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MEASURING THE BENEFITS FROM PUBLIC SERVICES: THE EFFECTS OF LOCAL GOVERNMENT SPENDING ON THE DISTRIBUTION OF INCOME IN NORWAY

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The purpose of this paper is to provide an evaluation of how local public in-kind benefits affect the distribution of income in Norway. To this end, a method that accounts for differences between municipalities in capacity to produce the same standard of public services is used for assessing the value of sector-specific local public services in each municipality. Moreover, recipient frequencies in various demographic groups are used as basis for determining the allocation of the assessed value of services on citizens of the municipalities. The empirical results show that inequality in the (marginal) distribution of municipal in-kind benefits is rather high. The contribution of municipal in-kind benefits to inequality in the distribution of extended income (cash (after-tax) income plus municipal in-kind benefits) proves, however, to be approximately neutral.

1. Introduction

Most studies of income distribution focus exclusively on cash income and ignore the value of public services, although important services like education and health care in many countries are publicly provided for redistributive purposes. As suggested by Smeeding *et al*. (1993) this practice may be due to the fact that "the problems inherent in the measurement, valuation, and imputation of non-cash income to individual households on the basis of micro data files are formidable." Moreover, in most countries the scope for dealing with these problems is constrained by data limitations. As will be demonstrated in this paper the data limitations are less severe in countries that have established extensive register data systems. This is one reason why Norway emerges as an attractive country for studying the measurement of benefits from public services. A second reason is that Norway has a relatively large public sector where the municipalities are supposed to play a key role in the provision of public services. To this end the central government has introduced an equalization program for municipalities that aims at providing municipalities with equal opportunities to produce the same standard of public services. However, since the central government also makes transfers to municipalities for other purposes, mainly for regional development, the production opportunities may vary across municipalities. Moreover, local governments

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may exhibit different spending behavior that may result in different priorities over different services and over different households and individuals. For instance, some municipalities may give priority to education and childcare services whereas others may focus on care for the elderly and disabled. Thus, it is far from clear that the program for equalization payments reduces the inequality in the distribution of income in Norway.

The purpose of this paper is to provide an evaluation of the effect of municipal in-kind benefits on the distribution of extended income among individuals living in Norway, where extended income is defined as the sum of private income after tax and the value of municipal services received by the household/individual. To this end, it is required to assess the value of local public services and allocate the actual amounts on households and individuals. To deal with the former problem we employ a method that accounts for differences between municipalities in capacity to produce the same standard of public services. The proposed valuation method, discussed in Section 2, is derived from a model of spending behavior of local governments, where spending on different services is specified as a function of economic, social, demographic and geographic variables. By accounting for variation in unit costs in the valuation of sector-specific municipal services, the distribution of public spending across heterogeneous municipalities is converted into a distribution of adjusted expenditures that is comparable across municipalities. Next, the valued and comparable municipal in-kind benefits have to be allocated on recipients. Section 3 deals with this problem by allowing for different treatment of services, depending on the justification of the service in question. Services like health care, social care and care for the elderly and disabled may be considered to serve as insurance for certain subpopulations or the entire population. For these services methods that for each municipality allocate the value of the public service on potential recipients are introduced. By contrast, the value of the production of education and childcare is allocated uniformly on the families that receive these services. Section 4 deals with the distribution of extended income and the interaction between private incomes and the value of local public in-kind benefit. Section 5 provides a sensitivity analysis, where the empirical results based on the valuation method introduced in this paper is compared with results produced on the basis of the standard government cost approach. A brief conclusion is given in Section 6.

2. The Value of Local Government Services

The standard approach in studies of the distribution of public services is to assume that the value of services equals the expenditures in service production (Ruggles and O'Higgins, 1981; Gemmell, 1985; Smeeding *et al*., 1993; Ruggeri *et al*., 1994). This means that in-kind transfers are treated similarly to cash transfers when this income component is added to private incomes in analyses of the distribution of extended income. Thus, this approach does not account for differences between municipalities in costs to produce a given set of public services. Since differences in costs of attaining minimum standards for various services affect the municipalities' capacity to produce a given package of local public services for a given income level, the standard approach may produce misleading results.

As demonstrated by Aaberge and Langørgen (2003b) the linear expenditure system (LES) provides a helpful basis for estimating municipal-specific costs of attaining minimum standards of various services. The municipal expenditure data are then assumed to be generated from a model specified as a linear expenditure system with eight service sectors:

$$u_i = \alpha_i + \beta_i(y - \alpha) + \varepsilon_i, \quad i = 1,2,\ldots,8, \tag{1}$$

$$\sum_{i=1}^{8} \beta_i = 1 \quad \alpha = \sum_{i=1}^{8} \alpha_i,$$

where u_i is per capita expenditure[1] on service sector i, y is per capita exogenous income of the local government,[2] the parameter α_i is called "subsistence expenditure," the parameter β_i is the marginal budget share, and ε_i is the random term for service sector i.[3] Subsistence expenditures are defined to be the product of unit costs and subsistence output. To identify variation in unit costs, we assume that unit costs vary as functions of observable characteristics. For instance, unit costs for some of the municipal services are assumed to depend on whether or not the municipality is densely populated. Moreover, subsistence output is assumed to be affected by variables that describe the structure of demand or needs in the local population. For instance, subsistence output in primary education is supposed to increase with the population share of children between 6 and 15 years of age. While variation in unit costs implies that output is not directly affected, we assume that the subsistence output factors affect output, but not unit costs. Thus, the idea is that variation in unit costs is identified if we interpret the explanatory variables as affecting either unit costs or output. Although these assumptions appear to be rather restrictive, the method is less restrictive than the standard approach, which ignores a possible variation in unit costs and presupposes that the introduced explanatory variables exclusively affect output. A more flexible modeling framework is obtained by allowing for the following parameter heterogeneity:

$$\alpha_i = \boldsymbol{\alpha}_{i1} z_{i1} + \boldsymbol{\alpha}_{i2} z_{i2}, \quad i = 1,2,\ldots,8, \tag{2}$$

where z_{i1} is a vector of variables that affect unit costs in service sector i, z_{i2} is a vector of variables that affect subsistence output in service sector i, and $\boldsymbol{\alpha}_{i1}$ and $\boldsymbol{\alpha}_{i2}$ are vectors of estimated parameters. The estimation results are reported in Aaberge and Langørgen (2003b). The parameter estimates prove to be consistent with the conventional wisdom of how the variables affect the expenditure profiles. The model includes the following service sectors:

(1) Administration
(2) Education
(3) Childcare

[1]Expenditure u_i includes wages to local government employees and purchases of goods and services for public production. However, expenditure on social services also includes cash transfers (social assistance). Note that expenditure is defined exclusive of interest payments.

