Spending and overspending in local government administration: A minimum requirement approach applied to Norway

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Abstract

A demand function for administration is estimated for Norwegian local authorities, emphasizing the per capita total budget, the population size and sociodemographic variables affecting the composition of local services. The demand function forms the basis of an analysis of the variation in the administrative resource use among the authorities. The methodological approach is inspired by productivity studies of manufacturing industries defining a 'best practice' frontier determined by the authorities with the lowest administrative spending per capita given the local characteristics. The minimum required administration serves as a benchmark for the estimation of administrative overspending of approximately 20%.

Keywords: Public administration; Local government; Efficiency

JEL classification: H72

1. Introduction

The size and the growth of the public administration is a concern in many countries. Empirical analyses of the efficiency of resource use in administration are hard to find. The present study investigates the use of resources in Norwegian
local government administration. The local authorities organize the same kind of welfare services across the country, and the administrative activities are expected to be similar. The analysis of comparable institutions allows us to identify the main determinants of the size of the administration and to study differences in resource use among similar units.

The approach assumes that administration is an input into the production of welfare services in local governments. The starting point is a decision model relating the demand for administration to the final demand for the services. The formulation leads to the concept of administrative intensity (see Pondy 1969), the share of total costs devoted to administration. Two determinants of administration size are focused, the volume and the composition of local public service production and the administrative intensities of the services.

In the literature, administrative intensity is often related to organizational size. In our context, population size is a potentially important factor in explaining local government administration. The standard assumption discussed by Mintzberg (1983) says that large units are more efficient than small – administrative intensity is decreasing with increasing organizational size. Three counter arguments are relevant for local authorities. Blau (1974) argues that complexity and coordination increase with size, inducing bureaucratic rigidity and cost. Oates (1988) introduces the ‘zoo effect’, here implying that new administrative functions are added in larger authorities. Ott (1980) relates the voter control of local administration and service production to population size, with small municipalities having a possible advantage. A priori, the role of population size is an open question.

Our approach is inspired by standard productivity analysis of private industries where the ‘best practice’ serves as a reference point. We define the alternative concept of a minimum required administration frontier as a benchmark for comparison of local authorities. The frontier is determined by the authorities with the lowest per capita administrative spending given their local characteristics on the basis of the demand model. The minimum requirement is not necessarily the optimal administration, but it serves as a reference point.

Two methods of establishing the minimum requirement frontier are applied. The first is parametric, based on standard estimation of a Cobb-Douglas expenditure demand model. The other is non-parametric, Data Envelopment Analysis, a programming method.

2. Administrative spending in Norwegian local governments

Local government expenditures on administration amount to about 10 bill. NOK in 1988, or 2.500 NOK per capita (about USD 400), as measured in this study. Administrative costs represent about 16% of total current spending of local governments. By international standards this seems to be on the high side. A
Table 1
Demand function for administration, logarithmic formulation. Estimated coefficients, t-values in parentheses

<table>
<thead>
<tr>
<th>Constant</th>
<th>lnY</th>
<th>lnP</th>
<th>lnC</th>
<th>lnS</th>
<th>lnG</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5118</td>
<td>1.0998</td>
<td>-0.1227</td>
<td>-0.3465</td>
<td>0.0125</td>
<td>0.4890</td>
</tr>
<tr>
<td>(-0.87)</td>
<td>(21.72)</td>
<td>(-11.37)</td>
<td>(-5.59)</td>
<td>(1.11)</td>
<td>(4.16)</td>
</tr>
</tbody>
</table>

R²_{adj} = 0.8309
N = 407

recent study by Lane (1987) suggests an administrative share of current spending of about 10% in Swedish local authorities.

The present study defines the administrative activities in terms of the accounts of local governments. According to the accounts, 'central administration' and sectoral administrations of the five main services (education, health care/care for the elderly, social services, culture and infrastructure) can be separated out. The definition does not capture all activities that can be characterized as administration, since some administration is made at the level of each institution (school, home for elderly etc.). On the other hand, some of the activities included may be considered as service production. Despite these shortcomings, the chosen measurement of administration seems to represent an acceptable basis of comparison and is the definition used in government publications.

