | 0.0016**        | 0.0076*         | −0.0029        | −0.0012*      | −0.0028***     |
| Garbage collection                      | −0.0014**       | 0.0011**        | 0.0028**        | 0.0002         | −0.0006       | 0.0049***      |
| Property tax                            | 0.0003**        | −0.0003***      | −0.0003**       | −0.0001        | −0.0000       | 0.0000*        |
| Recycling                               | 0.0179          | 0.2361*         | 0.8645**        | 0.2105         | 0.2204*       | −0.3348**      |
| Population                              | −0.0000**       | −0.0000***      | 0.0000*         | −0.0000**      | −0.0000       | −0.0000***     |
| ABS socio-economic disadvantage index   | −0.0387**       | −0.0081**       | −0.0013         | −0.0207**      | −0.0059       | −0.1227***     |
| Rate capping policy                     | −0.0198         | 0.0870***       | 0.0020          | 0.1157**       | 0.0099        | 0.1660***      |

Note: ABS, Australian Bureau of Statistics. * Statistical significance at 10%, ** and *** at 5% and 1% respectively. A positive sign for an estimate indicates inefficiency, and vice versa.
association efficiency indicating that the higher the resident density per kilometre of road length, the higher the efficiency of the local government.

Community satisfaction rating showed a positive association with efficiency in the overall model, which implies that the higher the economic efficiency, the higher the community satisfaction on local government performance. Usually, a complex set of issues underpin the local governments’ reputation. However, a good quality of service and good value for money can generally yield strong satisfaction ratings. Interestingly, councils with large populations showed an opposite effect suggesting there may be issues with quality signalling and community perceptions as these large councils grapple complex operations and ratepayers may not have all necessary information to make a better judgement. Again, this confirms the visual analysis conducted earlier. The relative socio-economic disadvantage index yielded a significant (at 5% level) positive association with efficiency. Higher values of the index represent less relative socio-economic disadvantage. Contrary to past evidence (Fogarty & Mugera, 2013), councils in which socio-economic disadvantage is greatest would appear to be inefficient.

CONCLUSIONS

The rate capping policy has been applied to restrict municipal taxation in several countries, but its efficiency implications are uncertain. To fill this gap, this paper tested two main hypotheses relating to rate capping using Victorian local government data from 2015 to 2019. The empirical results indicate that our hypothesis of ‘no significant efficiency enhancements from rate capping’ to be true. They also confirmed our second hypothesis that efficiency performance varies with the council group. The study also highlights that the efficiency of metropolitan councils has declined during the post-rate capping period. This decline could be the result of higher employee costs incurred during post-cap period which may have adversely affected efficiency. These findings challenge the very idea of the various reforms underlying NPM, which are designed to achieve greater efficiency and force the adoption of new process and technologies (Ferlie & Steane, 2002; Lapsley, 2008). The driving force in introducing rate capping is cost reduction with the aim to increase efficiency with reduced funding, but clearly this was not achieved.

The modest improvement in efficiency recorded in other council groups (regional, large shire, small shire and interface) during the post-rate cap period was not significant. In other words, the rate cap policy has not made a significant improvement in economic efficiency. This finding confirms the conclusions made by Drew and Dollery (2015) regarding rate capping and efficiency. Efficiency gains are also possible due to population growth and an increase in the total number of properties. There is evidence that, although the growth in council revenue generated by municipal rates and charges has slowed after the rate capping policy, the overall revenue collected has remained relatively stable due to the increase in the total number of properties. (Essential Services Commission, 2019). Since municipal waste charges are not part of the rate capping policy, it would be useful to monitor potential cost-shifting and changes to other revenue streams of councils including waste management.

Small shires recorded a comparable efficiency performance despite the claims in the literature that councils with larger populations can leverage scale economies (Balaguercoll et al., 2002; Drew et al., 2015) and become more efficient. Results also suggest that there is a positive relationship between community satisfaction ratings and efficiency. However, this relationship was not consistent across council groups but was more applicable to smaller council groups. Small councils engage in simpler operations and have more transparency compared to large councils and rate payers may not be able to make an informed judgement on council performance. Positive association between community satisfaction and efficiency of small councils further reinforces the argument.

