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CONFERENCE PAPERS

Local Government Cost Function: Case Study Analysis for Slovenian Municipalities

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Abstract: The appropriate creation and size of local jurisdictions are important for achieving efficiency gains in local government goods and services provision. In general, the size of local government units should efficiently combine scale and congestion effects in order to minimise local authority costs. The theory predicts four different potential effects of local government size on its costs: linear negative effect, linear positive effect, non-linear U-shaped effect and non-linear inverted U-shaped effect. In the first case, the bigger local government means lower costs, whereas in the second case, the bigger local government means larger costs. In the third case, costs of local government units fall at the beginning, however they start to rise after certain size of local government is achieved, which implies some "optimal" size of local jurisdictions. The last case shows that costs of medium-sized local units are the largest, as they have not experienced the economies of scale yet, but they still experience congestion effects. Consequently, the main purpose of the paper is to investigate the relationship between local government size and costs, empirical analysis being based on the data for Slovenian municipalities for the year 2011. The results reveal that the average costs function for Slovenian municipalities is U-shaped, and the estimated least-cost size of the municipality implies that the current number of municipalities is not optimal. Besides, the average cost efficiency of Slovenian municipalities is approximately 25% above estimated best-practice frontier.

Keywords: *Local public finance, Optimal size of local authorities, Cost efficiency, Municipalities, Slovenia*

JEL Classification: H11, H21

Introduction

The efficiency of various segments of the public sector is a topic of increasing interest in particular in the field of public economics. This is also true for the local govern-

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ment level, where the research is combined with the related topic of the appropriate creation and size of local jurisdictions, as this tends to be important for achieving efficiency gains in the provision of local government goods and services. In general, one could claim that local provision of goods and services is useful, although in practice its optimal scope must be found, to efficiently combine scale and congestion effects in order to minimize local authority costs or maximize efficiency. Specifically, this notion was derived from the club theory: the size of the local jurisdiction and welfare of the resident of that jurisdiction are both positively and negatively related. Namely, the larger size of local jurisdiction denotes also the greater number of taxpayers, which decreases the per capita costs of public goods provision, yet it also causes crowding problems (see Bises and Sacchi, 2011). Namely, local jurisdictions usually provide in-kind goods (schools, libraries, health services etc.), and a greater number of individuals sharing the benefit of those goods may cause crowding problems.

Holzer et.al. (2009) have argued that the non-linear relationship exists between the size of local jurisdictions and their performance, since too large jurisdictions experience diseconomies of scale (due to the organizational slack, prevailing horizontal integration of service plants delivering the major part of public services at local level etc.) and too small jurisdictions are not able to achieve economies of scale. In particular, economies of scale are persistent in capital-intensive services of local jurisdictions, those being, for example, water provision and rural road maintenance, meaning that larger units of local government can provide them more efficiently. In contrast, smaller units of local government deliver labor-intensive services more efficiently (for example, police and fire protection, refuse collection, public education etc.), since those services do not exhibit significant economies of scale.

Nevertheless, the existing literature suggests four different potential effects of local government size on its costs: linear negative effect, linear positive effect, non-linear U-shaped effect and non-linear inverted U-shaped effect (Andrews et.al., 2006). In the first case, the bigger local government means lower costs (economics of scale), whereas in the second case, the bigger local government means larger costs (possible bureaucratic congestions). In the third case, costs of local government units fall at the beginning, however they start to rise after certain size of local government is achieved. This means that costs of "medium" sized local authorities are lowest, which could be attributed to acquired economics of scale, but congestion effects have not been experienced yet. This implies some "optimal" size of local jurisdictions. Finally, the last case shows that costs of medium-sized local units are the largest, which could be attributed to the fact that they have not experienced the economies of scale yet, but they still experience congestion effects.

