The Demand for Local Public Services in Sweden

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Abstract

This paper analyzes the composition of municipal expenditures in Sweden by estimating a demand system for local public services, in which tax revenue collection is treated as endogenous. The estimation is based on the QAIDS specification. The empirical application uses panel data for the period 1998-2005 and for six local public services. The results show that the point estimates of all income elasticities except one are positive, and that none of them significantly exceeds one. Furthermore, the point estimates of the own-price elasticities are negative and less than one in absolute value for all services.

Key words: Demand system, local public finance, local government spending

JEL classification: D12, H71, H72

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1 Introduction

In the literature on local public expenditure determination, the *composition* of expenditures has received less attention than the *size*. Research commonly focuses on either the determinants of the aggregate expenditure or on the individual components. An understanding of the determinants of the expenditure composition in local jurisdictions is especially important for the central government for two reasons: (1) the design of national policies that redistribute revenues via an intergovernmental transfer system, and (2) the development of national policies whose objective is to steer local jurisdictions in a specific policy direction. This paper, which focuses on Swedish municipalities, simultaneously analyzes tax revenue collection and how the expenditures are allocated between different local public services. The empirical application is based on panel data for the period 1998-2005.

Previous studies dealing with the expenditure composition in the local public sector often assume that the municipality acts as if the policies are decided upon by a representative individual: solving such a decision problem for the local government yields a system of estimable demand equations. With this approach expenditure composition problems in the public sector are treated similar to consumer choices in the private sector. This approach was first applied by Deacon (1978), who extended earlier work in the field (e.g. Barr and Davies 1966; Borcherding and Deacon 1972; and Bergstrom and Goodman 1973)[1] by estimating a system of demand equations using US data on local public consumption expenditure (in the city of Seattle). He found that the local public sector allocation obeys two basic properties from traditional consumer theory: negative (compensated) own-price effects and zero degree homogeneity of demand in income and all prices. Other studies have extended the application of demand models to the pattern of consumption expenditures of local governments by including socio-economic indicators to account for differences in social needs and political considerations across local jurisdictions (see Dunne and Smith, 1983; Dunne et al., 1984; Borge and Rattsø, 1995; Aaberge and Langørgen, 2003).

[1] These studies focused either on the aggregate public spending or individual components of the total.

Earlier research on the composition of local public expenditures typically focuses on conditional demand systems, in which a given local public budget is allocated between the service sectors (Deacon, 1978; Borge and Rattsø, 1995). Such a framework is consistent with the idea of two-stage budgeting, where the local public revenues are collected in a first stage and allocated between the service sectors in a second stage. Analyzing the second step in such a process, therefore, presupposes that the revenues (or at least most of them) are predetermined. An alternative approach would be to consider the decision to collect revenue simultaneous with the decision to allocate resources between different local public services.

In order to fully understand the priorities made by the local public sector, the benchmark model in this paper does not separate the local public budget process into two steps. Instead, the benchmark model takes a more comprehensive approach by analyzing a complete system of demand equations, including private consumption. In order to compare results with previous studies, I also estimate a demand system that is conditioned on the resources available to the local public sector. Furthermore, this paper is the first study that analyzes the local public expenditure composition using Swedish data.

The approach where a municipality acts "as if" there is a representative individual that solves the resource allocation problem is referred to as the "community preference" model in the literature. It is typically assumed that the single individual allocates her/his resources between consumption of private goods and public services.[2] The present paper uses such a model for local public expenditures, where a representative agent derives utility from private and public consumption. The representative agent's demand for each good depends on, e.g., the total per capita income, prices and municipal characteristics. The demand system is specified as a 'quadratic almost ideal' demand system (QAIDS),[3] which is an extension to Deaton and Muellbauer's (1980) 'almost ideal' demand system (AIDS). The advantage with the QAIDS specification (which is estimated in terms of expenditure shares), compared to the AIDS formulation, is that it recognizes the possibility that the expenditure shares are nonlinear functions of income.[4]

[2] The community preference model is used in numerous studies (a review of the early empirical studies is provided by Gramlich, 1977). A good survey is given by Wildasin (1986).

[3] See Banks et al. (1997).

[4] Previous studies on local public expenditure decisions using Swedish data (e.g. Aronsson

In Sweden, the municipalities are responsible for providing services such as child care, comprehensive education and elderly care. The municipalities collect tax revenues by using a proportional income tax. Other important sources of revenue are user fees and grants from the central government. The empirical part of this paper presents results from estimating a complete demand system consisting of a composite private consumption good and six local public services (child care, social services, elderly care, comprehensive education, 'infrastructure and protection' and 'other expenditures'). The results show that the point estimates of all income elasticities except one are positive, and that none of them significantly exceed one. Furthermore, the results show that the point estimates of the own-price elasticities are negative and less than one in absolute value for all services. The results from the demand system that is conditioned on the size of the total public expenditure are similar to related studies based on Norwegian data (Borge and Rattsø, 1995; Aaberge and Langørgen, 2003).

The outline of the paper is as follows. Section 2 presents and discusses a representative agent model for local public expenditures. Section 3 contains a description of the data, the empirical model and the estimation method as well as a discussion of the results. Section 4 summarizes the results and concludes.

2 A Representative Agent Model for Local Public Expenditures

Earlier research on the composition of local public expenditures often focuses on a demand system for local public services defined conditional on the revenue available to the local public sector, i.e. the total resources available for local public expenditures (Deacon, 1978; Borge and Rattsø, 1995). This approach implies that the local public sector allocates a given resource, e, between a number of local public services, $g_1, ..., g_n$. The desired allocation of public consumption in this setting is given by maximizing the utility function

$$u = u(g_1, ..., g_n, c; \boldsymbol{\theta}) \tag{1}$$

subject to the budget constraint

and Wikström, 1995; Aronsson et al., 2000; Witterblad, 2007) find that income effects are nonlinear.

$$\sum_{j=1}^{n} p_j g_j = \hat{e} \tag{2}$$

where c is private consumption, $\boldsymbol{\theta}$ a vector of characteristics describing the community, p_j (discussed below) the unit price of service j net of matching grants and $\hat{e}$ the total local government spending. The outcome of this problem is a demand system conditioned on $\hat{e}$ and c, i.e.

$$g_j = \hat{f}_j(p_1, ..., p_n, \hat{e}, c; \boldsymbol{\theta}) \qquad j = 1, ..., n \tag{3}$$

The demand system given in equations (3) will be referred to as the 'conditional demand system'. The conditional demand system addresses how a given local public budget is allocated between local public services.

Let us now turn to the more comprehensive model (the benchmark model), which also recognizes how the municipality raises revenue. This model will be referred to as the 'complete demand system'. The representative agent still derives utility from the consumption of a private good c, and a bundle of public services, $g_1, ..., g_n$. The local government raises revenues by using a proportional income tax, τ, matching grants, $\varpi_1, ..., \varpi_n$, and a lump-sum transfer from the central government, z. The allocation of private and public consumption preferred by the representative agent is defined by maximization of the utility function

$$u = u(g_1, ..., g_n, c; \boldsymbol{\theta}) \tag{4}$$

subject to the private and local public budget constraints

$$c = y(1 - \tau) \tag{5a}$$

$$\sum_{j=1}^{n} p_j g_j = \tau y + z \tag{5b}$$

where the price of the private consumption good has been normalized to one and y is the representative agent's gross income. The matching grant to service sector j is part of p_j. By solving equation (5a) for τ and substituting into equation (5b), we can write the budget constraint of the representative agent as

$$c = x - \sum_{j=1}^{n} p_j g_j \tag{6}$$

where the representative agent's effective income (total income), x, is defined as $x = y + z$. Maximizing the utility function with respect to c and $g_1, ..., g_n$, subject to the budget constraints in equation (6), defines the representative agent's demand for the local public services and the private good as functions of prices, total per capita income and municipal characteristics

$$g_j = f_j(p_1, ..., p_n, x; \boldsymbol{\theta}), \qquad j = 1, ..., n \tag{7a}$$

$$c = f_{n+1}(p_1, ..., p_n, x; \boldsymbol{\theta}) \tag{7b}$$

Both the conditional and the complete demand system represent demand systems where the regular demand restrictions apply for the set of consumer goods (i.e., adding up, homogeneity and Slutsky symmetry).

