Demographic shift, relative costs and the allocation of local public consumption in Norway

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Received September 1993; final version received January 1995

Abstract

Local government responses to shifting demand and supply conditions are investigated. The desired allocation of local public consumption is determined in a voter group decision model where different age groups compete for services within an exogenous budget constraint. The model is implemented in an AIDS demand system built into a partial adjustment framework. The estimates indicate that the dramatic shift in the age composition of the population from the young to the elderly during the period studied has led to higher educational spending per pupil and less health care services per elderly. Age groups in decline are able to resist reallocations and gain in terms of spending per head.

Keywords: Local public finance; Group decision model; Adjustment inertia

JEL classification: H72

1. Introduction

The conflicting claims between the young and the old dominate local government decision-making in Norway. Since child care, primary education and services for the elderly are the key responsibilities of the local authorities, different age groups are rivals. Demographic shift during the 1980s has accentuated the allocation conflict: the number of children eligible...
for primary school has fallen by more than 20%, and the age composition has shifted towards the elderly. This study addresses the responses of local governments to demographic factors and investigates the influence of costs.

The understanding of local government priorities is usually linked to the choice between private consumption and local public services. The modelling has concentrated on the role of demand factors in a static framework, as summarized by Inman (1979) and Rubinfeld (1987). In Norway the choice set of the local voters is severely restricted, since the national government determines the revenues of each local government by general grants and an income tax revenue sharing system. The exogenous budget constraint implies that the choice between private consumption and local public spending is taken at the national level. What is left for the local decision-making process is the allocation of a fixed total budget between different services. Different age groups are fighting for pieces of a given pie.

Two issues are important in this context. First, what is the desired allocation of local government consumption that comes out of the political process? Second, at what speed are the local authorities implementing the desired allocation? The literature on incrementalist decision-making initiated by Wildavsky (1964) has documented the decisive advantage of the status quo in public institutions. The degree of adjustment inertia in local governments is investigated in a dynamic model integrating incrementalism with a model of the demand for services.

Although the main conflict of priority has been between services for the children and the elderly, all the six local service sectors are included in the analysis: central administration, primary education, health care/care for the elderly (called 'elderly' in the tables), child care, cultural services and infrastructure.1 The empirical investigation concentrates on operating costs, and the trends of the budget shares during the period under study are shown in Table 1. Significant changes are observed over time. Central administration, health care/care for the elderly and child care take an increasing share of the budget at the expense of primary education and infrastructure. The development traced in Table 1 is consistent with the experienced demographic shift from the young to the elderly. The cross-section variation between local governments is even more important. The standard deviations within a single year are large compared with the change in the average budget shares from 1986 to 1989.

Supply-side factors, often neglected in empirical analyses, may have an independent say in the resource allocation process. The wage growth has varied among labor of different skills and consequently the relative unit costs between local services have changed. The analysis can benefit from a

1 Health institutions are left out because of institutional reforms during the period under study.
Table 1
Budget shares of local government services

<table>
<thead>
<tr>
<th></th>
<th>Administration</th>
<th>Education</th>
<th>Elderly</th>
<th>Child care</th>
<th>Infrastructure</th>
<th>Culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average budget shares 1986–98 (%)a</td>
<td>11.2</td>
<td>43.0</td>
<td>17.5</td>
<td>3.9</td>
<td>17.8</td>
<td>6.6</td>
</tr>
<tr>
<td>1986</td>
<td>11.7</td>
<td>42.1</td>
<td>17.8</td>
<td>4.4</td>
<td>17.4</td>
<td>6.6</td>
</tr>
<tr>
<td>1987</td>
<td>12.0</td>
<td>41.6</td>
<td>18.4</td>
<td>4.7</td>
<td>16.7</td>
<td>6.6</td>
</tr>
<tr>
<td>1988</td>
<td>12.0</td>
<td>41.4</td>
<td>18.5</td>
<td>5.2</td>
<td>16.4</td>
<td>6.5</td>
</tr>
</tbody>
</table>

Cross-section variation in the budget shares, 1989

<table>
<thead>
<tr>
<th></th>
<th>Administration</th>
<th>Education</th>
<th>Elderly</th>
<th>Child care</th>
<th>Infrastructure</th>
<th>Culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min</td>
<td>4.8</td>
<td>20.3</td>
<td>10.1</td>
<td>1.1</td>
<td>7.8</td>
<td>2.7</td>
</tr>
<tr>
<td>Max</td>
<td>24.5</td>
<td>54.2</td>
<td>27.5</td>
<td>10.1</td>
<td>28.5</td>
<td>12.4</td>
</tr>
<tr>
<td>Stdev</td>
<td>3.3</td>
<td>5.9</td>
<td>3.7</td>
<td>1.9</td>
<td>4.3</td>
<td>2.1</td>
</tr>
</tbody>
</table>

Source: Local government accounts.

a The figures are unweighted averages for each year using a sample of 122 (out of 448) municipalities.

Data base identifying wages and labor use for each of the services over four years. Applying the public employment approach, the operating costs per unit of labor in each local service are interpreted as price variables. The development of relative prices is described in Table 2. The overall price level of local services, represented by a Stone index \((P)\), has increased by close to 20% over three years, well above the consumer price index. The total real local government expenditures \((Y/P)\) have increased by close to 3% per year. Relative prices have changed dramatically. The cost problem is most evident in the health care/care for the elderly sector. The increased budget share of this sector documented in Table 1 may partly reflect higher costs. The relative price of child care services has fallen because the national

Table 2
The development of prices and spending

<table>
<thead>
<tr>
<th></th>
<th>Adm.</th>
<th>Educ.</th>
<th>Elderly</th>
<th>Child</th>
<th>Infr.</th>
<th>Culture</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(P_i/P)</td>
<td>(P_i/P)</td>
<td>(P_i/P)</td>
<td>(P_i/P)</td>
<td>(P_i/P)</td>
<td>(P_i/P)</td>
</tr>
<tr>
<td>1986</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
</tr>
<tr>
<td>1987</td>
<td>111.40</td>
<td>98.23</td>
<td>107.23</td>
<td>85.61</td>
<td>97.40</td>
<td>99.56</td>
</tr>
<tr>
<td>1988</td>
<td>118.71</td>
<td>99.32</td>
<td>113.86</td>
<td>81.12</td>
<td>98.36</td>
<td>96.71</td>
</tr>
<tr>
<td>1989</td>
<td>119.35</td>
<td>100.94</td>
<td>102.61</td>
<td>96.94</td>
<td>95.03</td>
<td>97.85</td>
</tr>
</tbody>
</table>

Note: Price level \(P\), relative prices \(P_i/P\) \((i = 1, \ldots, 6)\), total real spending \(Y/P\). Index 1986 = 100.