[2]The major part of local government income in Norway is general grants-in-aid from the central government and local income taxes. The tax rate as well as the tax base is determined by the central government. For this reason both grants and taxes are treated as exogenous variables in the model.

[3]For further discussion of the model and its performance we refer to Aaberge and Langørgen (2003b).

(4) Health care
(5) Social services
(6) Care for the elderly and disabled
(7) Culture
(8) Infrastructure

For a detailed discussion of the variables that affect subsistence expenditures in different service sectors, we refer to Aaberge and Langørgen (2003b).[4] Note that the majority of the exogenous variables are also included as compensation criteria in the Norwegian cost-equalization formula for intergovernmental grants. However, there are important differences between our LES model and the cost-equalization formula of the national grant system, which first and foremost are due to the fact that the cost-equalization formula is derived from a mixture of estimated partial regression models, data from recipient surveys and normative models. By contrast, the LES approach provides a simultaneous treatment of the service sectors where exogenous variables are shown to affect expenditure in all service sectors. Moreover, the set of exogenous variables that have been tested in the LES model is more extensive than the set of variables that is included in the partial models used for the cost-equalization formula.[5]

In a more extensive analysis of local government spending behavior, several additional variables have been examined. However, these variables have been excluded from the model since they proved to have no significant effects on the expenditure. For instance, in contrast to the results in the U.S. literature there is no evidence that poverty raises the cost of educational output in Norway.

The variables that explain the variation in unit costs and subsistence output in different service sectors are displayed in Table 1. The estimated per capita subsistence expenditures in most service sectors are decreasing as a function of population size. This result is interpreted as evidence of economies of scale, which means that unit costs are higher in smaller municipalities. One important reason for variation in productivity is that smaller municipalities use a larger share of their economic resources on administration in most of the service sectors, including central administration (sector 1). This relationship is captured by an index for small municipalities[6] and the variable "inverse population size." For social services, however, the index for small municipalities is assumed to affect output and not unit costs, since a large part of social services are cash transfers (social assistance), and the value of output is consequently defined by expenditure. The explanatory variables in sector 5 are therefore assumed to affect output and not unit costs. For this reason variables like the share of unemployed, divorced and foreigners from remote cultures are assigned to the output category.

[4]The discretionary income ($y - \alpha$) is shown to vary considerably across municipalities, which suggests that there is local discretion in spending in many municipalities.

[5]As demonstrated by Langørgen and Aaberge (1999), the estimated effects of exogenous variables on spending behavior captured by partial regression models may be biased and moreover prove to differ significantly from the results obtained when a simultaneous modeling framework is used. Note, however, that a central government appointed commission has recently proposed a revised version of the current cost-equalization formula, which takes into account the results from the simultaneous model that forms the basis of the present study.

[6]The index for small municipalities decreases linearly from 1 to 0 in the interval 0–10,000 inhabitants, and equals 0 for municipalities with more than 10,000 inhabitants.

TABLE 1

VARIABLES THAT EXPLAIN VARIATION IN SUBSISTENCE EXPENDITURES BY TYPE OF VARIABLE AND SERVICE SECTOR

Variable Type	Variable Name	Included in Sector
z_{i1}	Index for small municipalities	1, 2, 3, 4, 6, 8
Variables affecting unit costs	Inverse population size	1
	Person hours (average traveling time)	2, 4, 6
	Population density	2
	Sewage purification degree	8
	Amount of snowfall	8
	Mentally disabled 7–15 years share of total population	2
	Mentally disabled 16 years and above share of total population	6
z_{i2}	Population share 0–5 years of age	3 and 4
Variables affecting subsistence output	Population share 6–15 years of age	2
	Population share 67–79 years of age	6
	Population share 80–89 years of age	4 and 6
	Population share 90 years and above	4 and 6
	Children 0–5 years with lone mother/father share of total population	3
	Unemployed 16–59 years share of total population	5
	Divorced/separated 16–59 years share of total population	5
	Foreigners from remote cultures share of total population	5
	Dummy for urban municipalities	5
	Dummy for suburban municipalities	7
	Index for small municipalities	5
	Population density	7

Note: Sector 1: Administration; Sector 2: Education; Sector 3: Childcare; Sector 4: Health care; Sector 5: Social services; Sector 6: Care for the elderly and disabled; Sector 7: Culture; Sector 8: Infrastructure.

Local government infrastructure services (sector 8) in Norway include sewage disposal and snow clearing. Local variation in the requirements for sewage purification derives from national environmental regulations, and is assumed to affect unit costs in sewage disposal. Furthermore, the unit costs for keeping roads open are assumed to increase with the amount of snowfall during the year.

Higher dispersion of the local settlement pattern is found to increase subsistence expenditures in education, health care and care for the elderly and disabled. We assume that these effects are due to variation in unit costs. For instance, school and class sizes tend to be smaller in sparsely populated school districts, and this is interpreted as reduced productivity. In care for the elderly and disabled the traveling time of the staff between client homes decreases with density, which implies higher unit costs in sparsely populated areas. By contrast, the estimated positive relationship between municipal expenditures on culture and population density is interpreted as higher supply and output in urban areas. Due to higher unit costs the observed local government expenditures are likely to overestimate the value of services in small and sparsely populated municipalities as compared to large and densely populated municipalities.

In agreement with Smeeding *et al*. (1993), we regard output in health related services as an insurance benefit, which is received independently of the actual use

of services. Public provision is thus compared to the alternative where citizens buy private insurance in the market. In this case output increases as a function of risk and coverage. Risk is described by the probabilities that residents with different characteristics become recipients, and coverage is described by the service standards that different types of clients can expect to receive. Since elderly people have a higher probability to become recipients of health related services than younger people, output is higher for elderly people (given the level of coverage). Thus it follows that the age structure affects output in health related services, which justifies the inclusion of these explanatory variables in subsistence output. For similar reasons the age structure affects subsistence output in childcare and education as well.

The population share of the mentally disabled is a variable that includes actual recipients rather than potential recipients. Local government expenditure increases with the number of mentally disabled people because this group is entitled to municipal care. The distribution of the mentally disabled across municipalities is partly explained by the fact that some of the municipalities have been appointed as host communities for the mentally disabled. Thus, a high observed share of the mentally disabled does not mean that the corresponding local environment produces a high risk of becoming mentally disabled. If we assume that the number of mentally disabled people affects subsistence output, it follows that total output and welfare in the local community increase with the number of mentally disabled people. By assuming that the number of mentally disabled affects unit costs, the referred potential bias does not arise. The basic argument for this assumption is that the distribution of the mentally disabled across municipalities is not related to the risk of becoming mentally disabled.

