AN EMPIRICAL EXAMINATION OF THE DETERMINANTS OF EXPENDITURE DISPERSION IN SOUTH AUSTRALIAN LOCAL GOVERNMENT

Carolyn-Thi Thanh Dung Tran*
Faculty of Arts and Social Sciences, the University of Sydney, Sydney, NSW 2006, Australia. Email: carolyn.tran@sydney.edu.au

Gemma Perez-Lopez
Department of Accounting and Finance, Faculty of Social Science, Universidad de Granada, Spain. Email: gemmapl@ugr.es

Brian Dollery
UNE Business School, University of New England, NSW 2351, Australia. Email: bdollery@une.edu.au

*Corresponding Author

ABSTRACT: The empirical analysis of the cost structure of local government has traditionally employed population as a proxy for municipal output, despite longstanding reservations as to its suitability, especially in terms of local service provision (Boyne, 1995). Based on alternative proxies for local government output, and employing data drawn from the South Australian local government system over 2015/16, the present paper examines per household expenditure dispersion by comparing estimates based on population size with estimates based on the number of households and businesses. We then consider how exogenous variables affect the per household expenditure structure of local councils in South Australia. Policy recommendations are drawn for improvement in South Australian municipalities.

Keywords: Expenditure, households, local government, population, South Australia

1. INTRODUCTION

Over the past several decades, the parlous state of local government finances worldwide has attracted the attention of policymakers and scholars alike (Kuhlmann and Bouckaert, 2016). Considerable effort has been directed at reducing municipal expenditure to address financial

unsustainability in the local government (Overmans and Timm-Arnold, 2016). Numerous remedial avenues have been explored (Cepiku *et al.*, 2016), ranging from statutory limitations on expenditure (Park *et al.,* 2018) to the pursuit of cost savings by means of municipal mergers (Allers and Geertsema, 2016), shared services (Bel and Warner, 2015), privatisation and contracting out (Bel and Gradus, 2018) and other policies premised on scale economies (Lago-Peñas and Martinez-Vasquez, 2013).

The empirical analysis of municipal expenditure is critically important in informing public policy on local government. A significant body of empirical work already exists on local government outlays. For example, studies have demonstrated that significant differences in expenditure exist between different types of local authorities (Kushner and Ogwang, 2017). Along analogous lines, some researchers have investigated the effects of density on municipal expenditure (Holcombe and Williams, 2008), often in terms of urban sprawl (Hortas-Rico and Solé-Ollé, 2010). Similarly, a great deal of empirical research has considered the impact of municipal size on the costs of local service provision, especially the hypothesis that larger local councils that have larger populations will experience substantial economies of scale (Faulk and Grassmueck, 2012).

Empirical work on scale economies in local government has evolved along two main strands. In the first place, a host of studies have investigated the impact of scale on cost with respect to specific services, particularly waste collection (Bel and Mur, 2009), water management (Marques and De Witte, 2011) and public transport (Walter and Cullmann, 2008). A subset of work in this area has considered how specialisation arising from non-discretionary environmental factors, such as the proportion of aged persons, can deliver cost advantages (Kalb *et al.,* 2012). The second strand of this empirical literature has considered how municipal size has affected the aggregate costs of service provision (Dollery *et al.,* 2012), notwithstanding the likelihood that different functional categories will have different cost characteristics (Drew *et al.,* 2014). In general, the empirical evidence on scale economies in local government has been mixed (Dollery *et al.,* 2012). This has had obvious deleterious implications for public policymaking aimed at reducing the costs of local government (Lago-Peñas and Martinez-Vasquez, 2013).

A striking feature of the vast bulk of empirical research on municipal expenditure and its determinants has been the use of population size as the proxy for local government output (Drew and Dollery, 2014), with some exceptions (Kushner and Ogwang, 2017). The ubiquitous use of population as a proxy for municipal production is surprising given that its limitations are well known. For example, more than two decades ago, Boyne (1995,

p. 219) observed that 'population is probably a very poor proxy for service outputs'. More recently, many other scholars have echoed these observations (Byrnes and Dollery, 2002; Narbón-Perpiñá and De Witte, 2018a).

