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Fiscal and Spending Behavior of Local Governments: An Empirical Analysis Based on Norwegian Data

Abstract:
This paper treats local governments as utility maximizing agents when they allocate resources among different service sectors. We present estimates for eight service sectors, based on a modified version of the extended linear expenditure system (ELES) and using observations at the municipal level for Norway. Our econometric model recognizes user fees and budget deficits as endogenous variables. Moreover, the model accounts for heterogeneity in local tastes and production costs. Price information for local public services is not available in the data. However, by allowing for heterogeneity in the marginal budget share parameters, we achieve identification of the complete ELES. The empirical results show that local public services are in general price-inelastic. Welfare services like education, social services and care for the elderly and disabled are income-inelastic, while infrastructure is rather income-elastic. A strong flypaper effect is revealed by the response of user fees to income changes. Finally, results from out-of-sample predictions show that the ELES model is able to simulate local government behavior quite well.

Keywords: Local public finance, local government spending, extended linear expenditure system

JEL classification: H71, H72, H74

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1. Introduction

Earlier local public finance and expenditure studies are either focusing on the trade-off between locally imposed taxes and total local public spending, or on the allocation of total expenditures on various service sectors when total expenditures are considered to be exogenous. The present study aims at analysing local public fiscal and spending behavior in a simultaneous setting. The common approach assumes that the fiscal and spending behavior is consistent with the preferences of the median voter. Our modelling approach differs from the standard median voter model by considering the dominant party or coalition,[1] represented by the local government, rather than the median voter as the decision-making unit. From the local government's viewpoint, the decision problem consists of choosing the best combination of locally imposed taxes, budget surplus or deficit, and output in public services subject to the constraint that local government spending plus budget surplus cannot exceed grants from the central government plus local taxes. As suggested by Barro (1972) and Johnson (1979) a major advantage of this modelling approach is that it allows different impacts of central government grants and residential income on the fiscal and spending policy of the local government. There appears to be strong empirical evidence in support of greater impact on local public spending from an increase in grants than from an equivalent increase in residential income. This regularity was called the "flypaper effect" by Gramlich and Galper (1973). Although the median voter models can be modified to account for flypaper effects, it appears rather artificial to allow for different tax and spending responses of grants-in-aid and residential income when the median voter is considered to be the decision-maker.[2] Furthermore, as applied to disaggregated analysis of spending, the median voter approach imposes rather curious restrictions on voter preferences.[3]

The purpose of this paper is to make a contribution to the understanding of the variety in the fiscal and spending behavior of local governments. The empirical analysis, which uses expenditure and fiscal data of Norwegian municipalities, is based on an application of a Stone-Geary utility function where local governments are assumed to have preferences over user fees (local taxes), budget surplus and output on eight service sectors, where user fees are treated as a negative good. The derived demand system differs from the extended linear expenditure system (ELES) by treating total income as well as total spending as endogenous variables, and by allowing the present value of changes in future exogenous incomes to differ from zero. The estimation of the demand system is based on the local government accounts and community characteristics for 1993. These data do not include

[1] For a discussion of this approach and alternative expenditure decision models we refer to Inman (1979) and Bahl et al. (1980).

[2] For a further discussion we refer to Barro (1972) and Johnson (1979).

[3] See Riker and Ordeshook (1973), Kramer (1973) and Romer and Rosenthal (1979).

information on prices. However, we achieve identification of the complete demand system by accounting for heterogeneity in the marginal propensities to charge fees, to spend and to save. Allowing for heterogeneity in the parameters of the demand system makes the Engel curves more flexible, and thus to a certain extent accomodate the conventional criticism against the LES and the ELES.

Our modelling approach permits the income and price elasticities to depend on variables that reflect differences in costs of providing minimum required service standards, as well as in taste patterns across local governments. Thus, we provide a detailed analysis of the expenditure effects of various community characteristics and of the fiscal and spending responses of local governments from an increase in exogenous income or prices.

The paper is organized as follows. Section 2 is devoted to a discussion of the institutional constraints that local governments face in Norway and to a description of the theoretical framework. Section 3 deals with empirical specification of the model. Section 4 reports the estimated parameters and elasticities. Results from out-of-sample predictions are displayed and discussed in Section 5. A brief summary and conclusion is given in Section 6.

2. Theoretical framework

2.1. The choice environment of local governments in Norway

In Norway local governments face balanced budget rules, income tax rules and other institutional constraints introduced by the central government. The constraints set by the central government have a significant impact on the choice environment of local governments including the budget constraint. Thus, information on the choice environment helps to clarify the definition of endogeneous and exogeneous variables in our modelling framework. The budget constraint is defined by

$$y + v = u_0 + \sum_{i=1}^{s} p_i q_i , \tag{2.1}$$

where y is exogenous income, v is user fees, u_0 is budget surplus, and p_i and q_i are price and quantity in service sector i.

The major part of local government income is general grants-in-aid from the central government and local income and property taxes. These incomes define the exogenous income y.[4] Grants-in-aid are

[4] Net interest and installment payments are subtracted in the definition of exogenous income.

mainly of a revenue-sharing or lump-sum type. Since matching grants only constitute a minor part of the total grants, we treat all grants as exogenous. The grant programme is financed by a national income tax which is collected by the central government. Local income and property taxes can be treated as exogenous variables since tax bases as well as tax rates are determined by the central government.

There is, however, one important supplementary revenue resource to the centralized system of financing. Local governments have wide discretion to charge user fees in payment for services received by residents. Following Borge (1995), we assume that user fees are fiscally motivated. Their purpose is to raise revenue in order to finance the production of local public services. Consequently, fee income (v) is the major local tax instrument in our model, while all other sources of income are treated as exogenous. In 1993 user fees on average accounted for 14 per cent of total local government incomes.

User charges in some services like kindergartens are set by local governments. Other services like primary schools are free of charge. Infrastructure services can be charged provided that charges do not exceed the costs of providing the services. However, this regulation is rather vague due to measurement and control problems and can be considered as a soft constraint.

Beyond the centralized system of financing, local governments also meet an extensive set of regulations and legal constraints. For example, the Local Government Act makes provisions against budget deficits. Although local governments face a balanced budget rule, budget deficits are regularly observed in the accounts. Thus, this is a case of a soft constraint. For this reason, the surplus is treated as endogenous in the analysis. However, although the budget rule does not work as an effective limit on current spending, it may still to some extent act to restrain borrowing and prevent long-term budget deficits.

A prevalant feature of local government in Norway is the freedom to make priorities over local public service production. Local governments can undertake whatever task they find desirable, and allocate resources as they like. But even this freedom is not totally unlimited. Different client groups have statutory rights to receive certain services for which local governments are given the responsibility. For example, the primary education for children 7-15 years of age is obligatory, the poor have a right to receive social benefits, and the elderly and disabled are entitled to be taken care of. It is the duty of local governments to meet these and a few other obligations given by the central government.

Not only types of services, but also service levels are affected by central government regulations. Local governments face national standards of maximum class sizes and maximum travelling distance to school for pupils in primary schools. Such national standards limit the scope for local priorities. The aim of these and other regulations is to ensure a minimum required size and quality of local public services across municipalities. Although the minimum standards are not specified in monetary terms, they certainly affect local government expenditures. For instance, the national norm of maximum travelling distance to school increases education expenditures in sparsely populated areas.

2.2. Prices and output

The budget constraint (2.1) introduces a division between prices and quantities in local public service production. We will now derive a concept of prices and quantities that is based on observable heterogeneity in the cost functions. One advantage of this approach is that effects of national service standards and other regulations can be integrated in the model.

The lack of adequate measures for public output is a major problem in the analysis of demand for public services. Using expenditure as a proxy for output, which relies on the assumption of constant prices, is obviously in conflict with reality. Alternatively, we may use the standard tax price which is defined to be equal to the median voter's tax share multiplied by the unit cost of each service. [5] This approach is, however, based on controversial assumptions. For instance, it is assumed that the median voter receives the median income. Moreover, the median voter's share is not appropriate as basis for the definition of prices when the local government rather than the median voter is treated as the decision-making unit. In this case it is useful to base the discussion of price effects on measures of unit costs in local public production.

Unit costs for public services are usually derived from factor input prices.[6] In the public employment approach developed by Ehrenberg (1973) and Bahl et al. (1980), employment is used as a proxy for output in a Leontief fixed-factor relation where nonlabor expenditure is assumed constant per unit of employment.[7] Unit cost measures can thus be derived from wage data. However, this approach is not without drawbacks. First, Bradford, Malt and Oates (1969) draw a distinction between the output produced directly by the public sector (termed "D-output") and the output that is of primary concern to the citizen-consumer (termed "C-output"). D-output is a function of purchased inputs; C-output is a function of D-output and the community environment. Even if the median voter is not assumed to be

[5] See Bergstrom and Goodman (1973).

[6] See Borcherding and Deacon (1972), Ehrenberg (1973), Bahl et al. (1980), Schwab and Zampelli (1987), and Borge and Rattsø (1995).

[7] The public employment approach has been applied to Norway by Rattsø (1989) and Borge and Rattsø (1995).

decisive, it does not follow that the local government is not at all concerned about C-output. Yet, the employment proxy is exclusively a measure of D-output.

Second, the public employment approach implicitly assumes that labor is homogenous within each service producing sector. However, most public services employ workers with different skills and professional qualifications. For instance, one have to assume that physicians, nurses and clerical assistants in public health care are equally productive. Thus, it is not recognized that wage cost differentials may reflect variations in labor productivity. When labor within a service is heterogenous, it becomes less plausible to assume a Leontief fixed-factor technology.

Third, when average wage rates are used as price variables, it may introduce simultaneity biases in the econometric model. In Norway, wages for different professions employed by local governments are mainly set in a bargaining process at the national level. However, due to local variations in community environment, local governments may choose different production techniques to meet local demands. Therefore, by the choice of production technique and combination of different types of labor, the average wage rate is endogenous in the local government decision process. The price variable is endogenous because inputs are in fact substitutable.

In this paper we adopt an indirect method for identifying price elasticities. Let the production function for service sector *i* be given by

$$q_i = f_i(\mathbf{x}_i, \mathbf{z}_i), \quad i = 1,2,\ldots,s \tag{2.2}$$

where $\mathbf{x}_i$ is a vector of factor inputs and $\mathbf{z}_i$ is a vector of community characteristics that affect production opportunities. Assuming constant returns to scale and cost minimization, the derived cost function is given by

$$C_i(q_i, \mathbf{w}_i, \mathbf{z}_i) = p_i(\mathbf{w}_i, \mathbf{z}_i)q_i \tag{2.3}$$

where $\mathbf{w}_i$ is a vector of factor prices and p_i is unit cost in sector *i*. Since wage rates in the public sector in Norway are set in a centralized system of bargaining, it seems plausible to assume that wage rates do not vary across municipalities. The more conventional assumption of constant prices on material inputs may derive from competition within a national factor market. Thus, it appears likely that variation in unit costs across municipalities solely is due to variation in local production opportunities which can be captured by relevant community characteristics.

2.3. Constrained maximization by the dominant party or coalition

This paper treats local governments as utility maximizing agents when they determine the levels of expenditures on various services as well as the level of user fees and budget deficits to finance these expenditures. The decision-making unit is a dominant political party or a coalition of parties. Local government decisions are assumed to be made on a per capita basis. As Inman (1971), Barro (1972), Ehrenberg (1973) and Johnson (1979) we use a Stone-Geary specification of the utility function. However, as opposed to their approach we allow for budget surpluses and deficits and follow Barro (1972) and Johnson (1979) by treating local taxes[8] (user fees) as an endogenous variable. Thus, local governments are assumed to have preferences over user fees (v), budget surplus[9] (u_0) and levels of output $(q_1, q_2, \ldots, q_s)$ on s service sectors which means that the decision-making unit faces an intertemporal utility maximization problem. By treating total expenditures in the linear expenditure system (LES) as an endogenous variable, Lluch (1973) developed ELES to deal with consumption and savings behavior within a given period of time, and demonstrated that this expenditure system can be given an interemporal interpretation. Howe (1975) provided an alternative justification of ELES based on an atemporal maximization of a Stone-Geary utility function. In Howe's approach savings is treated as a commodity with zero "subsistence quantity". We abolish this constraint and allow for variation in committed savings. Moreover, as opposed to the standard version of ELES we treat total income as well as total spending as endogenous variables. Thus, the utility function is assumed to have the following structure

$$W(v, u_0, q_1, q_2, \ldots, q_s) = (\kappa - v)^{\theta} (u_0 - \alpha_0)^{\beta_0} \prod_{i=1}^{s} (q_i - \gamma_i)^{\beta_i} \tag{2.4}$$

where

$$\theta + \sum_{i=0}^{s} \beta_i = 1, \tag{2.5}$$

and $0 \le \beta_i \le 1 \; \forall i$, $0 \le \theta \le 1$, $\gamma_i \le q_i$, $\alpha_0 \le u_0$ and $\kappa \ge v$.