A problem in the analysis of the demand for public services is the lack of appropriate measures of public output. The most common solution is to use expenditure as a proxy for output. The lack of information on service volumes also makes the identification of price effects problematic. A useful approach to this problem is to calculate the operating cost per unit of labor corrected for matching grants (see Ehrenberg 1973; Bahl et al. 1980).[5] Following Ehrenberg and Bahl et al., this paper assumes a labor-intensive Leontief production function for each public service.[6] Nonlabor expenditures (i.e. materials and capital) are assumed to be proportional to the labor input. Separating the expenditures into price and volume components gives

$$e_j = (w_j + r_j)n_j = p_j^* n_j \tag{8}$$

where e_j is the expenditure in service sector j, w the wage rate, r the cost of nonlabor input per unit of labor and n the labor input. The net price, p, is obtained by subtracting the matching grant per unit of labor

$$p_j = p_j^* - (\varpi_j / n_j) = (e_j - \varpi_j)/n_j \tag{9}$$

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[5] This "public employment approach" is applied to Norwegian data by Borge and Rattsø (1995) and Aaberge and Langørgen (2003).

[6] It follows, by their approach, that labor is considered to be homogenous within each service producing sector.

The net price per unit of labor reflects the wage rate, the cost of nonlabor inputs and the matching grants (the net price is further discussed in the next section).[7]

3 Empirical Analysis

The empirical part of the paper begins with a description of the data. I will then present the empirical model and the estimation results.

3.1 Data and some Institutional Characteristics

The sample consists of a panel containing 273 Swedish municipalities over an eight year period (1998-2005).[8] The data were obtained from Statistics Sweden, the Swedish Labour Market Board and the Swedish Association of Local Authorities and Regions. As mentioned above, Swedish municipalities collect tax revenues by using a proportional income tax. This tax is the most important source of funds for the majority of municipalities, followed by user fees and general grants. The Swedish intergovernmental transfer system is built around formula-based general grants. A significant policy reform in 1993 replaced the previous system of matching grants with a system of general grants. However, a small number of matching grants was also used by the central government during the period of study.

Let us now turn to the variables to be used in the estimations. The local public services examined are: child care, social services, elderly care, comprehensive education, 'infrastructure and protection'[9] (called 'infra' in the tables)

[7] Another useful approach to identify prices is to calculate the decisive voter's tax price, which is often measured as the tax share of the median income consumer in the locality (see Bergstrom and Goodman, 1973). The problem with extending a median voter model to a system of public sector demand equations is that the median individual generally will differ for different services. Extensions of the traditional median voter model (based on deterministic voting) to the multidimensional case gives a probabilistic voting model (see Enelow and Hinich, 1984, for an overview of probabilistic voting). Craig and Inman (1986) propose a voter group decision model to solve the multidimensionality problem, where the allocation is a political compromise among voter groups.

[8] The number of Swedish municipalities increased during the study period from 288 (1998) to 289 (1999-2002) to 290 (2003-2005). Three large municipalities are excluded from the study (Malmö, Göteborg and Gotland) due to partly joint expenditures between the municipality and the region during part of the study period. In addition, twelve municipalities are excluded due to missing values. This leaves a balanced panel with 273 municipalities.

[9] The service 'infrastructure and protection' includes expenditures on construction (roads,

and 'other expenditures'.[10] Together, these six services account for the entire operating expenditure in the municipalities, $\hat{e}$.[11] The local public expenditures are adjusted by Statistics Sweden to ensure that it measures the operating expenditure net of fees and net of services consumed by other municipalities.[12] The total per capita income, x, is computed as the sum of the average tax base in the municipality[13] and the per capita lump-sum transfer from the central government, z.

The demand systems in equations (3) and (7a)-(7b) will be estimated by using the QAIDS specification (the specification is further discussed in the next subsection). The data available describes service expenditures and not quantities, which suggests that the demand equations should be estimated in terms of expenditure shares. It is important to distinguish between the *conditional* demand system and the *complete* demand system when the models are operationalized. The expenditure shares in the conditional demand system, $\hat{s}_j$, are defined as local public budget shares, which means that they are computed as the expenditure on each service, j, divided by the total local public expenditures, i.e. $\hat{s}_j = e_j/\hat{e}$.[14] The private consumption, c, is defined as the total real per capita income net of local public consumption.[15] The expenditure shares in the complete demand system, s_j, are defined in terms of total income, meaning that they are computed as the expenditure associated with each service, j, divided by the total per capita income, i.e. $s_j = e_j/x$. The trends of the expenditure shares (both in terms of the local public budget and in terms of income) during the period of study are shown in Table A4 in the Appendix.

The price of each public service, p_j, is measured as the operating cost per

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parking lots, parks etc.), fire services, environmental protection, community protection, tourism and expenditures for promoting local business.

[10]The variable measuring 'other expenditures' includes expenditures on central administration, cultural services, leisure activities and expenditures for special events.

[11]The municipalities' business activities are not considered as operating costs. The reason is that the business activities are financed by fees and charges and not via the local public budget.

[12]The operating expenditure financed by fees is considered as private consumption by Statistics Sweden and therefore is not included in this measure of public expenditures.

[13]An alternative would be to measure the private income net of the taxes paid to the central and regional governments. Changing the income measure in this way does not alter any of the main qualitative results.

[14]See Deacon (1978) and Borge and Rattsø (1995).

[15]The per capita private consumption is calculated by using the budget constraint given by equation (6). The variable is adjusted by the CPI (2005 is base year).

unit of labor[16] corrected for matching grants, i.e. $p_j = (e_j - \varpi_j)/n_j$.[17] It is reasonable to assume that the labor input, to a large extent, is determined by the wage rate. The development of the wage rate in different service sectors is expected to be the main source of relative price shift. Higher wage rates or smaller matching grants increase the prices of public services, which are paid by the representative agent in the municipality.

There exists a number of specific grants. Some of them are matching while others are not. The data describing the specific grants is an aggregate of all the specific grants to each service in each municipality, which leaves two possible approaches; (1) treating all of them as matching grants or (2) treating all of them as lump-sum grants. As it turned out, both these approaches give similar qualitative results. In the main text I will treat all the specific grants as matching.[18] The trends of the relative prices during the period of study are shown in Table A3 in the Appendix.

Following earlier literature on the determinants of municipal expenditures, the models also include relevant local characteristics such as population density, age structure of the population, political preferences and political strength. The age variables correspond to the percentage of residents aged 6 or younger, CH, residents aged 7-15, YO, and residents aged 75 or older, EL. The population density, $DENS$, and the size of the population, POP, are included in the analysis to detect possible scale effects.[19] The density is measured by the number of residents per square kilometer. Political preferences are controlled for by including the share of the seats in the municipal parliament occupied by members of either the Social Democratic Party or the Left Party, $LEFT$.

[16] The hours worked within a service sector is converted into units of labor by the Swedish Association of Local Authorities and Regions. As a result, one unit of labor corresponds to a full-time job.

[17] 2005 is the base year.

[18] Earlier studies based on Swedish data for the current study period give no guidance as to whether the specific grants should be treated as matching or lump-sum grants. A policy reform implemented in 2002 meant that the majority of the specific grants to the child care sector became lump-sum grants. The specific grants to the child care sector will, therefore, be treated as block grants for the years 2002-2005. Estimating a model where all the specific grants are treated as block grants does not lead to any important changes in the qualitative results discussed below (the results are available from the author upon request). This suggests that the variation in the price variables is driven mainly by factors other than the specific grants.