The per capita administrative spending shows strong variation between the local authorities. In the municipalities studied, the expenditures vary from 1.500 NOK per capita to above 6.000 NOK, and the share of current expenditures devoted to administration varies from about 10% to above 25%. According to the documentation in Table 2 (average per capita spending), population size is clearly involved, and a U-curve is indicated.

3. A demand model of local government administration

The determination of the resource use in administration must be understood in the context of a model of the local decision making process. Since the administrative functions relate to different local services, the final demand of the services must be the starting point. The benchmark model of individual demand functions

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1 407 of the 448 municipalities are included in the analysis. 34 authorities are excluded because they are small (less than 1,000 inhabitants), big (the few cities with more than 50,000 inhabitants) or extremely rich (total per capita current expenditures excluding health institutions of more than 20,000 NOK). The very rich are local producers of electric power and are outliers on any dimension of the local government service production. Seven authorities are excluded because of lack of data.
for public services is laid out by Inman (1979) and Rubinfeld (1987). By analogy the local government can be treated like a single households maximizing the welfare given a budget constraint. This community preference model is applied here. It does not explicitly address how the political process reaches an outcome that can be described as a result of constrained maximization. As discussed by Wildasin (1986, ch. 3), the approach has been applied successfully in understanding important aspects of local government behaviour.

The model must take into account the Norwegian institutional context, first and for all the fact that the size of the local budget is given exogenously. The national government imposes a budget on each authority by determining the income tax revenue sharing and the general grants. Fees and property taxes amount to less than 10% of the revenues and are regulated by law. It follows that the choice between private consumption and local public services is decided at the national level, and the local public choice process only allocates the given budget between different services. The preference function consequently covers only the local public services. A model along these lines has been developed and implemented by Rattsø (1989).

The reduced form expenditure demand functions (for one authority) can be written on this general form:

\[ E_i = f_i(Y, Z) \]  

The per capita expenditures demanded for service \( i \), \( E_i \), are determined by the total per capita budget \( Y \) and a vector \( Z \) of sociodemographic variables. The model puts the attention to two determinants of the local services. First, the per capita total budget varies between local authorities. Poor municipalities are expected to concentrate the service production to necessities, while rich municipalities can afford more of luxuries. Second, the municipalities differ with respect to population size, age composition, settlement pattern etc. that may affect local priorities and cost conditions. No price effects are taken into account.

The next step in the model building relates the resource use in administration to the local services. The administrative expenditures are partly related to the overall coordination of the local authority, central administration, and partly to the sectoral service production. The model assumes that central administration is competing with the services for resources. The demand for sectoral administration is derived from the demand for sectoral services, given the administrative intensities.

The administrative intensity of service \( i \), \( k_i \), is defined as the share of the current expenditures devoted to administration:

\[ A_i/E_i = k_i \]  

\( A_i \) is the per capita administrative spending in the sectoral service \( i \). In central administration, all expenditures are administrative (if central administration is sector 1, \( k_1 = 1 \)). The administrative intensity in the service sectors, \( k_i \), may vary
between authorities. Increasing return to scale may allow for reduced administrative intensity with a higher sectoral output. This scale effect is captured by the same variables (population size and other sociodemographic factors) that influence the demand of the services.

The reduced form demand for administrative spending per capita, \( A \), the sum over the \( n \) sectors, can be written

\[
A = \sum_{i=1}^{n} A_i = \sum_{i=1}^{n} k_i f_i(Y, Z) = f(Y, Z) = \alpha Y^\beta Z^\gamma.
\]

(3)

The demand model of administrative resource use identifies local factors influencing the size of the administration and helps define a benchmark for the estimation of overspending.

4. The minimum requirement frontier of administrative spending

The methodology chosen to investigate the variation in the administrative spending is related to standard productivity measurement of industries, where 'best practice' serves as a reference point. Farrell (1957) introduced the method by which the technical efficiency of a micro unit could be measured against an efficiency frontier. A survey of efficiency measurement approaches is provided by Forsund et al. (1980).

