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# Measuring the Benefits from Public Services

## The Effects of Local Government Spending on the Distribution of Income in Norway

**Abstract:**
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. Next, the underlying justification of the various services is used as basis for determining the allocation of the assessed value of the services on the citizens in the municipalities. For instance, services like health care and care for the elderly and disabled are treated as an insurance arrangement. Thus, the corresponding in-kind benefits are allocated on the potential recipients. By contrast, the value of the production of education and child care is allocated uniformly on the families that receive these services. The empirical results show that the inequality in the (marginal) distribution of municipal in-kind benefits is rather high. The contribution of in-kind benefits to inequality in the distribution of extended income (cash (after-tax) income plus municipal in-kind benefits) is, however, approximately neutral. This result is due to the fact that elderly people and families with children receive the largest share of the municipal in-kind benefits and moreover are located in the central part of the distribution of extended income.

**Keywords:** Income distribution, local public finance

**JEL classification:** D31, H72

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# 1. Introduction

Most studies of income distribution focus exclusively on cash income and neglect the impact of public services, although important services like education and health care in many countries are publicly provided for redistributive purposes. Smeeding et. al. (1993) suggest a possible explanation in the following statement: "The problems inherent in the measurement, valuation, and imputation of non-cash income to individual households on the basis of microdata 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, like regional development, the opportunities may vary across municipalities. Moreover, local governments 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 child care 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.

This paper provides an evaluation of how the local public in-kind benefits affect the distribution of income among individuals living in Norway. Thus, we have to deal with the problem of assessing the value of local public services and allocating the actual amounts on households and individuals. To deal with the former problem a method that accounts for differences between municipalities in capacity to produce the same standard of public services is required. To this end we propose to use an equivalence scale type of framework for measuring the magnitude of such differences. As far as we are aware of this is the first attempt to employ an equivalence scale approach to perform comparisons of benefit from public services across municipalities. The proposed method 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.

Application of the municipality equivalence scale introduced in Section 2 provides valuation of sector-specific services that is comparable across municipalities. However, the problem of allocating the sector-specific amounts on recipients remains to be solved. Section 3 deals with this problem by treating services differently, depending on the justification of the services. One group of services may be considered to serve as insurance for certain subpopulations or the entire population. These services include health care, social care and care for the elderly and disabled. For these services methods that allocate the amounts in question on potential recipients are introduced. By contrast, the value of the production of education and child care is allocated uniformly on the families that receive these services. Empirical results for the distribution of municipal in-kind benefits between individuals are reported in Sections 4 and 5, whilst Section 6 deals with the distribution of extended income, defined as cash incomes after taxes plus municipal in-kind benefits. A brief conclusion is given in Section 7.