[19] See Borge and Rattsø (1993).

Political strength is represented by a Herfindahl index, $HERF$, i.e. the sum of the squared shares of each party in the local parliament. Finally, a variable measuring the unemployment rate, $UNEMP$, is also included as a control variable. Summary statistics for these variables are presented in Table A1-A2 in the Appendix.

3.2 Specification of the Empirical Model

I apply the QAIDS developed by Banks et al. (1997), implying that the conditional demand system in equations (3) is written as follows

$$\begin{aligned} \hat{s}^i_{jt} &= \hat{\alpha}_j + \sum_{k=1}^{n} \hat{\gamma}_{jk} \ln p^i_{kt} + \hat{\beta}_j \ln[\hat{e}^i_t / a^i(\mathbf{p}_t)] \\ &+ \left(\hat{\lambda}_j / b^i(\mathbf{p}_t)\right) \times \left(\ln[\hat{e}^i_t / a^i(\mathbf{p}_t)]\right)^2 \\ &+ \hat{\kappa}_j \ln c^i_t + \hat{\boldsymbol{\eta}}_j \ln \boldsymbol{\theta}^i_t + \hat{\varphi}^i_j + \hat{\pi}_{jt} + \hat{u}^i_{jt} \\ for \quad j &= 1, ..., n-1 \end{aligned} \tag{10}$$

where superscript i refers to municipality, subscript j to service sector, subscript t to time period, φ is a municipality-specific effect, π is a year-specific effect, and u is an error term. The public service 'other expenditures' is excluded when estimating the conditional demand system. The excluded equation follows by adding-up. The functions $\ln a^i(\mathbf{p}_t)$ and $\ln b^i(\mathbf{p}_t)$ are defined by

$$\ln a^i(\mathbf{p}_t) = \sum_{j=1}^{n} \hat{\alpha}_j \ln p^i_{jt} + \frac{1}{2} \sum_{j=1}^{n} \sum_{k=1}^{n} \hat{\gamma}_{jk} \ln p^i_{jt} \ln p^i_{kt} \tag{11}$$

$$\ln b^i(\mathbf{p}_t) = \sum_{j=1}^{n} \hat{\beta}_j \ln p^i_{jt} \tag{12}$$

The QAIDS is a quadratic extension to Deaton and Muellbauer's (1980) almost ideal demand system. The advantage with the QAIDS specification, compared to the AIDS formulation, is that it recognizes the possibility that expenditures are non-linear functions of income (or total expenditure).

The second specification that will be estimated is the complete demand system given by the equations (7a)-(7b)

$$
\begin{aligned}
s_{jt}^{i} &= \alpha_j + \sum_{k=1}^{n} \gamma_{jk} \ln p_{kt}^{i} + \beta_j \ln[x_t^i / a^i(\mathbf{p}_t)] \\
&\quad + \left(\lambda_j / b^i(\mathbf{p}_t)\right) \times \left(\ln[x_t^i / a^i(\mathbf{p}_t)]\right)^2 \\
&\quad + \boldsymbol{\eta}_j \ln \boldsymbol{\theta}_t^i + \varphi_j^i + \pi_{jt} + u_{jt}^i \\
for \;\; j &= 1, ..., n
\end{aligned} \tag{13}
$$

The composite private consumer good is excluded when estimating the complete demand system. The excluded equation follows by adding-up.

Blundell et al. (1993) simplify the estimations by using the Stone price index, $\ln P_t = \sum_{j=1}^{n} s_{jt} \ln p_{jt}$, instead of the translog form price index, $\ln a^i(\mathbf{p}_t)$, and by using unity instead of the price aggregator, $\ln b^i(\mathbf{p}_t)$. However, Matsuda (2006) finds that Laspeyre's price index, $\ln P_t = \sum_{j=1}^{n} s_{j\breve{t}} \ln p_{jt}$, where $s_{j\breve{t}}$ is the budget share for service j in the base period $\breve{t}$, performs better than the Stone price index.[20] According to Matsuda, the formulation of the price index is of great importance (especially if the time series turns out to be nonstationary). This paper follows Blundell et al. (1993) by replacing the price aggregator $\ln b^i(\mathbf{p}_t)$ with unity, and Matsuda (2006) by using Laspeyre's price index[21] (based on unity in 2005) instead of $\ln a^i(\mathbf{p}_t)$.[22]

Income is a potentially endogenous regressor, because a change in the municipal policy may affect the labor supply and, to some extent, also the migratory behaviour (for a similar reason, the total resources available for public consumption and the consumption of the composite private good are potentially endogenous regressors in the conditional demand system).[23] This suggests the use of an instrumental variables regression (IV) where the total income variables, $\ln(x_t/P_t)$ and $(\ln(x_t/P_t))^2$, are instrumented in the complete demand system. Similarly, the total expenditure variables, $\ln(\hat{e}_t/P_t)$ and $(\ln(\hat{e}_t/P_t))^2$,

[20] See also Moschini (1995).

[21] 2005 is used as the base year.

[22] Replacing Laspeyre's price index with Stone's price index does not alter the qualitative results discussed in the next subsection.

[23] Empirical studies based on Swedish data finds evidence that a change in taxation affects the labor supply (see Blomquist, 1983, and Aronsson and Palme, 1998). The relation between taxation and migratory behaviour, based on Swedish data, is analyzed by Westerlund and Wyzan (1995).

and the private consumption, $\ln c$, are instrumented in the conditional demand system.[24] The share of residents with college education, $COLLEGE$, and the average age of women giving birth to their first child, $FBORN$, are used as instrumental variables. A lower rate of college education and a lower average age of women giving birth to their first child are both expected to result in a lower income in the municipality. The lag of these variables as well as lagged exogenous variables[25] will also be used as instruments. Each system of demand equations is estimated by using 3SLS. This approach estimates the demand equations simultaneously rather than as separate equations, which makes it possible to analyze cross-price effects and test for symmetry.

[24] The lags of the endogenous variables would be valid as instruments in the absence of serial correlation. However, it turns out that the variables are serial correlated.

[25] The one and two-period lag of the exogenous variables DENS, POP, LEFT, HERF and UNEMP are used as instruments.

3.3 Results

The unconstrained parameter estimates for both the complete and the conditional demand system are reported in Tables B1-B2 in the Appendix. The diagnostics for the first-stage regression imply that the chosen instruments are significant and valid. The conventional test for instrument significance is the F-statistic of the joint significance of the instruments in the first-stage regression. However, this test is not valid when there are multiple endogenous regressors (see Baum et al., 2003). In these cases, Stock and Yogo (2002) suggest using the Cragg-Donald F-statistic (the authors also compute the critical values).[26] The estimate of the Cragg-Donald F-statistic rejects the null of weak instruments for both the complete demand system ($F= 10.96$) and for the conditional demand system ($F = 10.41$).[27] Besides significance, the instruments also need to be exogenous, i.e. there shall be no direct effect of the instruments on the dependent variable (other than through their effect on the endogenous regressor). The validity of the instruments is tested by using Hansen's J-test.[28] In 8 out of 11 cases, the estimates of Hansen's J cannot reject the null hypothesis that the instruments are uncorrelated with the error term at the five percent level (see Tables B1-B2 in the Appendix).[29]

The interpretation of the estimated income and price parameters, i.e. the estimated β:s, λ:s and γ:s, will be discussed in terms of income and price elasticities. The formula[30] for the income elasticity in the complete demand system

[26] The Cragg-Donald F-statistic is originally a test of under-identification.

