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An Empirical Analysis of Scale Economies in Administrative Intensity in the Paraná State Local Government System in Brazil

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Abstract: A substantial empirical study has investigated scale economies in local government functions, most notably in local transportation, water, and wastewater provision. By contrast, relatively little effort has been directed at the empirical analysis of economies of scale in municipal administration, including in Brazilian local government, despite its significance for public policy on structural reform in local government. In order to address this gap in the literature, we investigate administrative scale economies in the Paraná state local government system in Brazil over the period 2006 to 2018. We find that there was a 'U-shaped' scale effect between council size by population and administrative intensity after controlling for a range of economic and social variables. Various public policy implications are considered.

1. Introduction

Almost all local government systems comprise local authorities that vary significantly in terms of their environmental characteristics, such as population size, population density, geographic size, and topographical features. A substantial empirical study has examined the operational efficiency of local government, including the impact of scale economies at both the system-wide level and in specific municipal functions and services, especially in urban transportation, water, and wastewater [1–3]. The magnitude of scale economies in local government is significant in various respects, including in terms of public policy aimed at improving municipal performance through structural reform by means of municipal mergers, shared service programs, and other policy instruments [4,5].

Despite the voluminous empirical study on scale economies in local government, little effort has been directed at the empirical investigation of scale economies in municipal administration [6]. Given the emphasis frequently placed on minimizing administrative costs in real-world policy initiatives involving municipal mergers, this is surprising. However, some significant empirical work has been undertaken [6–10]. In the scholarly literature, administrative intensity is typically defined as the administrative costs of running an organization. Several methods have been used to proxy administrative intensity, such as the percentage of employees deployed in central administration and the proportion of total outlays expended on administration [11]. The degree of administrative intensity in any given public organization is affected by both its internal organizational characteristics [7,12–14] and its external environment [15,16].

Since a high proportion of 'back-office' costs to 'front-line' expenditure can lead to disproportionate overhead costs [12,17,18], and hence possibly diminish the operational efficiency of local government, it is unfortunate that the problem has not been thoroughly examined. Given the paucity of empirical analyses on scale economies in administrative

intensity in local government, we seek to address this gap in the empirical literature on local government by empirically examining scale economies in administrative intensity in the Paraná state local government system in Brazil between 2006 and 2018. In particular, we seek to establish whether (i) administrative scale economies exist in the Paraná state local government system, and (ii) whether any significant differences in administrative intensity are evident between metropolitan and non-metropolitan councils.

Given the high and increasing proportion of very small population size municipalities in the Paraná state local government system, as well as the institutional imperatives for forming new small municipalities, commentators have expressed concern over its impact on municipal performance [19,20]. A debate has subsequently arisen around whether public policy measures, such as structural reform through municipal mergers, should be introduced to increase the size by population of Paraná local authorities [19,20]. By investigating the question of scale economies in municipal administration, this paper can contribute to this debate.

The paper is divided into five main parts. By way of institutional background, Section 2 briefly describes the Brazilian local government, including the Paraná state local government system. Section 3 summarizes the empirical literature on administrative scale economies in local government. Section 4 describes the data and empirical strategy employed, while Section 5 presents the results of the analysis. Section 6 provides a discussion of the results and the associated broader policy implications. The paper ends in Section 7 with some brief concluding remarks.

2. Brazilian Local Government

Under its Constitution of 1988, Brazil has a federal system of government comprising a national government and 26 state governments, each with its own local government system [21]. As of November 2018, Brazil had a total of 5570 municipalities, together with a single federal district, for a population of some 208.5 million people across a spatial area of about 8.5 million km^2 [22].

The political structure of the Brazilian local government is unusual [21]. In essence, local authorities in the different Brazilian state local government systems have statutorily empowered elected mayors (*prefeito*) and deputy mayors (*vice prefeito*), overseen by an elected legislative body (*câmara de vereadores*) [21]. Mayoral elections take place every four years and mayors are restricted to a maximum of two consecutive terms [21].

The population size of a given municipality determines the composition of its elected body in terms of the aggregate number of councillors. There must thus be at least nine elected representatives for local governments with a total population of up to 15,000 residents, and no more than 55 elected representatives for local authorities with more than 8 million residents [23]. Elected councillors and mayors alike serve four-year terms [24]. In addition to assuming responsibility for the provision of local services, most notably primary education, public health services and public transportation, in Brazilian local government mayors also assume authority over cultural, environmental and heritage questions [21].

Since 1950, the number of Brazilian municipalities has increased exponentially in line with rapid population growth. Table 1 provides a summary of the growth in the number of municipalities in Brazil and Paraná, as well as municipal size by population and population density. As we can see from Table 1, over the period 1950 to 2018, the total Brazilian population rose from 51,944,397 to 208,494,900 people, which is about a fourfold increase. Notwithstanding a demographic shift from rural areas to cities, the non-metropolitan population nonetheless increased [22]. As a result, the number of local authorities rose in Paraná. A contemporary political debate has arisen over the optimal number of local government areas in Paraná, with some commentators recommending municipal mergers of local authorities with less than 5000 residents [19,25].

Table 1. Number of municipalities in Brazil and Paraná, 1950–2018.