In an empirical analysis conducted in the context of Australian local government using census data drawn from Victorian local government, Drew and Dollery (2014) examined the performance of alternative proxies for local government output comprising population size (in census years and intercensal periods), the number of households and the sum of the number of households plus businesses in a given local government area. They found that 'in Australia and the numerous other countries in which the role of local government focuses predominantly on the provision of 'services to property', both the number of households and the number of households plus the number of business entities represent superior proxies for the quantum of local government output' to population size per se (Drew and Dollery, 2014, p. 245-246). It should be stressed that Drew and Dollery (2014) deliberately qualified their conclusion by restricting it to countries in which local councils provide only a limited range of 'services to property', like local bridges and roads, footpaths, parks, stormwater systems and wasteful removal systems, rather than 'services to people', such as policing and public school education (Dollery *et al.,* 2006).

In this paper, we build on these empirical insights to examine municipal expenditure in the South Australian (SA) local government system using 2015/16 data. Specifically, we aim to contribute empirically to the literature by investigating the following questions:

1. Is the dispersion in per household/business expenditure greater than that in per capita expenditure in terms of the different categories of expenditure in SA local government?
2. If dispersion is indeed greater for per household, what exogenous variables affect the per household expenditure structure of local councils in SA?

The paper is divided into four main parts. Section 2 provides a synoptic description of SA local government by way of institutional background. Section 3 outlines the empirical strategy employed in the paper, whereas section 4 sets out the results. The paper ends in section 5 with concluding observations on its implications.

2. SOUTH AUSTRALIAN LOCAL GOVERNMENT

SA has its own local government system in line with other Australian states and territories. In common with other Australian local government systems, SA local government provides a relatively limited range of functions, largely focused on the provision of what has been termed 'services to property' (Dollery *et al.,* 2006), such as stormwater, waste collection, disposal and recycling, as well as bridges and roads (Dollery *et al.,* 2006). In contrast to numerous comparable countries, Australian local government systems, including SA municipalities, provide relatively few 'services to people', typically embraced under the modern welfare state, like education, police services and public housing that are state government responsibilities in Australia (Shah, 2006). Notwithstanding these circumstances, over the past few decades, Australian local government has broadened its range of services to include some 'services to people', especially aged care (Dollery *et al.,* 2006).

SA local government presently consists of 68 local councils functioning under the Constitution Act 1934 (SA), the Local Government Act 1999 (SA) and the Local Government (Elections) Act 1999 (SA). Furthermore, SA is characterised by a vast 'unincorporated area' governed by an Outback Communities Authority and five Aboriginal community councils. These entities possess similar functions and powers as local councils. However, they fall under different enabling legislation.

In terms of its sources of revenue, SA councils financed by means of property taxes (colloquially referred to as 'rates') (71 per cent), grants from higher tiers of government (14 per cent), user charges for designated services (11 per cent) and other minor sources of income (3 per cent) (South Australian Local Government Grants Commission, 2017). Over the 2015/16 financial year, some 86 per cent of total local government income in SA constituted 'own-source' revenue, largely $1.55 billion derived from property rates (South Australian Local Government Association [SALGA], 2017).

In common with other Australian local government systems, SA local government exhibits a high degree of diversity (SALGA, 2015). For example, in 2015, population size ranged from 96 inhabitants at the Gerard Community Council to 168,798 local residents in the City of Onkaparinga. Even in the greater Adelaide metropolitan region alone, population density varied greatly from 2,866 persons per square kilometre at Holdfast Bay to 50 residents in the Adelaide Hills. In terms of geographic size, local authorities ranged from the Coorong District Council with its 8,831 square kilometres to inner city Walkerville at roughly four-square kilometres. If

unincorporated SA is taken into account, the spatial scale rockets to 624,339 square kilometres in the Outback Communities Authority.