[27] The critical value for two endogenous variables, at the five percent level and allowing for a maximum relative bias of 10 percent compared to OLS, is 10.84. This level of maximum bias relative to OLS corresponds to the rule of thumb that, for the case of a single endogenous regressor, instruments are weak if the first-stage F-statistic is less than ten. The corresponding critical value for three endogenous variables is 10.14. Even if the null hypothesis is rejected for both demand systems, the set of instruments does not seems to be very strong. Estimating the demand systems by OLS, instead of by IV, does not change the qualitative results further discussed, neither in terms of point estimates of the elasticities nor in terms of t-values (one exception is that the t-value for the budget-elasticity for 'infra' in the conditional demand system turns significant, which suggests that 'infra' is a luxury good in the local public budget).

[28] This test is applicable in the presence of serial correlation and heteroskedasticity.

[29] Estimations where COLLEGE and FBORN are used as including instruments (only the lag of these variables and lagged exogenous variables are used as excluding instruments), do not alter the qualitative results discussed in this section.

[30] The formulas for the income and price elasticities are derived in Blundell et al. (1993).

is given by

$$E^i_{jt} = (\beta_j + 2\lambda_j \ln m^i_t)/s^i_{jt} + 1 \tag{14}$$

where $m^i_t = x^i_t/P_t$. The formula for the uncompensated price elasticity of service j with respect to the price of service k is given by

$$E^i_{jkt} = (\gamma_{jk}/s^i_{jt}) - (\beta_j + 2\lambda_j \ln m^i_t)(s^i_{k\check{t}}/s^i_{jt}) - h_{jk} \tag{15}$$

where $h_{jk} = 1$ if $j = k$ and $h_{jk} = 0$ if $j \neq k$. The compensated price elasticities then become

$$S^i_{jkt} = E^i_{jkt} + E^i_{jt}s^i_{kt} \tag{16}$$

The corresponding elasticities in the conditional demand system, to be called $\hat{E}^i_{jt}$, $\hat{E}^i_{jkt}$, and $\hat{S}^i_{jkt}$ respectively, are measured in the same general way. The income elasticity will be denoted 'budget elasticity' in the conditional demand system (where $\hat{m}^i_t = \hat{e}^i_t/P_t$). Note that the budget elasticity measures the percentage change in the quantity demanded if the real public budget increases by one percent. The price elasticities referring to the conditional demand system reflect increased costs of local services within a given local public budget.

The Conditional Demand System

The elasticities associated with the conditional demand system are presented in Table 1. Child care and elderly care are the services with the lowest point estimate of the budget elasticity, 0.80, whereas 'infra' is the service with the highest point estimate, 2.09.[31] Using that the sum of the weighted budget elasticities (where $\hat{E}^i_{jt}$ is weighted by $\hat{s}^i_{jt}$) is equal to one[32] gives a point estimate of the budget elasticity for the excluded service, 'other expenditures' (i.e. expenditures on cultural services, leisure activities, central administration and special events), equal to 1.09. The significance of the parameter estimates of the budget elasticities are tested with t-tests. None of the t-tests reject the null hypothesis that the budget elasticity is equal to one at the five percent significance level. This suggests that the budget elasticities are interpretable as if all

[31] The elasticities in the conditional demand system are evaluated at the mean of the data (the budget shares are evaluated at the base year).

[32] This is true by definition and easy to obtain by using $\sum_j(\partial\hat{s}_j/\partial\hat{m}) = 0$.

services are normal goods (at the mean of the data) in the local public budget. 'Infra' is close to being considered a luxury good, but the null hypothesis that the elasticity is one cannot be rejected at the five percent level ($t = 1.81$).

Comparing the point estimates of the budget elasticities between budget-quartiles (the municipalities are sorted with respect to the size of the total per capita budget) implies only small differences in the point estimates (the budget elasticities for each budget-quartile is presented in Table B3 in the Appendix). The coefficients of the conditional demand system reveal that the nonlinear effects of the total expenditure is significant (at the five percent level) in three out of five cases, which supports the use of QAIDS.

All the compensated own-price elasticities resulting from the conditional demand system are negative, suggesting that the negativity condition is fulfilled. The compensated own-price elasticities vary between -0.57 for education and -0.86 for social service. All the compensated cross-price elasticities are positive and relatively small (typically much smaller than the own-price elasticities). On the other hand, the uncompensated cross-price elasticities are in general negative, suggesting that the negative income effect dominates the positive substitution effect.

There are no previous studies, based on Swedish data, dealing with a conditional demand system for local public services. However, the Swedish local public decision structure resembles the Norwegian one in many respects (e.g. the organization of the public sector and the services provided by the local governments). Earlier research on the composition of local public expenditures in Norway are based on models resembling the conditional demand system (Borge and Rattsø, 1995; Aaberge and Langørgen, 2003).[33] Consistent with the Norwegian study by Aaberge and Langørgen, 'infra' is a sector with a relatively high point estimate of the budget elasticity. Also the budget elasticities for child care, elderly care and 'other expenditures'[34] resemble the corresponding budget elasticities in the study by Aaberge and Langørgen. Our point estimate of

[33] The system of financing the local public services in Norway is more centralized than in Sweden. The maximum tax rate that the Norwegian municipalities are allowed to use is set by the central government. Municipalities that set a higher tax rate than the one decided upon by the central government are expected to be penalized via the grant system.

[34] The point estimate of budget elasticity for 'other expenditure' (i.e. expenditures on cultural services, leisure activities, central administration and special events) is compared with the point estimates of the budget elasticities for 'administration' and 'cultural services' (which have the same point estimates) estimated by Aaberge and Langørgen (2003).

the budget elasticity of education, 1.01, is somewhat higher than the estimates found on Norwegian data (Borge and Rattsø, 1995; Aaberge and Langørgen, 2003) and earlier studies based on US data (Feldstein, 1975; Ladd, 1975).

Borge and Rattsø (1995) find that local public services and private consumption cannot be treated as separable. In the present study, a t-test shows that public services and private consumption cannot be treated as separable in the equation for social services (see Table B1 in the Appendix). Furthermore, a Likelihood ratio-test rejects a restricted version of the conditional demand system where private consumption is excluded, compared to the alternative where private consumption is included ($\chi^2_{[5]} = 32.49$).[35] This suggests that private consumption is not separable from the consumption of public services.

Table 1. Elasticities referring to the Conditional Demand System

A. Budget Elasticities:

	Commodity j				
	Child	Social	Eld	Edu	Infra
	0.80	1.04	0.80	1.01	2.09
	(-0.72)	(0.07)	(-1.26)	(0.07)	(1.81)

B. Compensated Price Elasticities:

	Commodity j				
Commodity k	Child	Social	Eld	Edu	Infra
Child	-0.73	0.05	0.25	0.08	0.13
	(-32.60)	(1.88)	(2.02)	(0.59)	(4.82)
Social	0.10	-0.86	0.39	0.03	0.05
	(1.80)	(-115.6)	(1.45)	(0.09)	(2.71)
Eld	0.20	0.25	-0.59	0.29	0.59
	(2.99)	(1.64)	(-54.43)	(14.91)	(3.66)
Edu	0.28	0.23	0.33	-0.57	0.51
	(4.30)	(1.61)	(29.96)	(-36.25)	(3.25)
Infra	0.08	0.05	0.34	0.05	-0.81
	(1.82)	(5.01)	(1.49)	(0.18)	(-75.91)

(Continued on next page).

[35] The critical value, at the five percent significant level, is 11.07.

Table 1. (Continued)

C. Uncompensated Price Elasticities:

	Commodity j				
Commodity k	Child	Social	Eld	Edu	Infra
Child	-0.83	-0.07	0.16	-0.04	-0.12
	(-15.49)	(-1.26)	(1.10)	(-0.26)	(-1.73)
Social	0.05	-0.92	0.35	-0.03	-0.07
	(0.73)	(-26.04)	(1.24)	(-0.11)	(-1.40)
Eld	-0.06	-0.08	-0.85	-0.03	-0.07
	(-2.06)	(-2.00)	(-14.58)	(-0.53)	(-1.53)
Edu	-0.01	-0.14	0.05	-0.93	-0.25
	(-0.30)	(-2.02)	(0.74)	(-15.16)	(-3.16)
Infra	0.02	-0.02	0.28	-0.02	-0.95
	(0.37)	(-0.56)	(1.19)	(-0.09)	(-20.26)

Note: t-values in parentheses. Under the null hypotheses it is assumed that the budget elasticities are equal to one and that the price elasticities are equal to zero.