Source: Local government accounts and a database of local government employees.

a The figures are unweighted averages for each year using a sample of 122 (out of 448) municipalities.

2 As explained in Section 4, the prices \((P_i)\) reflect net operating costs adjusted for matching grants.
government has stimulated child care by selectively matching grants to influence local priorities.

The cost problem of local service production is acknowledged in the public debate. Local governments are under criticism for rigidity and inefficiency. The present study captures the combined effects of increased costs and sluggish adjustment. Price and expenditure elasticities and the degree of inertia are estimated on the basis of a combined cross-section time-series data set.

Section 2 presents our understanding of the local decision-making process, and the dynamic framework is laid out in Section 3. The operationalization follows in Section 4, including the AIDS specification and the construction of the price variables. In Section 5 the estimated influence of age groups on the resource allocation is discussed. The adjustment inertia and the price and expenditure elasticities are reported in Section 6, while Section 7 decomposes the changes in the budget shares based on the econometric results. A brief concluding section summarizes the main findings.

2. The decision-making process of Norwegian local governments

The starting point of the literature is the median voter theorem implying that a stable majority rule equilibrium always exists when the local decision problem is one-dimensional and voter preferences are single-peaked. Empirical applications often use data from US school districts where one issue is handled and the assumption of single-peakedness may be satisfied.

The case of multi-purpose authorities is more difficult to handle. When the issue has more than one dimension, the decision-making process will suffer from a cycling problem where any allocation can be beaten by another proposal. A stable majority rule equilibrium will in general not exist. This cycling problem is rarely discussed in applied work, and Craig and Inman (1986) are one of the few exceptions. They propose a voter group decision model, where the actual outcome is a weighted average of each group's preferred allocation. A similar approach, the interest function model, has been developed by van Winden (1983). The resource allocation is a political compromise among groups of voters. A voter group decision model seems particularly relevant for the Norwegian setting. Primary education, health care services and child care make up two-thirds of the total budget. These services are publicly provided private goods directed towards specific subgroups of the population. Consequently, parents with children eligible for child care and primary education, and the elderly become important players in the local decision-making process.
The modelling takes into account the centralized system of financing in the Norwegian institutional context. Beginning in 1986, the first year of the analysis, most grants are consolidated in a single lump-sum grant to each local government. The grants are distributed according to a formula taking into account the local income level and local characteristics such as the age composition and the density of the population. The basic principle of the grant system is that the grants are independent of local spending decisions. A matching grant for child care remains, and is built into the budget constraint below.

Following Craig and Inman (1986), we assume that the desired allocation of local public consumption is a weighted average of each group’s preferred outcome. The outcome preferred by group \( g \) is defined by maximization of a group-specific utility function subject to the exogenous budget constraint:

\[
\max U^g (X_{1t}, \ldots, X_{nt}; I^g, Z_t) \text{ s.t. } \sum_{i=1}^{n} P_i X_{it} = Y_t,
\]

where \( X_{it} \) is the per capita local public service production of the \( i \)th of the \( n \) services in year \( t \) and \( Z_t \) is a vector of structural characteristics describing each community. Per capita private consumption, \( I^g_t \), is included to capture possible non-separability between local public services and services provided by the private market. The marginal rates of substitution between the local public services may be influenced by the level of private consumption. \( P_i \) is the unit price of service \( i \) and \( Y_t \) is total local government spending per capita. Eq. (1) defines group \( g \)'s desired expenditure shares for the local public services, \( A^g_{it} \), as functions of unit prices, total local government spending per capita, per capita private consumption and the structural characteristics:

\[
A^g_{it} = h^g_i (P_1, \ldots, P_n, Y_t, I^g_t, Z_t).
\]

Eq. (2) is a rationed demand system where the regular demand restrictions of adding up, homogeneity and Slutsky symmetry apply for the set of local public services. This is in contrast to the standard formulation where the median voter is constrained by a total budget covering both private and public goods. The desired expenditure shares of the local government, \( A^g_{it} \), are assumed to be a weighted average of the preferred outcome of all \( G \) groups. When \( \pi^g \) is the relative weight attained by group \( g \) and \( S_t \) a vector
of variables affecting these weights, the desired expenditure shares are given by

\[
A_{it}^* = \sum_{g=1}^{G} \pi^g(S_i)(P_{1i}, \ldots, P_{ni}, Y_i; I_i^g; Z_i), \quad \sum_{g=1}^{G} \pi^g = 1,
\]

where

\[
A_{it}^* = f_i(P_{1i}, \ldots, P_{ni}, Y_i; I_i^l; I_i^g, S_i, Z_i).
\] (3)

Fig. 1 illustrates the model in the case of two services \((X_1 \text{ and } X_2)\) and three voter groups \((A, B \text{ and } C)\). The bliss points of the voter groups are \(a, b \text{ and } c\). \(A \text{ and } B\) are client groups, and they prefer a large local public sector biased towards the provision of \(X_1 \text{ and } X_2\), respectively. Group \(C\) prefers a small local public sector. However, the size of the local public sector is not on the agenda. Given the exogenous budget constraint (the \(EE\)-line), the preferred allocations are \(a', b' \text{ and } c'\). The model assumes that the desired allocation, \(A_{it}^*\), is a weighted average of \(a', b' \text{ and } c'\).