The operational structure of local authorities in SA mirrors the Westminster system of government at the state and national levels in Australia and falls under the Local Government Act 1999 (SA). Elected representatives ('councillors') and an indirectly elected mayor determine policy, which is carried out by Chief Executive Officer together with a professional bureaucracy. Elections are held at four-yearly intervals.

3. EMPIRICAL STRATEGY

As indicated earlier, in this paper, we empirically investigate expenditure dispersion in SA local government using both population size and households plus business entities as proxies for local government output. In particular, we investigate two interrelated research questions:

(a) Is the dispersion in per household expenditures greater than that in per capita expenditures in terms of types of municipal expenditure in SA local government?
(b) If there are differences between per household expenditures and per capita expenditures, what environmental variables can account for these differences?

Our empirical analysis employed 2015/16 data drawn from 68 SA local councils. As dependent variables, we used the following measures of expenditure: The log of total expenditure per household (i.e. total operating expenses per household); the log of community and health expenditure per household, which includes expenditure on community support, community amenities, libraries, as well as cultural and health services; the log of recreational expenditure per household, which includes expenditure on recreational services; the log of environmental expenditure per household, which includes expenditure on waste management and other environment outlays; and the log of residual expenditure, which was calculated as total expenditure net of expenditure on community, recreation, as well as environmental and health services. This measure was constructed in order to capture major non-discretionary expenditure on local roads.

It should be stressed that in our empirical analysis, 'per household' includes both households and business units. This meant that the total number of households plus business units was divided by types of expenditure prior to determining logs.

Moreover, we try to analyse whether environmental factors affect municipal expenditure. In this context, Da Cruz and Marques (2014)

established a catalogue of environmental factors affecting the performance of councils. However, they stressed that the impact of these factors depends on the local conditions. In our analysis, we employed the following independent variables:

(i) Population variables: Population size, population squared and population density, as a measure of economies of scale. However, the empirical evidence is mixed (Narbón-Perpiñá and De Witte, 2018a).

(ii) The number of households and business units. These variables were included in order to provide more robust measures of local government expenditure compared to population per se (Drew and Dollery, 2014).

(iii) Exogenous variables: The average population growth rate over five years, percentage of Aboriginal and Torres Strait Islanders (ATSIC) population, median taxable income for the financial year 2015/16, the percentage of unemployed persons, the number of persons identifying as single parents, the number of persons receiving a federal government age pension, and dummy types of councils. These variables have been previously used as control variables in the Australian context (Drew *et al.,* 2014). According to Narbón-Perpiñá (2018a), population growth is a measure of service demand, ethnic fragmentation (percentage of ATSIC population) is expected to increase municipal expenditure and median income is used as an indicator of the citizen's pressure on politicians. The number of single parents and the number of pensioners (i.e. citizens over 65 years) can be related to a higher demand for certain types of services, such as recreation, health and social services (Lien and Pettersen, 2004; Narbón-Perpiñá and De Witte, 2018a). However, the empirical evidence of the effect of the proportion of the population aged over 65 on municipal expenditure is mixed (Bosch-Roca *et al.,* 2012). Finally, the inclusion of different categories of councils responds to the existence of specific environmental conditions that may affect council expenditure and management (Narbón-Perpiñá and De Witte, 2018a). These variables are summarised in Table 1.

In order to answer the research questions, we employed the following empirical approach:

1. The statistical test for equality of variances was used to investigate whether there is a difference (greater or less than) in variances of the expenditures per household and per capita with respect to various types of expenditures, holding other factors constant. Greater dispersion in expenditures should be evident as a better proxy to explain volatility in local councils' type of expenditures.

Table 1. Definitions and Summary Statistics of Variables (n = 68).
Source: the Authors.