The problem of local government size and efficiency has been regularly addressed in the local public finance literature, as the optimal organization and consolidation of local government units has also been one of the measures to deal with stagnating or even declining revenues or to contribute to the ability to achieve scale and scope economies (Carey et.al., 1996; Dollery et.al., 2007; Reingewertz, 2012). Consequently, this empirical paper will asses average costs function as well as cost efficiency for 200 Slovene municipalities for the 2011 fiscal year. This period relates to the most recent data availability as well as to the fact that in 2011 one additional municipality was established, leading to the current number of 211 municipalities that are functioning in Slovenia. This number includes also 11 so-called urban municipalities (cities), which have special status by the law and they perform also tasks given to them from central government involving the development of the city (urbanism etc.) (Local Self-Government Act, 2007). Costs function is estimated comprehensively for total municipal expenditures in order to avoid fungibility and classification issues related to different types of local government spending; and the study allows observing determinants causing variations in the costs of municipalities. Section 2 outlines the methodology of estimation of cost function as well as data employed in the analysis. Section 3 gives the estimation outputs and discussion on the results obtained. Section 4 presents concluding reflections.

Data and Methodology

A regression analysis is used to estimate average costs function for 200 existing Slovenian municipalities in the year 2011. This means that total population of municipalities is included in the analysis, excluding only 11 urban municipalities (cities), which tend to have slightly different responsibilities compared to other municipalities, so the costs of those two groups of municipalities could not be directly compared. The number of municipalities has substantially increased, in particularly in the period of the last 18 years, so cross-sectional data are employed in the analysis, and the data for the last available year (2011) are utilised. Specifically, the reduced-form regression model for average costs of municipalities is:

$$AC_i = \beta X_i + u_i,\ i=1,..,N,$$

where ACi stands for average total expenditures for municipality i (calculated as a division of total expenditures and number of residents in municipality i, and also serving as a proxy for costs), which is a dependent variable, and X_i represents explanatory variables that affect municipal expenditures, whereas u_i describes unobservable shocks to municipal spending. Besides to linear and squared term of municipal population, which enables us to have the focus on the (non-linear) effect of population on average costs, the inclusion of other explanatory socio-economic (control) variables is based on the on the empirical literature review (e.g., Carey, 1996; Acosta, 2010 etc.), predominantly to avoid problems related to the poor prediction and the instability of coefficients. Control variables in the model are the share of municipal population over 65 years of age and under 15 years of age, average yearly registered unemployment rate, spatial size of municipality (in km2), population density (population of municipality per km2), average yearly gross income per capita of municipal residents and average total transfer revenues received by municipality. The analysis utilises software package EViews to estimate average costs function.

Table 1. Descriptive statistics for variables in the average costs function estimation for 2011.

Variable	AC (EUR)	Population	Population over 65 (%)	Population under 15 (%)	Unemployment rate (%)
Mean	1092	6719	16.5	14.5	11.6
Median	999	4504	16.4	14.4	11.1
Maximum	3577	34195	26.9	20.5	24.1
Minimum	187	320	11.1	9.0	4.9
Std. Dev.	376	5974	2.3	1.8	3.8
Variable	Spatial size (km^2)	Population density (per km^2)	Transfer revenues per capita (EUR)	Average gross income per capita (EUR)	
Mean	91.9	98.2	214	15895	
Median	61.7	76.8	153	15788	
Maximum	555.4	556.2	1396	22636	
Minimum	6.9	5.0	3	10634	
Std. Dev.	86.3	87.5	210	1579	

Source: SORS (2013), Ministry of Finance (2013), author's calculations.