The utility function (2.4) of the local government decision-making unit increases in $q_1, q_2, \ldots, q_s$ and u_0, and decreases in v due to the implied reduction in income disposable for private consumption.

Maximizing (2.4) subject to (2.5) and the budget constraint (2.1) yields the following version of the extended linear expenditure system (ELES)

[8] User fees is the major local tax instrument available to municipalities in Norway.

[9] The net operating surplus is defined as current income plus user fees minus current expenditures minus compulsory installment and interest payments.

$$
\begin{aligned}
p_i\, q_i &= p_i\, \gamma_i + \beta_i \left(y + \kappa - \alpha_0 - \sum_j p_j\, \gamma_j \right), \; i = 1,2,\ldots,s \\
u_0 &= \alpha_0 + \beta_0 \left(y + \kappa - \alpha_0 - \sum_j p_j\, \gamma_j \right) \\
v &= \kappa - \theta \left(y + \kappa - \alpha_0 - \sum_j p_j\, \gamma_j \right).
\end{aligned}
\tag{2.6}
$$

The γ-parameters are conventionally interpreted as "subsistence" or minimum acceptable quantities of each of the local public services, and α_0 as the minimum acceptable level of savings (fiscal surplus). Similarly as Johnson (1979) we interpret κ as the maximum acceptable level of local taxes (user fees). Moreover, $y + \kappa - \alpha_0 - \sum \gamma_j\, p_j$ represents "supernumerary" income which is distributed between the private and the local public sectors in line with the marginal shared parameter θ. The local public share $(1-\theta)$ of the supernumerary income is distributed among the local public services including fiscal surplus in proportion to the parameters $\beta_i/(1-\theta), i = 0,1,\ldots,s$. Note that $\sum_{i=0}^{s} \left[\beta_i/(1-\theta)\right] = 1$.

Although we have used an atemporal framework in deriving the ELES version defined by (2.6) it can, as for the standard ELES, be given an intertemporal interpretation. The standard ELES assumes that exogenous income is constant over time which is equivalent to the assumption of zero committed savings in the atemporal version of ELES. Our modified version of ELES includes an additional parameter (α_0) that captures the presence of committed savings. In the intertemporal setting the parameter α_0 can be interpreted as the present value of changes in future exogenous incomes which means that exogenous income is allowed to vary over time. Thus our modified version of ELES may justify the presence of deficit financing.[10]

3. Empirical model specification

3.1. Endogenous variables

Our model specification relies on the sector classification that forms the basis of the local government accounts. This classification, which reflects central regulations and sectorspecific minimum required standards as well as priorities of local governments, is defined by the following eight service sectors:

[10] To allow for deficit financing, we assume that local governments at a given point in time face the same exogenous interest rate in a competitive loan market.

1. Administration
2. Education
3. Child care
4. Health care
5. Social services
6. Care for the elderly and disabled
7. Culture
8. Infrastructure

These eight expenditure categories together with the budget surplus and the fee income define the endogenous variables in our model. The budget surplus and the fee income are denoted sectors 0 and 9, respectively. Summary statistics are reported in Table 3.1.

Table 3.1. Summary statistics of budget surplus, user fees and eight expenditure groups for municipalities in Norway in 1993. 1000 NOK per capita

Sector	0	1	2	3	4	5	6	7	8	9
Mean	0.87	2.16	5.72	1.67	1.26	1.16	6.49	1.25	3.85	3.41
Minimum	-3.59	0.75	3.54	0.35	0.45	0.14	0.37	0.37	0.29	1.52
Maximum	25.33	7.86	14.92	5.78	5.56	3.29	17.51	4.01	16.62	8.00
Standard deviation	1.92	1.09	1.37	0.74	0.71	0.51	2.08	0.52	1.77	0.89

Table 3.1 demonstrates that per capita expenditure is largest in sector 6 (care for the elderly and disabled), followed by sector 2 (education), sector 8 (infrastructure) and sector 1 (administration). There is considerable variation in sectorspecific per capita expenditures across municipalities as well as in per capita budget surplus and fee income, that may motivate a structural analysis of the local government accounts. Previous empirical analyses of Norwegian local governments' fiscal and spending behavior have restricted to focus on either the allocation of a fixed income on different services or the financing of local public spending. [11]

3.2. Specification of heterogeneity in the structural parameters

The estimation of (2.6) requires information on price variation for all local public services. Our data do not include direct information on prices. Thus, it is convenient to use the conventional expenditure formulation of (2.6),

[11] See Borge and Rattsø (1993 and 1995) and Borge, Rattsø and Sørensen (1995) for analyses of the expenditure structure, Borge (1995) for an analysis of user fees, and Borge (1996) for an analysis of budget deficits.

$$
\begin{aligned}
u_i &= \alpha_i + \beta_i \left(y + \kappa - \alpha\right), \ i = 0,1,2,\ldots,s \\
v &= \kappa - \theta\left(y + \kappa - \alpha\right)
\end{aligned}
\tag{3.1}
$$

where $u_i = p_i\, q_i$ is expenditure on service sector i $(i \neq 0)$, $\alpha_i = p_i\, \gamma_i$ is subsistence requirement or minimum required expenditure on service sector i $(i \neq 0)$ and $\alpha - \alpha_0 = \sum_{i=1}^{s} \alpha_i$ is the minimum required expenditure on all local public services.

Similarly as standard LES and ELES the system (3.1) is not fully identified when price information is not available. The standard way of achieving identification is to introduce one additional restriction, for example by setting one of the α_i equal to zero. This practice suffers, however, from lack of convincing theoretical arguments. An alternative strategy is to allow for heterogeneity in the parameters and impose an identifying functional form on the parameter-heterogeneity. Pollak and Wales (1978) have described this procedure as "translating" the demand system. This approach appears particularly attractive since differences in fiscal and spending behavior across local governments may arise from differences in costs to attain minimum standards on various services, as well as from different taste patterns.

Let $z_1, z_2, \ldots, z_r$ be r variables that are assumed to affect the sectorspecific subsistence expenditures, the minimum acceptable fiscal surplus and the maximum acceptable level of user fees. Similarly, let $t_1, t_2, \ldots, t_m$ be m variables that are assumed to capture variation in preferences with regard to allocation of the supernumerary income. Specifically, we postulate a linear functional form

$$
\begin{aligned}
\alpha_i &= \alpha_{i0} + \sum_{j=1}^{r} \alpha_{ij}\, z_j, \ i = 0,1,\ldots,s \\
\kappa &= \kappa_0 + \sum_{j=1}^{r} \kappa_j\, z_j
\end{aligned}
\tag{3.2}
$$

and

$$
\begin{aligned}
\beta_i &= \beta_{i0} + \sum_{j=1}^{m} \beta_{ij}\, t_j, \ i = 0,1,\ldots,s \\
\theta &= \theta_0 + \sum_{j=1}^{m} \theta_j\, t_j .
\end{aligned}
\tag{3.3}
$$

Furthermore, by imposing the following restrictions on the parameters in (3.3)

$$\theta_j + \sum_{i=0}^{s} \beta_{ij} = 0, \quad j = 1,2,\ldots,m$$

(3.4)

$$\theta_0 + \sum_{i=0}^{s} \beta_{i0} = 1,$$

the adding-up constraint (2.5) is fulfilled.

By closer examination of the reduced form of the demand system defined by (3.1)-(3.4) it is evident that the demand system is completely identified provided that the two sets of heterogeneity variables (**z** and **t**) do not coincide.

In order to estimate the demand system defined by (3.1)-(3.4) we have to specify the variables (**z** and **t**) that are expected to capture the heterogeneity in the subsistence expenditures, minimum acceptable budget surplus and maximum acceptable level of user fees, and in preferences for allocation of supernumerary income. Obviously, the selection of **z** and **t** has to depend on characteristics of the choice environment with particular reference to the impact of central government regulations.

Analyses of public expenditures typically assume that sosioeconomic and demographic variables capture variations in tastes for local public services. [12] Schwab and Zampelli (1987) argue that not only tastes, but also the production process is likely to vary across municipalities. They demonstrate that failure to incorporate community characteristics in production and cost functions can yield misleading results. This means that there are two sources that can justify the selection of explanatory variables. Heterogeneity in the model parameters can either derive from heterogeneous preferences or from heterogeneous production costs.

In order to disentangle the two types of heterogeneity, it is convenient to exploit the traditional interpretations of the ELES parameters. As already mentioned, the parameters $\alpha_i \ (i \neq 0)$ are associated with unit costs and minimum standard requirements. Unit costs may vary either because of different production technologies or different factor prices. In the case of local public services, minimum requirements and other regulations are given by the central government. In our framework the subsistence quantities are considered as minimum standards for public services reflecting national regulations or norms developed jointly by the municipalities. Consequently, the α-parameters are assumed to depend solely on production technology and cost structure. By contrast, the allocation of discretionary spending or supernumerary income, the θ and β-parameters, are assumed to vary with local taste. Thus, the marginal budget share parameters depend on taste variables.

[12] See Inman (1979) and Bahl et al. (1980) for discussions of the expenditure determinants studies.

The assumption that taste variables affect marginal budget shares, but not subsistence expenditures enables us to identify the complete demand system. It is, however, not necessary for identification that all variables in **z** and **t** are mutually exclusive. However, this structure agrees well with conventional interpretations of the ELES model.

Due to their soft nature the central government regulations are not suitable for being directly integrated in the model. However, these regulations ought to be reflected in the selection of determinants of local government expenditure variations. Specifically, the sector-specific subsistence spending, the minimum fiscal surplus and the maximum acceptable user fees are assumed to depend on the central government regulations.

The due clients in services like education, child care, social services and care for the elderly and disabled are characterized by social and demographic variables. Consequently, demographic variables are one important group of factors explaining variations in subsistence expenditures. Subsistence expenditures are also assumed to vary with the settlement pattern within the municipality, scale properties, climatic conditions and sewage purification regulations. The precise definitions of these variables are displayed in Table 4.1 in Section 4.1 and Table D.1 in Appendix D.

Lluch (1973) and Howe (1975) implicitly assume that α_0 is equal to zero. A critique against the atemporal ELES version of Howe is that savings must be non-negative to be consistent with utility maximization (see Lluch, Powell and Williams (1977)). This is a rather implausible constraint. However, by including the parameter α_0, it is only required that savings must exceed the minimum savings parameter, which can be negative. Another advantage is, as shown in equation (3.2), that we can introduce heterogeneity in the minimum savings parameter.

The Local Government Act contains a balanced budget rule that prohibits local governments to plan for persistent deficits. However, the budget rule does not exclude adjustments to variations in annual incomes, which may result in temporary deficits. Indeed, budget deficits are regularly observed in the local government accounts. Local governments may adjust the fiscal surplus as a response to income fluctuations over time. This is done in order to attain a smoother time path of expenditures, so that local government activities are protected from casual income fluctuations. The budget surplus is used as a buffer device that absorbs parts of the short-term economic fluctuations and may justify the following structure in minimum fiscal surplus,

(3.5) $$\alpha_0 = \alpha_{00} + \alpha_{01}\,\Delta y$$

where Δy is the change in real exogenous income from the previous year. Since $-\alpha_0$ is equal to the present value of changes in future exogenous income it follows that $y - \alpha_0$ can be interpreted as permanent exogenous income. The constant term $(-\alpha_{00})$ is assumed to capture the present value of a long-term growth trend in exogenous income. Historical figures suggest that there is a positive growth trend in exogenous income for local governments in Norway. For positive growth trend and no change in current income $(\alpha_{00} < 0 \text{ and } \Delta y = 0)$, permanent income is higher than current income. When permanent income is higher than current income, local governments may want to accelerate current spending by deficit financing. However, the balanced budget rule imposed by the central government may be seen as an attempt to restrict α_{00} downwards, or more specifically, that the parameter should be non-negative.

Local governments are allowed to smooth out income fluctuations, as long as they do not operate with a structural, or persistent deficit. The parameter α_{01} in the specification (3.5) of α_0 is assumed to capture adjustmens to short-term fluctuations in exogenous income. When Δy is large and α_{01} is positive, the local government expects lower increases in future exogenous incomes. By contrast, a small positive or negative Δy may justify a temporary budget deficit since local governments then expect higher future incomes.