Variable	Definition	Mean /%	Standard deviation	Min	Max
Expenditures					
Total per household expenditure	Log of total local government expenditure per household.	8.235	0.495	7.436	9.927
Recreation expenditure per household	Log of local government recreation expenditure per household	6.029	0.491	4.922	7.533
Environmental expenditure per household	Log of local government environmental expenditure per household.	6.378	0.343	5.624	7.795
Community and health expenditure per household	Log of local government community and health expenditure per household.	6.267	0.509	5.088	8.018
Residual expenditure per household	Log of local government residual expenditure per household (i.e., Business Undertakings, Public Order and Safety, Economic Development and environmental and Agricultural Services).	7.428	0.749	5.959	9.750
Demographics					
Businesses	Number of business units in each local government	2,080	2,754.2	124	15,509
Households	Number of households in each local government	9,076	12,840.2	356	60,525
Population density	Population per square kilometre	446.43	814.24	0.200	2755.6
Population growth	Average population growth rate over five years.	0.069	0.179	(0.389)	0.465
ATSI	Percentage of Aboriginal and Torres Strait Islanders population.	2.501	3.613	0.085	16.958
Groups of local councils					
Metropolitan	1 = metropolitan; 0 = otherwise, n = 15	0.22			
Regional	1 = regional/fringe; 0 = otherwise, n = 15	0.22			
Very large and large agricultural	1 = very large and large agricultural; 0 = otherwise, n = 17	0.25			
Medium and small agricultural	1 = medium and small agricultural; 0 = otherwise, n = 21	0.31			
Controls					
Median employee wage	Median taxable income for the financial year 2015/16.	$42,772	$7,718	$30,000	$84,478
Unemployed	Percentage unemployed.	6.205	2.912	0.738	15.512
Single parents	Number of persons identifying as single parents.	543	932	7	4,473
Aged pensioners	Number of persons receiving a federal government aged pension.	3,167	4,443	14	21,704

2. To identify what factors contribute to the instability in expenditure based on the results in (1) above, we used a multiple regression model to estimate possible effects of population size, population density, number of households and business units and environmental factors on local government expenditures.

$$E = \alpha + \beta_1 P + \beta_2 X + \mu \qquad (1)$$

In Equation (1), E is the log of per household expenditure, P is a vector of population variables (i.e. population, population squared, population density, households and business units), X is a vector of exogenous control variables (i.e. the average population growth rate over five years, percentage of ATSIC population, median taxable income for the financial year 2015/16, the percentage employed persons, the number of persons identifying as single parents, the number of persons receiving a federal government age pension, and dummy types of councils), and μ is an error term.

To provide a comprehensive examination of scale economies in SA local government, we tested for the presence of (i) linear scale economies and (ii) non-linear scale economies by estimating our series of regression models with and without a quadratic population term. This approach was undertaken in order to capture the presence of either increasing or decreasing scale economies in the provision of local government services (i.e. identifying the presence of a 'U-shaped' relationship). In addition, unlike previous studies, we use the bootstrapping techniques with 2,000 replications to eliminate unobserved errors in order to produce more robust findings.

In essence, our empirical strategy was divided into the following four main parts:

First, we tested the difference in the variances of per capita and per household expenditure with respect to various types of expenditure. This method provides us with empirical evidence as to why per household expenditure would be a better indicator to explain variation in the expenditures of local councils in SA local government.

Then, we examined the impacts of environmental variables as mentioned in (iii), population size and population density, the number of household and business units on the log of total expenditure per household, using a linear regression model. We then disaggregated the log of total per household expenditure into its various components (i.e. recreational, environmental, community and health, and residual per household) in order to estimate the association between the expenditure type and environmental factors and population size. This approach allowed us to examine whether environmental influences are present for particular

components of total expenditure since some local government services may be more likely to be affected than other services. Finally, we then extended this model to non-linear regression models.