The above discussion suggests the following valuation of services in sector i:

$$u_i^* = \boldsymbol{\alpha_{i1}}\bar{\boldsymbol{z}}_{\boldsymbol{i1}} + \boldsymbol{\alpha_{i2}}\boldsymbol{z_{i2}} + \beta_i(y-\alpha) + \varepsilon_i, \quad i = 1,2,\ldots,8. \tag{3}$$

where u_i^* is the value of services in sector i, and $\bar{\boldsymbol{z}}_{\boldsymbol{i1}}$ is the weighted average of the variables that affect unit costs.[7] From equations (1)–(3) it follows that the value of local government service production in sector *i* equals

$$u_i^* = u_i - \boldsymbol{\alpha_{i1}}(\boldsymbol{z_{i1}} - \bar{\boldsymbol{z}}_{\boldsymbol{i1}}), \quad i = 1, 2, \ldots 8. \tag{4}$$

Thus, in assessing the value of sector-specific services, observed expenditures are adjusted for the difference between municipal-specific unit costs and average unit costs across municipalities. In municipalities where unit costs exceed (fall below) the mean unit costs, the value of services is found to be below (above) the observed expenditures. This implies, for instance, that the imputed value of services for small and sparsely populated municipalities tends to be lower than the observed expenditure, and vice versa for large and densely populated municipalities. Equation (4) captures variation in the output that can be supplied for a given budget due to different local production possibilities.

In addition to the adjustment for variables that affect unit costs, expenditures are also adjusted for variation in the employers' social security tax rate, which is regionally differentiated in Norway. The value of services is computed for an

[7]The weights are equal to population shares for each municipality.

TABLE 2

Summary Statistics for the Ratio Between the Value of Municipal Services and Observed Expenditures by Municipality Size in 1998, Percentages

Municipality Size	Number of Municipalities	Mean	Minimum	Maximum	Standard Deviation
Small: 0–4,999 residents	245	84.6	66.8	100.2	5.8
Medium: 5,000–19,999 residents	150	97.5	71.2	112.8	7.9
Large: 20,000 residents and above	40	105.4	90.8	114.4	3.9
All municipalities	435	91.0	66.8	114.4	9.9

average value of the tax rate. Moreover, the value of municipal in-kind benefits is calculated exclusive of user fees. The value of services produced by county governments (the intermediate level of government in Norway) and central government is not included in the analysis. Thus, since the capital city Oslo is both a county government and a local government, we have estimated the share of expenditures in Oslo which is allocated to local government services.

The valuation of total service production in different municipalities is reported in Table 2. Note that the total value of services is assumed to be equal to the total expenditures for the entire local government sector. However, the estimated value of services for a given municipality may exceed or fall below the municipality's expenditures, depending on whether the municipality has low or high unit costs. Table 2 shows that the valuation falls below the expenditure for small municipalities, whereas the valuation exceeds the expenditure for large municipalities. Note that the national average falls below 100 percent simply because municipalities with different population sizes are given equal weights, which means that weights per capita are higher in smaller municipalities. Valued services vary between 66.8 percent and 114.4 percent of expenditures.

The results in Table 2 demonstrate that there are large differences between the observed and the assessed valuation of expenditures on the municipal level. However, as can be observed from columns 2 and 6 in Table 3 the differences between observed and assessed valuation of sector-specific expenditures almost vanish when we aggregate expenditures and values of municipal services across municipalities. This issue will be further explored in Section 5.

Education and care for the elderly and disabled are the dominating service sectors and make up on average more than half of the total expenditure. Moreover, as can be observed from Table 3 there is significant variation in the level of per capita in-kind transfers across municipalities. However, in order to explore the influence of differences in per capita in-kind transfers across municipalities on the distribution of (extended) income, it is required to allocate the assessed values of sector-specific public services in each municipality on its inhabitants.

3. Methods for Allocating In-Kind Benefits on Individuals

The analysis in this paper relies on 1998 data for 4.4 million individuals, 2 million families and 435 municipalities. The allocation of municipal in-kind benefits and user fees on families and individuals is based on six different data sources:

TABLE 3

MEAN EXPENDITURES AND MEAN VALUE OF MUNICIPAL SERVICES BY SERVICE SECTORS, 1998

	Expenditures				Valued Services			
Service Sector	Mean NOK per capita	Percent	Minimum NOK per capita	Maximum NOK per capita	Mean NOK per capita	Percent	Minimum NOK per capita	Maximum NOK per capita
Administration	2,800	8.6	800	13,300	2,200	7.7	600	11,500
Education	7,900	26.0	5,100	18,100	7,100	26.1	3,800	16,500
Childcare	2,500	8.2	700	8,600	2,300	8.3	300	8,200
Health care	1,500	4.9	100	7,500	1,300	4.6	0	7,000
Social services	700	2.4	0	2,300	700	2.6	0	2,300
Care for the elderly and disabled	9,500	30.5	2,000	34,600	8,600	30.9	2,200	19,200
Culture	1,500	4.9	500	8,200	1,500	5.4	500	8,300
Infrastructure	4,600	14.5	100	37,300	4,100	14.3	0	36,800
All service sectors	31,000	100.0	19,800	106,800	27,000	100.0	18,100	102,800

Note: The means are computed on the basis of the values of 435 municipalities. Thus, it is not accounted for variation in population size across municipalities. This fact explains why the overall mean of valued services differs from the overall expenditures mean.

- Local government accounts that provide sector-specific expenditures and fees at the municipality level.
- Demographic, social and geographic characteristics, which affect the subsistence expenditures of the municipalities and hence the valuation of services.
- Number of recipients of different services in each municipality by age and gender.
- Prices in kindergartens and care for the elderly and disabled reported by municipalities. Prices are reported for different family income levels.
- Register information on age, sex, family type, municipality, education level and private incomes for individuals (and families).
- Data from sample surveys that provide information on the use of public services for individuals and families.

The allocation of in-kind transfers on families and individuals is made stepwise in the following order:

(1) Selection of the recipients of different services.
(2) Allocation of municipal in-kind benefits on the recipients.
(3) Aggregation of in-kind benefits within each family.
(4) Choice of family equivalence scales for different services.
(5) Allocation of equivalent in-kind transfers on family members.