The price and expenditure elasticities derived from the demand system (3) differ from those estimated in median voter studies. By definition, the weighted average of the expenditure elasticities of local services equals 1, and the expenditure elasticities are not comparable with those of private goods. The price elasticities reflect the impact of the increased costs of local services within a given local government budget, and thus the price elasticities cannot be compared with those obtained under the assumption of
an endogenous local government budget constraint. In the regular median voter setup, price inelasticity means that the local government budget will increase with higher costs. In the Norwegian situation, the total budget is not allowed to increase. The price elasticities are expected to be higher in absolute value in this case.

The demand function \( f_i \) satisfies the homogeneity restriction: an equal proportional change in all prices and total per capita local government spending will not alter each group's preferred allocation, and thus \( A^*_{it} \) is homogeneous of degree zero in prices and total per capita spending. The Slutsky-symmetry condition is more complicated, but it can be shown that the demand system (3) satisfies the symmetry conditions if and only if condition (4) is satisfied for all pairs of services:

\[
\text{Cov}\left[\pi^g(X^*_i - X^g_i), D^g_i\right] = \text{Cov}\left[\pi^g(X^*_i - X^g_i), D^g_j\right], \quad i \neq j.
\]

\( X^*_i \) and \( X^g_i \) represent the per capita service production corresponding to \( A^*_{it} \) and \( A^g_{it} \), respectively. \( D^g_i \) is group \( g \)'s Engel derivative for service \( i \). Condition (4) does not hold in general, but it holds in the special case where the Engel derivatives are the same for all groups. Variation in the Engel derivatives seems quite reasonable, and it is highly consistent with the model that symmetry fails to hold for the demand system (3).

3. The dynamics of the decision-making process

Economic analyses of local government priorities are dominated by static models investigating price and expenditure elasticities. A serious weakness of these models is the lack of attention paid to implementation problems. It is assumed that the policy formulated by the median voter is executed instantly. Pressman and Wildavsky (1973) initiated an interest in implementation problems that has motivated the present study. In the political science literature, dynamics are often captured by the incremental model based on bounded rationality. The decision-making is a search among alternatives which deviates marginally from the existing situation. The idea of incremental decision-making is well established in budgetary theory by Wildavsky (1964). We introduce dynamics by combining the voter group decision model with the partial adjustment rule.

The dynamic formulation distinguishes between the 'desired' allocation \( (A^*_{it}) \) and the 'actual' allocation \( (A_{it}) \) for each year. The desired allocation is determined by the static model developed in Section 2. The relationship between the desired and the actual allocation is formulated as a partial adjustment process. The actual change in the expenditure share of service \( i \) is a fraction of the desired change:
When (3) is substituted into (5), the equation can be solved with respect to $A_{it}$:

$$A_{it} = \lambda_i f_i(P_{it}, ..., P_{nt}, Y_t, I_{it}^1, ..., I_{it}^G, S_t, Z_t) + (1 - \lambda_i)A_{it-1}.$$  

Eqs. (3) and (6) can be interpreted as the long-run and the short-run demand functions, respectively. The adjustment coefficient $\lambda_i$ indicates the sluggishness of the local government responses to changing demand. A small value of the coefficient means that only a small fraction of the desired reallocation of services is implemented in the first year—the sluggishness is strong. A companion paper, Borge et al. (1995), analyzes how political characteristics of the local governments influence the sluggishness in a simplified version of this model.

The partial adjustment model developed above has no normative implications. It is not necessarily the case that a high speed of adjustment is optimal. The desired reallocation is determined by current values of the exogenous variables and last year's spending, while expectations about the future play no role. Demographic shifts can be mean-reverting. In this case the desired reallocation calculated from the partial adjustment model can be larger than the optimal reallocation.

### 4. Operationalization of the model

The analysis addresses the importance of supply-side factors in influencing the resource allocation by including the relative prices of the six services. The lack of information of service volumes makes the identification of price variables problematic. There are two ways to get around the problem. The standard approach is to calculate the median voter’s tax price. The tax price formulation, however, is not of much relevance in Norway where local government revenues are exogenous. We have chosen to follow the alternative public employment approach innovated by Ehrenberg (1973) and Bahl et al. (1980). This method was first applied to Norwegian local governments by Rattsø (1989). A crucial assumption is that the use of labor is a good approximation of the level of production of each service. This is true in a Leontief production function world with a proportional relationship

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4 The partial adjustment formulation includes no mechanism to guarantee the adding up condition of the 'actual' expenditure shares; see Borge and Rattsø (1993, p. 592) for further discussion. In the empirical analysis the demand system works for $n - 1$ of the services, while cultural services are treated as a residual factor. The coefficients of the residual sector are calculated from the budget restriction.
between employment and true output. No scale effects or factor substitution are allowed. The labor-intensive local services are not expected to offer much scope for shifting factor intensities. The starting point is a decomposition of the operating costs into price and volume components:

\[ E_i = W_i N_i + R_i M_i = (W_i + a_i R_i)N_i = P_i^* N_i. \]  

(7)

The operating costs of service \( i \), \( E_i \), are related to labor input, \( N_i \), and materials, \( M_i \). The unit factor prices are \( W_i \) and \( R_i \), respectively. The use of materials is assumed to be proportional to the labor input with the proportionality factor \( a_i \). The net price, \( P_i \), is constructed by subtracting selective matching grants per unit of labor, \( SG_i \):

\[ P_i = P_i^* - SG_i. \]  

(8)

The net price per unit of labor, \( P_i \), reflects the wage rate, the unit price of materials, the proportionality factor and selective grants. The development of the wage rate and the matching grant for child care are expected to be the main sources of relative price shifts.