4. EMPIRICAL RESULTS

In this section, we summarise our empirical findings in terms of the research questions set out earlier:

Difference in Variances of Per Capita and Per Household Expenditures in Terms of Various Types of Expenditure

Using the F test for equality of variances, we found that the variances in per household expenditures were significantly higher than those in per capita expenditures. From Table 2, it can be seen that the variances in per household expenditures on health and community were five times greater than those of per capita expenditures on health and community. In an analogous vein, variances of per household residual expenditures were more triple than those of per capita residual expenditures. With respect to other types of expenditures, the variances of per household expenditures showed greater volatility (more than twice as large compared to the variance of per capita expenditures). These findings provide statistical evidence that per household expenditure could be potentially a more precise proxy to explain large variations in expenditures of local councils, as indicated in the relevant empirical literature (Dollery and Drew, 2014; Kushner and Ogwang, 2017).

Table 2. Difference in Variances of Expenditure Per Capita and Per Household. Source: the Authors.

Expenditure (‘000)	Variances per capita	Variances per household	F value [b]
Total	3.05	7.76	0.30***
Recreation	0.04	0.09	0.41***
Environment	0.03	0.09	0.30***
Community & health	0.04	0.20	0.20***
Residuals	1.35	4.92	0.27***

[b] The F test for equality of variances, *** the significance level at 1%

The Impacts of Independent Variables and Environmental Factors on Per Household Expenditures in Terms of Various Types of Expenditure

Tables 3 and 4 present the impacts of population size and environmental variables, including proportion of ATSIC persons, number of age pensioners, single parents, median income, proportion of unemployed people, households, businesses and types of councils on per household expenditures with respect to different types of expenditures.

Table 3. Log of Per Household Expenditure by Type of Expenditure in 2015/16 (n = 68). Source: the Authors.

LINEAR	**Model 1: Total expenditure**	**Model 2: Recreational Expenditure**	**Model 3: Environmental Expenditure**	**Model 4: Community and Health Expenditure**	**Model 5: Residual Expenditure**
Population/10000	-0.0492	-0.429	-0.156	-0.496	0.418
	(0.3537)	(0.393)	(0.311)	(0.512)	(0.568)
Density (log)	-0.0711	-0.030	-0.022	-0.056	-0.087
	(0.0519)	(0.054)	(0.0495)	(0.074)	(0.080)
Households	-0.000072	-0.000019	0.000018	0.00019	-0.00028*
	(0.00011)	(0.00013)	(0.000089)	(0.00015)	(0.00017)
Businesses	0.000082	0.00016	0.000076	0.000013	0.00011
	(0.000104)	(0.00010)	(0.000052)	(0.000059)	(0.00016)
Proportion of Aboriginals	0.0408***	0.040***	0.018**	0.023	0.046**
	(0.0139)	(0.010)	(0.0093)	(0.024)	(0.021)
Population growth	4.5740	1.144	-0.435	7.304	5.866
	(4.813)	(5.763)	(5.140)	(8.788)	(7.035)
Number of pensioners	0.000070	0.00016	-0.000025	-0.00016	0.00023*
	(0.000089)	(0.00012)	(0.00008)	(0.000104)	(0.00013)
Single parents	0.00054	0.00093***	0.00037	-0.000044	0.00063
	(0.00035)	(0.00033)	(0.00029)	(0.00038)	(0.00057)
Median employment income	0.000014	0.000035**	0.000024	0.0000065	0.000012
	(0.000016)	(0.000018)	(0.000021)	(0.000026)	(0.000020)
Proportion of unemployment	-0.040**	-0.035*	-0.011	0.016	-0.064**
	(0.018)	(0.022)	(0.018)	(0.030)	(0.028)
Very large-large agriculture	0.058	0.268	0.276	-0.029	0.085
	(0.292)	(0.364)	(0.282)	(0.491)	(0.494)
Medium-small agriculture	0.079	0.662	0.332	0.294	-0.095
	(0.382)	(0.439)	(0.362)	(0.596)	(0.637)
Regional	-0.057	0.086	0.133	0.408	-0.224
	(0.219)	(0.251)	(0.214)	(0.294)	(0.388)
Metro					
Constant	7.993***	4.294***	5.183***	5.784***	7.653***
	(0.734)	(0.872)	(0.873)	1.225	0.972
R^2	69.04	54.45	30.38	25.95	67.02