Two types of administrative inefficiency can be defined. The first is the technical inefficiency, the authorities are not able to produce the maximum attainable administrative output given the resources used in administration. Clearly this factor may contribute to high administrative spending to run the service production. The other type is ineffectiveness, administration is given too high or too low a priority in the resource allocation compared to the service production. The two types are interlinked. Technical inefficiency may lead to ineffectiveness, since more resources are needed to administer the services properly. Ineffectiveness may stimulate technical inefficiency. More resources put into administration may open up for slack.

Since we are not able to identify and measure the administrative output, we cannot separate the two types of inefficiency. To get around the problem and to describe the variation in administrative spending, a minimum requirement frontier is defined as an alternative to the 'best practice'. The authorities with the lowest per capita spending on administration defines a minimum requirement dependent on local characteristics that others can compare to.

The method is explained by Fig. 1 presenting the relationship between a local characteristic and per capita administrative spending. Five local authorities are shown, A, B, C, D and E. The first four of them are placed on the minimum requirement frontier. They have the lowest per capita administrative spending
given their local characteristics. Authority E has a larger administration than predicted necessary by the local characteristics. Point J serves as a reference for authority E, the per capita administrative expenditures of the reference frontier given the same local characteristics. The minimum requirement ratio is HJ/HE, the share of the per capita administrative spending in authority E predicted by the local characteristics. The distance JE consequently describes the overspending. A reference unit, such as point J in Fig. 1, is established for every authority.

The strength of the method is that the overspending compared to the minimum requirement can be identified for each authority. The method offers information about excessive spending that the bureaucrats and the politicians of a particular authority can be confronted with. The minimum required administration is not necessarily the best. Needless to say, more administration may improve the political decision making and contribute to cost savings and better quality of services. We cannot say whether the extra resources put into administration represent bureaucratic waste or the priority of the political leadership to achieve cheaper and better services. The minimum requirement and the overspending defined are not without interest, however. Some authorities can make do with the minimum required administration. Even the authorities with the lowest administrative spending have administrative costs above 10% of current expenditures.

5. Estimating the minimum requirement frontier – the parametric method

The first method applied to investigate the variation in the administrative spending makes use of the parametric version of the demand model outlined. The stochastic demand function is estimated by standard OLS. A deterministic refer-
ence frontier is established by adjusting the constant term of the estimated equation so that all authorities have zero or positive residuals. The location of the reference frontier is set by the authority with the lowest per capita administrative spending given the local characteristics (zero residual). Compared to Fig. 1, now in general only one authority is located at the frontier. The method assumes that the functional form of the reference frontier is the same as the average function. The parameters of the reference frontier, e.g. the expenditure elasticity, are the same as for the average function. The procedure is discussed by Førsund et al. (1980).

The demand equation is specified in logarithmic form. Log-linear functional form simplifies the procedure to determine the reference frontier. The coefficients estimated are constant elasticities. The per capita administrative spending (\( A \)) is analyzed in relation to the total per capita budget (\( Y \)), the population size (\( P \)), the age composition of the population (\( C \)), the settlement pattern (\( S \)) and the population growth rate (\( G \)). The sociodemographic variables included represent the main factors expected to influence local public service demand as documented in previous Norwegian studies. The age composition variable \( C \) is the share of children attending primary school (age 7 to 15 years) in the population. The settlement pattern \( S \) is measured as the average travelling distance (in minutes) to the administration center of the local authority. The data set for 1988 is based on the local government accounts and a databank of sociodemographic characteristics.

The deterministic reference frontier function is specified as (4) (\( j \) is observation \( j = 1, \ldots, 407 \)):

\[
\ln A_j = h + a_1 \ln Y_j + a_2 \ln P_j + a_3 \ln C_j + a_4 \ln S_j + a_5 \ln G_j + u_j. \tag{4}
\]

The residual \( u_j \) is a one-sided error term representing overspending. The residual represents the per capita administrative spending in excess of the minimum required as defined by the demand variables. Eq. (4) is equivalent to the following equation to be estimated:

\[
\ln A_j = H + a_1 \ln Y_j + a_2 \ln P_j + a_3 \ln C_j + a_4 \ln S_j + a_5 \ln G_j + v_j, \tag{5}
\]

where

(i) \( H = h + \mu \),

(ii) \( v_j = u_j - \mu \).