Operationalization of the model involves a parametric specification of the demand functions, \( f_i \). We apply the AIDS demand system developed by Deaton and Muellbauer (1980), in which case Eq. (3) is reformulated as follows:

\[ A_{it}^* = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \log P_{jt} + \beta_i \log Q_t + \mu_i \log I_t + \tau_i S_t + \eta_i Z_t, \]  

(9)

\[ \log Q_t = \log Y_t - \log P_t, \]  

(10)

\[ \log P_t = \alpha_0 + \sum_{j=1}^{n} \alpha_j \log P_{jt} + \frac{1}{2} \sum_{k=1}^{n} \sum_{j=1}^{n} \gamma_{kj} \log P_{kt} \log P_{jt}. \]  

(11)

The structural characteristics, private consumption and the political influence variables are assumed not to affect the price and expenditure elasticities. By adding a superscript \( k \) for community, a community specific term \( (v_i^k) \) and a white noise error term \( (u_{it}^k) \), the short-run demand system is given by

\[ A_{it}^k = \lambda_i \alpha_i + \lambda_i \sum_{j=1}^{n} \gamma_{ij} \log P_{jt}^k + \lambda_i \beta_i \log Q_t^k + \lambda_i \mu_i \log I_t^k \]

\[ + \lambda_i \tau_i S_t^k + \lambda_i \eta_i Z_t^k + (1 - \lambda_i)A_{it-1}^k + v_i^k + u_{it}^k, \]

\[ k = 1, \ldots, N; \quad t = 1, \ldots, T. \]  

(12)

Eq. (12) is the dynamic version of the AIDS demand system following from the partial adjustment rule. Dunne et al. (1984) is the only study known applying a dynamic version of the AIDS model to analyze the demand for
public services. Several authors have used a dynamic AIDS model to analyze private consumer spending, among these are the models of Anderson and Blundell (1983) and Blanciforti and Green (1983) most closely related to ours. Blanciforti and Green use lagged quantity in their partial adjustment model, while Anderson and Blundell use lagged expenditure shares within the more general error correction approach. Owing to the short time series available, we have chosen not to experiment with more complex dynamics. The model enables us to separate between the short-run and long-run effects of different factors. The short-run reactions follow from Eqs. (10)–(12), while the long-run responses are described by Eqs. (9)–(11). The formulas for price and expenditure elasticities are given in Appendix A.

The general price index (11) is replaced by the Stone index (13) in the estimation procedure:

$$\log P_t = \sum_{j=1}^{n} A_{jt} \log P_{jt}. \quad (13)$$

This widely used simplification facilitates the estimation, and Deaton and Muellbauer (1980) show that the Stone index may be a good approximation of the general index.

Per capita private consumption of each group appears in the demand function, Eqs. (3) and (6), and captures the possible non-separability between local public services and private consumption. The model allows the structure of this non-separability to vary across the groups, i.e. a service may be a complement to private consumption for one group and an alternative to private consumption for another group. However, due to data limitations, it has not been possible to construct this variable for the three subgroups. Only average after-tax income per capita ($I_t$) is included in the model implemented. Consequently, the empirical model does not account for possible variations in the structure of the non-separability across the groups.

As discussed in Section 2, the elderly and parents with children eligible for child care and/or primary school are important for the local decision-making process. Their relative political influence, the $\pi$-weights, are assumed to depend on the numerical strength of the groups. The same specification of political influence is applied by Craig and Inman (1986), while Renaud and van Winden (1991) model each group's political influence as a weighted average of the numerical strength and the party composition of the local council. The political influence of elderly voters is approximated by the share of elderly ($EL$) in the population, while the numerical strength of parents is represented by the share of youth ($YO$) and the share of children ($CH$). Inhabitants classified as children or young do not vote, but the share of voters with children will be an increasing function of $YO$ and
CH. We expect the groups to stimulate resource use for their ‘own’ services and to reduce spending for all other services.

In the empirical model, two variables are included to capture varying structural characteristics among the communities. On the basis of the experiences of numerous Norwegian expenditure studies, e.g. Rattsø (1989) and Borge and Rattsø (1993), they are the population density $DE$ and the population size $POP$, both in log form. The constant terms of the demand functions are allowed to shift from year to year to represent factors not included (such as shifts in the division of labor with the state).

The model is implemented using a database covering 122 (of 448) local authorities during the period 1986–89. The time period and the number of municipalities are limited by the availability of reliable data regarding the use of labor. It is shown in Appendix C that the sample of 122 authorities is quite representative.

In the choice of estimation method, we try to combine two goals. First, to obtain proper estimates of the coefficients of the lagged endogenous variables, it is important to allow for community-specific effects. Second, when the time series is short and the cross-section variation is important, as shown in Table 1, we are reluctant to rely on the time-series variation in the data only. Neither the method of ordinary least squares (OLS) nor the least squares dummy-variable method (LSDV) achieves these goals.⁵ We use the method of Balestra and Nerlove (1966), which assumes that the community-specific effects are uncorrelated with the exogenous variables. They are correlated with the lagged endogenous variable by definition, and the instrument-variable method (IV) is used to obtain consistent estimates. The choice of instruments is a difficult task. Particularly because variables that are correlated with previous spending already should be included in the model as exogenous variables. Then, the remaining valid instruments are lagged values of the exogenous variables. The IV method is the benchmark of our estimation. The estimates of the lagged dependent variables are compared with those obtained using OLS and LSDV.

5. The role of the age composition of the population

The homogeneity and symmetry restrictions are tested in Appendix B. Consistent with the underlying model, homogeneity is accepted and Slutsky

⁵OLS utilizes both the cross-section variation and the time-series variation in the data. However, the error term of the model $(\epsilon_t + u_k)$ captures the community-specific effects. There will be a positive correlation between the error term and the lagged endogenous variable, and, consequently, OLS is likely to overestimate the adjustment inertia. On the other hand, LSDV does not utilize any cross-section variation in the data, only time-series variation within each local authority. Moreover, LSDV underestimates the adjustment inertia when the time span is short (Nickel, 1981).
Symmetry rejected. The following discussion of the influence of age groups, adjustment inertia and price and expenditure elasticities relies on a version where only homogeneity is imposed. Moreover, the equations are estimated as a system, i.e. by 3SLS with lagged values of the exogenous variables as instruments. The complete estimation results are presented in appendix Table A2.