Panel A: Brazil				
Year	Municipalities	Population	People Per Municipality	Density (Population/Km^2)
1950	1889	51,944,398	27,498	6.1
1960	2766	70,324,103	25,424	8.34
1970	3952	93,134,846	23,567	11.1
1980	3991	119,011,052	29,820	14.23
1990	4491	146,825,475	32,693	17.26
2000	5507	169,799,170	30,833	19.92
2010	5565	190,747,731	34,276	22.43
2018	5570	208,494,900	37,431	26.69
Panel B: Paraná				
Year	Municipalities	Population	People Per Municipality	Density (Population/Km^2)
1950	80	2,115,547	26,444	10.62
1960	162	4,263,721	26,319	21.56
1970	288	6,929,821	24,062	35.11
1980	290	7,629,849	26,310	38.89
1990	323	8,448,713	26,157	42.37
2000	399	9,003,804	22,566	47.96
2010	399	10,444,526	26,177	52.40
2018	399	11,348,937	28,443	56.93

One reason for the increase in the number of 'small' municipalities in recent decades resides in the incentive structure and associated government transfers, which are primarily derived from the Municipal Participation Fund (MPF) [26]. Under the current arrangements, Brazilian municipalities with smaller populations receive, on average, a higher level of municipal participation funding on a per capita basis. This, in turn, has encouraged the proliferation of 'small' municipalities (<10,000 residents), which have become increasingly dependent on intra-governmental transfers [27]. Given the high proportion of small local authorities by population in the Paraná local government system, it provides a valuable real-world case to examine scale economies in terms of administrative intensity.

3. Economies of Scale in Municipal Administration

In the public administration literature, two conflicting hypotheses can be identified on the impact of administrative intensity in the public sector. In the first place, a public choice perspective holds that the costs associated with administration represent a "bureaucratic burden" that reduces the scarce resources available for public service provision [28]. By contrast, other scholars have argued that administrative intensity can improve organizational performance through enhanced decision-making, planning, and coordination [18,29,30]. Empirical research into administrative intensity has considered several aspects of the problem in public sector entities, ranging from relatively uncomplicated single-purpose local public entities, such as American school districts [18,31] to complex multi-purpose public organizations, such as universities [13]. However, apart from Andrews and Boyne [7] and a handful of other investigators [6,8,9,15,16,32–34], scant empirical research has examined administrative intensity in local government.

With respect to scale economies in municipal administrative intensity, Andrews and Boyne [7] found that municipal size by population is negatively related to administrative costs in English local government. Similarly, in their study of local government in the Netherlands, Bikker and van der Linde [9] (p. 460) established that scale economies in local administration exist "at 17% around the mean—higher for smaller and lower for larger municipalities". In contrast, in their study of administrative intensity in the Sabah state local government system in Malaysian Borneo, Ting, Dollery and Villano [8] found that for

small and large local authorities, population size had no impact on administrative intensity. However, the number of employees had a non-linear (inverted 'U-shaped') effect on the proportion of administration costs. Along similar lines, in their study of the New South Wales local government system in Australia, Reddy Yarram, Tran and Dollery [6] found that municipal size by population revealed a 'U-shaped' relationship with regard to the administration costs of urban municipalities. However, they found no evidence of scale economies in administrative intensity in rural and regional local authorities. Given these mixed empirical findings, we investigate whether a statistically significant relationship exists between administrative intensity and municipal size by population in the Paraná state local government system.

4. Empirical Strategy

The data employed in this study were derived from multiple sources, which routinely collect and publish annual data on Brazilian local government areas. Expenditure data were sourced from FINBRA [35], which has published detailed information on municipal expenditure since 1986. This data collection, which is managed by IPARDES [36] and Sidra [37], includes information on population size, geographical area, population density, population growth, and the principal economic activity of the local government area (i.e., agricultural, industrial, or trade). The data collected by IBGE [38] yields information on the political dimension of municipal institutions. Finally, the data compiled by the RAIS [39] provides information on all formal workers in the state of Paraná. Moreover, data from IBGE [40] was used to classify each local government area as either metropolitan or non-metropolitan.

Data from these varied sources were used to construct a 13-year panel dataset over the period 2006 to 2018. When creating our panel dataset, we excluded a small number of missing observations (1.62%). Thus, our final sample comprised 5104 observations for 399 local government areas over 13 years. It is important to note that theoretical insights drawn from the literature on administrative intensity drove the selection of the dependent and independent variables and the specification of the subsequent econometric model. The dependent variables used in the econometric analysis were selected to measure administrative intensity, which is comprised of expenditure on planning, general administration, financial administration, internal control, territorial planning, human resource training, revenue management, outsourcing, and social communication. As a result, administrative expenditure represents a sound proxy for back-office costs in the context of Brazilian local government data. Several independent variables were also included in our econometric models to capture and control for the effects that municipal size and a variety of municipal characteristics may exert on administrative intensity.

4.1. Dependent Variables

In our subsequent statistical analysis, we employed the following measures of administrative intensity for the 399 local government areas in Paraná over the period 2006 to 2018: (i) the natural logarithm of administrative expenditure per capita; and (ii) the natural logarithm of administrative outlays as a percentage of total net expenditure.