The results reported by Borge (1995) show that fee income increases with increasing exogenous municipal income. At first glance this result may seem inconsistent with our model. However, local governments may not have a strong inclination to reduce user charges, since user charges are not allowed to exceed the unit costs in service provision. An exogenous income increase gives local governments the opportunity to supply larger quantities without increasing user charges. Even if user charges per unit are reduced, the volume increase may counteract such reductions, such that total fee income increases. This mechanism is incorporated in our model by allowing the maximum acceptable fee income to increase with the level of exogenous income.[13]

(3.6) $$\kappa = \kappa_0 + \kappa_1 (y - \alpha_2 - \alpha_5)$$

where α_2 are subsistence expenditures in education and α_5 are subsistence expenditures in social services. Subsistence expenditures in education and social services are subtracted since such services are provided free of user charges. When $\kappa_1 > 0$, equations (3.1) and (3.6) show that a change in exogenous income y affects the fee income v in two different ways. Since user fees is a negative good,

[13] This formulation departs slightly from Johnson (1979), where the maximum acceptable level of local taxes depends on private disposable income.

exogenous income has a direct negative effect on user fees. However, this negative effect is counteracted by a positive indirect effect which acts through the maximum acceptable fee income. The total effect may be positive, zero or negative.

The above discussion concerns variables that are assumed to capture heterogeneity in the subsistence expenditures, the minimum acceptable fiscal surplus and the maximum acceptable level of user fees. As suggested above there may also be heterogeneity in preferences for allocation of supernumerary income. Politics at the local level is characterized by representative democrazy and a multi-party system in which the division between socialist and non-socialist parties is regarded as a major cleavage.[14] Thus, priorities are affected by the party composition of the municipal council. For a given party composition, priorities may depend on political strength and party concentration in the council. The reelection constraint may also induce politicians to be sensitive to popular tastes and attitudes towards local public services in the electorate. We assume that such tastes vary across subgroups of the population, as a function of socioeconomic status. Education level and private disposable income are used as indicators of social composition of the population. We assume that party priorities are partly ideological and partly adjusted towards the tastes of dominating socioeconomic groups.

3.3. The flypaper effect

User fees is the only tax instrument in our model that local governments can use to reallocate resources between the private and the local public sector. In analyses where the local decision-maker is treated as a median voter with full discretion to allocate disposable local resources over private and public goods, it is concluded that the reaction to a lump-sum income increase should be independent of whether the income increase is received by the private or the local public sector.[15] For instance, if the central government pays more grants-in-aid to the local government, or if the same amount is distributed directly to local residents as tax reductions, the allocation outcome should be exactly the same. However, empirical evidence suggests that money given to the private sector tends to stick to the private sector, and is not taxed away, whilst grants-in-aid to the local government tends to stick in the public sector and get spent there. An increase in grants to the local government are more stimulative on local government expenditures than an equivalent in increase in private incomes. This phenomenon is called the flypaper effect, since money sticks where it hits.[16]

In our model, the disposable income of local residents is not included in the budget constraint of the local government. We assume that the private and public sector mix is primarily settled in the political

[14] Local political priorities in Norway are analysed by Borge (1995), Borge (1996) and Sørensen (1995).

[15] See e.g. Bradford and Oates (1971).

[16] A survey of the literature on flypaper effects is given by Hines et al. (1995)

process at the national level. Due to the centralized system of financing, local governments have only a limited scope for adjustments by collecting user charges. Most user charges are bounded not to exceed unit costs, so there are limited opportunities for local governments to control private consumption. Therefore, private disposable income does not enter the model through the budget constraint, but only as a taste variable in line with the education level and the party composition of the local council. Moreover, the revenue-sharing money granted to local governments are accompanied by implicit contracts to provide certain goods by the public sector. Consequently, the flypaper effect can not be considered as an anomaly in our model. Since the scope for local reallocations between the private and public sector is considerably restricted by central regulations, appearance of a flypaper effect seems rather plausible.

4. Estimation results

The model (3.1)-(3.4) was estimated on a per capita basis by the maximum likelihood method where the error terms were assumed to have a multinormal distribution with mean 0 and unrestricted covariance matrix. The estimates rely on detailed local government accounts and community characteristics for 426 municipalities in 1993. We find the estimated parameters to be generally significant and of the expected sign. Estimation results are reported in Sections 4.1 - 4.3. Section 4.1 gives estimated sectorspecific subsistence parameters, minimum fiscal surplus and maximum fee income. Section 4.2 presents estimates of parameters related to marginal budget shares. Section 4.3 reports the distribution of income and price elasticities. Note that an additional set of variables has been subject to empirical testing. The results are reported in Appendix D.

4.1. Heterogeneity in subsistence expenditures, minimum required fiscal surplus and maximum acceptable user fees

The set of selected demographic variables and other characteristics that affect subsistence expenditures, minimum fiscal surplus and maximum user fees is defined in Table 4.1, which also reports corresponding parameter estimates and t-values. The effects of the age structure of the residentials on the subsistence expenditure allocation shows to conform with theoretical reasoning. Children in pre-school age raise child care expenditures, and children in school age raise education expenditures. We also find a positive, but weakly significant effect of pre-school children on healt care expenditures. The results show a significant effect in health care for those in the age group 80 years and above. The estimated coefficient for the elderly below 80 years is insignificant for health care services, but elderly 67-89 years of age increase expenditures in care for the elderly and disabled. Moreover, it is found that elderly 90 years and above of age have a significant impact on expenditures in care for the elderly and disabled that is substantially higher than for elderly below 90 years of age.

For explanatory variables on a per capita form, the corresponding coefficients can be interpreted as effects of partial marginal changes. Thus, the partial effect of one more child 0-6 years of age is found to increase child care expenditures by 8.170 NOK. If the child is supported by a single adult, the expenditure increases by an additional amount of 13.660 NOK. Children also increase costs in health care, but this effect is only weakly significant. When the population increases by one person in the age group 7-15 years, the education expenditure increases by 27.850 NOK. If this person is mentally retarded there are additional costs that amount to 216.530 NOK. By contrast, one additional mentally retarded person aged 16 years or more increases expenditures by 363.780 NOK in care for the disabled.

The marginal impact of elderly 80 years and above equals 7.950 NOK in health services. In care for the elderly and disabled, one more person in the age groups 67-89 years and 90 years and above increases expenditures by 14.270 NOK and 150.840 NOK, respectively. Mentally retarded children were, however, neither found to have a significant effect on expenditures in care for the elderly and disabled nor in child care services. This result suggests that local governments on average devote more recources to adults than to children with mental retardation. Thus, it seems that local governments reduce their costs by limiting the relief to parents with mentally retarded children. Such cost savings can also induce increases in national insurance benefits to the parents. Therefore, national insurance regulations may in effect weaken incentives to assist the parents.

Larger occurrence of foreign citizens with remote cultural background, and unemployed, divorced and separated persons are found to significantly increase expenditures in social services. The estimates of marginal increases in expenditures for these groups are in the range of 12.000 to 15.000 NOK per person. These effects are due to the relatively high propensities for unemployed, divorced and immigrants to receive social benefits and other social services.

Education expenditures decrease with population density and increase with average travelling time to the municipal centre. Such cost increases are due to a decentralized school structure with small classes in sparesely populated areas. The demand for accessibility also implies higher health care expenditures when average travelling time increases. One hour increase in average travelling time increases expenditures by 1.190 NOK per capita in the education sector and by 490 NOK per capita in health care services.

Table 4.1. Estimates of subsistence expenditures, minimum budget surplus and maximum user fees parameters [a b]

	0	1	2	3	4	5	6	7	8	9
Constant	-0.41 (1.89)	-0.37 (1.62)	-0.77 (1.41)	-0.68 (1.98)	-1.06 (2.09)	0.18 (1.72)	-0.34 (0.62)	0.05 (0.35)	-0.26 (0.49)	1.62 (6.75)
Population share 0-6 years of age				8.17 (3.19)	5.52 (1.58)					
Population share 7-15 years of age			27.85 (8.53)							
Population share 80 years and above					7.95 (2.28)					
Population share 67-89 years of age							14.27 (6.20)			
Population share 90 years and above							150.84 (4.88)			
Children 0-6 years with lone mother/father per capita				13.66 (1.70)						
Mentally retarded 7-15 years per capita			216.53 (2.33)							
Mentally retarded 16 years and above per capita							363.78 (22.03)			
Unemployed 16-59 years per capita						12.78 (3.54)				
Divorced/separated 16-59 years per capita						14.71 (6.21)				
Foreigners from remote cultures per capita						12.67 (3.82)				
Population density			-0.47 (2.12)		0.32 (1.90)			0.15 (1.69)		
Personhours (average travelling time)			1.19 (5.97)		0.49 (3.19)					
Population inverted (thousands)		1.08 (6.08)					0.71 (2.40)			
Dummy for small municipalities		0.22 (2.45)	0.57 (4.65)	0.28 (3.29)	0.31 (3.85)				0.41 (2.14)	
Dummy for urban municipalities						0.19 (1.96)				
Dummy for suburban municipalities								-0.15 (2.89)		
Sewage purification degree									0.51 (3.14)	
Duration and severity of cold winter period		0.13 (6.55)	0.16 (7.18)	0.07 (3.42)	0.06 (3.22)		0.10 (2.53)	0.07 (6.41)	0.18 (3.80)	
Per capita change in municipal income	0.44 (8.51)									
Per capita exogenous income excl. of min. exp. eq. 2 and 5										0.18 (6.71)
R^2 adjusted	0.75	0.84	0.80	0.63	0.50	0.40	0.77	0.65	0.75	0.34

[a] The dependent variables are per capita operating result in equation 0, per capita expenditures in equation 1-8, and per capita fee income in equation 9. All pecuniary amounts are in thousands of Norwegian kroner. T-statistics are in parentheses.
[b] The model equation numbers refer to

Equation 0: Net operating result
Equation 1: Administration
Equation 2: Education
Equation 3: Child care
Equation 4: Health care
Equation 5: Social services
Equation 6: Care for the elderly and disabled
Equation 7: Culture
Equation 8: Infrastructure
Equation 9: Fee income

The estimation results indicate that health care expenditures depend positively on the population density of the municipality. The explanation may be that ill-health frequencies are higher in densely populated areas due to higher exposure to air pollution and unhealthy life style. The estimation shows that culture expenditures also tend to increase with population density. This effect is allowed for in the model, although the estimate is hardly significant. Cultural services are usually centrally located, but may serve sparesely populated sorrounding areas as well, even outside the municipality. The latter effect emerges in the coefficient which shows that suburban municipalities have significantly lower expenditures on culture activities than otherwise similar non-suburban municipalities. The culture expenditures of suburban municipalities are estimated to fall below those of other municipalities by 150 NOK per capita.

Inverse population size and the dummy variable for small municipalities are included to account for economies of scale or centrality. The two variables are included to test for the possibility that diseconomies may either decline gradually or abruptly as a function of population. Significant scale economies show to be present in all services except social services and culture. Scale economies are particularly significant in the administration sector. Costs of urbanization are found to affect the social services. Social care expenditures of urban municipalities exceed those of other municipalities by 190 NOK per capita.

High requirements for sewage purification increase infrastructure expenditures significantly. A long an severe cold period in winter increases expenditures for administration, education, child care, health care, care for the elderly and disabled, culture and infrastructure. These effects arise from higher heating costs and infrastructure maintenance costs in cold periods.

In agreement with the hypothesis, minimum acceptable fiscal surplus depends significantly on changes in municipal income relative to the preceding year. The negative sign of the constant term of the minimum acceptable fiscal deficit suggests that local governments expect a positive long-term growth in exogenous income. Approximately 44 percent of the temporal change in exogenous income is used to improve the budget balance.

Higher exogenous income is assumed to increase maximum acceptable fee income, because the local government can supply larger quantities without increasing user charges per unit. Thus, although user charges are reduced, the volume may increase and counteract this effect and lead to an increase in total fee income. The coefficient estimate is highly significant. An increase of 1.000 NOK in exogenous income induces an increase in maximum acceptable fee income by 180 NOK.

Table 4.2 reports summary statistics for the distribution of estimated minimum required expenditures, minimum acceptable budget surplus and maximum acceptable user fees. Total subsistence expenditures for each municipality is equal to the sum of subsistence expenditures in the 8 service sectors, and amounts on average to 17.850 NOK per capita. The variation across municipalities ranges from a minimum of 11.600 NOK per capita to a maximum of 25.310 NOK per capita. Education (4.780 NOK per capita on average) and care for the elderly and disabled (5.450 NOK per capita on average) emerge as the two sectors with highest mean subsistence expenditures.

Table 4.2. Summary statistics of the distribution of estimated sectorspecific subsistence expenditures, minimum required fiscal surplus and maximum acceptable user fees. 1000 NOK

	α_0	α_1	α_2	α_3	α_4	α_5	α_6	α_7	α_8	κ	$\alpha - \alpha_0$	α	$\alpha + \kappa$
Mean	-0.32	1.46	4.78	1.13	0.92	1.16	5.45	0.84	2.11	4.36	17.85	17.52	21.88
Minimum	-2.64	0.57	3.09	0.70	0.44	0.46	2.37	0.43	1.03	2.77	11.60	11.84	15.17
Maximum	2.05	5.66	7.41	2.44	1.86	2.34	12.17	1.45	3.86	14.51	25.31	25.15	36.37
St. dev.	0.43	0.58	0.70	0.24	0.25	0.32	1.40	0.19	0.56	1.25	2.81	2.81	3.65

Estimated subsistence expenditures prove to be positive in every service sector and each municipality. However, estimated minimum fiscal surplus take both negative and positive values. The constant term in the function for minimum acceptable fiscal surplus (shown in Table 4.1) is negative. This implies that a local government that faces no changes in exogenous income and have zero supernumerary income will decide to have a deficit. Thus, the requirement of balanced budgets does not work as an effective binding constraint. Only 19 percent of the municipalities had minimum fiscal surpluses above zero. These municipalities faced income increases of at least 940 NOK per capita.