Our description of the decision-making system in Norway assumes that different age groups compete for local services. As mentioned in the introduction, the local authorities have experienced a dramatic shift in the age composition of the population even during the short period investigated, 1986–89. The population shares of the three age groups, reflecting numerical strength, have the expected effects. First and for all, the share of youth stimulates the use of resources in primary education, and the share of elderly increases spending on health care/care for the elderly. Because of the exogenous budget constraint, higher spending in one sector has to be financed by cutbacks in other sectors. This explains why a high share of elderly reduces spending on education and child care, and that a high share of youth reduces spending on health care/care for the elderly, child care, cultural services and infrastructure. The results obtained from other group decision models are mixed. Craig and Inman (1986) use income to define groups of voters and find no significant effects in their analysis of the US states. However, Renaud and van Winden (1991) document that numerical strength variables (defined with respect to occupation) influence the behavior of Dutch local governments.

The age composition of the population is clearly important for the allocation of local public services across the nation. The share of inhabitants over 67 years of age varies from 6% to 25% of the population in the sample, while the share of youth varies from 10% to 19%. It is of interest to investigate how the shift in the age composition has affected the educational spending per pupil and the spending in health care/care for the elderly per inhabitant over 67 years of age. The effect of a shift in the age share of the population by 1 percentage point from the young to the elderly is simulated. Using the estimated coefficients and the mean of the variables, we find that the short-run effect is to increase school spending per pupil by 5.2% and to decrease spending in health care/care for the elderly by 4.7% per person over 67 years of age. To some extent the short-run effect reflects the inertia of the adjustment process. The long-run effect is to increase educational spending per pupil by 2.8% and to reduce spending in health care/care for

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6 Of the 122 authorities, 115 had a fall in the number of 7–15 year olds, and in 46 of them the reduction has been more than 10%. Of the 122, 108 had an increase in the number of elderly over 67 years of age, 62 of them by more than 5%.
the elderly by 2.6% per elderly. Both the short- and long-run effects are significant at the 1% level.

The results basically say that spending per ‘client’ goes up when the size of the client group is reduced, and vice versa. The conclusion is not favorable to the voter group decision model where influence is determined by numerical strength. The development of spending per head for each age group is dependent upon whether the age group is growing or declining. When the numbers of youth go down, they are able to defend the resource use in primary education and actually gain in terms of spending per head. A possible explanation for this contradictory result may be that the partial adjustment model assumes the current age composition to be equal to that of the long run. If the age composition tends to be mean-reverting, it may be rational to increase school spending per pupil as a response to a temporary reduction in the number of pupils.7

6. Adjustment inertia and price and expenditure elasticities

The estimated adjustment coefficients indicate how fast the local authorities are able to restructure the service production in response to the demographic shift. As discussed in Section 4, the short time series limits the robustness of investigating the dynamics. The estimated coefficients of the lagged dependent variables are sensitive to the choice of estimation method. Table 3 reports the IV estimates of the adjustment coefficients \(1 - \lambda_i\) together with the OLS and LSDV estimates. OLS gives an average adjustment coefficient of 0.86, compared with only 0.22 using LSDV. When

<table>
<thead>
<tr>
<th></th>
<th>Administration</th>
<th>Education</th>
<th>Elderly</th>
<th>Child care</th>
<th>Infrastructure</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV*</td>
<td>0.44</td>
<td>0.46</td>
<td>0.49</td>
<td>0.75</td>
<td>0.42</td>
<td>0.51</td>
</tr>
<tr>
<td></td>
<td>(8.04)</td>
<td>(10.20)</td>
<td>(6.74)</td>
<td>(7.66)</td>
<td>(6.83)</td>
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</tr>
<tr>
<td>OLSb</td>
<td>0.81</td>
<td>0.86</td>
<td>0.85</td>
<td>0.92</td>
<td>0.86</td>
<td>0.86</td>
</tr>
<tr>
<td></td>
<td>(46.64)</td>
<td>(77.63)</td>
<td>(56.68)</td>
<td>(49.93)</td>
<td>(61.35)</td>
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</tr>
<tr>
<td>LSDVc</td>
<td>0.14</td>
<td>0.24</td>
<td>0.19</td>
<td>0.37</td>
<td>0.17</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td>(4.16)</td>
<td>(8.74)</td>
<td>(6.11)</td>
<td>(9.49)</td>
<td>(5.69)</td>
<td></td>
</tr>
</tbody>
</table>

Note: t-values in parentheses.

* 2SLS using lagged values of the exogenous variables as instruments.

b Seemingly unrelated regressions without community-specific effects.

* Seemingly unrelated regressions with community-specific fixed effects. The variable DE is deleted because it is constant over time.

7 This interpretation was suggested to us by a referee.
OLS is applied, the sluggishness of the adjustment process is likely to be overestimated due to community-specific omitted variables. On the other hand, LSDV underestimates the inertia when the time span is short. Given this range of estimates, we are reluctant to draw strong conclusions about sluggishness.

The instrument variable method implies that about 50% of the desired reallocation is implemented in the first year. Assuming that the community-specific effects are uncorrelated with the exogenous variables, our IV estimates are consistent even when the time span is short. The result is in accordance with the findings from other countries such as Dunne et al. (1984) for the United Kingdom and Ehrenberg (1973) and Inman (1989) for the United States.\(^8\)

The price and expenditure elasticities are reported in Table 4. Except for the residual sector, cultural services, there is a systematic difference between the short- and long-run expenditure elasticities. Because of adjustment inertia, the elasticities are close to unity in the short run. Consistent with earlier Norwegian studies, primary education is the service with the

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Estimated elasticities*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Administration</td>
</tr>
<tr>
<td>Short-run</td>
<td></td>
</tr>
<tr>
<td>Engel(^b)</td>
<td>1.04</td>
</tr>
<tr>
<td></td>
<td>(1.03)</td>
</tr>
<tr>
<td>Cournot(^c)</td>
<td>-0.66</td>
</tr>
<tr>
<td></td>
<td>(-19.50)</td>
</tr>
<tr>
<td>Slutsky(^c)</td>
<td>-0.54</td>
</tr>
<tr>
<td></td>
<td>(-16.07)</td>
</tr>
<tr>
<td>Long-run</td>
<td></td>
</tr>
<tr>
<td>Engel(^b)</td>
<td>1.07</td>
</tr>
<tr>
<td></td>
<td>(1.03)</td>
</tr>
<tr>
<td>Cournot(^c)</td>
<td>-0.40</td>
</tr>
<tr>
<td></td>
<td>(-6.50)</td>
</tr>
<tr>
<td>Slutsky(^c)</td>
<td>-0.27</td>
</tr>
<tr>
<td></td>
<td>(-4.59)</td>
</tr>
</tbody>
</table>

*The elasticities are calculated at the mean of the variables.