The two first steps differ between service sectors, and are discussed separately for each service sector in the Appendix. The first step concerns identification of recipients while the second step determines the allocation of the value of municipal services on recipients. Specific subgroups of the population are the target of some services. We use two different methods to identify such subgroups. The first method is direct identification from available data. Although this method may

yield the highest possible level of precision, the data required for exact identification of recipients is normally not available for public services. However, primary education represents an important exception since primary schools are compulsory, which means that the subgroup of recipients is almost identical to the population in the age group 6–15 years. Age serves in this case as a key variable for identifying the recipients.

When there is no option for direct identification of recipients our strategy is to use available micro data as a basis for estimating the probability of being recipient as a function of demographic and socioeconomic variables. When the population subgroups are defined by criteria that are relevant for the distributional policy of local governments, it is possible to approximate the distribution of services by random drawing of the correct number of recipients in each subgroup and for each municipality. Although the identity of the actual recipients is not revealed by this procedure, the method captures important features of the distribution of municipal services. Thus, to the extent that relevant characteristics of the recipients are taken into account, we are able to provide fairly precise approximations of the distributional profiles of these services.

For some services, like health care and social care, we rely on the risk-related insurance benefit approach of Smeeding *et al*. (1993) by adopting the view that health care is an insurance benefit received by all coverees, independently of the actual use of services. However, the probability of receiving benefits is allowed to vary by age, gender and family type in line with differences in need. By contrast, allocating the value of health care on the actual recipients makes less sense, simply because the ill and disabled will then appear to have rather high welfare compared to those who are in good health. To be meaningful this approach would require that the direct welfare loss associated with illness and disability be taken into account.

When the recipients have been selected by simulation, the value of services is distributed uniformly among the selected recipients. For instance, we do not account for different opening hours and staying time in kindergartens. Moreover, demand for culture is assumed to be constant for a given education level. However, when services are allocated according to the insurance benefit approach, which applies to health care, social care and care for the elderly and disabled, we assume that benefits are distributed in proportion to the probability of being recipients. Thus, differences in allocated in-kind transfers across persons may either arise from variation in the probability of being recipient, or from variation in the economic situation and service sector priorities across local governments.

The allocation method for the municipal in-kind benefits combines the estimated probabilities of being recipient with the assumption of a uniform distribution on selected recipients or on potential recipients with common characteristics. In administration, culture and infrastructure the probability of being recipient is equal to 1 for all citizens, while the probability varies with individual characteristics for all other services.[8] The characteristics that are included in the analysis for eight different service sectors are displayed in Table 4. We refer to the Appendix

[8]For culture we have estimated the average demand on each education level rather than the probability of being recipient.

TABLE 4

Distribution of Different Municipal Services as a Function of Individual Characteristics

	Age	Sex	Family Type	Education Level	Private Income
Administration					
Education	x				
Childcare	x		x	x	
Health Care	x	x			
Social care	x				x
Care for the elderly and disabled	x	x	x		
Culture				x	
Infrastructure					

for further details on the methods that have been used for selecting recipients and distributing the value of services in different service sectors.

Aggregating benefits over family members constitutes the third step of the analysis, whereas the fourth step concerns the choice of family equivalence scales for different services. Family equivalence scales are designed to adjust for differences in income needs for families of different sizes and composition, and thereby make incomes comparable across individuals. By adjusting each family's income by its equivalence scale, the distribution of incomes across heterogeneous families is converted into a distribution of (equivalent) incomes across individuals. To this end we will employ the class of equivalence scales introduced by Buhman *et al*. (1988), defined by S^a where S is the size of the family and a is the elasticity of the scale rate. To make incomes comparable the total income for each family is divided by the scale rate S^a. Buhman *et al*. found that a wide range of scales in use, including the OECD scale, can be summarized quite well by this parametric family. The parameter a can take different values between 0 and 1. The value a = 1 means that there are no economies of scale, while the value a = 0 signifies the maximum degree of economies of scale, where the scale is constant and independent of the family size. Smeeding *et al*. (1993) assume that there are no economies of scale in non-cash income (in-kind transfers), and consequently specify a = 1. Their study includes services like education, health care and housing. This assumption is common in most analyses of the incidence of government expenditure, although the choice of equivalence scale is rarely discussed.

It is plausible to assume that the services provided by local governments in Norway are private goods on the family level, but some of the services exhibit economies of scale within families. We assume that social services, care for the elderly and disabled, and infrastructure exhibit economies of scale. All other services are treated as private goods within the family. For instance, cultural services like subsidies for sports activities are consumed individually by the family members and not shared within the family. By contrast, family members share the benefits from social services like child protection and alcohol abuse protection. If a father is violent or abusing alcohol, and if he is cured by treatment, it is plausible to assume that the benefits are larger the larger is the family, simply because there are more persons to benefit. Therefore, we assume that social services are shared as a public good within families, so a = 0 for this sector.

Care for the elderly and disabled includes nursing and assistance with household work. While the individual recipient consumes nursing, assistance with household work yields benefits, which are consumed in common by family members. For instance, if a public employee cleans the home, all household members derive a direct benefit. The benefit of each family member from having the home cleaned is not affected by the number of family members. Thus, care for the elderly and disabled is a mixture of private and public goods. Consequently we have chosen an intermediate value for the scale parameter, $a = 0.5$.

Infrastructure services include public roads, housing, water supply, and sewage and refuse collection. All these services are consumed commonly within the household. For instance, given the connection to water pipes, the marginal cost (and marginal user fee) for water in Norway is zero. Thus all household members may consume as much as they like, so the number of family members does not affect the benefit per person. Thus, we assume that infrastructure is shared as a public good within families, so $a = 0$ for this sector.

The standard approach in analyses of the personal income distribution is to assume that incomes are equally distributed within households or families. This assumption is simply a consequence of sparse information on the internal distribution of consumption within families. In the case of in-kind benefits, however, we know the primary recipients of each family. An alternative to in-kind transfers is to purchase similar services in the private market or to include them as part of the household production. For instance, parents may benefit from a reduction in household work when children are taken care of in kindergartens. Thus, it does not seem plausible to assume that the primary recipients are the only beneficiaries. Therefore we apply the standard assumption of equal distribution within families in the fifth step.

4. Inequality in the Distribution of Extended Income

Detailed results for the marginal distribution of municipal in-kind benefits are reported by Aaberge and Langørgen (2003a). The major finding is that total in-kind benefits are relatively low in the age group 16–66 years, which is largely due to the fact that the basic local government services are primarily reserved for children and the elderly. As a consequence the inequality in the marginal distribution of municipal in-kind benefits proves to be relatively high, with a Gini coefficient equal to 0.393. This result is due to high inequality in the distributions of in-kind benefits *within* municipalities, whereas the inequality *between* municipalities is low. The largest service sectors (education, childcare and care for the elderly and disabled) are disequalizing and explain the high level of inequality in the distribution of municipal services.