The limitations of our study include the focus on rate capping and its impact on one factor, that is, the efficiency of the local councils. Although this is consistent with the aim of the study, providing only the efficiency view raises more questions as to whether the rate capping has impacted other areas such as road maintenance, user fees and asset management. However, despite this limitation, the analysis provided robust efficiency estimates and rich insights. This allowed for testing of a range of exogenous variables in explaining the efficiency differential. Further investigation is required regarding the selection of variables that capture both the quality and quantity of goods and services provided by local governments. This is important because the quality of service delivery is a critical aspect of council’s public good provision.

There is also the possibility that performance indicators are not accurately capturing the required information. The obvious policy implication is that the LGPRF, which is a major step towards making council operations transparent, should invest in refining its performance indicators which would accurately reflect the quality aspects of service delivery. This will help inform the strategic direction of LGPRF. Another area is the heterogeneity of councils when deriving efficiency indicators. Techniques such as meta-frontier analysis, which can accommodate group heterogeneity upfront, will provide a more refined assessment of efficiency of local governments. Further research into a more sophisticated ‘multi-cap’ model that accounts for group heterogeneity and the revenue raising ability of local governments is warranted.

This study relied on the assumption that the production technology did not change over the study period. In other words, dynamic effects on efficiency and technical change were not considered. The analysis used a semiparametric double-bootstrap DEA model, which is an improvement of the naive two-stage estimation
approach. However, the approach relies on the assumption of separability between input–output space and the space of environmental variables. Future research could focus on analyses involving non-parametric conditional efficiency methodologies, which avoids the restrictive separability assumption (Badin et al., 2014; De Witte & Kortelainen, 2013) and the influence of spatial interdependence on efficiency in order to strengthen the case for the use of an efficiency factor in the rate capping formula. This would not only facilitate robust assessments of council performance but also enable a more accurate estimation of efficiency factors used in rate capping decisions.

ACKNOWLEDGEMENTS

The authors are grateful to colleagues who provided useful feedback on the paper at the 2020 School of Business and Law Seminar Series, CQ University. Any remaining errors are the responsibility of the authors.

DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

NOTES

1. The term ‘rate capping’ characterizes a state government imposing municipal tax restrictions on local governments by announcing a maximum tax rate (a cap) that can be collected from residents for a given period. This paper uses the terms ‘municipal rates’ and ‘property tax’ interchangeably.

2. Australia has six states (New South Wales, Victoria, Queensland, South Australia, Western Australia and Tasmania) and two territory governments (Australian Capital Territory, and Northern Territory & Norfolk Islands).

3. NSW has been using a form of rate capping (or ‘rate pegging’ as it referred in the state) since the 1970s. South Australia and Northern Territory temporarily applied rate capping in 1997–99 and 2007–10, respectively.

4. As part of this initiative, the state government maintains a dedicated website called ‘Know Your Council’ summarizing performance indicators for 79 Victorian local governments. The website allows citizens to make comparisons between similar councils on 11 service categories.

5. See Lopez et al. (2020) for a comprehensive review of local government efficiency.

6. Bootstrap is a general computer-based data simulation method where it mimics the distribution of the original dataset to generate a sample of replicates (usually about 2000), which can be used for statistical inference.

7. For a comprehensive review of the variables used in local government efficiency analysis, see Da Cruz and Marques (2014).

8. The household size data were obtained from the Australian Bureau of Statistics’ (ABS) National Regional Profile 2010–2014, and it is assumed that this will remain constant for the study period.

9. LGV emphasizes that the commentary provided alongside data should be considered in analyses and reporting, and some data may change as councils may need to update their performance data ahead of their annual reporting. LGV also discourages publishing any simplistic league tables of councils.

10. ‘Fully efficient’ councils may also have inefficiencies as DEA is a relative performance measure.

11. These efficiency estimations are only comparable because of the same model specification used.

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