\(^b\)The elasticities are assumed to be 1 under the null hypothesis.

\(^c\)The elasticities are assumed to be 0 under the null hypothesis.

\(^8\)Barnett (1986) for the United Kingdom and Ladd and Yinger (1989) for the United States document stronger adjustment inertia. However, their results may be explained by the choice of estimation method.
lowest expenditure elasticity, while health and child care services are most elastic. US studies also tend to find that education has the property of necessities, as summarized by Inman (1979). The same result is established by Dunne et al. (1984) for the United Kingdom.

The short-run Cournot and Slutsky elasticities are significant and negative for all six services. The lowest absolute value of the Cournot elasticity is found for central administration (0.66), while the highest value is for cultural services (1.11). The rest of the services have elasticities of about 0.8–0.9 in absolute value. As expected, they are much higher than the representative estimates in American studies of about 0.2–0.4, as summarized by Oates (1986). In the United States, the total local government budget is growing when the cost of producing public services increase. The higher elasticity in Norway reflects the exogenously determined total budget. The exogenous budget constraint also explains the high price elasticity of UK public services estimated by Dunne et al. (1984).

The Cournot and Slutsky elasticities are significantly negative in the long run as well, implying that the estimated elasticities are consistent with the underlying demand approach. In all sectors but health care services, the absolute value of the elasticities are lower in the long run than in the short run.

Among the structural characteristics, the size of the population is the most influential. The effect of population size in central administration and primary education may be interpreted as a kind of economies of scale, and the resources saved in large communities are spent on health care/care for the elderly, cultural services and infrastructure. A lower density of the population increases the use of resources in primary education at the expense of health care/care for the elderly and cultural services. According to the estimated coefficients, local public services and private consumption cannot be treated as separable. On average private consumption seems to be complementary to child care services and infrastructure and an alternative to primary education and health care/care for the elderly.

7. Decomposition of the changes in the budget shares

The model allows for a decomposition of the changing budget shares to identify the driving forces of the reallocation process. The consequences of economic variables, prices and total spending can be compared with the effects of sociodemographic trends. The budget shares will change from year to year even when relative prices, total spending and sociodemographic variables are constant. In general the allocation is different from the long-run equilibrium, and thus the budget shares will be changing in the movement towards the equilibrium. The shifting intercept term reflects additional changes from year to year.
The econometric model assumes separate intercepts for each year. Consequently, OLS estimates with average values of the independent variables for each year will fit the regression line. Our 3SLS estimates approximately hold the same characteristics. By utilizing this feature, the following decomposition of the change in the budget share can be reached:

\[
\dot{A}_{i89} - \dot{A}_{i86} = (\bar{A}_{i86} - \bar{A}_{i85}) \sum_{t=87}^{89} (1 - \lambda_i)^{89-t+1} + \sum_{t=87}^{89} \omega_t (1 - \lambda_i)^{89-t} \\
+ \sum_{t=87}^{89} \sum_{j=1}^{n} \lambda_j \gamma_{ij} \frac{(\log P_{it} - \log P_{i86})}{(1 - \lambda_i)^{89-t}} \\
+ \sum_{t=87}^{89} \lambda_i \beta_t \frac{(\log Q_t - \log Q_{86})}{(1 - \lambda_i)^{89-t}} \\
+ \sum_{t=87}^{89} \lambda_i \mu_t \frac{(\log I_i - \log I_{86})}{(1 - \lambda_i)^{89-t}} \\
+ \sum_{t=87}^{89} \lambda_i \tau_t (\tilde{S}_t - \tilde{S}_{86}) (1 - \lambda_i)^{89-t} \\
+ \sum_{t=87}^{89} \lambda_i \eta_t (\tilde{Z}_t - \tilde{Z}_{86}) (1 - \lambda_i)^{89-t} .
\]

Variables with a bar are sample averages and \( \omega_t \) is the parameter corresponding to the dummy variable for year \( t \). Seven components of the budget shares are separated out in Eq. (14):

(i) the effect of the first year not being a long-run equilibrium;
(ii) a shift in the intercepts;
(iii) a shift in relative prices given real expenditures;
(iv) a shift in real per capita local government expenditures;
(v) a shift in real per capita private consumption;
(vi) a shift in the political influence/age composition of the population; and
(vii) a shift in the structural characteristics.

The decomposition in Table 5 is calculated on the basis of (14) with the 3SLS estimates replacing the corresponding parameters. The decomposition for the residual sector follows from (14) and the budget restriction. In Table 5 we have chosen to aggregate the components (i), (ii) and (vii) which are of less economic interest than the remaining four.