Following, this paper employs also the stochastic parametric approach to cost efficiency measurement in Slovenian municipalities. The analysis uses Frontier software programme for the maximum likelihood estimation of the stochastic cost function of the Slovenian municipalities. Specifically, cost function is based on the Battese and Coelli (1995) specification, which can be written as:

$$C_i = Y_i\beta + (V_i + U_i),\ i=1,...,N,$$

where C_i stands for the logarithm of the costs of the i-th municipality, Y_i is a k*1 vector of transformation of the input prices and output of the i-th municipality, β represents a vector of unknown parameters, the V_i are normally distributed and independent random variables, and the U_i represents the non-negative random variables accounting for the cost of the inefficiency in production, often assumed to be half-normally distributed. The inclusion of input and output variables in the stochastic parametric analysis is predominantly based on the literature dealing with local government efficiency (e.g., Geys et.al., 2010). Total expenditures in the municipality in 2011 are taken as input variables (C), whereas four output variables (Y) that describe important responsibilities of the Slovenian municipalities with respect to the social, educational and infrastructure services are: the number of pupils in primary schools (nine years programme); the total population of municipality (this is the most important variable in the model, since it indicates possible scale effects); the population over 65 year of age; and the number of employed persons in municipality.

Table 2. Descriptive statistics of the selected variables in efficiency estimation for 2011.

Variable	Minimum	Maximum	Mean	Std. deviation
Total expenditures (in EUR)	568026	37584411	6810097	5916354
Pupils (primary schools)	4	3288	579	555
Population	320	34195	6719	5974
Population above 65 years	69	4921	1094	959
Employed persons	118	14707	2741	2480

Sources: SORS (2013), Ministry of Finance (2013), author's calculations.

Results

Table 3 presents the results of the econometric estimation of the average costs function for Slovenian municipalities in the year 2011. Both population variables and five additional socio-economic control variables are able to explain more than 70% of variation in average costs among municipalities. Indeed, two control variables are dropped out of the model due to the statistical reasons, and all the others included are statistically significant.

Although both population variables are statistically significant, they actually represent rather small part of the story, as some other variables are statistically more important for explaining the magnitude of variations, in particular variable Transfer revenues, which has the largest effect on the variations in average costs of municipalities. All variables have the expected direction of sign, exceptions being variables for population below 15 years of age and unemployment, where one would expect positive signs due to the expected effect of the increased demand for municipal services (Worthington and Dollery, 1999), although recent literature also recognises possible existence of "preference effect", which should decrease demand for high-cost public services. Namely, this demand is likely to decrease with smaller income levels as well as with reduced available income (Geys et.al., 2010), and this consequently negatively affects municipal costs.

Table 3. Estimation output for the average costs function for Slovenian municipalities.

Explanatory variables	Dependent: AC
Population	-0.046 (-6.03)***
Population^2	1.38E-06 (5.71)***
Share of population below 15	-44.74 (-4.61)***
Unemployment rate	-11.17 (-2.85)***
Spatial size	0.39 (3.44)***
Transfer revenues p.c.	1.28 (12.22)***
Average gross income p.c.	0.02 (1.66)*
Constant	1507.34 (5.64)***
$R^2_{adj.}$	0.70
see	235.42
d-stat.	2.03
F-stat.	68.06***
Ramsey χ^2 (p)	0.31

*Note: N=200, Weighted least squares (WLS) regression, t-values are in parentheses. *** denotes significance at 99% level, ** at 95% level, and * at 90% level. Control variables are excluded from the model upon χ^2 test.*

Source: author's calculations.

The results suggest that U-shaped (convex) function of average costs can be observed in Slovenia, which means that at some point average costs of municipalities start to increase, as the squared population term seems to be positive. If we assume that a territory can be divided up arbitrarily with no restrictions, the above stated calculations enable us to determine the "optimal size" of municipality, which is the one that yields minimum average costs (least-cost size of municipality). If we divide the number of residents living in 200 observed Slovenian municipalities (slightly less than 1.4 million) with the calculated least-cost size of municipality (calculated as first order derivative that minimizes average costs function, and being consequently slightly less than 17 thousand inhabitants), the preferred number of municipalities would be roughly around 80, which is substantially lower than the actual number. This would imply that municipal consolidation should be considered. Nonetheless, it should be admitted that the average costs function is rather flat, and, more important, the effect of population on the variation in costs is rather limited, so the potential gains resulting from consolidation should be assessed conservatively, taking into the account all the limitations imposed by econometric modelling. Furthermore, the results of the stochastic parametric estimation of municipal cost functions are presented in table 4. The results indicate that Slovenian municipalities are, on average, approximately 25% above the cost efficiency frontier.