In Norway local governments face minimum national standards in services like education, social services and care for elderly and disabled. Thus, we expect that the subsistence expenditures of these service sectors account for a larger share of the total sectorspecific expenditures than the remaining service sectors. The results of Table 4.3 confirm this hypothesis.

Table 4.3. Subsistende expenditures as shares of total sectorspecific expenditures. Per cent

Expenditure sector	1	2	3	4	5	6	7	8
	67.6	83.6	67.7	73.0	99.5	84.0	67.2	54.8

There is considerable variation in estimated maximum acceptable fee income which on average was 4.360 NOK per capita. The lowest and highest maximum acceptable user fees were 2.770 NOK and 14.510 NOK per capita, respectively.

The model is consistent with utility maximization provided that spending levels exceed subsistence levels and user fees are below the maximum acceptable level. These constraints imply that supernumerary income must be non-negative. Predictions for supernumerary income are positive for all municipalities, except for one observation with a small negative value.

4.2. Heterogeneity in marginal budget shares

Table 4.4 gives the estimated coefficients of the marginal budget shares. The budget surplus, child care and culture expenditures, and fee income increase significantly with increasing private disposable income. User fees is the main instrument that local governments can use to reallocate recources from the private to the local public economy. Thus, the response of fees to private income changes can be interpreted as a conventional income effect. Municipalities with comparatively rich local residents also show to have a special preference for child care services, as reflected in the marginal budget shares. This is a plausible result, since rich parents tend to work more hours and demand more child care services. Higher production of child care may also bring about higher municipal fee income. Spending on culture services are also increasing with residential income.

Table 4.4. Estimates of marginal budget share parameters[a b]

	0	1	2	3	4	5	6	7	8	9
Constant	-0.190	0.113	0.164	-0.251	0.125	-0.012	0.268	-0.076	0.348	0.511
	-	(2.68)	(2.10)	(4.36)	(2.10)	(0.25)	(2.44)	(2.49)	(3.75)	(6.27)
Per capita private disposable income	0.371	0.003	0.018	0.236	-0.044	0.025	-0.150	0.063	-0.195	-0.326
	-	(0.08)	(0.22)	(3.94)	(0.68)	(0.43)	(1.30)	(2.06)	(1.85)	(3.64)
Average education level for persons 30-59 years	0.027	-0.007	-0.032	0.031	-0.028	0.002	-0.013	0.037	0.010	-0.027
	-	(0.78)	(2.22)	(3.51)	(2.40)	(0.19)	(0.60)	(4.52)	(0.60)	(1.76)
Share of socialists in municipal council	-0.254	0.013	-0.015	0.123	-0.002	-0.021	0.072	0.026	0.133	-0.076
	-	(0.45)	(0.29)	(4.51)	(0.05)	(0.84)	(1.14)	(1.02)	(2.01)	(1.45)
Herfindahl-index for party concentration	0.170	-0.054	0.023	0.002	0.037	-0.014	-0.018	-0.020	-0.074	-0.051
	-	(0.90)	(0.28)	(0.06)	(0.49)	(0.31)	(0.16)	(0.48)	(0.73)	(0.54)
R^2 adjusted	0.75	0.84	0.80	0.63	0.50	0.40	0.77	0.65	0.75	0.34

[a] The dependent variables are per capita operating result in equation 0, per capita expenditures in equation 1-8, and per capita fee income in equation 9. All pecuniary amounts are in thousands of Norwegian kroner, except for private disposable income, which is in hundreds of thousands. T-statistics are in parentheses.

[b] The model equation numbers refer to

Equation 0: Net operating result
Equation 1: Administration
Equation 2: Education
Equation 3: Child care
Equation 4: Health care
Equation 5: Social services
Equation 6: Care for the elderly and disabled
Equation 7: Culture
Equation 8: Infrastructure
Equation 9: Fee income

The higher the education level, the stronger are the local government preferences for child care services and culture services, and the weaker is the aversion against user charges. Authorities in well educated communities put lower priority on education and health care services. This effect might be due to ommitted cost factors in the subsistence expenditures for education and health care. However, no such effect occured when we controlled for the effect of the education level in the subsistence expenditures. Thus, we conclude that the education level is properly included as a taste variable.

The estimates show that socialist parties give special priority to child care services, which is in line with the socialist program for public welfare and increased female participation in the labour force. The results also suggest that socialists tend to devote more resources to infrastructure services than non-socialists. The infrastructure sector comprises different services like public water and sewage facilities, refuse disposal, public transportation, housing and industrial development. More detailed analysis is required to throw light on which parts of the sector are favored by socialists. Besides, socialists have a lower marginal propensity to save than non-socialists. Socialists also tend to collect more fee income, but this last effect is only slightly significant.

The higher the party concentration in the municipal council, the higher is the marginal propensity to save. Thus, a strong political leadership has the opportunity to resist pressure for spending increases. The increase in budget surplus due to party concentration is mainly financed by reductions in administration and infrastructure expenditures, and by increased user charges.

Table 4.5 reports summary statistics for the estimated marginal budget shares. Marginal budget shares are defined as the proportions of a marginal increase in income that is distributed to the different service sectors. Summary statistics for the distribution of the θ and β parameters are reported in Table 4.5. As suggested by equations (3.1) and (3.6) the income derivative for fees will not be equal to θ since exogenous income also affects κ, and κ depends on exogenous income. Thus, the derivative for fees with respect to exogenous income is reported in the second column of Table 4.5, assuming that minimum saving is kept constant. The marginal budget share for the fiscal surplus is defined as the proportion of the increase in total income (including fees) that is saved for future spending. The marginal budget shares for the service sectors are standardized such that the shares of the eight service sectors add up to one, which means that we report the marginal expenditure shares.

Table 4.5. Summary statistics of the distribution of estimated sectorspecific marginal budget shares

	θ	$\frac{\partial v}{\partial y}$	$\frac{\beta_0}{1-\theta}$	$\frac{\beta_1}{1-\theta-\beta_0}$	$\frac{\beta_2}{1-\theta-\beta_0}$	$\frac{\beta_3}{1-\theta-\beta_0}$	$\frac{\beta_4}{1-\theta-\beta_0}$	$\frac{\beta_5}{1-\theta-\beta_0}$	$\frac{\beta_6}{1-\theta-\beta_0}$	$\frac{\beta_7}{1-\theta-\beta_0}$	$\frac{\beta_8}{1-\theta-\beta_0}$
Mean	0.117	0.043	0.168	0.123	0.162	0.099	0.056	0.001	0.179	0.076	0.304
Minimum	-0.043	-0.043	0.062	0.089	0.099	0.000	-0.031	-0.014	0.066	0.031	0.211
Maximum	0.190	0.233	0.412	0.148	0.247	0.300	0.113	0.022	0.216	0.203	0.338
Standard deviation	0.035	0.042	0.047	0.010	0.018	0.042	0.017	0.006	0.019	0.022	0.017

The model is consistent with utility maximization provided that the estimated θ's and marginal budget shares are non-negative. The estimated θ's and marginal budget shares are positive for most observations. There are a few negative predictions for θ and the marginal budget shares in health care and social services, but these are statistically insignificant. The derivative of fees with respect to exogeneous income is positive for 89 percent of the municipalities. For fee income, this means that positive volume effects are dominating over price reductions in response to a wider economic choice set.

On average 17 percent of a marginal income increase is used for improvement of the fiscal balance. We observe particularly high marginal expenditure budget shares in infrastructure services. Marginal budget shares for fiscal surplus and child care services and the derivatives of fees with respect to exogenous income show to vary considerably between municipalities. By contrast, the marginal budget shares for administration, education, health care and infrastructure vary modestly, whilst the marginal budget shares for social services are extremely small for all municipalities.

The estimated effect on fees from an increase in private disposable income of 100 NOK is 3 NOK on average. This is a rather low figure both in an international context and compared to the effect of intergovernmental grants. As shown in Table 4.5, the impact of grant money on fee income is on average positive and will in fact induce reductions in private consumption in most municipalities. This result owes to the fact that increased volume of local public services dominates over the tendency to reduce user charges in response to increased municipal income. As a consequence, the flypaper effects reported in this paper are extraordinary strong.

4.3. The distribution of income and price elasticities

The expressions for Engel, Cournot and Slutsky elasticities are given in Appendix B. The Engel elasticities are obtained under the assumption that minimum fiscal surplus is unaffected by the income

change. The endogenous variables that enter into the formulas are replaced by predicted values. Since we have allowed for heterogeneity in subsistence levels and marginal budget shares it is of interest to examine how heterogeneity in production costs and local tastes affect the various price and income elasticities. Table 4.6 reports mean, minimum, maximum and standard deviations of income elasticities and direct price elasticities. Fiscal surplus elasticities are not included in Table 4.6 since fiscal surplus may be equal to zero.

Table 4.6. Summary statistics of income and price elasticities

Equation number	1	2	3	4	5	6	7	8	9
Engel elasticities									
Mean	1.09	0.51	1.05	0.82	0.01	0.50	1.09	1.47	0.24
Minimum	0.51	0.29	0.01	-0.90	-0.42	0.25	0.60	0.98	-0.50
Maximum	1.60	0.79	2.04	1.81	0.38	0.83	2.00	2.04	0.99
Standard deviation	0.17	0.09	0.33	0.24	0.12	0.09	0.20	0.17	0.22
Direct Cournot elasticities									
Mean	-0.36	-0.25	-0.34	-0.27	0.00	-0.26	-0.34	-0.54	
Minimum	-0.76	-0.66	-0.80	-0.82	-0.28	-0.63	-0.85	-0.90	
Maximum	-0.09	-0.12	0.00	0.37	0.17	-0.10	-0.05	-0.22	
Standard deviation	0.11	0.08	0.14	0.13	0.05	0.08	0.13	0.13	
Direct Slutsky elasticities									
Mean	-0.26	-0.11	-0.25	-0.22	0.00	-0.11	-0.28	-0.28	
Minimum	-0.66	-0.52	-0.70	-0.76	-0.27	-0.49	-0.80	-0.67	
Maximum	0.02	0.02	0.02	0.35	0.16	0.03	0.01	0.05	
Standard deviation	0.11	0.08	0.13	0.13	0.04	0.07	0.13	0.13	

The income elasticities turn out to be positive, except for a few municipalities with negative elasticities in health care and social services. For social services, all variation is captured by unobservables since the estimates in column five of Table 4.4 are insignificant. Hence, the results are consistent with the assumption of normal goods with the modification that the fee income response is ambiguous due to the income effect on maximum fees. Infrastructure is a service sector in which almost all municipalities have income elastic demand. For child care, administration and cultural services Engel elasticities are on average larger than one. For health care, some municipalities have income-elastic demand, but on average the demand is income-inelastic. Education, care for the elderly and disabled, and social services are income-inelastic for all municipalities. The Engel elasticity for fee income is within the range of -0.50 and 0.99, with a mean of 0.24.

Apart from the municipalities with negative income elasticities in social servicesand health care, all direct Cournot elasticities are negative. All goods are price-inelastic, with a Cournot elasticity below one in absolute value. In resemblance with the results for Engel elasticities, the Slutsky elasticities are particularly small in social services, education, and care for the elderly and disabled. This may be due to the fact that these service sectors to a greater extent than the remaining sectors are subject to requirements and regulations from the central government. Thus, when these requirements are met the local governments give priority to spending in infrastructure, administration, child care and culture.

Since income and price elasticities depend on municipal income, the pattern of variation with respect to income may provide essential information. Table 4.7 displays mean elasticities by deciles of total municipal income. The results for deciles 3-8 vary only slightly and are reported by their mean value. The mean per capita income in the two lowest, the middle and two highest decile groups are found to be equal to 16.990, 18.490, 22.910, 30.600, and 40.670 NOK, respectively.

Table 4.7 shows that the Engel elasticities for education and care for the elderly and disabled increase with per capita income, whilst the Engel elasticities for administration, child care, culture and infrastructure decrease as a function of income. Hence, Engel elasticities tend to increase with income for income-inelastic services and decrease with income for income-elastic services. The largest variation in income elasticities across service sectors is found for municipalities with low per capita income.