Prior to logarithmic transformation, our dependent variables were converted in 2018 to Reais (BRL) using the Brazilian Extended National Consumer Price Index (IPCA) to remove any inflationary effects. Figure 1 illustrates the trend in our untransformed dependent variables between 2006 and 2018. Two important points are worth noting. In the first place, per capita administrative expenditure has grown from around BRL 400 in 2006 to BRL 560 in 2018 (an increase of 40%). Secondly, administrative expenditure (as a proportion of total expenditure) has steadily declined from 19.20% in 2006 to 15.50% in 2018. This indicates that while per capita administrative expenditure is increasing, it is growing at a rate less than the growth in total municipal expenditure.
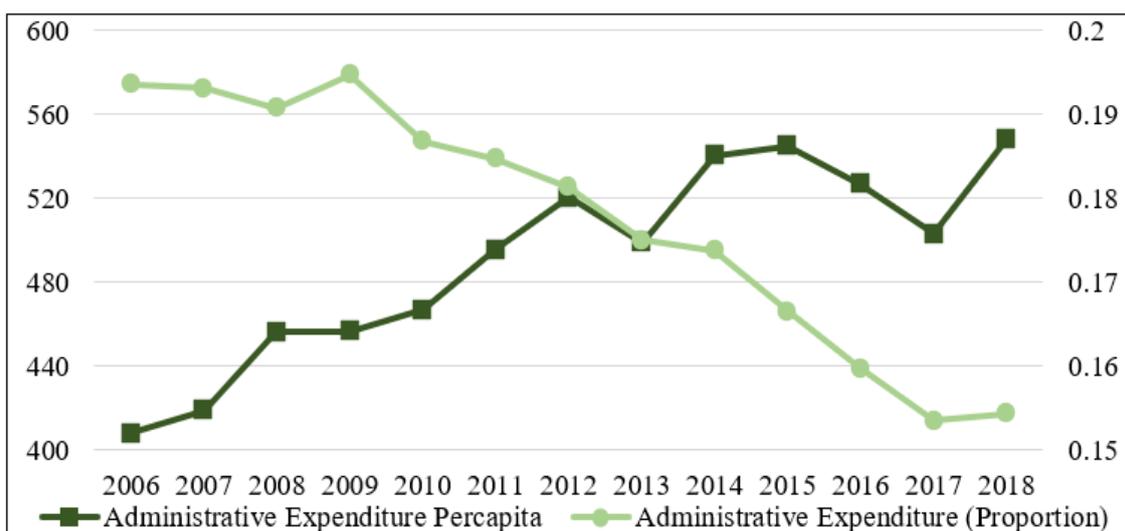
Figure 1. The administrative intensity in Paraná, 2006–2018.

We then transformed our dependent variables into a natural logarithmic scale to correct for skewness and to normalize our data. This type of transformation is commonplace, and it has been previously employed in similar studies that have empirically examined whether economies of scale are present in municipal expenditure [20,41–44].

4.2. Explanatory Variables

The explanatory variables employed in our subsequent empirical analysis were broadly classified as either population variables or control variables. For each municipal area, our population variables consisted of population size, the square of population size, and population density. In the context of local government, population size is a measure commonly used in debates on structural reform through municipal mergers, and it is often the variable that policymakers employ to propose changes in local authority boundaries [7]. Thus, our investigation is based on council size by population size in order to shed light on the current debate on municipal amalgamation in Brazilian local government. We also include population density—split into four categories—to control for municipalities with vastly different population density profiles [20,41,42].

Municipal differences in terms of socioeconomic factors were accounted for by the inclusion of the following control variables: (i) age diversity, (ii) ethnic diversity, (iii) political outlook (i.e., left-wing mayor), (iv) income level (municipalities in the bottom 25% of the income distribution), (v) whether the municipality was classified as metropolitan or non-metropolitan, and (vi) the municipality's principal economic activity (i.e., agricultural, industrial, or trade).

The diversity of the population, estimated as age diversity and ethnic diversity, is an essential control variable because a more varied local population may require more resources to identify and address its needs [7]. To measure these variables, we used data from RAIS [39], which provides data on all formal workers in Brazil. We constructed our demographic diversity variables following Andrews and Boyne [7]. More specifically, "the proportion of the sub-groups within each of these categories", within a municipal area, "were squared and then summed before being subtracted from 10,000", [7] (p. 749). The construction of the ethnic diversity variable is based on the following subgroups: White, Black, Asian, Mixed, and Indian. The construction of the age diversity variable is based on the following subgroups: 16–25; 26–35; 36–45; 46–55; 56–65. Thus, a higher score reflects a higher level of age and ethnic diversity, respectively.

Another important control variable is related to the economic activity of a local government area [10]. As such, we included a measure of the main economic activity for each local government area (i.e., agricultural, industrial, or trade). Furthermore, the

nature of political disposition has also been routinely used in the empirical literature, given its putative impact on local public expenditure. Thus, we include a binary variable to denote if the elected mayor is affiliated with a left-wing political party. We classified the following political parties as being left of centre: PCdoB (Partido Comunista do Brasil), PDT (*Partido Democrático Trabalhista*), PMN (*Partido da Mobilização Nacional*), PPL (*Partido Pátria Livre*), PPS (*Partido Popular Socialista*), PSB (*Partido Socialista Brasileiro*), PSOL (*Partido Socialismo e Liberdade*), PT (*Partido dos Trabalhadores*), PV (*Partido Verde*) and REDE (*Rede Sustentabilidade*) [45]. However, it is critical to note that delineating between two ideological political platforms in Brazil (i.e., left and right of centre) is particularly challenging given the proliferation of political parties [21]. Finally, a wave indicator (year) was also included to account for period effects. The definitions and summary statistics of the variables employed in our econometric analysis are reported in Table 2.

Table 2. Definitions and summary statistics.