The indicated large inequality in the distribution of in-kind benefits is not necessarily in conflict with equalization policies that utilize local public in-kind transfers to redistribute welfare from rich to poor families. To discuss this issue the relationship between in-kind benefits and private incomes has to be taken into account. Thus it is helpful to introduce the term *extended income*, defined as private income after taxes plus the value of municipal services. To allocate private family incomes on individuals we rely on standard practice and assume that

TABLE 5

MEAN VALUE AND GINI COEFFICIENT FOR THE DISTRIBUTION OF EXTENDED INCOME BY MUNICIPALITY SIZE

	Small: 0–4,999	Medium: 5,000–19,999	Large: 20,000 and above	All municipalities
Mean extended income (NOK, 1998)	210,100	217,100	229,800	222,800
Gini coefficient	0.192	0.197	0.236	0.218

TABLE 6

MEAN VALUE OF (EQUIVALENT) AFTER-TAX PRIVATE INCOMES, MUNICIPAL IN-KIND BENEFITS AND EXTENDED INCOME BY FAMILY TYPE AND AGE, NOK 1998

Belonging to Household Type	Age	After-Tax Private Incomes	Municipal In-Kind Benefits	Extended Income
Single without children	16–66 years	164,800	12,200	177,000
	67–79 years	116,300	47,600	163,900
	80 years and above	90,600	121,300	211,900
Couple without children	16–66 years	231,600	13,400	245,000
	67–79 years	155,100	20,000	175,000
	80 years and above	123,400	52,700	176,100
Single with children	0–5 years	122,700	29,400	152,200
	6–15 years	140,800	41,000	181,800
	16–66 years	175,100	23,600	198,700
Couple with children	0–5 years	195,300	22,600	217,900
	6–15 years	206,700	33,300	240,000
	16–66 years	237,200	21,700	258,900
All	All	197,000	25,800	222,800

incomes are equally distributed within families. To account for scale economies in private incomes we follow Atkinson *et al*. (1995) and use the square root scale. The summary information for the distribution of extended income in Table 5 shows that the mean extended income is increasing with municipality size. Moreover, inequality in the distribution of extended income is increasing with municipality size.

Table 6 provides a decomposition of the mean value of individual (equivalent) extended income with respect to private incomes and municipal in-kind benefits, where municipal in-kind benefits are defined as the (equivalent) value of municipal services minus user fees. After-tax private incomes include market incomes and cash transfers minus taxes. The mean values of the income components are reported for various family types and age groups. The results of Table 6 show that singles and elderly earn relatively low after-tax private incomes, and that elderly people aged 80 years and above receive high in-kind benefits. Persons in the age group 16–66 years have the highest average extended income due to high private income. Singles with children have lower private incomes and receive higher in-kind benefits than couples with children.

To get a better understanding of the relationship between the distributions of private incomes and public in-kind transfers, it is useful to decompose the inequality in the distribution of extended income with respect to income components. Extended income is defined by the sum of income components:

$$X = \sum_{i=1}^{s} X_i, \tag{5}$$

where X is extended income, X_i is component i and s is the number of income components. Note that subscripts for person are suppressed in equation (5). As demonstrated by Rao (1969), the Gini coefficient (G) admits the following decomposition:

$$G = \sum_{i=1}^{s} v_i(G) = \sum_{i=1}^{s} \frac{\mu_i}{\mu} \gamma_i. \tag{6}$$

where μ_i/μ is the ratio between the means of X_i and X respectively, which is denoted the income share of component i. The concentration coefficient γ_i can be interpreted as the conditional Gini coefficient of component i given the rank order in extended income (X). The product of the income share and the concentration component is denoted the inequality contribution $v_i(G)$. Note that the concentration component γ_i can be considered as a measure of interaction between X_i and X. Assume for example that $\mu_i > 0$. Then a negative value of γ_i expresses negative interaction, which means that component i gives an equalizing contribution to total inequality. A positive value of γ_i expresses positive interaction, which means that component i gives a disequalizing contribution to total inequality. The case where $\gamma_i = 0$ corresponds to a situation where every person receives an equal amount of component i. Thus, in this case the contribution to overall inequality from component i is said to be neutral.

By recognizing the multidimensional character of the decomposition problem, the decomposition method defined in equation (6) provides a simultaneous treatment of the income components in question. Thus, the v's provide information of the contributions from the various income components to the observed overall income inequality. However, when attention is turned to the effect of a marginal change in an income component (given that the other income components are kept fixed) it is, as proposed by Lerman and Yitzhaki (1985), appropriate to consider the Gini elasticity defined by:

$$\frac{\partial \log G}{\partial \log \mu_i} = \frac{\mu_i}{\mu}\left(\frac{\gamma_i}{G} - 1\right), \quad i = 1, 2, \ldots, s. \tag{7}$$

The decomposition method defined in equation (6) will be used to decompose inequality in the distribution of extended income with respect to market income, social assistance, cash transfers, taxes, municipal user fees and the value of municipal services. Market income includes salary, income from self-employment and capital income. Social assistance is separated from other public cash transfers, since local governments grant social assistance, while other cash transfers in Norway are provided by the central government. Municipal user fees are treated similarly to taxes, which means that municipal services as a component of

TABLE 7

DECOMPOSITION OF THE GINI COEFFICIENT FOR THE DISTRIBUTION OF EXTENDED INCOME WITH RESPECT TO COMPONENTS OF PRIVATE INCOMES AND THE TOTAL VALUE OF MUNICIPAL SERVICES

	Inequality Share	Income Share	Concentration Coefficient
Market incomes	1.676	0.970	0.376
Social assistance	–0.012	0.005	–0.502
National cash transfers	–0.131	0.219	–0.130
Taxes	–0.525	–0.309	0.370
Municipal user fees	0.002	–0.032	–0.014
Municipal services	–0.010	0.147	–0.014

extended income include services that are financed by user fees. The results from the decomposition are displayed in Table 7.