The priorities of the two main services, primary education and health care/care for the elderly, are well explained by the development of the relative prices, the per capita real local government spending and the numerical strength of the associated voter groups. During the period under study, the age composition has shifted towards the elderly. The share of
Table 5
Decomposition of the changes in the budget shares, 1986–89

<table>
<thead>
<tr>
<th></th>
<th>Administration</th>
<th>Education</th>
<th>Elderly</th>
<th>Child</th>
<th>Infrastructure</th>
<th>Culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative prices</td>
<td>-0.12</td>
<td>-0.07</td>
<td>0.79</td>
<td>-0.26</td>
<td>-0.36</td>
<td>0.02</td>
</tr>
<tr>
<td>Local government</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>spending</td>
<td>0.05</td>
<td>-0.71</td>
<td>0.22</td>
<td>0.14</td>
<td>0.10</td>
<td>0.20</td>
</tr>
<tr>
<td>Private cons.</td>
<td>0.14</td>
<td>-0.65</td>
<td>-0.71</td>
<td>0.11</td>
<td>0.99</td>
<td>0.12</td>
</tr>
<tr>
<td>Age composition</td>
<td>0.25</td>
<td>-1.98</td>
<td>0.62</td>
<td>0.21</td>
<td>0.67</td>
<td>0.23</td>
</tr>
<tr>
<td>Other</td>
<td>0.50</td>
<td>1.80</td>
<td>0.08</td>
<td>1.11</td>
<td>-2.79</td>
<td>-0.70</td>
</tr>
<tr>
<td>Total</td>
<td>0.82</td>
<td>-1.61</td>
<td>1.00</td>
<td>1.31</td>
<td>-1.39</td>
<td>-0.13</td>
</tr>
</tbody>
</table>

Note: Percentage points.

Youth is reduced from 13.4% of the population in 1986 to 12.1% in 1989, while the share of elderly has increased from 14.0% to 14.6%. The shifting age composition has contributed to a reduction in school spending of almost 2 percentage points and an increase in health care/care for the elderly of 0.6 percentage points. The shift in relative prices and increased spending have had a similar effect. Increased costs per unit of labor have increased the share of the pie allocated to health care services and the elderly, while the increasing total budget is an important factor explaining the trend for primary education.

The four components separated out in Table 5 are not able to explain the trends in central administration, child care services and infrastructure. These trends are best explained by the first year not being a long-run equilibrium and the changing intercepts.

8. Conclusions

Local government priorities are analyzed in a group decision model, studying the allocation of local government consumption between six services. The local decision-making process is formulated as a mechanism producing a political compromise between different groups of voters. Moreover, it is assumed that relative political influence is determined by numerical strength.

In the Norwegian institutional context the total budget can be regarded as exogenously determined, and this allows us to handle the priorities within an ordinary consumer demand system. The use of labor works as a proxy for true output, and the operating cost per unit of labor corrected for matching grants is the corresponding price. Dynamics are brought into the model by assuming that the difference between the actual and the desired allocation can be described as a partial adjustment process.
The support for the voter group decision model is mixed. A higher share of elderly is followed by a significant increase in resource use in health care/care for the elderly, and a significant reduction in school spending, while a higher share of youth has the opposite effect. This supports the view that client groups fight for pieces of the given pie. However, a shift in the age composition from youth towards the elderly increases school spending per pupil and reduces health care spending per elderly. Age groups in decline are able to resist reallocations and gain in terms of spending per head.

Consistent with the underlying demand approach, the estimated price elasticities are significantly negative. The expenditure elasticities imply that primary education must be classified as a necessity, while child care is the winner when the total budget is growing. The sources of the changing budget shares are analyzed using a decomposition of the econometric results. Both economic variables, relative prices and total expenditure, as well as changes in the age composition of the population have played a major role in the restructuring of local service supply.

Acknowledgements

We wish to thank two referees and seminar participants in Oslo, Bergen, Åsgårdstrand and Santa Barbara, in particular Robert Inman, Eilev Jansen, Wallace Oates and Rune Sørensen, for comments. The project is funded by the Norwegian Research Council.

Appendix A: Formulas for the price and expenditure elasticities

The short-run Engel (E), Cournot (ε) and Slutsky elasticities (s) follow from Eqs. (8)–(10). They are stated below (suppressing the subscript t):

\[ E_i^s = 1 + \frac{\lambda_i \beta_i}{A_i}, \]  \hspace{1cm} (A1)

\[ \varepsilon_{ij}^s = \frac{\lambda_i \gamma_{ij}}{A_i} - \frac{\lambda_i \beta_i}{A_i} \left[ \lambda_j \alpha_i + \frac{1}{2} \sum_{k=1}^{n} (\lambda_k \gamma_{ij} + \lambda_j \gamma_{jk}) \log P_k \right] - \delta_{ij}, \]  \hspace{1cm} (A2)

\[ s_{ij}^s = \varepsilon_{ij}^s + A_j E_i^s. \]  \hspace{1cm} (A3)

δij equals 1 if i = j and 0 otherwise. The long-run elasticities are calculated
assuming that the actual expenditure share is equal to the desired expenditure share for all services:

\[ E_i^\epsilon = 1 + \frac{\beta_i}{A_i}, \]  
(A4)

\[ \epsilon_{ij}^\epsilon = \gamma_{ij} \frac{A_i}{A_{i'}} \left[ \alpha_j + \frac{1}{2} \sum_{k=1}^{n} (\gamma_{kj} + \gamma_{jk}) \log P_k \right] - \delta_{ij}, \]  
(A5)

\[ s_{ij}^\epsilon = \epsilon_{ij}^\epsilon + A_j E_i^\epsilon. \]  
(A6)

**Appendix B: Estimation results and tests of homogeneity and symmetry**

The AIDS demand system is well suited for testing the general restrictions of demand systems. The homogeneity restriction \( \sum_j \gamma_{ij} = 0 \) is equivalent to \( \lambda_i \sum_j \gamma_{ij} = 0 \), implying that homogeneity imposes a single linear restriction within each equation. In order to test the restriction, it is sufficient to estimate each equation separately by 2SLS using lagged values of the exogenous variables as instruments. According to the t-statistics in Table A1, homogeneity is fairly consistent with the data. In all sectors except central administration, homogeneity cannot be rejected at the 10% level.

It is bit more complicated to test the symmetry restriction \( \gamma_{ij} = \gamma_{ji} \). The reason is that symmetry imposes restrictions across the equations, and that these restrictions are non-linear since the adjustment coefficients vary across the sectors. Symmetry is tested using a Wald \( \chi^2 \)-test based on the 3SLS estimates imposing homogeneity. It follows from Table A1 that symmetry is rejected even at the 1% level. However, accepting homogeneity and rejecting symmetry is consistent with the voter group decision model. Table A2 reports the estimation results when homogeneity is imposed.