Variable	Description	Mean	SD	Min	Max
Administrative Intensity					
Administrative expenditure (proportion) *	The log of administrative expenditure as a percentage of net current expenditure	0.18	0.07	0.03	0.81
Administrative expenditure (per capita) *	The log of the per capita administrative expenditure	491.62	285.95	56.40	4375
Demographics					
Population	The number of people residing in each local government area divided by 10,000	2.74	10.39	0.13	191.72
Population squared	Population squared	115.46	1712.74	0.02	36,756
Density 1	Population density < 16.66; 0 = otherwise	0.25	0.43	0	1
Density 2	1 = Population density from 16.67 to 25.19; 0 = otherwise	0.24	0.43	0	1
Density 3	1 = Population density from 25.20 to 39.71; 0 = otherwise	0.25	0.43	0	1
Density 4	Population density from 39.72 to 4.408.71; 0 = otherwise	0.25	0.44	0	1
Controls					
Age diversity *	The log of the age diversity	7595.82	124.47	6834.43	7880.80
Ethnic diversity *	The log of the ethnic diversity	5137.36	2456.69	0	9945.92
Political positioning	1 = Left wing mayor; 0 otherwise	0.28	0.45	0	1
Income bottom 25%	1 = Municipality in the bottom 25% of the income distribution; 0=otherwise	0.25	0.43	0	1
Metropolitan	1 = metropolitan; 0 = otherwise	0.33	0.47	0	1
Agricultural	1 = agricultural is the main activity; 0 otherwise	0.50	0.50	0	1
Industry	1 = industry is the main activity; 0 otherwise	0.07	0.26	0	1
Trade	1 = trade is the main activity; 0 otherwise	0.42	0.49	0	1

* Note: Summary statistics before logarithmic transformation.

4.3. Empirical Approach

The association between administrative intensity and population size was estimated using panel data. The simplest version of the analysis is the pooled model, which assumes that the model has constant coefficients, referring to both intercepts and slopes. The fixed-effects model allows unobserved individual effects to be captured in the model. However, we also estimated a random-effects model by including the differences between units as parametric shifts of the regression function. This technique is appropriate when sampled cross-sectional units are drawn from a large population. There are various well-known differences between pooled, fixed-effects, and random-effects models. We applied the Breusch–Pagan Lagrange multiplier (LM) test in order to verify which model produces more consistent results (i.e., pooled or random-effect model). We then used the Hausman test to compare the differences between the random-effects and the fixed-effects models.

More specifically, we applied a pooled OLS, random-effects, and fixed-effects model for each local government area i over period t:

$$AI_{it} = \alpha_{it} + \beta_1 P + \beta_2 X_{it} + \mu_{it} \tag{1}$$

The dependent variables in Equation (1)—*AI*—are the administrative intensity variables (i.e., the natural logarithm of per capita administrative expenditure and administrative expenditure as a percentage of total net expenditure), *P* is a vector of population variables (i.e., population size, population squared, and population density), *X* is a vector of control variables as described above, and *μ* is an error term. In our econometric analysis, the quadratic population term is of primary interest since it enables us to identify the existence of a 'U-shaped' association between administrative intensity and population size.

The empirical approach adopted in this study consists of two main parts. In our first econometric specification, we investigate the relationship between the natural log of per capita administrative expenditure and population with three different models (pooled, random-effects, and fixed-effects). Second, we extend our initial econometric specification to include a different proxy for administrative intensity, thereby estimating three-panel models with administrative expenditure as a percentage of total net expenditure as our dependent variable.

5. Results

Before reporting the results from our econometric analysis, in Table 3, we present annual per capita municipal administrative expenditure stratified according to population size. Annual per capita municipal administrative expenditure is stratified into eight population groups ranging from small (<2500 residents) to large (>90,000 residents). As we can see from Table 3, administrative per capita expenditure is markedly higher among local government areas with less than 2500 residents. For example, administrative per capita expenditure in local government areas with less than 2500 residents is BRL 1119, which gradually declines as the population increases. A similar pattern emerges from our other dependent variable—administrative expenditure in proportion of total current expenditure—which is 0.2135 among municipalities with less than 2500 inhabitants, and then falls in line with population size. For example, in municipalities with more than 90,000 residents, administrative expenditure represents 15.76%.

Table 3. The administrative intensity stratified by population, Paraná, 2006–2018.

Expenditures	Population Category							
	Population ($\times$10,000)							
	<0.25	0.25–0.4	0.4–0.6	0.6–1	1–2	2–4	4–9	>9
Administrative expenditure (per capita)	1119	780	634	449	358	336	268	347
Administrative expenditure (proportion)	0.2135	0.2053	0.2035	0.1836	0.1594	0.1578	0.1367	0.1576
Observations	451	743	579	779	893	415	283	174
Number of councils	14	51	72	62	104	49	21	23

Note: Constant *Reais* (BRL) values (2018).

While these initial descriptive results display an obvious pattern, this initial result should not be viewed in isolation since we need to conduct a formal empirical test to verify whether there is a statistically significant quadratic relationship between population size and per capita municipal administrative expenditure, while simultaneously controlling for a variety of factors that may influence administrative expenditure. Accordingly, we now turn to the results from our econometric analysis, which was designed to account for these various factors.

In Table 4, we report the association between the log of per capita administrative expenditure and population size. As noted earlier, we estimated the model using three different specifications (pooled, random-effects, and fixed-effects). The models provide

an adequate level of statistical explanation of the variation in the administrative intensity variable (Table 4). In order to assist in the interpretation of our results, we divided the population size by 10,000 so that the estimated regression coefficient represents the marginal effect of a 10,000-resident increase in the population. Moreover, it is important to stress that the population and population-squared coefficients are statistically significant ($p < 0.01$), indicating the presence of a 'U-shaped' curve.

Table 4. The administrative intensity in per capita expenditure, Paraná, 2006–2018.