Table 4.7. Income and price elasticities by deciles of total income

Equation number	1	2	3	4	5	6	7	8	9
Engel elasticities									
Decile 1	1.24	0.42	1.19	0.81	0.03	0.49	1.14	1.50	0.31
Decile 2	1.22	0.44	1.18	0.74	0.04	0.46	1.20	1.50	0.30
Decile 3-8	1.10	0.50	1.03	0.81	0.01	0.49	1.09	1.50	0.22
Decile 9	0.92	0.58	0.95	0.88	-0.05	0.57	0.99	1.40	0.19
Decile 10	0.90	0.66	0.98	0.93	-0.03	0.61	1.02	1.34	0.27
Direct Cournot elasticities									
Decile 1	-0.30	-0.18	-0.27	-0.17	-0.01	-0.20	-0.26	-0.43	
Decile 2	-0.32	-0.19	-0.30	-0.18	-0.01	-0.21	-0.29	-0.46	
Decile 3-8	-0.35	-0.23	-0.32	-0.24	-0.01	-0.24	-0.33	-0.53	
Decile 9	-0.40	-0.32	-0.40	-0.36	0.02	-0.32	-0.40	-0.64	
Decile 10	-0.50	-0.42	-0.52	-0.50	0.01	-0.40	-0.54	-0.74	
Direct Slutsky elasticities									
Decile 1	-0.19	-0.04	-0.16	-0.13	-0.01	-0.06	-0.18	-0.18	
Decile 2	-0.22	-0.06	-0.20	-0.14	-0.01	-0.06	-0.22	-0.20	
Decile 3-8	-0.25	-0.09	-0.23	-0.19	-0.01	-0.09	-0.26	-0.26	
Decile 9	-0.30	-0.17	-0.32	-0.31	0.02	-0.16	-0.35	-0.36	
Decile 10	-0.40	-0.27	-0.44	-0.44	0.00	-0.24	-0.48	-0.48	

Table 4.8. Mean values of own and cross Cournot elasticities

	1	2	3	4	5	6	7	8	9
Price 1	-0.36	-0.03	-0.06	-0.05	0.00	-0.03	-0.06	-0.09	0.05
Price 2	-0.22	-0.25	-0.21	-0.17	0.00	-0.10	-0.22	-0.30	-0.06
Price 3	-0.05	-0.02	-0.34	-0.04	0.00	-0.02	-0.05	-0.07	0.04
Price 4	-0.04	-0.02	-0.04	-0.27	0.00	-0.02	-0.04	-0.06	0.03
Price 5	-0.06	-0.03	-0.06	-0.04	0.00	-0.03	-0.06	-0.08	-0.02
Price 6	-0.25	-0.12	-0.24	-0.19	0.00	-0.26	-0.25	-0.34	0.20
Price 7	-0.04	-0.02	-0.04	-0.03	0.00	-0.02	-0.34	-0.05	0.03
Price 8	-0.10	-0.04	-0.10	-0.07	0.00	-0.04	-0.10	-0.54	0.07

Cross-price elasticities are reported in Tables 4.8 and 4.9. In general, Slutsky cross-price elasticities are positive and rather small. This substitutability property is implied by the ELES model. Cournot cross-price elasticities are in general negative which means that the negative income effect is dominating over the positive substitution effect. However, the Cournot cross price elasticities for fee income are positive, except for education and social services. For other sectors than education and social services, increased unit costs operate on fees only through the reduction in supernumerary

income. The cross-price effects of education and social services on fees are ambiguous because subsistence expenditures for those sectors also reduce maximum acceptable fees. This is reflected in the computed elasticities, which take both positive and negative signs.

Table 4.9. Mean values of own and cross Slutsky elasticities

	1	2	3	4	5	6	7	8	9
Price 1	-0.26	0.02	0.04	0.03	0.00	0.02	0.04	0.06	0.07
Price 2	0.08	-0.11	0.08	0.06	0.00	0.04	0.08	0.11	0.01
Price 3	0.04	0.02	-0.25	0.03	0.00	0.02	0.04	0.05	0.06
Price 4	0.02	0.01	0.02	-0.22	0.00	0.01	0.02	0.03	0.05
Price 5	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.01	0.00
Price 6	0.09	0.04	0.09	0.07	0.00	-0.11	0.09	0.13	0.27
Price 7	0.03	0.01	0.03	0.02	0.00	0.01	-0.28	0.04	0.04
Price 8	0.10	0.05	0.09	0.08	0.00	0.05	0.10	-0.28	0.12

5. Out-of-sample predictions

Although the estimated model parameters are found to be consistent with our theoretical framework it is important to examine how the model performs with respect to prediction. In this section the empirical model that was estimated on data for 1993 is used to predict the fiscal and spending behavior of local governments in 1994. For the sake of comparability the observed accounting data for 1994 were deflated to 1993 prices. The price index for local government consumption in the National Accounts of Norway was used as deflator. The prediction results are reported in Table 5.1.

The relative mean prediction error in the third row is the difference between the first and the second row divided by the figures in the first row. The relative mean prediction error is quite small for most of the service sectors which suggests that there is little evidence of systematic over- or underprediction by the model. The largest relative mean prediction errors are found for the fiscal surplus and the health care expenditures.

Table 5.1. Actual and predicted means of endogenous variables for 1994. 1000 NOK per capita[1]

Equation number	0	1	2	3	4	5	6	7	8	9
Mean actual	1.52	2.16	5.75	1.78	1.14	1.15	6.82	1.26	4.05	3.61
Mean predicted	1.27	2.25	5.81	1.73	1.30	1.16	6.63	1.32	4.03	3.51
Relative mean error	0.16	-0.04	-0.01	0.03	-0.14	-0.01	0.03	-0.05	0.00	0.03
Simulated R^2 adjusted	0.72	0.85	0.78	0.62	0.36	0.37	0.80	0.63	0.74	0.30

[1] The sample for 1994 consists of 429 municipalities. Out of a total of 435 municipalities, one municipality was left out because of missing data, and five since they were considered to be outliers.

The results of Table 5.1 show that the performance is almost as good as the model's ability to reproduce the 1993 observations. To visualize the simulation fits, prediction errors in the 10 model sectors are plotted against a ranking on total income for the municipalities. The plots are reported in Appendix C. The municipality with the lowest per capita total income is given rank one in the income ranking, continuing up to the municipality with the highest per capita total income, which is rank 429 in the ranking. There is no systematic relationship between the income level and the prediction errors. Therefore, the overall impression from the out-of sample predictions is that the model simulates local government allocations rather well.

6. Summary and conclusion

This paper focuses on the variety in the fiscal policy and the structure of public spending among local governments. The econometric analysis, which is based on detailed local government accounts for Norwegian municipalities in 1993, recognizes total spending as well as total income as endogenous variables. We present estimates for eight service sectors based on a modified version of the extended linear system (ELES). As opposed to the standard ELES our ELES version allows the present value of changes in future exogenous incomes to differ from zero. This property justifies the presence of budget deficits among local governments.

Our data do not include information on prices. However, by using municipality characteristics to account for heterogeneity in the marginal budget share parameters, we achieve identification of the complete demand system. This means that we may assess price elasticities even though we have no direct information on prices. Moreover, allowing for heterogeneity in the parameters of the demand system makes the Engels curves more flexible, and thus to a certain extent accommodate the conventional criticism against the LES and the ELES.

Due to observed heterogeneity in local tastes and production costs the paper provides a detailed analysis of the expenditure effects of various community variables and of the spending responses from increases in exogenous income and prices. The results show that small municipalities normally face higher per capita production costs than large municipalities. This regularity is probably due to scale economics in service production. The effects of the age structure of the residentials on the allocation of the subsistence expenditures conform with a priori expectations. Furthermore, expenditures on cultural activities were found to be significantly lower in suburban municipalities than in otherwise similar non-suburban municipalities, and verifies the claim that suburban municipalities take advantage of the cultural services offered by urban municipalities. Expenditures

on most service sectors prove to depend on the climatic conditions of the municipalities. These effects arise from higher heating costs and infrastructure maintenance costs in cold periods.

Heterogeneity in preferences for allocation of supernumerary income is shown to be properly captured by variables that reflect the degree of dominance of the socialist parties and the average socioeconomic status of the municipal population. Local governments that are dominated by socialist parties give priority to child care services and infrastructure investments. The strong focus on child care appears to be in line with the socialist program for public welfare and increased female participation in the labour force.

Expenditures on national welfare services as education, social services and care for the elderly and disabled are only weakly sensitive to changes in the economic conditions of the municipalities. When the quality of these services is ensured to be in line with the requirements of the central government, it seems that the local governments give priority to spending in infrastructure, administration, child care and culture. The impact of grants-in-aid on fees is on average positive and will induce a reduction in private consumption for the majority of the municipalities. This result owes to the volume increase in local public services as a response to increased exogenous income.

In order to examine how the 1993-based model performs with respect to prediction we used it to predict the fiscal and spending behaviour of local governments in 1994. The results of the out-of-sample predictions show that the model predicts local governments behavior rather well.

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Appendix A

Data

1. Data from the local government accounts

Observations of the endogenous model variables are provided by the local government accounts reported for the year 1993. The administration sector in the model solely contains central administration, while sector administration is included in the service sectors. Expenditures are defined to include net transfers to municipalities, counties and others. Exogenous income consists of tax income and net transfers from the central government. The operating result equals current income plus user fees minus current expenditures minus net interest and installment payments.

2. Data from other sources

The Norwegian population register along with the 1990 Census provide observations of the following dempographic and municipality variables:

- Total population
- Dummy for small municipalities with less than 5 000 inhabitants
- Population data by age group
- Foreign citizens with remote cultural background (These include citizens of African, Asiatic and Latin-American countries and also Turkey)
- Persons that are divorced or separated
- Children with a single supporter
- Personhours - residents average travelling time to the center of the municipality
- Population density - share of population living in densely populated areas
- Dummy for urban municipalities containing a center with more than 15 000 inhabitants
- Dummy for suburban municipalities that are not themselves urban, but are near to an urban center measured in travelling time

The number of mentally retarded by age groups was obtained from the Ministry of Health and Social Affairs.

The number of unemployed persons was defined equal to the number registered by the Directorate of Labour.

The purification degree is the share of total sewage disposal capacity that utilizes an intensive purification process. The data are collected by Statistics Norway at the plant level. To construct data

at the municipality level we had to divide the capacity in joint sewage plants, where the shares of persons connected to the plant in different jurisdictions were used as weights.
The information on cold winter periods was delivered by the Norwegian Meteorological Institute. The cold variable is measured as the average number of degrees below 17 degrees of Celcius per day through the whole year, recording every day with a temperature above 17 degrees as an observation of zero.

Private disposable income is derived from the Income register of Statistics Norway. We use the definition in the register, except that debt interest payments are not subtracted, whilst municipal social security benefits are subtracted.

The local education level is defined as the average number of years beyond the compulsory 9 years in primary school accomplished by residents in the age group 30-59 years. The source is the official register of highest completed educations.

The share of socialist representatives in the local government council was derived from the official election statistics. The Norwegian Labour Party and all parties to its left are defined as socialist parties. The Herfindahl-index for party concentration in the local government council was derived from the same source. Let S_j be the share of representatives from party *j* in the local council. Then the Herfindal-index is defined as

$$H = \sum_{j=1}^{P} S_j^2$$

where P is the number of parties. The index takes its maximum value of 1 when a single party holds all seats in the local council, while the minimum value of 1/P is attained when the seats are equally divided among the P parties.

Appendix B

Formulas for computation of elasticities

The parameters α_i, β_i, θ and κ are computed as defined in equations (3.2), (3.3), (3.5) and (3.6). The heterogeneity vectors **z** and **t** are given in Tables 4.1 and 4.3. The endogenous variables that enter into the formulas are replaced by predicted values in the computation.