Standard errors in parentheses with 2,000 bootstrap replications
* p<0.10, ** p<0.05, *** p<0.01

All regressions control for average population growth rate over five years, percentage of Aboriginal and Torres Strait Islanders population, median taxable income for the financial year 2015/16, percentage unemployed, number of persons identifying as single parents, and number of persons receiving a federal government aged pension.

Table 4. Log of Per Household Expenditure by Type of Expenditure in 2015/16 (n = 68). Source: the Authors.

NONLINEAR	**Model 1: Total expenditure**	**Model 2: Recreational Expenditure**	**Model 3: Environmental Expenditure**	**Model 4: Community and Health Expenditure**	**Model 5: Residual Expenditure**
Population/10000	-0.091	-0.427	-0.152	-0.495	0.334
	(0.316)	(0.411)	(0.318)	(0.532)	(0.485)
Population squared	0.010	-0.00054	-0.0010	-0.00011	0.020**
	(0.007)	(0.0072)	(0.0063)	(0.0063)	(0.0095)
Density (log)	-0.078*	-0.030	-0.021	-0.056	-0.101
	(0.045)	(0.053)	(0.050)	(0.075)	(0.066)
Households	-0.000046	-0.000020	0.000015	0.00019	-0.00023
	(0.000096)	(0.00014)	(0.000092)	(0.00016)	(0.00015)
Businesses	0.000061	0.00016	0.000079	0.00001	0.00007
	(0.000079)	(0.00010)	(0.000055)	(0.00007)	(0.00011)
Proportion of Aboriginals	0.033**	0.040***	0.019**	0.023	0.030*
	(0.014)	(0.011)	(0.0091)	(0.024)	(0.018)
Population growth	6.398	1.045	-0.622	7.285	9.540
	(4.354)	(5.922)	(5.30)	(8.998)	(5.957)
Number of pensioners	0.0000058	0.00017	-0.000019	-0.00016	0.00010
	(0.000082)	(0.00012)	(0.000085)	(0.00011)	(0.00012)
Single parents	0.00012	0.00095***	0.00042	-0.00004	-0.00023
	(0.00046)	(0.00037)	(0.00042)	(0.00047)	(0.00060)
Median employment income	0.000012	0.000035**	0.000024	0.00001	0.0000082
	(0.000015)	(0.000018)	(0.000020)	(0.00003)	(0.000017)
Proportion of unemployment	-0.012	-0.037	-0.014	0.015	-0.0070
	(0.018)	(0.024)	(0.020)	(0.030)	(0.026)
Very large-large agriculture	-0.062	0.274	0.288	-0.028	-0.158
	(0.261)	(0.372)	0.292	(0.495)	(0.429)
Medium-small agriculture	-0.036	0.668	0.344	0.295	-0.327
	(0.338)	(0.449)	(0.377)	(0.604)	(0.538)
Regional	-0.039	0.085	0.131	0.408	-0.189
	(0.208)	(0.282)	(0.229)	(0.318)	(0.321)
Constant	8.169***	4.284***	5.165***	5.782***	8.008***
	(0.668)	(0.898)	(0.851)	(1.195)	(0.844)
R^2	74.99	54.47	33.93	25.95	77.58

Standard errors in parentheses with 2,000 bootstrap replications
* p<0.10, ** p<0.05, *** p<0.01

All regressions control for average population growth rate over five years, percentage of Aboriginal and Torres Strait Islanders population, median taxable income for the financial year 2015/16, percentage unemployed, number of persons identifying as single parents, and number of persons receiving a federal government aged pension.