	Pooled	**Random-Effects**	**Fixed-Effects**
Demographic			
Population	−0.0209 ***	−0.0284 ***	−0.0469 ***
	(0.002)	(0.005)	(0.011)
Population squared	0.0001 ***	0.0001 ***	0.0001 **
	(0.000)	(0.000)	(0.000)
Density 2	−0.0261	−0.1306 ***	−0.1242 ***
	(0.019)	(0.026)	(0.029)
Density 3	−0.0854 ***	−0.2243 ***	−0.2002 ***
	(0.020)	(0.030)	(0.036)
Density 4	−0.2770 ***	−0.2824 ***	−0.1926 ***
	(0.024)	(0.038)	(0.047)
Controls			
Age diversity	0.2947	−0.1609	−0.2302
	(0.473)	(0.371)	(0.377)
Ethnic diversity (log)	0.1597 ***	0.0246 ***	0.0180 **
	(0.013)	(0.008)	(0.008)
Political positioning (log)	−0.0430 ***	−0.0293 ***	−0.0266 ***
	(0.015)	(0.008)	(0.008)
Income bottom 25%	−0.0317	0.0020	0.0065
	(0.021)	(0.010)	(0.010)
Metropolitan	0.0592 ***	0.0453 ***	0.0417 ***
	(0.015)	(0.014)	(0.014)
Industry	−0.0292	0.0857 ***	0.0948 ***
	(0.028)	(0.021)	(0.022)
Trade	−0.2265 ***	−0.0159	−0.0028
	(0.017)	(0.012)	(0.012)
Wave control	Yes	Yes	Yes
Constant	2.2884	7.3105 **	7.9930 **
	(4.203)	(3.314)	(3.366)
R-squared	0.2622	0.2108	0.2151
Breusch–Pagan Lagrange test		18,959	
Hausman-test			115.94
N. of cases	5104	5104	5104

Standard errors in parentheses. * $p <0.1$, ** $p <0.05$, *** $p <0.01$.

It should be noted that all models yield similar results, indicating that the findings are robust to alternative econometric models. However, according to the Breusch–Pagan LM test, the random-effect model generates superior results to the pooled model. We then conducted a Hausman test to verify the differences between the random-effects and fixed-effects models, and found that the fixed-effects model was the preferred econometric specification.

Considering both the population and the population squared coefficients, an increase from 10,000 to 20,000 residents in a given local government area will, on average, lead to a decline in per capita administrative expenditure from BRL 475.68 to BRL 453.92. This represents a reduction of 4.57% in administrative expenditure in the fixed-effect model.

Furthermore, we note that our population density variables have a strong negative influence on per capita municipal expenditure, which is in line with the existing urban sprawl literature [46,47]. For instance, compared to the low-density reference group (Density 1),

administrative per capita expenditure for medium-density (Density 2) local government areas are, on average, 21% lower. The remaining density coefficients reported in Table 4 can be interpreted in a similar way. Intuitively, population density may influence expenditure in many respects. For example, a municipality with a small area can be administratively efficient, even with less than 10,000 residents, since the smaller the managed area, the lower the expenditure. Following this line of reasoning, we cannot compare a municipality with 10,000 inhabitants in the area of 1300 km^2 with a different municipality with 10,000 inhabitants in an area of 50 km^2.

Other interesting results emerge from an analysis of the economic, demographic and political variables. Demographic diversity does not appear to affect administrative intensity in the Paraná local government system. This finding is similar to other studies, such as Andrews and Boyne [7]. Moreover, it is important to note that we constructed this variable based on data on all formal sector workers in Brazil (i.e., more than 46 million people in 2018). However, while this is an extensive sample, it nonetheless represents only economically active persons, typically between the ages of 18 to 65. Despite this limitation, our large sample allows the generation of a very good sample for diversity in Brazil. Ethnic diversity, for example, yields striking results. The estimations of all three models reveal statistically significant coefficients ($p < 0.01$), indicating that ethnic diversity positively affects administrative expenditure.

Although the presumed partiality of left-wing mayors for higher levels of spending might lead to the expectation that administration costs would increase in left-wing controlled municipal areas, our results show a negative impact. We also included a variable to control for the level of municipal income, although this variable is not statistically significant. Finally, our results reveal that the administrative expenditure is higher for those municipalities located metropolitan areas compared to those municipalities located in non-metropolitan areas.

We also estimated administrative intensity as a percentage of total net expenditure. The results are presented in Table 5. In common with the previous estimations, we find the presence of a 'U-shaped' cost curve as the population and population-squared coefficients are statistically significant ($p < 0.01$). According to Breusch–Pagan LM and the Hausman, the fixed-effects model once again produces the most consistent results.

Table 5. The administrative intensity as a percentage of total net expenditure, Paraná, 2006–2018.

	Pooled	Random-Effects	Fixed-Effects
Demographic			
Population	−0.0114 ***	−0.0171 ***	−0.0413 ***
	(0.001)	(0.003)	(0.011)
Population squared	0.0000 ***	0.0001 ***	0.0001 **
	(0.000)	(0.000)	(0.000)
Density 2	0.0373 ***	−0.0106	−0.0089
	(0.014)	(0.022)	(0.028)
Density 3	−0.0198	−0.0554 **	−0.0363
	(0.014)	(0.025)	(0.034)
Density 4	−0.0446 ***	−0.0525 *	0.0080
	(0.017)	(0.031)	(0.045)
Controls			
Age diversity (log)	1.8397 ***	0.2377	−0.0140
	(0.339)	(0.345)	(0.360)
Ethnic diversity (log)	0.0859 ***	0.0389 ***	0.0328 ***
	(0.009)	(0.007)	(0.007)
Political positioning	0.0010	−0.0244 ***	−0.0248 ***
	(0.010)	(0.007)	(0.007)