The Complete Demand System

The elasticities in Table 2 refer to the complete demand system.[36] The complete demand system recognizes that the local public expenditure composition is determined simultaneously with the collection of local public revenues. Social service has the lowest point estimate of the income elasticity, -0.51. For all other services, the point estimate of the income elasticity is positive. 'Infra' is the service with the highest point estimate of the income elasticity, 1.37. As can be seen from Table 2, t-tests can reject the null hypothesis that the income elasticity is equal to one for social services, elderly care and education. The null hypothesis that the income elasticity is equal to zero is rejected for all services except for social services (t = -1.41), which is close to being considered an inferior good. The t-tests imply that all services, except for social services, are normal goods at the mean of the data. Elderly care and education are necessities if measured at the mean of the data, meaning that the estimates of the income elasticity for these services are significantly positive and significantly less than one.

[36] The elasticities in the complete demand system are evaluated at the mean of the data (the income shares are evaluated at the base year).

Comparing the income elasticities between income-quartiles (the municipalities are sorted with respect to the size of the total per capita income) indicates only small differences (see Table B3 in the Appendix). The parameter estimates of the complete demand system show that the nonlinear effect of the total income is significant in five out of six cases at the five percent level (see Table B2 in the Appendix), which motivates the use of the QAIDS.

The compensated own-price elasticities implied by the complete demand system are negative for all services. The lowest absolute value is found for education, 0.75, while the highest value is found for social services, 0.89. In general, the compensated cross-price effects are positive and quite small. The point estimates of the uncompensated cross-price elasticities differ in sign across services and are relatively small in absolute value.

It is not easy to relate the results in Table 2 to earlier Swedish studies, as these have either focused on the determinants of aggregate local public spending (Aronsson and Wikström, 1996; Dahlberg and Jakobsson, 2000),[37] or individual components of total spending (Ahlin and Johansson, 2001).[38] In general, the income elasticities are smaller than the corresponding budget elasticities in the conditional demand system (especially for social services). All the own-price elasticities in the complete demand system are higher in absolute value compared to the own-price elasticities in the conditional demand system. Finally, both demand systems imply that the cross-price elasticities are relatively small (at least by comparison with the own-price elasticities).

What will happen to the share of income spent on municipal services, as the total per capita income increases in the municipality? The marginal effect that corresponds to this decision is given by

$$\frac{\partial s_g^i}{\partial m^i} = \sum_{j=1}^{6} \frac{\partial s_j^i}{\partial m^i} = \sum_{j=1}^{6} (\beta_j + 2\lambda_j \ln m^i)/m^i \tag{17}$$

[37] Using the median voter approach when analyzing the determinants of the total local public expenditures in Sweden, Aronsson and Wikström (1996) estimated the income elasticity to be 0.82 and the price elasticity to be 0.53 in absolute value. Dahlberg and Jakobsson (2000) also analyze the total local public expenditures in Sweden and found income elasticities in the interval 0.47-1.30 and price elasticities in the interval 0.67-1.48 in absolute value.

[38] Ahlin and Johansson (2001) estimated the income elasticity for local school expenditures in Sweden to be 0.73-1.13 by using a method based on survey data.

where the summation represents the six local public services included in the regression of the complete demand system. Calculating the marginal effect (as an average for all municipalities) implies that the total local public budget, as a share of the total income, decreases by 0.09 percentage points when the real total per capita income increases by 1000 SEK. Comparing the marginal effect between income-quartiles indicates only small differences.

Table 2. Elasticities referring to the Complete Demand System

A. Income Elasticities:

	Commodity j					
	Child	Social	Eld	Edu	Infra	Other
	0.83	-0.51	0.43	0.49	1.37	1.24
	(-0.91)	(-4.16)	(-4.40)	(-5.00)	(0.79)	(0.80)

B. Compensated Price Elasticities:

	Commodity j					
Commodity k	Child	Social	Eld	Edu	Infra	Other
Child	-0.77	0.02	0.18	0.20	0.06	0.17
	(-60.12)	(0.75)	(5.98)	(6.78)	(2.01)	(7.97)
Social	0.03	-0.89	0.29	0.32	0.04	0.01
	(2.88)	(-119.8)	(4.66)	(5.17)	(3.96)	(0.76)
Eld	0.02	-0.07	-0.79	0.11	0.15	0.12
	(1.13)	(-1.53)	(-67.82)	(11.44)	(2.67)	(3.28)
Edu	0.12	-0.05	0.17	-0.75	0.05	0.28
	(4.95)	(-0.99)	(10.16)	(-67.61)	(0.82)	(6.93)
Infra	0.01	0.00	0.23	0.28	-0.83	0.04
	(1.30)	(0.33)	(4.64)	(5.49)	(-71.29)	(5.12)
Other	0.03	0.02	0.21	0.26	0.06	-0.85
	(3.50)	(1.27)	(4.87)	(5.94)	(2.79)	(-61.42)

(Continued on next page).

Table 2. (Continued)

C. Uncompensated Price Elasticities:

	Commodity j					
Commodity k	Child	Social	Eld	Edu	Infra	Other
Child	-0.80	0.04	0.16	0.18	0.02	0.13
	(-53.48)	(1.39)	(4.85)	(5.61)	(0.61)	(5.73)
Social	0.02	-0.88	0.28	0.31	0.02	-0.01
	(1.27)	(-95.14)	(4.41)	(4.92)	(1.29)	(-1.22)
Eld	-0.05	-0.02	-0.82	0.07	0.02	0.01
	(-2.87)	(-0.66)	(-48.91)	(4.36)	(0.63)	(0.29)
Edu	0.04	0.00	0.08	-0.79	-0.08	0.16
	(1.86)	(0.06)	(4.56)	(-49.75)	(-1.67)	(4.72)
Infra	-0.01	0.01	0.23	0.27	-0.86	0.02
	(-0.52)	(1.32)	(4.27)	(5.11)	(-62.67)	(1.53)
Other	0.02	0.03	0.20	0.25	0.03	-0.88
	(1.32)	(1.89)	(4.37)	(5.41)	(1.27)	(-56.01)

Note: t-values in parentheses. Under the null hypotheses it is assumed that the income elasticities are equal to one and that the price elasticities are equal to zero.

Turning to the effects of local characteristics (the vector $\boldsymbol{\theta}$) implied by the complete demand system (see Table B2 in the Appendix), the results are qualitatively similar to those of earlier comparable literature on local public expenditures.[39] Recall that the municipalities are responsible for providing child care, comprehensive education and elderly care. We find that the higher the share of individuals in the age corresponding to child care (0-6), primary education (7-15), and the oldest residents in the municipality (75-), respectively, the higher the expenditure share in the corresponding service sector. Political preferences have significant effects on the expenditures: the results suggest that a municipality represented by a large share of left wing seats in the local parliament, ceteris paribus, is associated with higher expenditure shares on elderly care and 'infra'. A higher rate of unemployment contributes to a higher expenditure share on education.[40]

Finally, the results have been used for testing the general restrictions of the demand system. Tests of homogeneity and symmetry are given in Tables B1-B2 in the Appendix. A Likelihood ratio-test rejects a restricted demand system

[39] Replacing the local characteristics with the one-period lag of the local characteristics does not alter the qualitatively results.

[40] Many municipalities offer comprehensive education also to adults.