Market incomes are shown to be the dominating income component with a clear disequalizing effect on the distribution of extended income. Since taxes are a negative income component, it follows from the positive concentration coefficient that taxes provide an equalizing contribution. The contributions from social assistance and central government cash transfers are also equalizing. Due to a higher income share the equalizing contribution is substantially higher for central government cash transfers than for social assistance. Inequality contributions that are close to zero indicate that user fees and municipal services have a neutral effect on the distribution of income, which means that the effect is similar to that obtained by an equal cash transfer to all citizens (corrected for economies of scale within families). Although we find large inequality in the marginal distribution of municipal in-kind benefits, the contribution from municipal in-kind benefits to inequality in the distribution of extended income is weakly equalizing or approximately neutral. However, by considering the effect of a 1 per cent increase in the value of municipal services, we find by inserting the relevant figures from Tables 5 and 7 in equation (7) that the Gini coefficient for the distribution of extended income will decrease by 0.16 per cent, provided that the concentration coefficients are not affected by the marginal change in municipal services.

The tax component in Table 7 includes income taxes that are collected by municipalities to finance local government services, as well as taxes collected by counties and the central government. The main sources for financing local government services in Norway are intergovernmental grants, income taxes, property taxes and user fees. Thus, it is of interest to study the net contribution from local public expenditures, taxes and user fees to the inequality in the distribution of extended income. The tax record data allow us to allocate municipal income taxes on families and individuals. Municipal property taxes are not subtracted in the definition of extended income, since property taxes are not reported in the tax records. Property taxes in Norway account for only 2.3 percent of total municipal expenditures. Thus, this component has solely a minor impact on the spending behavior of local governments.

Table 8 reports the net contribution to income inequality from local public services, which takes into account the allocation of valued services as well as the allocation of income taxes and user fees on families and individuals. Note that the

TABLE 8

Decomposition of the Gini Coefficient for the Distribution of Extended Income with Respect to Private Incomes after Non-Municipal Taxes and In-Kind Benefits Exclusive of Municipal Income Taxes

	Inequality Share	Income Share	Concentration Coefficient
Private incomes subtracted non-municipal taxes	1.139	0.962	0.258
In-kind benefits subtracted municipal income taxes	–0.139	0.038	–0.789

TABLE 9

Decomposition of the Gini Coefficient for the Distribution of Extended Income with Respect to Total Private Disposable Income and Municipal Service Sectors

	Inequality Share	Income Share	Concentration Coefficient
Private disposable income	1.010	0.853	0.258
Administration	0.000	0.009	0.006
Education	0.008	0.030	0.060
Childcare	0.000	0.011	0.004
Health care	–0.000	0.005	–0.016
Social services	–0.010	0.008	–0.276
Care for the elderly and disabled	–0.011	0.041	–0.057
Culture	0.001	0.007	0.042
Infrastructure	0.001	0.036	0.007

income component "in-kind benefits subtracted municipal income-taxes" does solely account for 3.8 per cent of the extended income. Thus, the large negative concentration coefficient for this income component explains why local government spending and financing jointly provides a substantial equalizing contribution to overall inequality. By combining the information provided by Tables 7 and 8 we find that this result is first and foremost due to the strong equalizing contribution from municipal income taxes.

Private disposable income is defined to be the sum of market incomes, social assistance and national cash transfers minus taxes and municipal user fees. The last component in Table 7 is municipal services, which can be further subdivided into components that represent different service sectors. Decomposition of the inequality in the distribution of extended income by total private disposable income and eight municipal service sectors is displayed in Table 9. The purpose is to provide information on the interaction between extended income and the value of various municipal services. We find that the contributions from social services and care for the elderly and disabled are weakly equalizing, whereas the contributions from the remaining municipal service sectors are approximately neutral. However, as can be observed by inserting the estimated concentration coefficients and income shares from Table 9 in equation (7), the effect on inequality of a marginal change in the expenditure on care for the elderly and disabled is significantly stronger than the effect of a marginal change in the expenditure on social services, despite the fact that the concentration coefficient for social services is more than four times as large as the concentration coefficient for the sector "care for the

TABLE 10

DECOMPOSITION OF DECILE-SPECIFIC EXTENDED INCOME BY INCOME COMPONENTS, NOK 1998

	Market Incomes	Social Assistance	National Cash Transfers	Taxes	Municipal User Fees	Municipal Services	Extended Income
1. decile	33,400	4,000	52,400	–12,400	–6,400	30,000	101,000
2. decile	65,000	2,300	76,200	–24,800	–7,100	33,000	144,600
3. decile	109,800	1,600	63,700	–36,200	–7,400	34,000	165,500
4. decile	144,800	1,000	54,800	–45,100	–7,500	34,800	182,900
5. decile	175,300	700	48,800	–53,600	–7,500	35,200	198,900
6. decile	204,800	500	44,600	–62,600	–7,400	35,200	215,000
7. decile	236,500	400	41,300	–73,100	–7,200	34,800	232,800
8. decile	275,800	300	38,500	–86,800	–7,000	33,800	254,700
9. decile	338,300	300	34,300	–109,300	–6,500	30,200	287,300
10. decile	576,200	200	32,500	–184,900	–6,200	27,100	444,900
All deciles	216,000	1,100	48,700	–68,900	–7,000	32,800	222,800

elderly and disabled." Moreover, note that the sector-specific contributions to inequality in the distribution of extended income are rather different from the various sector-specific contributions to inequality in the marginal distribution of in-kind transfers.[9]

To provide more detailed information on the decomposition of the inequality in the distribution of extended income, mean values of different income components by decile are reported in Table 10. Extended income in the seventh column equals the sum of the six income components. The results show that market incomes and (the absolute value of) taxes increase with extended income, and social assistance decreases with extended income. National cash transfers increase from the first to the second decile, and decrease from the second to the tenth decile. Thus, we find that the national welfare system only to a limited degree redistributes incomes to the 10 percent of the population with lowest incomes.

The decile groups with medium extended incomes receive higher average values of municipal services and pay slightly more user fees than the lower and the higher decile groups. This means that municipal services are targeted neither towards the poor nor towards the rich; it is the middle-income groups that receive the highest in-kind benefits. The average value of municipal services is 30 percent higher in the fifth decile than in the tenth decile and 18 percent higher than in the lowest decile.

The percent of valued municipal services that originates from different service sectors is reported for each decile group in Table 11. In the first decile social care accounts for a relatively high share of valued municipal services, which explains the equalizing contribution from social care that was found in Table 9. The low value of municipal services in the first, ninth and tenth decile groups in Table 10 is mainly due to low benefits from education, childcare and care for the elderly and disabled. These three service sectors account for shares of valued services that

[9]For further details, see Aaberge and Langørgen (2003a).