Table 5. *Cont.*

	Pooled	Random-Effects	Fixed-Effects
Income bottom 25%	0.0186	−0.0083	−0.0063
	(0.015)	(0.010)	(0.010)
Metropolitan	0.0452 ***	0.0287 **	0.0231 *
	(0.011)	(0.013)	(0.014)
Industry	0.0069	0.0669 ***	0.0748 ***
	(0.020)	(0.020)	(0.021)
Trade	−0.0882 ***	−0.0060	0.0038
	(0.012)	(0.011)	(0.012)
Wave control	Yes	Yes	Yes
Constant	−18.7174 ***	−4.0367	−1.7100
	(3.009)	(3.080)	(3.218)
R-squared	0.1569	0.1991	0.2014
Breusch–Pagan Lagrange test		13,408	
Hausman test			79.21
N. of cases	5,104	5,104	5,104

Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Our results show that an increase from 10,000 to 20,000 residents in a given local government area will, on average, lead to a decline in administrative expenditure ratio from 18.30% to 17.56%. Moreover, we also observe the relationship between population density and the administrative expenditure ratio. In contrast to the previous model, we do not find statistically significant differences by density group in our fixed-effect model.

6. Discussion

In this paper, we investigated administrative scale economies in the Paraná state local government system in Brazil over the period 2006 to 2018. Our study contributes to the present debate in the international literature as to whether local government expenditure exhibits economies of scale. The results show that population size and population density have statistically significant effects on the administrative expenditure in the State of Paraná. More specifically, we identified a 'U-shaped' cost curve which indicates that an increasing population will initially reduce average costs. However, beyond some level of population, the average cost will begin to increase. This behavior is also observed in other international studies [42,44].

However, it is important to note that Brazilian local governments are numerous, and many of them are small and financially unsustainable [48]. More precisely, in 2018, about 75% of municipalities had less than 20,000 inhabitants in the Paraná local government system (Table 3), which indicates that a significant reduction in administrative expenditure would flow from an amalgamation of small local government areas. On this question, our results contribute to the current political debate on merging small municipalities in Brazil [25], and particularly to the discussion in Paraná [19], as well as other states, such as Santa Catarina [26]. In this sense, when considering municipal mergers, policymakers should consider the benefits of a reduction in administrative costs [7].

From a public policy perspective, our study suggests that the local government consolidation of small municipalities, at least in the context of the Paraná local government system, can improve efficiency in municipal administration. However, this does not imply that other reform options could not contribute to improving municipal performance in Paraná. For example, public policies that promote shared services in Paraná local government may lead to a reduction in administrative expenditure. However, the results of the impact of shared services on Brazilian local government expenditure are not conclusive [48]. As such, the Paraná government should investigate the role that shared services may play in potentially reducing costs and improving municipal efficiency [20]. Furthermore, the constitutional amendment proposed by the federal government, which recommends the amalgamation of municipalities with less than 5000 inhabitants and own revenue of less

than ten per cent of their total revenue, should be further investigated since it could reduce administrative expenditure. In sum, our study contributes to the wider policy debate on the structural reform in local government in Brazil by providing empirical evidence of scale economies in administrative expenditure in the Paraná state local government system.

7. Conclusions

This paper has sought to address a gap in the empirical literature on Brazilian local government by investigating scale economies in administrative intensity in the Paraná state local government system. Drawing on a variety of data sources, we were able to contribute to the extant empirical literature by providing the first comprehensive analysis of municipal economies of scale in terms of administrative intensity for the 399 municipalities in the Paraná state local government system. The design of our study was informed by the international empirical literature on scale economies in municipal administration. As we have seen, we found empirical evidence for economies of scale in administrative expenditure in Paraná.

Our most important finding is that there is a 'U-shaped' scale effect on administrative intensity after controlling for a range of economic and demographic variables. This empirical result has two main public policy implications for the present policy debate in Brazil, which has focused on a large number of municipalities with less than 5000 residents and an own-source revenue of less than ten per cent of total revenue [25], in the context of ensuring the long-run sustainability of local governments. Firstly, the existence of scale economies in municipal administration provides empirical support for structural change through municipal mergers on the obvious grounds that larger local government entities expend a smaller proportion of their revenue on administration compared with their smaller counterparts. Secondly, at a more nuanced level, the presence of scale economies in administrative intensity provides empirical evidence in favor of shared services in municipal administration without the need for radical and expensive structural change that simply abolishes small municipalities and creates new larger local government bodies in their place. Detailed models of shared services in municipal administration have been advanced in the scholarly literature, such as the joint board model described by Dollery and Johnson [49]. These models, sometimes designated as "area integration models", focus on minimizing municipal expenditure by combining the administrative services of several small local councils into a single unit. In this way, existing small municipalities retain their political autonomy but reduce outlays on administration. However, public policymakers need to be cognizant of political barriers to both municipal mergers and shared services [50].

Future research in the area could potentially fruitfully investigate the relationship between administrative intensity and local government size by population by analyzing other Brazilian state local government systems. This would generate useful comparative data on the existence and extent of scale economies in municipal administration in Brazil, and thereby inform public debate.