The residuals \( u_j \) are assumed to be independently and identically distributed with mean \( \mu \) and finite variance, and uncorrelated with the explanatory variables. The error term of Eq. (5) has zero mean, and the ordinary least squares method produces unbiased and consistent estimators for \((h + \mu)\) and the \(a\)'s, as shown by Richmond (1974) and Schmidt (1985). A consistent estimate of the intercept \( h \) of the frontier function is found by correcting the intercept \( H \) such that no residual is negative and one is zero, following Green (1980):

\[
h = H - |v_{\text{min}}|.\]
Table 2
Minimum requirement ratio, actual spending and overspending

<table>
<thead>
<tr>
<th>Inhabitants</th>
<th>( N )</th>
<th>Average min. req. ratio</th>
<th>Average per capita spending</th>
<th>Average per capita overspend.</th>
<th>Total overspend. mill.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.000-1.999</td>
<td>59</td>
<td>0.72 (0.09)</td>
<td>4264 (853)</td>
<td>1254 (594)</td>
<td>110</td>
</tr>
<tr>
<td>2.000-2.999</td>
<td>68</td>
<td>0.75 (0.10)</td>
<td>3262 (637)</td>
<td>862 (466)</td>
<td>150</td>
</tr>
<tr>
<td>3.000-4.999</td>
<td>95</td>
<td>0.74 (0.09)</td>
<td>2736 (536)</td>
<td>740 (332)</td>
<td>270</td>
</tr>
<tr>
<td>5.000-6.999</td>
<td>51</td>
<td>0.75 (0.07)</td>
<td>2374 (410)</td>
<td>608 (233)</td>
<td>190</td>
</tr>
<tr>
<td>7.000-9.999</td>
<td>47</td>
<td>0.77 (0.08)</td>
<td>2113 (360)</td>
<td>507 (234)</td>
<td>200</td>
</tr>
<tr>
<td>10.000-19.999</td>
<td>64</td>
<td>0.75 (0.10)</td>
<td>2002 (346)</td>
<td>517 (286)</td>
<td>480</td>
</tr>
<tr>
<td>20.000-49.999</td>
<td>23</td>
<td>0.67 (0.08)</td>
<td>2184 (391)</td>
<td>734 (281)</td>
<td>490</td>
</tr>
<tr>
<td>All</td>
<td>407</td>
<td>0.74 (0.09)</td>
<td>2782 (925)</td>
<td>756 (446)</td>
<td>1900</td>
</tr>
</tbody>
</table>

\(^a\) Parametric reference frontier. Groups of authorities by population size, amounts in NOK. Unweighted averages, standard deviation in parentheses.

\( u_{\min} \) is the largest negative residual of the average function estimated, and represents the authority with the lowest per capita administrative spending given the local characteristics.

The expenditure demand model (5) is well established in Norwegian studies of local government resource allocation, as documented by Rattsø (1989) and Borge and Rattsø (1993). The estimates shown in Table 1 are consistent with previous studies and capture a large part of the variation in per capita administrative spending. First and for all the total per capita budget \( (Y) \) is important. The expenditure elasticity is 1.10, implying that the administration takes an increasing share of the budget under growth. The elasticity is significantly larger than 1 at the 2.5% level.

The role of population size \( (P) \) for administrative spending has been investigated by alternative functional forms to detect a U-curve or a continuous scale effect. The constant elasticity formulation of Table 1 implies that the per capita administrative spending falls with respect to population size. The cost sharing of administration as a collective good seems to dominate. Since the elasticity is
constant, the scale effect is declining with size. It is hard to choose between different specifications of the population size effect, and the alternatives have some influence on the estimated expenditure elasticity because of multicollinearity. The ranking of overspending is robust with respect to different functional forms. It cannot be ruled out that the zoo effect and administrative complexity drive up administrative costs per head for the largest authorities.

The other sociodemographic factors are included to represent demand factors affecting the composition of services. The population growth \( G \) tends to increase the per capita administrative expenditures, presumably by giving priority to the infrastructure sector that has high administrative intensity (planning etc.). The age composition of the population is a decisive factor in determining the development of local public services. A bias towards many in the school age \( C \) necessitates a concentration of resources to primary school with low administrative intensity. A high spending share of education may itself represent a scale effect reducing the administrative intensity of the school sector. A decentralized settlement pattern \( S \) seems not to be an important factor.