(where all the restrictions are imposed) against the unconstrained alternative for both the complete demand system ($\chi^2_{[26]} = 397.09$) and the conditional demand system ($\chi^2_{[19]} = 344.19$).[41] However, even if homogeneity and Slutsky symmetry are imposed, this does not alter the main findings discussed above. The estimation results from the restricted versions of the demand systems, and a discussion of the restrictions, are presented in the Appendix C.

4 Conclusion

This paper, which concerns the determinants of municipal expenditures in Sweden, simultaneously analyzes tax revenue collection and how the resources are allocated between different local public services. In order to understand the priorities made by municipalities, a complete demand system is required, implying that private consumption is also considered in the model. The empirical study is based on panel data for the period 1998-2005 and contains results from estimating a demand system comprising a composite private consumption good and six local public services. The local characteristics that affect the allocation of local public consumption according to the theoretical model, such as total per capita income, prices, and municipal characteristics, are considered in the regressions. The results show that the point estimates of all income elasticities except one are positive, and that none of them significantly exceed one. Among the results, it is also found that the own-price elasticities are negative and less than one in absolute value for all services.

For purposes of comparison, we also estimate a demand system that is conditioned on the total revenue that can be used for local public consumption. The results from this conditional demand system are similar to related studies based on Norwegian data (Borge and Rattsø, 1995; Aaberge and Langørgen, 2003).

[41] The critical value, at the five percent significance level, is 38.89 when testing the complete demand system, and 30.14 when testing the conditional demand system.

Appendix A: Summary Statistics

Table A1. Description of the variables

Variable	Description
s_j	The expenditure on service j as a share of the total income in the municipality.
$\hat{s}_j$	The expenditure on service j as a share of the local public budget.
p_j	The price of the local public service j.
x	Total income, the sum of the tax base and the general grants (SEK per capita).
$\hat{e}$	Total budget (SEK per capita).
c	The consumption of the composite private good (SEK per capita).
CH	The percentage of residents aged 6 or younger.
YO	The percentage of residents aged 7-15.
EL	The percentage of residents aged 75 or older.
DENS	The population density, residents per square kilometer.
POP	The population size, number of persons.
LEFT	The percentage of Social Democrats and Left Party members in municipal parliament.
HERF	A Herfindahl index (in percent) measuring political strength in the municipal parliament.
UNEMP	The percentage of unemployed.
FBORN	The average age of women giving birth to their first child.
COLLEGE	The percentage of residents with college education.

Table A2. Summary statistics, 1998-2005

Variable	Mean	Std.dv.	Min	Max
$\hat{m}$	36109	4820	22261	54203
m	127777	15020	94217	219500
$c^{a)}$	91911	13547	63569	180656
CH	7.32	1.07	4.71	11.77
YO	12.41	1.13	6.81	16.43
EL	9.70	2.23	2.85	16.03
DENS	105.7	346.9	0.1	4107.0
POP	29244	51739	2553	771038
LEFT	46.93	11.28	11.11	77.42
HERF	24.81	4.36	16.60	45.47
UNEMP	3.98	1.44	0.9	10.9
FBORN	27.43	1.24	23.02	33.03
COLLEGE	13.89	5.12	6.72	39.71

Note: The figures are unweighed averages over the estimation period using a sample of 273 municipalities (out of 290). The variables $\hat{m}$ and m are deflated by Laspeyre's price index.
$^{a)}$ The private consumption is deflated by the Swedish CPI(2005=100).

Table A3. Development of relative prices and real total per capita income

	P	$\frac{P_{child}}{P}$	$\frac{P_{social}}{P}$	$\frac{P_{eld}}{P}$	$\frac{P_{edu}}{P}$	$\frac{P_{infra}}{P}$	$\frac{P_{other}}{P}$	x/P
1998	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1999	101.03	101.90	105.13	99.03	100.28	98.06	100.27	103.04
2000	101.90	102.86	100.82	99.67	100.43	96.54	99.08	107.47
2001	103.05	103.54	97.85	100.20	100.40	92.73	101.12	112.87
2002	104.52	107.14	104.54	100.02	99.39	90.22	100.91	117.69
2003	106.01	108.19	102.24	100.06	99.64	88.82	100.97	122.14
2004	106.99	109.83	101.42	99.91	99.51	90.44	100.08	126.62
2005	107.90	109.80	100.16	99.23	100.38	91.29	99.05	129.73

Note: The figures are unweighted averages over the estimation period using a sample of 273 municipalities (out of 290). The price index P is the Laspeyre's price index.

Table A4. The Expenditure Shares

A. In terms of Total Public Expenditures

	Child	Social	Eld	Edu	Infra	Other
Average budget shares (multiplied by 100) 1998-2005						
1998	11.7	6.2	29.4	35.2	7.6	10.0
1999	11.3	5.9	30.2	36.0	7.3	9.4
2000	10.9	5.9	31.0	36.6	7.0	8.7
2001	10.7	5.6	31.5	36.7	7.0	8.5
2002	11.4	5.6	31.6	36.2	6.9	8.3
2003	11.6	5.7	31.8	35.9	6.8	8.1
2004	11.7	5.8	31.7	36.1	6.8	8.0
2005	12.0	5.8	31.6	35.9	6.8	7.9
Cross-section variation in the budget shares, 2005						
Min	5.7	1.4	13.4	26.4	2.5	3.9
Max	21.2	11.1	42.3	48.2	14.9	13.0
Stdev	2.8	1.9	4.8	3.4	1.7	1.5

(Continued on next page).

Table A4. (Continued)

B. In terms of Total Income

	Child	Social	Eld	Edu	Infra	Other	Private
Average budget shares (multiplied by 100) 1998-2005							
1998	3.3	1.7	8.6	10.1	2.2	2.9	71.3
1999	3.2	1.7	8.9	10.4	2.2	2.7	70.9
2000	3.0	1.6	8.9	10.4	2.0	2.5	71.5
2001	3.0	1.6	9.1	10.4	2.0	2.4	71.5
2002	3.2	1.6	9.2	10.3	2.0	2.4	71.4
2003	3.3	1.6	9.2	10.2	2.0	2.3	71.4
2004	3.2	1.6	8.9	10.0	1.9	2.2	72.1
2005	3.2	1.6	8.8	9.9	1.9	2.2	72.4
Cross-section variation in the budget shares, 2005							
Min	1.9	0.5	3.0	4.9	0.8	0.9	63.2
Max	5.0	3.1	15.2	13.1	5.3	3.8	82.3
Stdev	0.5	0.5	2.1	1.2	0.6	0.5	3.2

Note: The figures are unweighted averages over the estimation period using asample of 273 municipalities (out of 290).