TABLE 11

VALUE OF MUNICIPAL SERVICES BY SERVICE SECTOR IN PERCENT OF TOTAL VALUE OF MUNICIPAL SERVICES BY DECILES OF EXTENDED INCOME

Service Sector	1	2	3	4	5	6	7	8	All
1. decile	6.3	9.8	5.0	4.0	16.1	27.6	4.7	26.5	100.0
2. decile	5.7	14.9	7.3	3.7	6.8	33.1	4.2	24.1	100.0
3. decile	5.6	19.2	7.8	3.5	5.4	30.4	4.3	23.6	100.0
4. decile	5.4	22.4	8.5	3.4	4.3	28.5	4.3	23.2	100.0
5. decile	5.4	23.7	8.6	3.3	3.7	27.8	4.4	23.0	100.0
6. decile	5.4	24.2	8.7	3.3	3.5	27.3	4.5	23.1	100.0
7. decile	5.5	24.0	8.3	3.3	3.3	27.4	4.6	23.5	100.0
8. decile	5.7	22.5	7.7	3.4	3.3	28.1	4.9	24.4	100.0
9. decile	6.4	20.9	7.1	3.7	3.7	25.3	5.6	27.2	100.0
10. decile	7.2	20.1	6.9	4.1	4.0	20.9	6.6	30.2	100.0

Note: Sector 1: Administration; Sector 2: Education; Sector 3: Childcare; Sector 4: Health care; Sector 5: Social care; Sector 6: Care for the elderly and disabled; Sector 7: Culture; Sector 8: Infrastructure.

are first increasing for lower decile groups and then decreasing for higher decile groups. This means that the beneficiaries of these services, which are the elderly and families with children, account for a relatively high share of the middle-income groups. The elderly and families with children are less prone to earn high (equivalent) incomes. Moreover, the welfare system in Norway includes age pensions, child benefits and municipal in-kind benefits, which reduce the occurrence of low extended incomes among the elderly and families with children.[10] The fact that the middle-income groups receive higher benefits from municipal services is supplementary to the main conclusion that the contribution from municipal services to income inequality is neither equalizing nor disequalizing.

5. SENSITIVITY ANALYSIS

The method for valuation of government output introduced in this paper may be considered as a variant of the standard government cost approach. However, while the standard approach uses observed public expenditures as a measure of the value of government services, our approach aims at accounting for the variation across municipalities in unit costs for producing public services. The purpose of this section is to examine whether the empirical results depend on the choice of valuation method. Results based on the standard government output approach are displayed in Table 12. Note that the methods for allocating the value of in-kind benefits on households/individuals including specification of equivalence scale are identical to those used for producing the results in Table 7.

By comparing the results in Tables 7 and 12, we find that the main conclusion of the paper is not significantly affected by choice of valuation method. However, this does not mean that that the two valuation methods yield

[10]For detailed results on the age composition of different income groups, see Aaberge and Langørgen (2003a).

TABLE 12

DECOMPOSITION OF THE GINI COEFFICIENT FOR THE DISTRIBUTION OF EXTENDED INCOME WITH RESPECT TO COMPONENTS OF PRIVATE INCOMES AND TOTAL EXPENDITURES ON MUNICIPAL SERVICES

	Inequality Share	Income Share	Concentration Coefficient
Market incomes	1.681	0.970	0.376
Social assistance	–0.012	0.005	–0.507
National cash transfers	–0.133	0.219	–0.132
Taxes	–0.526	–0.309	0.369
Municipal user fees	0.002	–0.032	–0.012
Municipal services	–0.012	0.147	–0.018

identical distributions of extended income. On the contrary, the distributions of in-kind benefits across and within regions and municipalities are significantly affected by the valuation method, as demonstrated by the results displayed in Table 2.

6. CONCLUSION

This paper has considered the valuation of local public in-kind transfers and the distribution of benefits on families and individuals. In order to estimate the value of in-kind transfers, local government expenditures are adjusted for variation in characteristics that affect unit costs in service production. The adjustment method is based on a structural model of local government behavior. The central conclusions of the paper are found to be robust to the choice of valuation method.

The allocation of in-kind benefits on families and individuals for eight different service sectors is based on extensive register data systems for Norway, which are combined with household survey data and recipient statistics reported by local governments. The value of the production of education and childcare is allocated uniformly on the families that receive these services. By contrast, the allocation of services like health care and care for the elderly and disabled is justified by an insurance benefit approach, which means that potential recipients derive benefits in proportion to their probability of becoming a recipient. For instance, the probability of receiving health care and care for the elderly is increasing with age, while the probability of receiving social care is decreasing with age.

To study interactions between the distributions of local public in-kind benefit and private income, we define extended income by private after-tax income plus the value of municipal services. Although the inequality in the marginal distribution of municipal services is high, the contribution of municipal services to inequality in the distribution of extended income appears to be approximately neutral. This result is due to the fact that recipients of major municipal services like primary education and care for the elderly are dominating the central part of the distribution of extended income. However, the net effect of local government spending and financing is highly equalizing; mainly due to the equalizing contribution from municipal income taxes.

Appendix

This Appendix spells out the detailed methods for selecting recipients and distributing the value of services on recipients in different service sectors.

Administration

The value of administration services and user fees is assumed to be distributed uniformly on all local residents within each municipality. This assumption is adopted since we have no data on the distribution of administration services.

Education

Local governments in Norway are responsible for 10 years of primary education. Secondary education is provided by county governments, and is not included in the analysis. The value of municipal education services and user fees is assumed to be distributed uniformly on all children in the age group 6–15 years.

Childcare

There are both municipal and private kindergartens in Norway. Since local governments subsidize private kindergartens, they are included in the analysis of in-kind transfers. The population is ordered in subgroups according to the age of the children, family type and education level of the mother in the family (or the father if there is no mother). From summary statistics we know the number of children in kindergartens by age and municipality. For information on family type and education level we utilize a national survey, which includes 5,000 families, where the type of childcare is reported for each child. This information is used to estimate the total number of children in kindergartens by family type and education level. Thus we have information on the marginal distribution of children in kindergartens by age and municipality, and also the marginal distribution by family type and education level. The estimation of the simultaneous distribution by age, family type, education level and municipality is based on a log-linear model where the second-order interaction-component is equal to zero. The model is introduced by Birch (1963), and the maximum likelihood estimation method is called "iterative proportional fitting" or "raking." The estimation results show that the probability that children are taken care of in a kindergarten increases with the age in the interval from 0 to 5 years of age. Furthermore, the probability increases with the education level of the mother (father), and children with a lone parent have a higher probability than those with parents who live together. These results refer to averages, since the probability also varies across municipalities.