References

1. Narbón-Perpiñá, I.; De Witte, K. Local governments' efficiency: A systematic literature review—part I. *Int. Trans. Oper. Res.* **2018**, *25*, 431–468. [CrossRef]
2. Narbón-Perpiñá, I.; De Witte, K. Local governments' efficiency: A systematic literature review—part II. *Int. Trans. Oper. Res.* **2018**, *25*, 1107–1136. [CrossRef]

3. Rogge, N.; Agasisti, T.; De Witte, K. Big data and the measurement of public organisations' performance and efficiency: The state-of-the-art. *Public Policy Adm.* **2017**, *32*, 263–281.
4. Tavares, A.F. Municipal amalgamations and their effects: A literature review. *Misc. Geogr.* **2018**, *22*, 5–15. [CrossRef]
5. Lago-Peñas, S.; Martinez-Vazquez, J. (Eds.) *The Challenge of Local Government Size: Theoretical Perspectives, International Experience and Policy Reform*; Edward Elgar Publishing: Cheltenham, UK, 2013.
6. Reddy Yarram, S.; Tran, C.; Dollery, B.E. *Administrative Intensity in Local Government: Do Scale Economies Exist in New South Wales Local Government? Unpublished manuscript*; UNE Centre for Local Government, University of New England: Armidale, Australia, 2020.
7. Andrews, R.; Boyne, G.A. Size, structure and administrative overheads: An empirical analysis of English local authorities. *Urban. Stud.* **2009**, *46*, 739–759. [CrossRef]
8. Ting, S.K.; Dollery, B.; Villano, R. Administrative scale economies in local government: An empirical analysis of Sabah municipalities, 2000 to 2009. *Urban. Stud.* **2014**, *51*, 2899–2915. [CrossRef]
9. Bikker, J.; van der Linde, D. Scale economies in local public administration. *Local Gov. Stud.* **2016**, *42*, 441–463. [CrossRef]
10. Elston, T.; Dixon, R. The effect of shared service centers on administrative intensity in English local government: A longitudinal evaluation. *J. Public Adm. Res. Theory* **2020**, *30*, 113–129. [CrossRef]
11. Darnley, M.; Rutherford, A.; Rabovsky, T. Tipping the scales: The causes and consequences of administrative spending. *Public Adm.* **2019**, *97*, 467–482. [CrossRef]
12. Andrews, R.; Boyne, G.; Mostafa, A.M.S. When bureaucracy matters for organisational performance: Exploring the benefits of administrative intensity in big and complex organisations. *Public Adm.* **2017**, *95*, 115–139. [CrossRef]
13. Andrews, R.; Boyne, G.A. Task complexity, organisation size, and administrative intensity: The case of UK universities. *Public Adm.* **2014**, *92*, 656–672.
14. Boyne, G.A.; Meier, K.J. Burdened by bureaucracy? Determinants of administrative intensity in public organisations. *Int. Public Manag. J.* **2013**, *16*, 307–327. [CrossRef]
15. Kalseth, J.; Rattsø, J. Spending and overspending in local government administration: A minimum requirement approach applied to Norway. *Eur. J. Political Econ.* **1995**, *11*, 239–251. [CrossRef]
16. Kalseth, J.; Rattsø, J. Political control of administrative spending: The case of local governments in Norway. *Econ. Politics* **1998**, *10*, 63–83. [CrossRef]
17. Peters, B.G. *The Politics of Bureaucracy*, 5th ed.; Routledge: London, UK, 2001.
18. Rutherford, A. Reexamining causes and consequences: Does administrative intensity matter for organisational performance? *Int. Public Manag. J.* **2016**, *19*, 342–369. [CrossRef]
19. Fernandes, A.L.; Beal, D.A.; Junior, J.J.P.; Silva, L.F. *Estudo de Viabilidade Municipal*; Tribunal de Contas do Estado do Paraná (TCE-PR): Curitina, Brazil, 2015.
20. Bernardelli, L.V.; Kortt, M.A.; Dollery, B. Economies of scale and Brazilian local government expenditure: Evidence from the State of Paraná. *Local Gov. Stud.* **2020**, *46*, 436–458. [CrossRef]
21. Avellaneda, C.N.; Gomes, R.C. Is small beautiful? Testing the direct and non-linear effects of size on municipal performance. *Public Adm. Rev.* **2015**, *75*, 137–149. [CrossRef]
22. IBGE. Panorama. 2020. Available online: https://cidades.ibge.gov.br/brasil/panorama (accessed on 21 December 2020).
23. Brasil. Emenda constitucional no. 58 2009, de 23 de setembro de 2009. In *Art. 29, Emenda no. 58*; Brasil, Ed.; Presidência da República, Casa Civil, Subchefia para Assuntos Jurídicos, 2009. Available online: http://www.planalto.gov.br/ccivil_03/constituicao/Emendas/Emc/emc58.htm (accessed on 21 December 2020).
24. Calvão, A.M.; Crokidakis, N.; Anteneodo, C. Stylised facts in Brazilian vote distributions. *PLoS ONE* **2015**, *10*, e0137732. [CrossRef]
25. Brasil Senado Federal. Proposta de Emenda À Constituição N° 188, DE 2019. Altera arts. 6°, 18, 20, 29-A, 37, 39, 48, 62, 68, 71, 74, 84, 163, 165, 166, 167, 168, 169, 184, 198, 208, 212, 213 e 239 da Constituição Federal e os arts. 35, 107,109 e 111do Ato das Disposições Constitucionais Transitórias; acrescenta à Constituição Federal os arts. 135- A, 163-A, 164-A, 167-A, 167-B, 168-A e 245-A; acrescenta ao Ato das Disposições Constitucionais Transitórias os arts. 91-A, 115, 116 e 117; revoga dispositivos constitucionais e legais e dá outras providências. 2019. Available online: https://legis.senado.leg.br/sdleg-getter/documento?dm=8035580&ts=1582036854418&disposition=inline (accessed on 21 December 2020).
26. Rodrigues, A.F.O.; Schnitzler, E.L.; Sallum, S.B. *Emancipação dos Municípios Catarinenses: Análise Estatística dos Impactos Econômicos da Fragmentação Territorial Florianópolis*; Tribunal de Contas do Estado de Santa Catarina (TCE-SC): Florianópolis, Brazil, 2017.
27. Favato, D.D.P.C.; Toledo, M.R. Federalism, emancipation and dependence of municipalities: An analysis of Santa Cruz de Minas city-MG. *Cad. De Geogr.* **2017**, *27*, 184–199. [CrossRef]
28. Boon, J.; Verhoest, K. On a diet: Explaining differences in overhead among public agencies in the era of austerity. *Public Perform. Manag. Rev.* **2014**, *38*, 234–260. [CrossRef]
29. Goodsell, C.T. *The Case for Bureaucracy: A Public Administration Polemic*, 2nd ed.; Chatham House Publishers: Chatham, NJ, USA, 1985.
30. Van Helden, G.J.; Huijben, M. Controlling overhead in public sector organisations. *Int. J. Public Sect. Manag.* **2014**, *27*, 475–485. [CrossRef]
31. Terrien, F.W.; Mills, D.L. The effect of changing size upon the internal structure of organisations. *Am. Sociol. Rev.* **1955**, *20*, 11–13. [CrossRef]