1. Engel elasticities

(B.1) $$\frac{\partial \log u_i}{\partial \log y} = \frac{y}{u_i}\beta_i(1+\kappa_1) \quad i = 1,2,\ldots,8$$

(B.2) $$\frac{\partial \log v}{\partial \log y} = \frac{y}{v}(\kappa_1 - \theta(1+\kappa_1))$$

2. Cournot elasticities

(B.3) $$\frac{\partial \log q_i}{\partial \log p_i} = \frac{\alpha_i}{u_i}(1-\beta_i) - 1 \quad i = 1,2,\ldots,8$$

(B.4) $$\frac{\partial \log q_i}{\partial \log p_j} = -\frac{\alpha_j}{u_i}\beta_i \quad i \neq j$$

(B.5) $$\frac{\partial \log v}{\partial \log p_j} = \frac{\alpha_j}{v}\theta \quad i \neq 2,5$$

(B.6) $$\frac{\partial \log v}{\partial \log p_j} = \frac{\alpha_j}{v}(\theta - \kappa_1(1-\theta)) \quad i = 2,5$$

3. Slutsky elasticities

(B.7) $$\frac{\partial \log q_i}{\partial \log p_i} = \frac{\alpha_i}{u_i}(1-\beta_i) - 1 + \beta_i(1+\kappa_1) \quad i = 1,2,\ldots,8$$

(B.8) $$\frac{\partial \log q_i}{\partial \log p_j} = -\frac{\alpha_j}{u_i}\beta_i + \frac{u_j}{u_i}\beta_i(1+\kappa_1) \quad i \neq j$$

(B.9) $$\frac{\partial \log v}{\partial \log p_j} = \frac{\alpha_j}{v}\theta + \frac{u_j}{v}(\kappa_1 - \theta(1+\kappa_1)) \quad i \neq 2,5$$

(B.10) $$\frac{\partial \log v}{\partial \log p_j} = \frac{\alpha_j}{v}(\theta - \kappa_1(1-\theta)) + \frac{u_j}{v}(\kappa_1 - \theta(1+\kappa_1)) \quad i = 2,5$$

Prediction errors in the model equations, 1000 NOK per capita

Figure C1. Prediction error of net operating result by rank of total municipal income

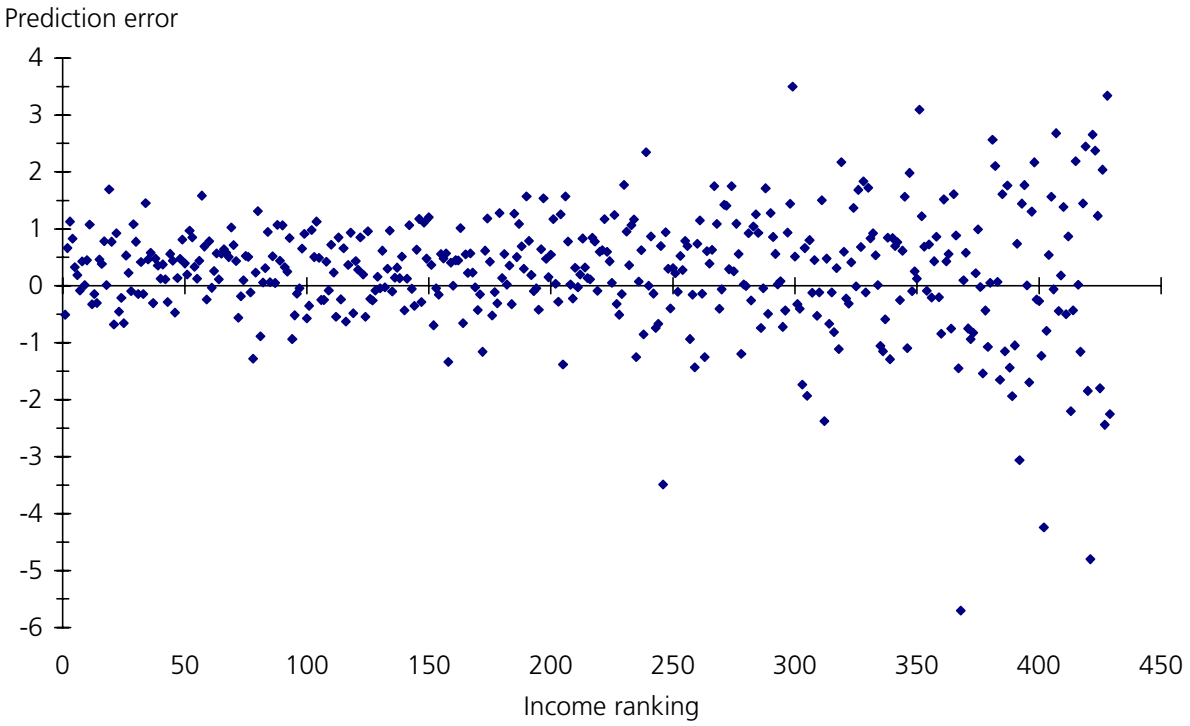


Figure C2. Prediction error of administration expenditures by rank of total municipal income

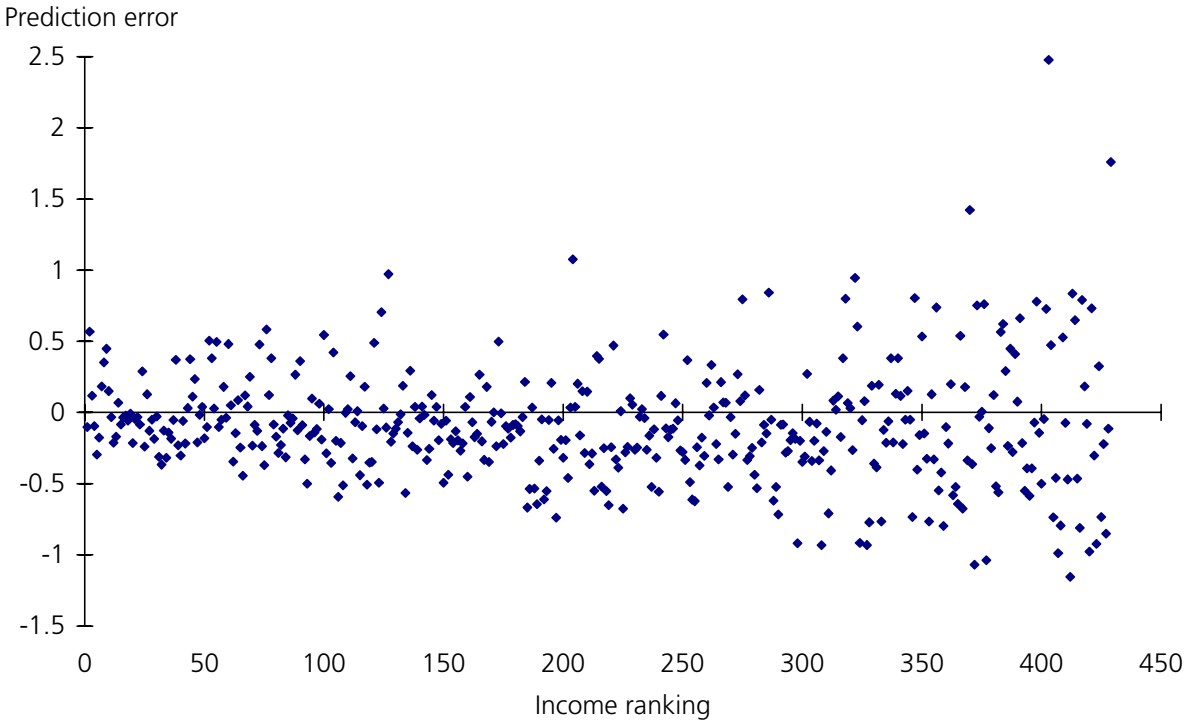


Figure C3. Prediction error of education expenditures by rank of total municipal income

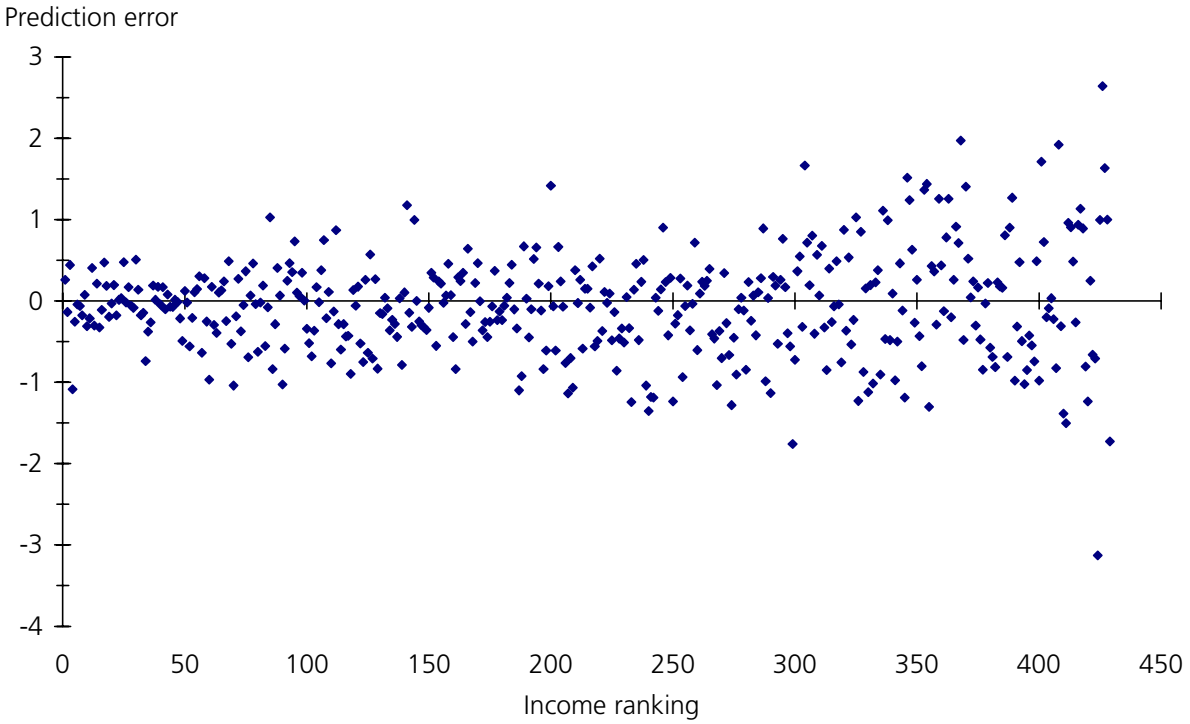


Figure C4. Prediction error of child care expenditures by rank of total municipal income

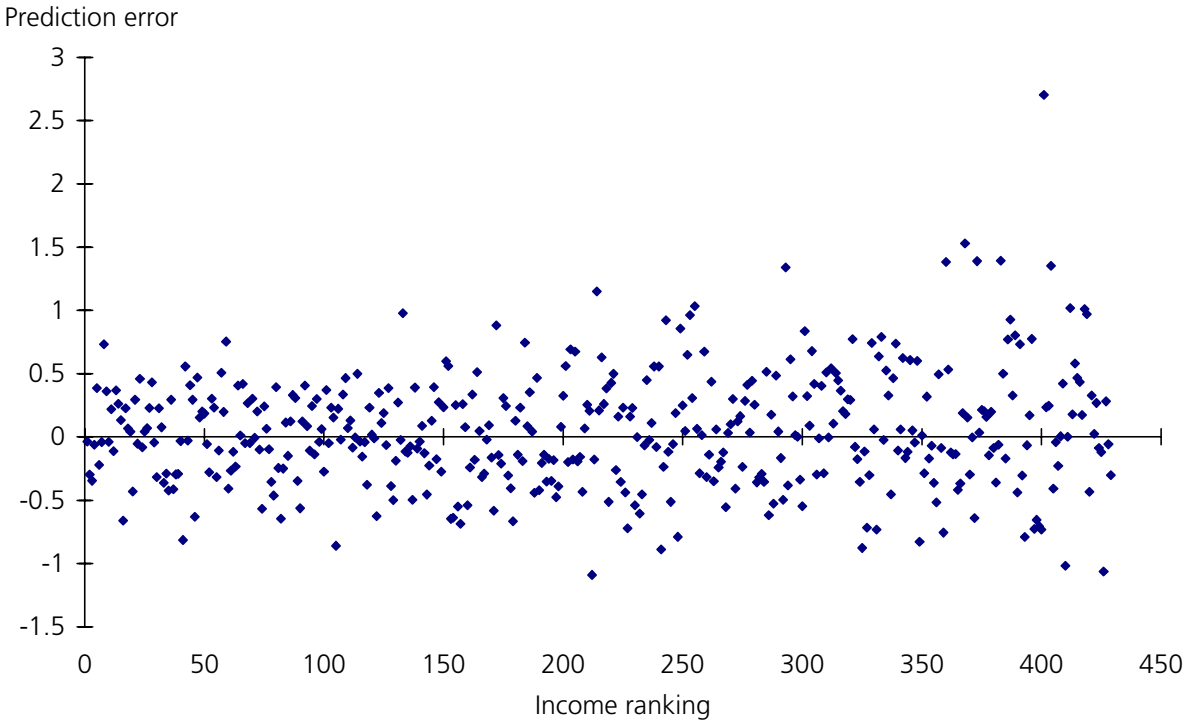


Figure C5. Prediction error of health care expenditures by rank of total municipal income