The econometric estimates of Table 1 allow the determination of the minimum requirement ratio as explained in Fig. 1, the share of the actual administrative spending in each authority predicted by the minimum requirement frontier. The average minimum requirement ratio of the authorities is 0.74, implying that on average 26% of the expenditures in local government administration are in excess of the predicted minimum, as shown in Table 2.

The sum of the overspending compared to the minimum requirement is 1.9 bill 1988-NOK (about 300 mill 1988-USD) or 650 NOK per capita (about 100 USD). This sum indicates the potential saving if all local governments ran the administration at the minimum required level given their local characteristics, about 28% of the administrative spending in the 407 municipalities. As reported above, the result is robust with respect to both alternative model specifications and different years of estimation.

The method chosen is sensitive to extreme observations. Sensitivity analysis is made by deleting the authorities with the smallest per capita administrative expenditures given their local conditions, since they may represent measurement error. When the 20 authorities with the lowest per capita administrative costs (5% of the observations) are deleted, the expenditures in excess of the minimum required amounts to 1.5 bill NOK or 22% of the administrative expenditures in the remaining 387 authorities. Even when the authorities with the lowest administrative spending are left out, the overspending is significant.

6. Estimating the minimum requirement frontier – the non-parametric method

The robustness of our results are checked by an alternative approach to efficiency estimation – Data Envelopment Analysis. The method determines the
reference frontier by a piecewise linear envelopment of the data without assuming any specific functional form. It is well suited for this type of analysis where a priori knowledge of the relationships is scarce. The DEA method is a generalization of Farrell's efficiency measurement, and was developed by Charnes et al. (1978). Compared to the parametric method, the frontier will be closer to the actual observations.

The starting point is a general relationship between the demand variables and the per capita administrative spending as formulated above. A piecewise linear reference frontier representing the authorities with the lowest administrative spending given their local characteristics is established. In Fig. 1, four authorities (A, B, C and D) define the minimum requirement frontier. The frontier represents reference units that the other authorities can be compared with. Each reference authority (such as J in Fig. 1) is a linear combination of the characteristics of other authorities.

The weight of each authority is determined by a minimization problem: the relationship \( H_J / H_E \) is minimized for each authority such as E given three main conditions. First, the measure of \( H_J / H_E \) multiplied by observed per capita administrative spending, that is the administration of the reference unit (point J), must be greater than or equal to a weighted average of the per capita administrative expenditures in the other authorities.

Second, each local characteristic observed must be smaller than or equal to a weighted sum of the same characteristic in other authorities. (The variables are defined so that they all have a positive impact on administrative spending.) This condition implies that the reference unit (point J) must have at least as low spending as the authority observed, i.e. the reference unit does not have a higher per capita expenditure with the same local characteristics than the observed authority (E). Only authorities with the minimum required administration will influence the position of the reference unit (point J), and the set of authorities determining the reference unit will vary dependent on what authority is observed (A and B for E in Fig. 1).

Third, the sum of the weights is 1 by assumption. The intuition of this condition relates to the comparison between authorities. The authorities defining the reference unit are supposed to have similar characteristics as the observed authority. The assumption implies variable return to scale. In our context it is important since local authorities of different population size may have different administrative functions. A general formulation of the method is described by Charnes et al. (1978).

The results of the DEA analysis are reported in Table 3. The average (un-weighted) minimum requirement ratio is 0.84, i.e. 84% of the observed per capita administrative spending is predicted by the DEA minimum requirement frontier. The overspending adds up to about 1.2 bill 1988-NOK, as documented in Table 3, representing about 17% of total administrative expenditures in the 407 authorities.