Table 4. Estimation output of the Cobb-Douglas type frontier analysis.

Variable	**Dependent: TC**
Constant (β_0)	8.74 (48.98)***
Pupils in primary schools	-0.92E-08 (-6.23)***
Population	-0.05 (-1.49)
Population above 65 years	-0.46E-10 (-0.29)
Employed persons	0.84 (31.37)***
Summary statistics on cost efficiency	
Average	1.25
Minimum	1.00
Maximum	1.75
Standard deviation	0.24

*Note: N=200, t-values are in parentheses. *** denotes significance at 99% level, ** at 95% level, and * at 90% level.*

Source: author's calculations.

Concluding Reflections

Based upon the estimation outputs, we could argue that current average size of Slovenian municipalities is below its appropriate level, so excessive fragmentation of local jurisdictions could be seen as a problem, potential solution being municipal consolidation. Nevertheless, although average cost curve for Slovenian municipalities is U-shaped, implying also some optimal size (and number) of municipalities, we should also acknowledge that, on average, the effect of size on costs, although highly statistically significant, is rather modest as it describes less than 10% of the variation in municipal expenditures, other factors being more important. Among those factors the effect of transfer expenditures should be stressed, implying substantial expenditure effects of revenue-sharing. Besides, the estimated U-curve is rather flat, which means that potential savings could be rather limited. Furthermore, the cost efficiency estimation has also revealed certain inefficiencies in Slovenian municipalities, which indicates that the issues related to municipal consolidation and increased efficiency should be addressed further.

REFERENCES

Acosta, P., (2010): **The "fly-paper effect" in presence of spatial interdependence: evidence from Argentinean municipalities,** ***Annals of Regional Science***, 44: 453 - 466

Andrews, R., et.al., (2006): **Population Size and Local Authority Performance**, London: Department for Communities and Local Government

Battese, G.E., Coelli, T.J., (1995): **A Model for Technical Inefficiency Effects in a Stochastic Frontier Production Function for Panel Data,** ***Empirical Economics***, 20: 325 - 332

Bises, B., Sacchi, A., (2011): **On Cash Transfers, In-kind Provision, and the Size of Local Jurisdictions,** ***Public Finance Review***, 39: 527 - 550

Carey, M., et.al., (1996): **Optimal consolidation of municipalities: An analysis of alternative designs,** ***Socio-Economic Planning Science***, 30: 103 – 119

Dollery, B., et.al., (2007): **Is bigger better? Local government amalgamation and the South Australian rising to the challenge inquiry,** ***Economic Analysis & Policy***, 37: 1 - 14

Geys, B., et.al., (2010): **Voter Involvement, Fiscal Autonomy and Public Sector Efficiency: Evidence from German Municipalities,** ***European Journal of Political Economy***, 26: 265 - 278

Holzer, M., et.al., (2009): **Literature Review and Analysis Related to Optimal Municipal Size and Efficiency**, Newark: Rutgers University

Local Self-Government Act (2007): **Official Gazette of RS**, No. 94/2007

Ministry of Finance (2013): **Financial Statements of Municipalities,** Ljubljana: Ministry of Finance of RS, http://www.mf.gov.si [Accessed 14.2.2013]

Reingewertz, Y., (2012): **Do Municipal Amalgamations Work? Evidence from Municipalities in Israel",** ***Journal of Urban Economics***, 72: 240 - 251

SORS (2013): **SI-Stat Data Portal**, Ljubljana: Statistical Office of the Republic of Slovenia, http://www.stat.si [Accessed 10.2.2013]

Worthington, A.C., Dollery, B.E., (1999): **Fiscal Illusion and the Australian Local Government Grant Process: How Sticky is the Flypaper Effect?,** ***Public Choice***, 99: 1 - 13