The population is divided into subgroups according to the four dimensions age, family type, education level and municipality, and from each subgroup the estimated number of children in kindergartens is selected by random drawing. Thus the four dimensions above are taken into account in the selection of recipients. For each municipality we assume that the assessed value of the childcare services is distributed uniformly on the selected recipients.

User fees in kindergartens are means tested against family gross income. The distribution of user fees is based on a sample of 105 municipalities, which have

reported standardized charges for three different levels of family gross income. The data are used in a linear regression of charges on family income and local government income. The charges are found to increase with family income and decrease with local government income. The model is used to predict the charges for all children that have been selected as recipients. Thus predictions are made out-of-sample in the sense that 330 municipalities are not included in the sample. Also the model is simulated with family income as a censored continuous variable, while charges are only reported for three different income levels in the sample. In the simulations family income is censored from below at 0, and from above at 375,000 NOK, which is the highest level of charges reported in the sample. The prediction for each child is adjusted for the average rate of price reduction for brothers and sisters, and the predictions are calibrated against the sum of user fees reported in the local government accounts.

Health Services

County governments or the central government run hospitals in Norway. However, general practitioners provide health services that are subsidized by local governments. These municipal health services are treated as insurance benefits in the analysis. For information on age and gender distribution of the patients we utilize a national survey that includes 5,000 families. Respondents are asked whether or not they have visited a general practitioner in the last 14 days before the interview. This information forms the basis for estimating the age and sex specific probability of visiting a physician. The probability is found to increase with age for men, but not for women. Thus among younger adults women have a higher probability than men, but among the elderly men have a higher probability than women. The value of health care and user fees in each municipality is distributed on persons in proportion to their probability of being recipient.

Social Care

Local governments provide social assistance, child protection and alcohol abuse protection. Since social assistance is defined as cash-transfers to poor families, these transfers are not included in our analysis of in-kind transfers. From the income data we know the distribution of social assistance on persons and families, but the distribution of expenditures for child protection and alcohol abuse protection is not known. However, it is plausible to assume that the distribution of these in-kind benefits is similar to the distribution of social assistance. Thus, we have computed the probability of receiving social assistance in different income and age groups. The estimate of probability in a given subgroup is based on the frequency of social assistance for families within the subgroup. We find that the probability decreases with income and age. This probability is utilized to derive a distribution for social services in-kind. Each family receives a share of the value of social services in-kind, which is proportional to the probability of receiving social assistance. Consequently child protection and alcohol abuse protection are treated as insurance benefits. Everyone receive benefits, but poor families receive more than rich families, and elderly people receive less than young adults. We assume that families that are in the same income and age group (and in the same

municipality) receive equal in-kind benefits from social services. Recall that we use the equivalence scale parameter a = 0 for social services, which means that all persons receive the same amount as the family to which they belong. User fees are distributed in families according to the same weights as in-kind benefits.

Care for the Elderly and Disabled

This service sector includes two types of recipients: those who live at home, and those who live in institutions. In the distribution of in-kind transfers we do not separate between the two types of clients, since they are not treated separately in the local government accounts. From summary statistics we know the number of recipients by age group, sex and municipality. For information on family type we utilize a national survey, which includes 5,000 families. This information is used to estimate the total number of elderly and disabled recipients by family type. Those who live in institutions are not included in the survey, so we assume that the patients in nursing homes are distributed in family types in proportion to the estimated probabilities of being a recipient of home-care for a given family type.

Thus the available data provide information on the marginal distribution of recipients by age, sex and municipality, and also estimates of the marginal distribution by family type. The estimation of the simultaneous distribution by age, sex, family type and municipality is based on a log-linear model where the second-order interaction-component is equal to zero. The estimation results show that the probability of being a recipient increases with age, and that elderly women have a higher probability than elderly men. Furthermore, the elderly who are single have a higher probability than elderly persons who are married. These results refer to averages, since the probability also varies across municipalities.

While the selection of recipients in childcare is based on random drawing, we use a different procedure in care for the elderly and disabled. Recall that the imputations in care for the elderly and disabled are based on a risk-related insurance-benefit approach. First the estimates of the number of recipients in subgroups of the population by age, sex, family type and municipality are used to derive frequencies of recipients in each subgroup. These frequencies are used as estimates of the probability of being a recipient for different subgroups. The value of care for the elderly and disabled in each municipality is distributed on persons in proportion to their probability of being recipients. This means that all persons receive benefits, but the benefits vary as a function of the characteristics, which affect the probability of being a recipient, and also as a function of the economic situation and priorities of each local government.

User fees in home-care and nursing homes are means tested against family income. Unfortunately we have no information on actual prices in nursing homes. Thus, we assume that user fees in nursing homes are proportional to user fees in home-care services. User fees in home-care for the elderly and disabled have been reported in a sample of 314 municipalities. These data show standardized charges for five different income groups, which cover different intervals of family taxable income. It is found that charges typically increase as a function of income. To derive estimates for all municipalities in Norway, we compute the average charge per month as a function of income group. The average charge is weighted by the

probability of being a recipient, based on estimates of probabilities as a function of age, sex, family type and municipality. This weighted average charge gives an estimate of the charge for each person, and after aggregation over persons within each municipality, we derive the share of charges paid by each person. Thus, the estimates are calibrated against the sum of user fees reported in the local government accounts.

Culture

Municipalities in Norway provide subsidies to cultural activities like sports, arts, museums, libraries, cinemas and churches. The frequencies of participation in the different types of activities are reported in a national survey, which includes 5,000 households. To construct an index of demand for culture by different respondents, the rates of participation in different activities are weighted by total municipal expenditures for each activity. The respondents are divided in groups according to education level (low, medium and high), and the average index of demand is computed for each education level. It is found that average demand is increasing with the education level. The value of cultural services in each municipality is distributed on persons in proportion to the average demand by different education levels. All persons in a given family receive in-kind transfers, which are determined by the education level of the person with the highest education level in the family. For a given education level and a given municipality the in-kind transfer is constant for all persons. Since we have no information on participation in cultural activities at the municipal level, we do not account for variation in demand between persons with the same education level. User fees are distributed to persons according to the same weights as services.

Infrastructure

Infrastructure services include public roads, housing, water supply, and sewage and refuse collection. For these services we assume that in-kind transfers and user fees are distributed uniformly across families. Thus, for a given municipality, each family receives the same transfer. Since the equivalence scale parameter $a = 0$ for this sector, it follows that all persons in a given municipality receive the same benefit. However, there are variations in the individual benefits across municipalities.

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