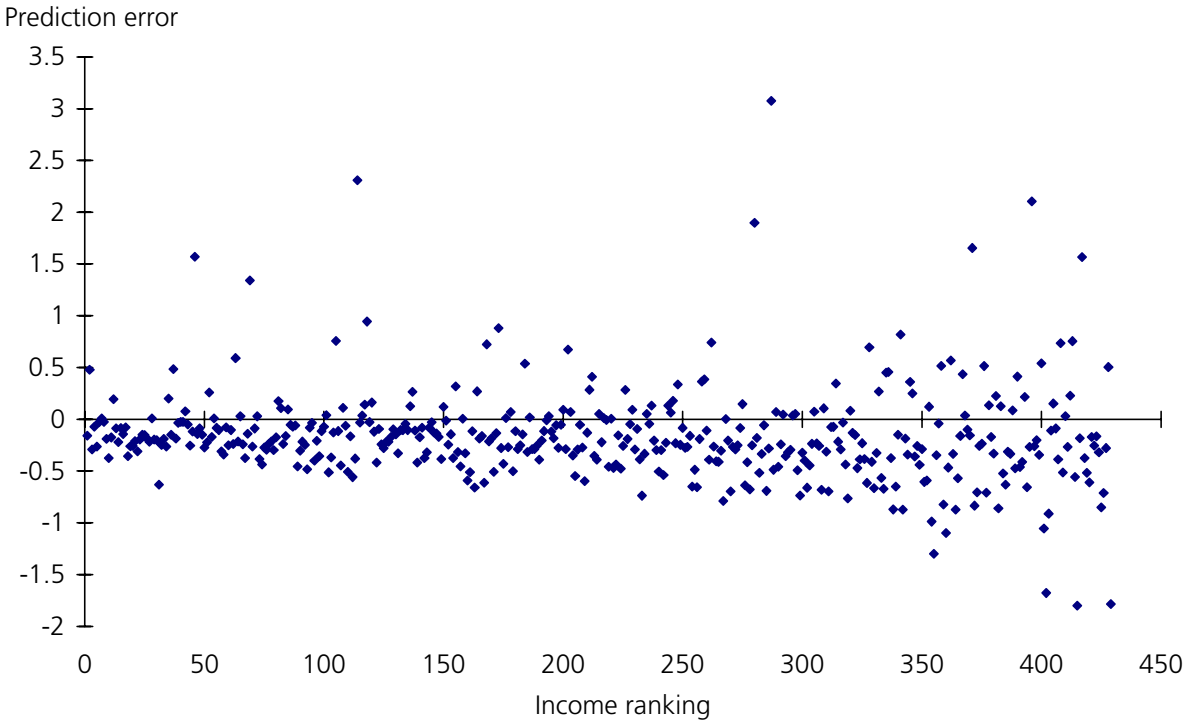


Figure C6. Prediction error of social service expenditures by rank of total municipal income

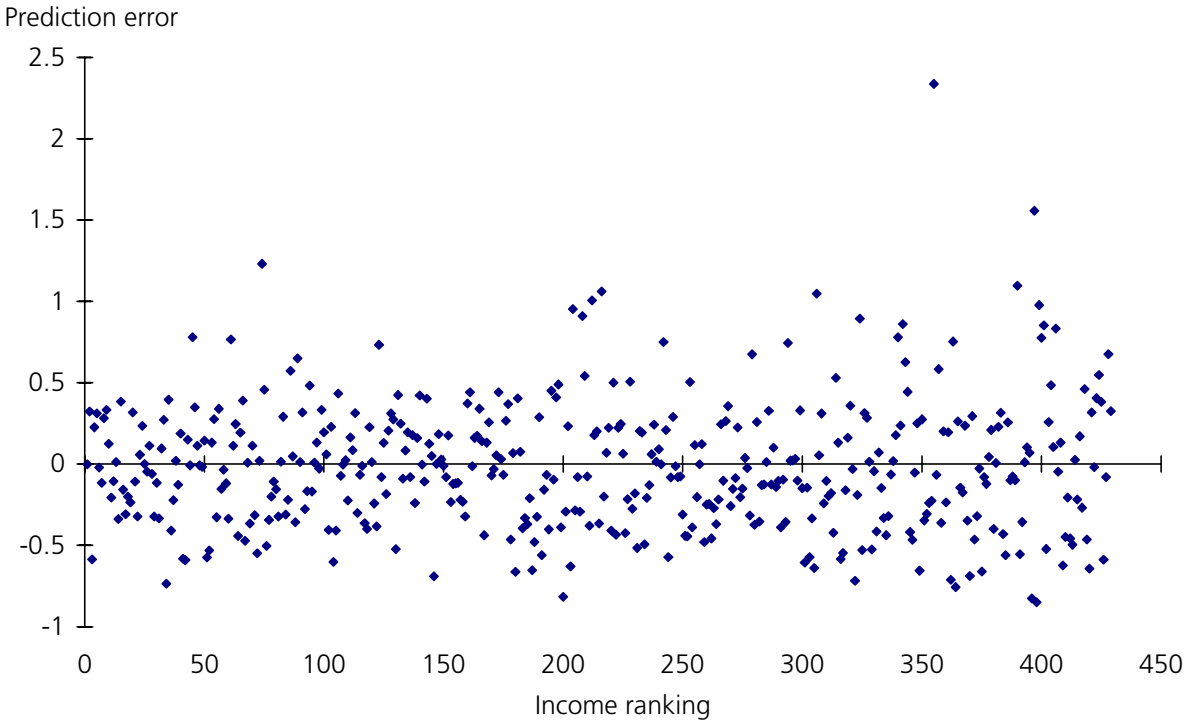


Figure C7. Prediction error of care for the elderly and disabled expenditures by rank of total municipal income

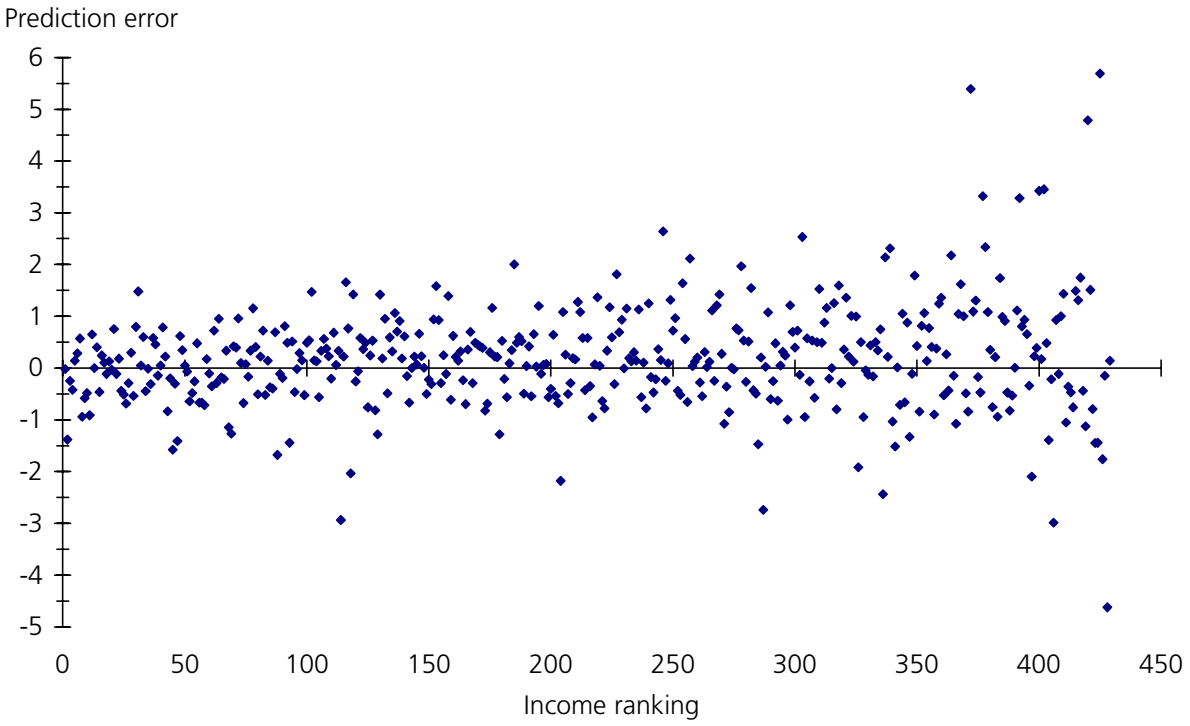


Figure C8. Prediction error of culture expenditures by rank of total municipal income

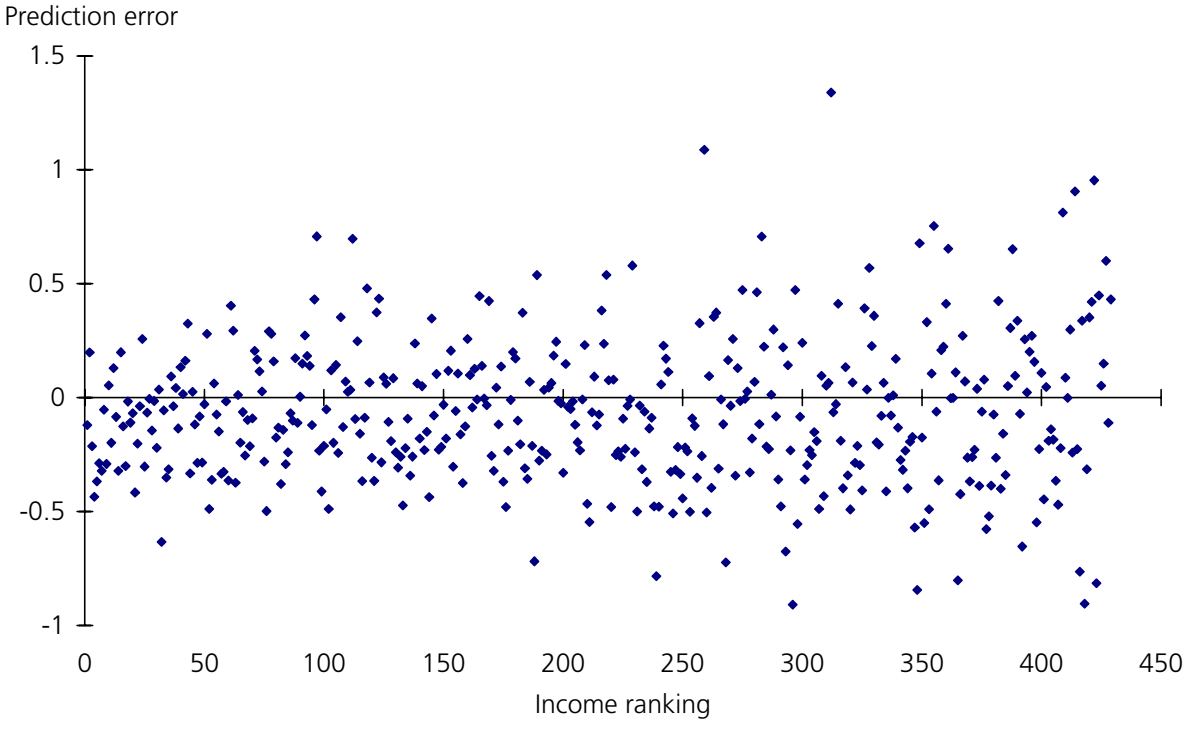


Figure C9. Prediction error of infrastructure expenditures by rank of total municipal income