Appendix B: Estimation Results

Table B1. The Parameter Estimates from the Conditional DS

	Share Equations				
Variable	Child	Social	Eld	Edu	Infra
$\ln\hat{m}$	-0.090*	0.369***	0.127	0.011	-0.089
	(-1.73)	(7.29)	(1.57)	(0.14)	(-1.37)
$(\ln\hat{m})^2$	0.003	-0.017***	-0.009**	-0.000	0.008***
	(1.18)	(-6.74)	(-2.20)	(-0.09)	(2.34)
$\ln P_{child}$	0.018***	-0.004	-0.003	-0.011***	-0.005
	(6.62)	(-1.62)	(-0.77)	(-2.70)	(-1.61)
$\ln P_{social}$	0.000	0.005***	-0.002***	-0.003***	0.001*
	(0.50)	(10.86)	(-2.45)	(-5.30)	(1.81)
$\ln P_{eld}$	-0.008***	-0.005**	0.028***	-0.010***	-0.004
	(-3.57)	(-2.18)	(8.19)	(-3.09)	(-1.35)
$\ln P_{edu}$	-0.002	-0.008**	-0.003	0.025***	-0.016***
	(-0.63)	(-2.14)	(-0.58)	(4.36)	(-3.25)
$\ln P_{infra}$	-0.002***	-0.001*	-0.005***	-0.001*	0.009***
	(-4.02)	(-1.70)	(-5.15)	(-1.68)	(11.95)
$\ln P_{other}$	-0.001	-0.001	-0.004**	-0.000	-0.001
	(-0.64)	(-1.09)	(-2.21)	(-0.43)	(-0.49)
lnc	0.022	-0.053***	0.004	-0.012	0.003
	(1.12)	(-2.85)	(0.14)	(-0.43)	(0.14)
lnCH	0.039***	-0.034***	0.041***	-0.040***	-0.010
	(6.38)	(-5.66)	(4.36)	(-4.48)	(-1.25)
lnYO	0.009	-0.058***	0.015	0.069***	-0.050***
	(0.83)	(-5.77)	(0.95)	(4.51)	(-3.88)
lnEL	-0.005	-0.023***	0.081***	-0.029***	0.000
	(-0.65)	(-3.37)	(7.55)	(-2.87)	(0.04)
lnPOP	0.036***	-0.100***	-0.033	0.043**	0.025
	(2.72)	(-7.85)	(-1.62)	(2.26)	(1.55)
lnDENS	0.003	-0.001	-0.021***	-0.002	0.017***
	(0.58)	(-0.23)	(-2.49)	(-0.22)	(2.51)
lnLEFT	0.004	-0.003	0.011***	-0.012***	0.006
	(1.36)	(-1.02)	(2.49)	(-2.88)	(1.56)
lnHERF	-0.002	0.002	-0.016***	0.002	0.003
	(-0.65)	(0.76)	(-3.86)	(0.41)	(0.95)
lnUNEMP	0.002	-0.000	-0.002	-0.001	-0.000
	(1.13)	(-0.10)	(-0.83)	(-0.52)	(-0.17)
R^2	0.94	0.91	0.96	0.93	0.79
Listed variable, $\chi^2_{[17]}$	170.33***	37.82***	475.49***	670.58***	54.58***
Mun. effects, $\chi^2_{[272]}$	22.68***	29.01***	33.30***	20.45***	15.57***
Time effects, $\chi^2_{[7]}$	20.91***	4.69***	13.70***	8.44***	3.12***
Hansen J, p-value	0.11	0.13	0.01***	0.28	0.06*
Homogeneity, t-value	0.49	-1.68**	0.79	-0.11	-1.43
No. of observations	2184	2184	2184	2184	2184
No. of municipalities	273	273	273	273	273

Symmetry: $\gamma_{ij}=\gamma_{ij}$, $\chi^2_{[10]}=2.78$; $\lambda_i=\epsilon\beta_i$, $\chi^2_{[4]}=9.96$
Note: t-values in parentheses. The regressions in Table B1 include municipality specific effects and period specific effects. ***,** and * denote significance at the 1, 5 and 10 percent level, respectively.

Table B2. The Parameter Estimates from the Complete DS

	Share Equations					
Variable	Child	Social	Eld	Edu	Infra	Other
lnm	-0.016**	0.064***	0.048***	-0.002	-0.032***	-0.041***
	(-1.98)	(8.26)	(3.07)	(-0.16)	(-2.70)	(-4.43)
$(\ln m)^2$	0.000	-0.004***	-0.004***	-0.002**	0.002**	0.002***
	(0.80)	(-6.94)	(-3.87)	(-2.15)	(2.01)	(3.08)
$\ln P_{child}$	0.006***	0.000	0.002***	0.003***	0.000	0.003***
	(15.06)	(0.96)	(2.85)	(4.08)	(0.75)	(6.20)
$\ln P_{social}$	0.000	0.001***	0.000	-0.001***	0.001***	-0.000
	(1.31)	(12.41)	(0.05)	(-2.45)	(2.79)	(-0.99)
$\ln P_{eld}$	-0.002***	-0.000	0.011***	0.001	0.001	0.000
	(-3.04)	(-0.79)	(10.92)	(0.97)	(0.67)	(0.34)
$\ln P_{edu}$	0.001*	-0.000	0.004***	0.015***	-0.002*	0.004***
	(1.80)	(-0.04)	(2.82)	(14.11)	(-1.65)	(4.80)
$\ln P_{infra}$	-0.000***	-0.000	-0.001***	0.000*	0.003***	0.000***
	(-3.21)	(-0.75)	(-2.64)	(1.77)	(13.04)	(2.86)
$\ln P_{other}$	0.000	0.000	0.000	0.002***	0.001*	0.003***
	(1.00)	(0.94)	(0.22)	(4.57)	(1.65)	(9.09)
lnCH	0.012***	-0.007***	0.011***	-0.007***	-0.003	0.001
	(6.53)	(-4.31)	(3.17)	(-2.33)	(-1.24)	(0.50)
lnYO	0.005**	-0.011***	0.010**	0.038***	-0.009***	0.008***
	(2.10)	(-4.83)	(2.30)	(9.63)	(-2.61)	(3.03)
lnEL	-0.001	-0.001	0.026***	-0.002	0.003	-0.005***
	(-0.34)	(-0.78)	(7.30)	(-0.54)	(1.00)	(-2.47)
lnPOP	0.010***	-0.019***	-0.004	0.027***	0.016***	0.018***
	(3.19)	(-6.12)	(-0.60)	(4.94)	(3.42)	(4.99)
lnDENS	0.001	0.000	-0.004	0.002	0.007***	0.001
	(0.69)	(0.31)	(-1.27)	(0.58)	(3.15)	(0.64)
lnLEFT	0.001	-0.000	0.005***	-0.001	0.003**	-0.001
	(1.54)	(-0.25)	(3.17)	(-0.78)	(2.16)	(-1.49)
lnHERF	0.001	0.001	-0.003**	0.003**	0.002	0.004***
	(0.66)	(1.32)	(-2.26)	(2.09)	(1.61)	(4.61)
lnUNEMP	0.000	0.000	0.000	0.002***	0.001	0.001*
	(0.90)	(1.14)	(0.69)	(2.78)	(1.13)	(1.74)
R^2	0.83	0.89	0.97	0.94	0.84	0.88
Listed variable, $\chi^2_{[16]}$	163.93***	32.29***	301.32***	498.48***	40.59***	90.82***
Mun. effects, $\chi^2_{[272]}$	18.75***	26.89***	44.08***	23.34***	16.06***	22.10***
Time effects, $\chi^2_{[7]}$	33.39***	3.41***	25.89***	9.99***	4.73***	17.02***
Hansen J, p-value	0.13	0.06*	0.08*	0.00***	0.07*	0.02***
Homogeneity, t-value	5.27***	1.50	7.91***	11.70***	2.18**	8.02***
No. of observations	2184	2184	2184	2184	2184	2184
No. of municipalities	273	273	273	273	273	273

Symmetry: $\gamma_{ij} = \gamma_{ij}$, $\chi^2_{[15]} = 4.22$; $\lambda_i = \epsilon\beta_i$, $\chi^2_{[5]} = 11.61$
Note: t-values in parentheses. The regressions in Table B2 include municipality specific effects and period specific effects. ***,** and * denote significance at the 1, 5 and 10 percent level, respectively.