Since the reference frontier is established by envelopment of the units studied,
Table 3
Minimum requirement ratio, actual spending and overspending

<table>
<thead>
<tr>
<th>Inhabitants</th>
<th>N</th>
<th>Average min. req.</th>
<th>Average per capita spending</th>
<th>Average per capita overspend.</th>
<th>Total overspend. mill.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.000-1.999</td>
<td>59</td>
<td>0.91 (0.11)</td>
<td>4264 (853)</td>
<td>379 (495)</td>
<td>40</td>
</tr>
<tr>
<td>2.000-2.999</td>
<td>68</td>
<td>0.82 (0.12)</td>
<td>3262 (637)</td>
<td>632 (531)</td>
<td>110</td>
</tr>
<tr>
<td>3.000-4.999</td>
<td>95</td>
<td>0.81 (0.10)</td>
<td>2736 (536)</td>
<td>551 (355)</td>
<td>200</td>
</tr>
<tr>
<td>5.000-6.999</td>
<td>51</td>
<td>0.81 (0.09)</td>
<td>2374 (410)</td>
<td>480 (264)</td>
<td>150</td>
</tr>
<tr>
<td>7.000-9.999</td>
<td>47</td>
<td>0.85 (0.10)</td>
<td>2113 (360)</td>
<td>339 (254)</td>
<td>130</td>
</tr>
<tr>
<td>10.000-19.999</td>
<td>64</td>
<td>0.87 (0.11)</td>
<td>2002 (346)</td>
<td>281 (274)</td>
<td>260</td>
</tr>
<tr>
<td>20.000-49.999</td>
<td>23</td>
<td>0.83 (0.10)</td>
<td>2184 (391)</td>
<td>409 (283)</td>
<td>260</td>
</tr>
<tr>
<td>All</td>
<td>407</td>
<td>0.84 (0.11)</td>
<td>2782 (925)</td>
<td>456 (397)</td>
<td>1200</td>
</tr>
</tbody>
</table>

*Non-parametric reference frontier. Groups of authorities by population size, amounts in NOK. Unweighted averages, standard deviation in parentheses

extreme observations (with respect to per capita administrative expenditures and local characteristics) will be among the minimum requirement units defining the reference frontier. They do not have reference units with similar characteristics to compare with. When a minimum requirement authority is not one of the authorities defining the reference unit of any other authority, it is likely to be an extreme observation. This is the case for 15 authorities (of the 58 minimum requirement authorities identified) in this study. 11 are among the small authorities having less than 2,000 inhabitants. They are extreme observations in the sense that they have different characteristics from others, but they are not necessarily inefficient. The exclusion of the very small, the very large and the very rich municipalities has reduced this problem.

The choice between a parametric and a non-parametric model must be based on the apriori knowledge. The parametric formulation is more restrictive, while the non-parametric may underestimate the overspending of authorities with ‘extreme’ local characteristics. The predicted minimum requirement ratio differs first and for all for the small and the large authorities. The parametric method may underestimate the diseconomies of scale in the small and overestimate the economies of scale in the large authorities. Broadly the two methods identify the same overspenders, and the simple correlation between the minimum requirement ratios with the two methods is 0.65, while the Spearman rank correlation is 0.64. When authorities with less than 2,000 and more than 20,000 inhabitants are eliminated from the sample, the correlation is about 0.80.

7. Concluding remarks

A demand model of administrative spending is shown to capture the main determinants of local administration size. First and for all the per capita resource
use in administration is affected by the total per capita budget and the population size. But even authorities very similar with respect to the income level, the population size, the age composition of the population etc. have very different resource use in administration. Our analysis throws some light on the variation in administrative spending after taking into account sociodemographic factors influencing local public service demand.

All authorities are compared to a minimum requirement reference frontier representing the authorities with the lowest per capita resource use in administration, correcting for local demand factors. Using two different methods to identify the frontier, a parametric and a non-parametric (DEA), the overspending compared to the minimum requirement is estimated to between 17% and 28% of total administrative expenditures in the 407 local authorities.

The study may be of methodological interest since productivity measurement methods from industry are applied to local government expenditures. The standard product- or cost function is substituted by a demand function representing the relationship between local characteristics and local priorities. The determination of the reference frontier and the calculation of distances from the minimum requirement to the observed expenditures describe the variation of resource use in local administration.

The main weakness with the deterministic method is that it does not allow any statistical noise in the determination of the frontier. The method does not account for measurement errors or omitted variables that may affect the required resource use in administration. This means that all spending in excess of the frontier is regarded as overspending. The strength of the method is that the overspending of each authority can be identified and confronted with the authority in question. The approach offers input to political-economy models that can investigate the sources of the variation of the resource use in administration.

Acknowledgment

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