32. Lewis, B.D. Local government borrowing and repayment in Indonesia: Does fiscal capacity matter? *World Dev.* **2003**, *31*, 1047–1063. [CrossRef]

33. Lewis, B.D. Local government taxation: An analysis of administrative cost inefficiency. *Bull. Indones. Econ. Stud.* **2006**, *42*, 213–233. [CrossRef]

34. Haneda, S.; Hashimoto, A.; Tsuneyoshi, T. Evaluating administrative efficiency change in the post-merger period: A study on Ibaraki prefecture (1979–2004). *Int. Reg. Sci. Rev.* **2012**, *35*, 237–262. [CrossRef]

35. FINBRA, Finanças do Brasil. Contas Anuais. 2019. Available online: www.tesouro.fazenda.gov.br/contas-anuais (accessed on 21 December 2020).

36. IPARDES. Base de dados do Estado. 2020. Available online: http://www.ipardes.pr.gov.br/imp/index.php (accessed on 21 December 2020).

37. SIDRA, Sistema IBGE de Recuperação Automática. Banco de Tabelas Estatísticas. 2019. Available online: www.sidra.ibge.gov.br (accessed on 21 December 2020).

38. IBGE. Produto Interno Bruto dos Municípios. 2020. Available online: https://www.ibge.gov.br/estatisticas/economicas/contas-nacionais/9088-produto-interno-bruto-dos-municipios.html?=&t=o-que-e (accessed on 21 December 2020).

39. RAIS. Relação Anual de Informações Sociais. Acesso Online à RAIS. 2020. Available online: http://pdet.mte.gov.br/acesso-online-as-bases-de-dados (accessed on 20 December 2020).

40. IBGE. Pesquisa de Informações Básicas Municipais—MUNIC. 2020. Available online: https://www.ibge.gov.br/estatisticas/sociais/protecao-social/10586-pesquisa-de-informacoes-basicas-municipais.html?=&t=o-que-e (accessed on 20 December 2020).

41. Holcombe, R.G.; Williams, D.W. Are there economies of scale in municipal government expenditures? *Public Financ. Manag.* **2009**, *9*, 416–438.

42. Drew, J.; Kortt, M.A.; Dollery, B. Economies of scale and local government expenditure: Evidence from Australia. *Adm. Soc.* **2014**, *46*, 632–653. [CrossRef]

43. Kortt, M.A.; Dollery, B.; Drew, J. Municipal Mergers in New Zealand: An Empirical Analysis of the Proposed Amalgamation of Hawke's Bay Councils. *Local Gov. Stud.* **2016**, *42*, 228–247. [CrossRef]

44. Tran, C.; Kortt, M.; Dollery, B. Population size or population density? An empirical examination of scale economies in South Australian local government, 2015/16. *Local Gov. Stud.* **2019**, *45*, 632–653. [CrossRef]

45. CONGRESSO EM FOCO. Direita cresce e engole o centro no Congresso mais fragmentado da história. 2018. Available online: https://congressoemfoco.uol.com.br/legislativo/direita-cresce-e-engole-o-centro-no-congresso-mais-fragmentado-da-historia/ (accessed on 21 December 2020).

46. Burchell, R.W.; Mukherji, S. Conventional development versus managed growth: The costs of sprawl. *Am. J. Public Health* **2003**, *93*, 1534–1540. [CrossRef]

47. Litman, T. *Understanding Smart Growth Savings: What We Know about Public Infrastructure and Cost Savings, and How They are Misrepresented by Critics*; Victoria Transport Policy Institute: Victoria, BC, USA, 2004.

48. Silvestre, H.; Marques, R.C.; Dollery, B.; Correia, A.M. Shared services in Brazilian local government: Urban development in small counties. *Public Adm.* **2019**, *97*, 686–702. [CrossRef]

49. Dollery, B.; Johnson, A. An analysis of the joint board or county model as the structural basis for effective Australian local governance. *Aust. J. Public Adm.* **2007**, *66*, 198–209. [CrossRef]

50. Carr, J.B.; Feiock, R.C. (Eds.) *City-County Consolidation and its Alternatives: Reshaping the Local Government Landscape*; M.E. Sharpe: Armonk, NY, USA, 2004.