Table B3. The Sum of the Budget and Income Elasticities

Budget Elasticities Resulting from the Conditional Demand System

	Commodity j				
	Child	Social	Eld	Edu	Infra
Entire sample	0.79	1.04	0.79	1.01	2.15
	(-5.03)	(0.32)	(-5.93)	(11.49)	(3.96)
1st quartile	0.81	1.14	0.78	1.01	2.21
	(-5.19)	(2.38)	(-5.02)	(10.03)	(4.54)
2nd quartile	0.80	1.07	0.79	1.01	2.20
	(-4.41)	(2.55)	(-5.42)	(10.99)	(3.88)
3rd quartile	0.79	1.02	0.79	1.01	2.16
	(-5.83)	(1.04)	(-7.50)	(12.02)	(3.98)
4th quartile	0.76	0.91	0.81	1.01	2.05
	(-6.18)	(-0.92)	(-9.45)	(14.37)	(3.87)

Income Elasticities Resulting from the Complete Demand System

	Commodity j					
	Child	Social	Eld	Edu	Infra	Other
Entire sample	0.82	-0.67	0.39	0.48	1.40	1.26
	(-6.72)	(-2.67)	(-3.39)	(-7.06)	(3.02)	(3.14)
1st quartile	0.82	-0.57	0.45	0.51	1.36	1.23
	(-7.68)	(-3.22)	(-5.09)	(-9.89)	(3.24)	(4.93)
2nd quartile	0.82	-0.61	0.41	0.49	1.38	1.24
	(-7.07)	(-3.14)	(-3.67)	(-9.83)	(3.34)	(4.09)
3rd quartile	0.83	-0.66	0.39	0.49	1.41	1.26
	(-6.92)	(-2.94)	(-3.71)	(-8.14)	(3.25)	(4.01)
4th quartile	0.83	-0.85	0.30	0.45	1.46	1.31
	(-6.01)	(-2.20)	(-3.02)	(-5.57)	(2.94)	(2.70)

Note: t-values in parentheses. It is assumed that the budget and income elasticities are equal to one under the null hypothesis.

Appendix C: The Restricted Models

Since homogeneity in all prices ($\sum_{k=1}^{n} \gamma_{jk} = 0$) is a within-equation restriction, it is sufficient to test for it by estimating each equation separately. According to the t-statistic in Table B2, homogeneity is rejected at the five percent level for all service sectors except social services.

Given the standard Slutsky symmetry restriction on the price parameters ($\gamma_{jk} = \gamma_{kj}$), a second condition is required aiming to satisfy proportionality between the parameters associated with $\ln m$ and $(\ln m)^2$ (i.e. $\lambda_j = \epsilon\beta_j$, where

$\epsilon = 0$ implies that the demand system is linear in income).[42] The symmetry restrictions are tested by using a Wald χ^2-test. According to the χ^2-statistics in Tables B1-B2, all the symmetry restrictions are rejected at the five percent level.

The income and price elasticities corresponding to the restricted versions (homogeneity and Slutsky symmetry are imposed) of the models are presented in Tables C1-C2. The results imply that neither the relative size of the income (or budget) elasticities, nor the negativity of the own-price elasticities, are altered when the restrictions are imposed. Most of the cross-price elasticities have the same sign. None of the cross-price elasticities that are significantly negative in the unrestricted models become significantly positive, or vice versa, in the restricted model.

Table C1. Elasticities in the Restricted Conditional Model

A. Budget Elasticities:

	Commodity j				
	Child	Social	Eld	Edu	Infra
	0.92	0.20	0.91	0.98	1.37
	(-0.67)	(-3.42)	(-1.28)	(-0.41)	(1.41)

B. Compensated Price Elasticities:

	Commodity j				
Commodity k	Child	Social	Eld	Edu	Infra
Child	-0.75	0.05	0.16	0.12	0.12
	(-77.85)	(2.26)	(3.25)	(2.25)	(5.46)
Social	0.07	-0.86	0.20	0.10	0.05
	(3.32)	(-127.1)	(1.74)	(0.82)	(6.90)
Eld	0.24	0.05	-0.60	0.29	0.36
	(6.92)	(0.58)	(-84.93)	(41.07)	(4.50)
Edu	0.28	0.03	0.32	-0.57	0.45
	(6.98)	(0.31)	(40.58)	(-97.79)	(4.95)
Infra	0.06	0.06	0.17	0.10	-0.80
	(3.60)	(7.49)	(1.83)	(1.00)	(-90.33)

(Continued on next page).

[42] This restriction is required in order to satisfy the integrability conditions of demand theory (see Blundell et al., 1993).

Table C1. (Continued)

C. Uncompensated Price Elasticities:

	Commodity j				
Commodity k	Child	Social	Eld	Edu	Infra
Child	-0.86	0.03	0.05	0.01	-0.04
	(-46.17)	(2.77)	(0.88)	(0.09)	(-3.61)
Social	0.02	-0.87	0.14	0.04	-0.03
	(0.73)	(-57.98)	(1.24)	(0.35)	(-1.26)
Eld	-0.05	-0.02	-0.88	-0.02	-0.08
	(-5.05)	(-2.02)	(-40.00)	(-0.79)	(-7.11)
Edu	-0.06	-0.04	-0.01	-0.92	-0.04
	(-5.44)	(-4.71)	(-0.40)	(-44.85)	(-4.08)
Infra	-0.00	0.04	0.11	0.04	(-0.89)
	(-0.03)	(3.29)	(1.13)	(0.35)	(-45.69)

Note: t-values in parentheses. Under the null hypotheses it is assumed that the budget elasticities are equal to one and that the price elasticities are equal to zero.

Table C2. Elasticities in the Restricted Complete Model

A. Income Elasticities:

	Commodity j					
	Child	Social	Eld	Edu	Infra	Other
	0.99	-0.36	0.59	0.66	1.40	1.66
	(-0.05)	(-3.81)	(-3.20)	(-3.30)	(0.87)	(2.17)

B. Compensated Price Elasticities:

	Commodity j					
Commodity k	Child	Social	Eld	Edu	Infra	Other
Child	-0.82	0.00	0.09	0.11	0.01	0.04
	(-84.13)	(0.20)	(3.40)	(3.82)	(0.46)	(4.13)
Social	0.02	-0.89	0.21	0.21	0.01	-0.00
	(1.81)	(-127.7)	(3.40)	(3.41)	(1.94)	(-0.68)
Eld	0.02	-0.05	-0.81	0.06	0.05	0.08
	(0.95)	(-1.55)	(-109.0)	(11.41)	(1.20)	(2.85)
Edu	0.05	-0.09	0.09	-0.83	0.10	0.14
	(2.44)	(-2.51)	(9.26)	(-138.6)	(2.37)	(4.64)
Infra	-0.00	-0.01	0.16	0.18	-0.85	0.02
	(-0.20)	(-1.42)	(3.28)	(3.57)	(-85.92)	(3.42)
Other	0.02	-0.01	0.14	0.16	0.03	-0.89
	(2.75)	(-0.88)	(3.35)	(3.71)	(4.23)	(-78.08)

(Continued on next page).

Table C2. (Continued)

C. Uncompensated Price Elasticities:

	Commodity j					
Commodity k	Child	Social	Eld	Edu	Infra	Other
Child	-0.86	0.01	0.07	0.09	-0.04	-0.01
	(-72.69)	(1.87)	(2.34)	(2.73)	(-4.55)	(-1.17)
Social	0.00	-0.89	0.20	0.20	-0.01	-0.03
	(0.18)	(-101.7)	(3.15)	(3.16)	(-0.86)	(-2.94)
Eld	-0.07	-0.02	-0.87	0.01	-0.07	-0.07
	(-6.56)	(-1.68)	(-62.92)	(0.47)	(-6.82)	(-4.87)
Edu	-0.05	-0.05	-0.00	-0.90	-0.03	-0.02
	(-5.23)	(-5.50)	(-0.26)	(-74.81)	(-3.28)	(-1.66)
Infra	-0.02	0.02	0.15	0.17	-0.87	-0.01
	(-1.93)	(2.23)	(2.91)	(3.20)	(-71.81)	(-1.09)
Other	-0.00	0.00	0.13	0.15	0.00	-0.93
	(-0.08)	(0.12)	(2.86)	(3.21)	(0.13)	(-69.95)

Note: t-values in parentheses. Under the null hypothesis it is assumed that the income elasticities are equal to one and that the price elasticities are equal to zero.

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