Population Size/Density and Population Growth

As indicated in Tables 3 and 4, population size (squared) only affects positively and significantly per household residual expenditures in the non-linear model. This implies that an increase in population would increase per household residual expenditures. The findings are in line with the results found in Tran *et al.* (2019). We note that population size does not influence other types of per household expenditures in both the linear and non-linear regression models. Furthermore, it is interesting to observe that population density negatively and significantly affects per household total expenditures: that is, a 10 per cent increase in the population density leads to 0.78% decrease in per household total expenditure. However, population growth did not contribute to variation in types of per household expenditures.

Proportion of ATSIC Persons

The coefficient of the proportion of ATSIC persons is positively and significantly related to types of per household expenditures in both the linear and non-linear models, except for per household expenditure on community and health. This finding reveals that the higher the proportion of ATSIC persons, the higher the expenditure per household on various types of services provided by local authorities. The proportion of ATSIC persons does not affect per household expenditure on health and community because ATSIC persons might participate proportionately less in these services. A recent study by Tran and Dollery (2020) indicated that the proportion of ATSIC had a significantly negative effect on efficiency in expenditure of local councils. In other words, the higher the proportion of ATSIC, the larger the expenditure; thus it would cause less efficiency in using the expenditure of local councils.

Number of Age Pensioners

The estimated coefficient of the number of age pensioners indicates that there is a positive and significant association between the number of pensioners and per household expenditures of residuals. The higher the number of pensioners, the higher the expenditures per household for residuals. The results are accordant with the findings of Tran and Dollery (2019) in which the number of pensioners positively affected the total expenditures of local councils. However, this coefficient has no effect on other types of per house expenditures, but a positive influence was found for community, environmental and recreational expenditures in Tran and

Dollery (2019) and for recreational expenditure in Kusher and Ogwang (2017).

Single Parents

The estimated model shows that the effect of the proportion of single parents is positive and significant for per household expenditures for recreation in both linear and non-linear models. In essence, the proportion of single parents, the higher the expenditure on recreation in the surveyed sample. However, the rise in recreational expenditure per household caused by this variable is marginal. Moreover, the single parent variable has no influence on other types of per household expenditures in SA local government. The findings of Tran and Dollery (2019) revealed that the effect of single parents was mixed for total expenditures and other types of expenditures of local councils.

Median Income

The results from regression models indicate that the higher median incomes lead to higher per household expenditures on recreation. Nevertheless, the coefficient of this variable is negligible. It is surprising to see that - except for per household recreational expenditure - the level of income does not seem to affect other types of per household expenditures at all. This finding is in line with the literature when testing the relationship between median income and expenditure of local municipalities (Kushner and Ogwang, 2017; Tran and Dollery, 2019),

Proportion of Unemployed People

Our empirical findings reveal that the proportion of unemployed persons is negatively and significantly associated with total expenditure, recreational and residual expenditure per household. The higher the proportion of unemployment, the less the expenditure per household on recreation and residual, thereby the less the total expenditure for local authorities. The results of Tran and Dollery (2019) provided the same findings as in our paper, that is, the proportion of unemployment negatively impacts recreational expenditures, and in the rural areas.

Households/Businesses/Types of Councils

The number of households affects negatively and significantly per household residual expenditures only. However, the estimated coefficient in the linear regression model showed that this effect was negligible. By contrast, the number of businesses did have no impact on the types of per household expenditures. In the same vein, there is no difference in per household expenditures between types of councils (i.e. very large and large agriculture, medium and small agriculture, and regional councils) and the reference category of council (i.e. metro councils). Using Hardle and Mammen's model, Tran and Dollery (2019) showed that household/businesses had mixed influences on total expenditures and types of expenditures of local councils and these influences were significant at the 5% significance level.