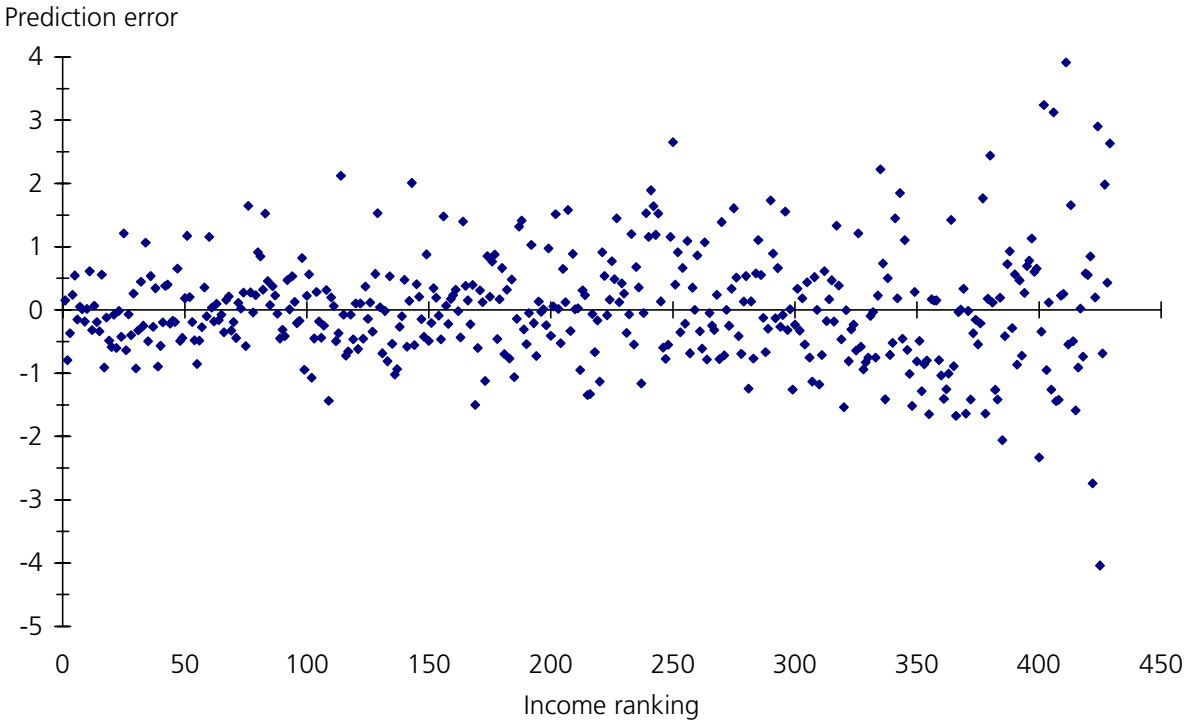
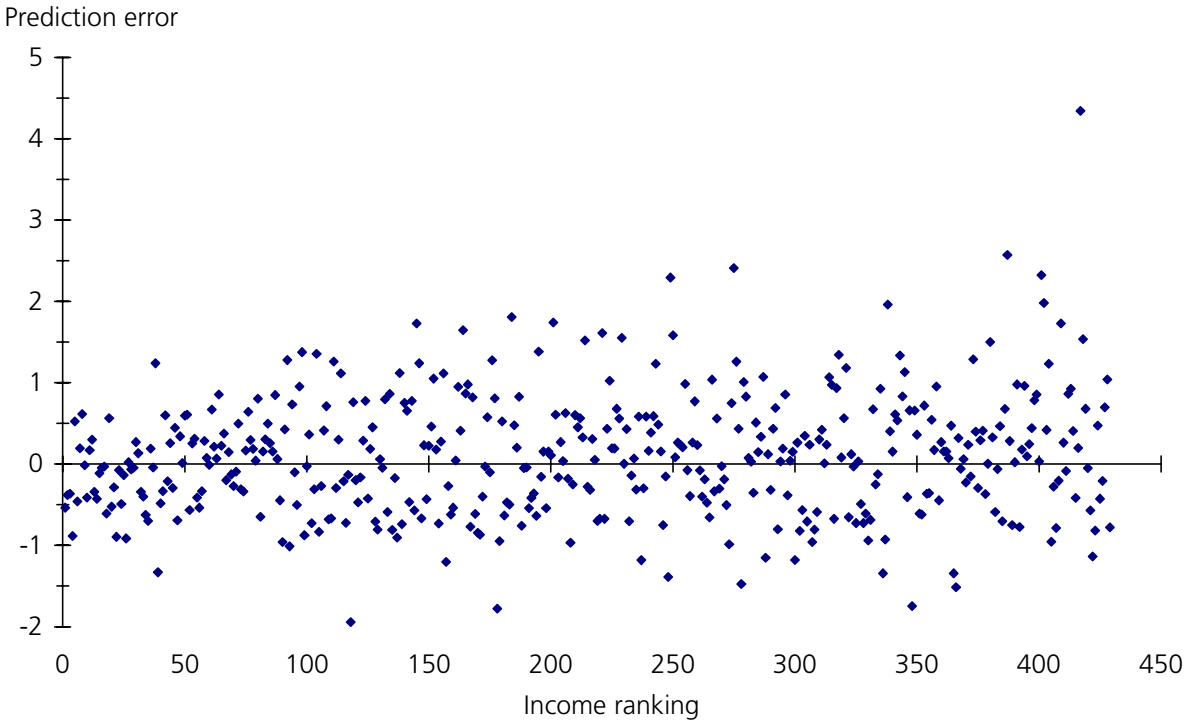


Figure C10. Prediction error of fee income by rank of total municipal income



Appendix D

An extended version of the empirical model

The empirical model reported in Section 4 includes a large set of community characteristics that are assumed to capture the essential features of heterogeneity in production costs, minimum budget surplus, maximum user fees, and tastes across municipalities. An additional set of variables that can be considered as theoretically relevant for capturing heterogeneity in local government behavior has been subject to empirical testing. The results of the evaluation are reported in this appendix.

1. Variables excluded in ML estimations

The employers' social security tax rate is regionally differentiated in Norway. We hypothesised that the tax rate will affect the unit costs in municipal production. Thus, the rate was included in the heterogeneity functions for subsistence expenditures. In this case the estimation results were not too encouraging. The overall effect of higher social security tax rate on subsistence expenditures was found to be negative, implying that unit costs will decrease with higher tax rate. Also, the results indicate that budget surplus increase and fee incomes decrease with increasing social security tax rate. We interpret these results as spurious. What is captured could for instance be variations in attitudes or efficiency that are correlated with centrality and the social security tax rate. It should be recognized that the expenditure system design is not very suitable to account for substitution between labour and other inputs in response of changes in relative factor prices. Thus, we chose to ommit the social security tax rate from the analysis, leaving the subject to future research. The other results of the analysis are only to a limited degree sensitive to whether or not the tax rate is included.

As mentioned in Section 3, unit costs in education and health care may depend on the education level of local residents. We found no evidence of such a relationship. Besides, the estimated effect from a foreign first language on education expenditures was not significant.

The public sector in Norway is organized in three levels, made up by local governments, county governments and the central government. While local governments are responsible for primary health care and care for the elderly and disabled, public hospitals are owned and operated by counties or the central government. Hence, hospital services may to some degree be substitutes for local government services. A plausible hypothesis is that nearness to a public hospital may reduce municipal expenditures. To test for this, a hospital dummy variable was included in the subsistence expenditures for health care and care for the elderly and disabled. The dummy equals 1 in municipalities where there are located at least one hospital, and 0 otherwise. The estimated coefficients emerged as

insignificant, although the coefficient for health care was significant in a reduced form version of the model.

The marginal budget shares are assumed to depend on the party structure in the local councils. The division between socialist and non-socialist parties may be too coarse to account for the complex pattern of political cleavages in the Norwegian multy-party system. To test this proposition, the share of representatives from center parties along the right-left dimension was included as heterogeneity in the marginal budget shares. None of the coefficients emerged as significant.

2. Other effects excluded in ML estimations

Our preffered model is reported in Tables 4.1 and 4.3. A more general model specification is reported in tables D.1 and D.2. Table D.2 corresponds to Table 3.4. In Table D.1, we include all the hypothesised effects on subsistence expenditures that have been excluded in Table 3.2, due insignificant parameter estimates.

Table D.1 also includes one variable that is excluded in Table 3.2. The number of mentally retarded children 0-6 years have no significant effect on expenditures, neighter in child care, health care, nor care for the elderly and disabled. Furthermore, there is no evidence that health care expenditures are affected by the number of mentally retarded youth and adults. Expenditures in care for the elderly and disabled are not affected significantly by the number of mentally retarded children and youth.

The effect of unemployment on health care expenditures is insignificant. The same applies to the effect of foreigners from remote cultures on school expenditures. This effect was assumed to capture needs for special lessons.

The effects of scale economies or centrality were tested in all service sectors using the inverted population and the dummy for small municipalities. The estimates of the coefficients are reported in Table D.1.

Uban municipalities are expected to have lower education expenditures and higher health care and culture expenditures than other municipalities. Low education expenditures could arise because average travelling time to the municipal center capture costs of decentralization that do not apply to large cities. Higher frequencies of illness or more supply-generated demand in cities may occasion higher health care expenditures. Higher culture expenditures may derive from municipal liabilities as a regional center. However, none of these hypotheses were confirmed in the analysis.

Table D.1. Estimates of subsistence expenditures, minimum budget surplus and maximum user fees parameters[a b]

	0	1	2	3	4	5	6	7	8	9
Constant	-0.41 (1.80)	-0.38 (1.59)	-0.60 (1.02)	-0.69 (1.89)	-1.14 (1.77)	0.29 (2.25)	-0.27 (0.42)	-0.02 (0.11)	-0.31 (0.55)	1.75 (7.67)
Population share 0-6 years of age				8.02 (2.98)	5.86 (1.62)					
Population share 7-15 years of age			26.17 (7.75)							
Population share 80 years and above					8.15 (1.89)					
Population share 67-89 years of age							14.42 (5.44)			
Population share 90 years and above							147.15 (4.45)			
Children 0-6 years with lone mother/father per capita				13.08 (1.50)						
Mentally retarded 0-6 years per capita				54.46 (0.58)	-172.5 (1.25)		85.37 (0.32)			
Mentally retarded 7-15 years per capita			207.47 (2.11)		-38.38 (0.40)		-52.97 (0.30)			
Mentally retarded 16 years and above per capita					7.58 (0.44)		360.05 (14.73)			
Unemployed 16-59 years per capita					1.71 (0.25)	11.11 (2.79)				
Divorced/separated 16-59 years per capita						13.99 (5.64)				
Foreigners from remote cultures per capita			-3.71 (0.43)			11.62 (3.24)				
Population density			-0.27 (1.12)		0.41 (2.16)			0.15 (1.35)		
Personhours (average travelling time)			1.26 (5.37)		0.65 (3.69)		-0.51 (1.26)			
Population inverted (thousands)		1.16 (6.43)	0.32 (0.99)	-0.03 (0.18)	0.32 (1.49)	-0.15 (1.02)	0.66 (1.66)	-0.03 (0.20)	0.18 (0.42)	
Dummy for small municipalities		0.22 (2.03)	0.56 (3.28)	0.31 (2.70)	0.26 (2.58)	-0.04 (0.70)	0.16 (0.61)	0.05 (0.52)	0.43 (1.62)	
Dummy for urban municipalities			-0.24 (0.78)		-0.09 (0.36)	0.22 (1.89)		0.11 (0.93)		
Dummy for suburban municipalities								-0.12 (2.15)		
Sewage purification degree									0.49 (2.88)	
Duration and severity of cold winter period		0.13 (6.17)	0.16 (6.68)	0.07 (3.19)	0.06 (2.99)		0.10 (2.19)	0.08 (5.82)	0.18 (3.64)	
Per capita change in municipal income	0.44 (8.19)									
Per capita municipal income excl. of min. exp. eq. 2 and 5										0.16 (6.25)
R^2 adjusted	0.75	0.84	0.80	0.63	0.52	0.40	0.77	0.65	0.75	0.34

[a] The dependent variables are per capita budget surplus in equation 0, per capita expenditures in equation 1-8, and per capita fee income in equation 9. All pecuniary amounts are in thousands of Norwegian kroner. T-statistics are in parantheses. n=426.

[b] The model equation numbers refer to

Equation 0: Budget surplus
Equation 1: Administration
Equation 2: Education
Equation 3: Child care
Equation 4: Health care
Equation 5: Social services
Equation 6: Care for the elderly and disabled
Equation 7: Culture
Equation 8: Infrastructure
Equation 9: Fee income

Table D.2 Estimates of marginal budget share parameters

	0	1	2	3	4	5	6	7	8	9
Constant	-0.189	0.114	0.149	-0.266	0.095	-0.014	0.299	-0.069	0.341	0.512
	-	(2.24)	(1.70)	(4.11)	(1.28)	(0.24)	(2.16)	(1.93)	(3.10)	(5.89)
Per capita private disposable income	0.386	0.006	0.018	0.252	-0.037	0.014	-0.172	0.059	-0.193	-0.332
	-	(0.12)	(0.19)	(3.87)	(0.46)	(0.21)	(1.17)	(1.66)	(1.63)	(3.21)
Average education level for persons 30-59 years	0.023	-0.007	-0.024	0.032	-0.018	0.005	-0.018	0.037	0.013	-0.030
	-	(0.71)	(1.39)	(3.07)	(1.17)	(0.41)	(0.71)	(3.77)	(0.59)	(1.56)
Share of socialists in municipal council	-0.261	0.014	-0.017	0.129	-0.001	-0.019	0.074	0.025	0.141	-0.085
	-	(0.43)	(0.31)	(4.01)	(0.02)	(0.74)	(0.91)	(0.88)	(1.72)	(1.52)
Herfindahl-index for party concentration	0.183	-0.057	0.012	0.005	0.027	-0.008	-0.014	-0.019	-0.077	-0.052
	-	(0.86)	(0.11)	(0.12)	(0.32)	(0.16)	(0.10)	(0.41)	(0.61)	(0.52)
R^2 adjusted	0.75	0.84	0.80	0.63	0.52	0.40	0.77	0.65	0.75	0.34

[a] The dependent variables are per capita budget surplus in equation 0, per capita expenditures in equation 1-8, and per capita fee income in equation 9. All pecuniary amounts are in thousands of Norwegian kroner, except for private disposable income, which is in hundreds of thousands. T-statistics are in parantheses. n=426.

[b] The model equation numbers refer to

Equation 0: Budget surplus
Equation 1: Administration
Equation 2: Education
Equation 3: Child care
Equation 4: Health care
Equation 5: Social services
Equation 6: Care for the elderly and disabled
Equation 7: Culture
Equation 8: Infrastructure
Equation 9: Fee income

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