Our finding differs from what is obtained in regular estimation of consumer demand systems based on household data. In his survey, Deaton (1986, p. 1791) concludes that "... there is a good deal of accumulated

<table>
<thead>
<tr>
<th></th>
<th>H (t-value)</th>
<th>S given H (( \chi^2 )-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration</td>
<td>3.58</td>
<td>24.88*</td>
</tr>
<tr>
<td>Education</td>
<td>-1.42</td>
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</tr>
<tr>
<td>Elderly</td>
<td>-0.02</td>
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</tr>
<tr>
<td>Child care</td>
<td>1.47</td>
<td></td>
</tr>
<tr>
<td>Culture</td>
<td>-1.40</td>
<td></td>
</tr>
<tr>
<td>Infrastructure</td>
<td>-0.98</td>
<td></td>
</tr>
</tbody>
</table>

* d.f. = 10, critical values are 18.31 (5%) and 23.21 (1%).
Table A2
Combined cross-section and time-series analysis, 1986–89

<table>
<thead>
<tr>
<th></th>
<th>Administration</th>
<th>Education</th>
<th>Elderly</th>
<th>Child</th>
<th>Infrastructure</th>
<th>Culture</th>
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<td>$A_{it-1}$</td>
<td>0.442</td>
<td>0.461</td>
<td>0.491</td>
<td>0.751</td>
<td>0.423</td>
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<tr>
<td></td>
<td>(8.04)</td>
<td>(10.20)</td>
<td>(6.74)</td>
<td>(7.66)</td>
<td>(6.83)</td>
<td></td>
</tr>
<tr>
<td>$\log P_1$</td>
<td>4.052</td>
<td>-1.847</td>
<td>-1.063</td>
<td>0.123</td>
<td>-1.250</td>
<td>-0.016</td>
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<tr>
<td></td>
<td>(10.28)</td>
<td>(-3.93)</td>
<td>(-2.48)</td>
<td>(0.68)</td>
<td>(-2.56)</td>
<td>(-0.47)</td>
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<tr>
<td>$\log P_2$</td>
<td>-3.859</td>
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<td>$\log P_5$</td>
<td>0.282</td>
<td>-2.502</td>
<td>-0.543</td>
<td>0.164</td>
<td>3.134</td>
<td>-0.535</td>
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<td>(1.03)</td>
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<td>(-1.73)</td>
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<td>$\log P_6$</td>
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<td>-1.288</td>
<td>0.339</td>
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<td>-0.187</td>
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<td>(0.95)</td>
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<td>(3.28)</td>
<td>(3.16)</td>
<td>(1.44)</td>
<td>(3.67)</td>
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<td>$\log I$</td>
<td>1.629</td>
<td>-7.583</td>
<td>-8.124</td>
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<td>(2.10)</td>
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<td>(1.13)</td>
<td>(1.82)</td>
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<td>$\log YO$</td>
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<td>-3.845</td>
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<td>(-1.76)</td>
<td>(7.06)</td>
<td>(2.00)</td>
<td>(-2.12)</td>
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<td>(-1.80)</td>
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<tr>
<td>$\log EL$</td>
<td>0.015</td>
<td>-3.487</td>
<td>2.911</td>
<td>-0.394</td>
<td>1.215</td>
<td>-0.261</td>
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<td></td>
<td>(0.04)</td>
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<td>(4.69)</td>
<td>(-1.68)</td>
<td>(2.14)</td>
<td>(-0.49)</td>
</tr>
<tr>
<td>$\log DE$</td>
<td>-0.209</td>
<td>1.270</td>
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<td>-0.115</td>
<td>0.135</td>
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<td>(-1.38)</td>
<td>(5.61)</td>
<td>(-2.46)</td>
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<td>$SE$</td>
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<td>2.171</td>
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<td>0.704</td>
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<td>$R^2$</td>
<td>0.802</td>
<td>0.868</td>
<td>0.792</td>
<td>0.844</td>
<td>0.822</td>
<td></td>
</tr>
</tbody>
</table>

Note: t-values in parentheses.

Evidence rejecting these restrictions. The evidence is strongest for homogeneity, with less (or perhaps no) evidence against symmetry over and above the restrictions embodied in homogeneity'. The evidence from studies of public sector demand is mixed. In the static model of Dunne and Smith (1983) homogeneity is rejected for three of four countries, while both homogeneity and symmetry are accepted within the dynamic model of Dunne et al. (1984). The influential analysis of Deacon (1978) accepts homogeneity but rejects symmetry.

Appendix C: Data sources

Five data sources were brought together to estimate the model: the local government accounts, a databank of local government employees except
teachers, separate data for teachers, data of taxable income and taxes paid, and finally a databank of demographic variables describing each municipality. The data are publicly available and can be obtained from the authors. On the basis of these data sources the following variables have been constructed (separate for each authority):

- $P_i$—the operating cost per unit of labor corrected for matching grants, the six services;
- $Y$—aggregate per capita local government expenditure of the services included in the study;
- $A_i$—expenditure shares, the six services;
- $I$—average after-tax income per capita, deflated by the consumer price index;
- $CH$—the share of the population below 7 years of age;
- $YO$—the share of the population between 7 and 15 years of age;
- $EL$—the share of the population over 67 years of age;
- $DE$—population density measured as the average travel distance to the center of the municipality; and
- $POP$—population size.

The analysis is based on combined cross-section and time-series data for the years 1986–89 and covers 122 Norwegian municipalities, i.e. about 25% of the total number. The limited number of authorities covered is due to missing or not reliable labor data for many municipalities. To check if our sample is representative, the means of the local characteristics for the year 1986 are compared with the 442 (out of 448) municipalities included in the expenditure model of Borge and Rattsø (1993). The comparison is shown in Table A3. It appears that our sample of 122 municipalities is quite representative with respect to the age composition of the population and the population density, while large municipalities tend to be over-represented. However, the difference between our sample and the whole population is not considered serious.

### References


Oates, W., 1986, The estimation of demand functions for local public goods: Issues in specification and interpretation, Department of Economics, University of Maryland, MD.