In sum, it is clear that the variables included in our empirical analysis impact differently on different types of per household expenditures. Furthermore, the main factors affecting total expenditure are population density, the proportion of ATSI persons and unemployed persons. In the case of recreational expenditure, the main variables that affect this type of expenditure are the proportion of ATSI persons, single parents, median income levels and unemployment. Environmental expenditures are associated only with the proportion of ATSIC persons. Finally, only the number of households, the proportion of ATSI persons, the number of pensioners and unemployed persons affect the residual expenditures.

Table 5. Summary of Results. Source: the Authors.

Controls/Expenditures	Total	Recreation	Environment	Residual
Population size (squared)				+
Density	-			
Households				-
Aboriginal	+	+	+	+
Pensioners				+
Single parents		+		
Income		+		
Unemployment	-	-		-

5. DISCUSSION AND CONCLUSION

A major objective of the empirical analysis conducted in this paper was to investigate the comparative merits of using population size and the number of households and business entities as proxies for local

government outputs in terms of the different services provided by local authorities. In addition, we wanted to determine which exogenous variables best explained differences in expenditure dispersion.

Following our empirical analysis, our major findings can be summarised as follows: First, dispersion in the distribution of per household expenditure is significantly greater than that in the distribution of per capita expenditure, as indicated in Table 2. This implies that per household expenditure could be potentially a more accurate proxy to capture the volatility in the expenditure of local councils. Then, environmental factors impact differently on the various kinds of per household expenditures. It follows local authorities may find it difficult to reduce (or at least slow the rate of increase) their expenditures given that these non-discretionary factors fall outside of their control.

An apparent anomaly in our findings is that expenditure on community and health is not affected by any of the variables included in the analysis. This is counterintuitive. One possible explanation may reside in the nature of the data collected for this variable. In terms of Australian fiscal federalism, health services are primarily a state government function. In SA local government, in terms of official data collection, it may well be that community and health services as a category may not accurately describe the nature of the outlays involved. Future research into the area could focus on this ostensive anomaly.

At least two policy implications flow from our analysis. Firstly, in terms of public policies aimed at securing financial sustainability in SA local government, the significance of non-discretionary factors in municipal expenditure, which fall outside of the control of individual local authorities, implies that policy intervention aimed at reducing expenditure through compulsory council consolidation or statutory limitations on property tax increases (i.e. 'rate-pegging') is unlikely to succeed. This supports the conclusions of other empirical work on financial sustainability in SA local government through rate-capping (Dollery and McQuestin, 2017) and forced mergers (Dollery and Drew, 2017). A more promising approach would be adjusted the inter-governmental grant system in SA to calibrate grants more closely to non-discretionary factors, which impose upward pressure on expenditure in financially struggling councils.

Secondly, in the host of countries worldwide which operate local government systems with a preponderant emphasis on 'services to property', both empirical analysis of the determinants of municipal expenditure, as well as allied policy development on restraining expenditure, should use the number of households and business entities as the proxy for local government output rather than population size. Apart

from Australia and New Zealand, most of sub-Saharan Africa, India, Pakistan and many other Asian countries, like Malaysia, all have comparatively narrowly focused local government systems in which households and businesses are the best proxies for municipal output. Moreover, the use of population as a proxy for local service output is generally extended on the study of local government efficiency because it is expected to represent the service volume that a council must provide (Balaguer-Coll, 2004; Pérez-López *et al.,* 2015). In this sense, when the global efficiency of the council is calculated - including 'services to property' such as waste collection or water distribution - the population is used as a measure of the output of the services (Narbón-Perpiñá and De Witte, 2018b). In this sense, it should be interesting to consider also the number of households and businesses as service output.

In conclusion, our paper has contributed to the literature in terms of the finding that using per household expenditure could be potentially a better proxy to capture the volatility in the expenditure of local councils, and that environmental factors had influences on various types of per household expenditures. However, further studies should investigate more exogenous factors that are more likely to influence expenditures. In addition, panel data are more likely to be suggested to capture the level of influence of independent variables and exogeneous factors on per household expenditure.

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