# 2. The value of local government services

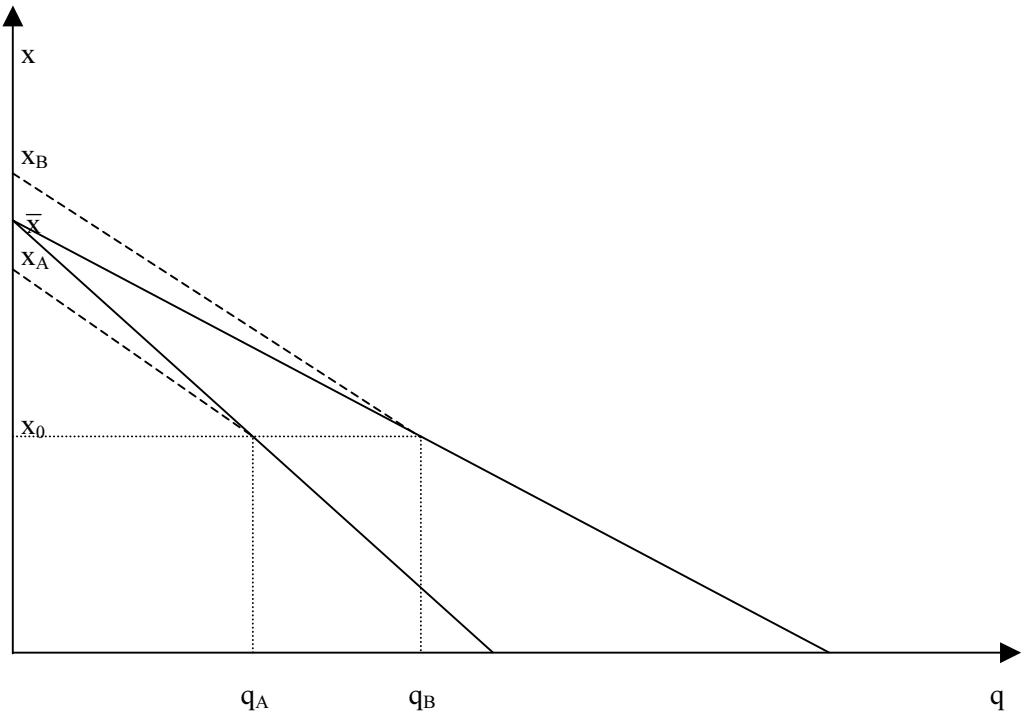
The common approach in studies of the distribution of public services is to assume that the value of services equals the expenditures in service production, see Ruggles and O'Higgins (1981), Gemmell (1985), Smeeding et al. (1993) and Ruggeri et al. (1994). This means that in-kind transfers are treated similarly as cash transfers when this income component is added to private incomes in analyses of income distribution. A shortcoming of this approach is that it does not account for variation in prices per unit of output in the production of public services.

By assuming that prices do not vary across municipalities, it follows that the choice sets are identical for two consumers with equal incomes (when there is no government regulation). With identical choice sets it makes sense to assume that the two consumers enjoy equal economic welfare.[1] By contrast, if different consumers face different prices, then choice sets and economic welfare may differ even when incomes are equal. For many goods one may argue that competitive markets prevent large variation in prices, and that consumers are free to buy from those suppliers who offer the lowest price. However, this argument is less relevant for publicly provided goods. Usually recipients accept the services they are offered by public authorities. When expenditures are used as a measure of the value of local government service production, one has to assume that costs per unit of output are constant across regions. This assumption is quite restrictive, since regions differ with respect to economic,

[1] Income is one of the primary goods in the theory of Rawls (1971). If the various institutional primary goods were equally supplied, then Rawls would call for equalizing the remaining one, which is income. This principle is criticized by Sen (1992), who argues that well-being is affected by human diversity and variation in capabilities. However, since there is little available information about the distribution of capabilities, this dimension is not included in our analysis.

demographic and geographic characteristics. For instance, one would expect that unit costs are affected by settlement patterns and economies of scale that vary across regions.

**Figure 1. Valuation of a publicly provided good with variation in unit costs**




A situation with different unit costs for a publicly provided good is shown in Figure 1. There are two recipients, A and B, who receive quantities $q_A$ and $q_B$ of the publicly provided good. The recipients live in different municipalities, 1 and 2, with different production costs per unit of q, where unit costs are given by $p_1$ and $p_2$, respectively. The private incomes of A and B are assumed to be equal and given by $x_0$. We also assume that the cash-equivalent transfers to A and B are equal and given by $\bar{x} - x_0 = p_1 q_A = p_2 q_B$. Thus the sum $\bar{x}$ of private incomes and individual-specific public expenditures is equal for A and B. However, as $p_1 > p_2$, municipality 1 produces less output for given expenditure than municipality 2. Therefore, $q_B > q_A$, and welfare is higher for B than for A. The effect of different prices is, however, ignored when the value of the publicly provided good is defined by public expenditure $\bar{x} - x_0$. To accommodate this criticism it seems reasonable to define a common value per unit of q across municipalities, and we propose that valuation is based on the average unit cost $\bar{p} = (p_1 q_A + p_2 q_B)/(q_A + q_B)$. It follows that the value of in-kind transfers is lower for A than for B. This is shown in the figure where total incomes including the value of services are given by $x_A$ and

$x_B$. Note that this method ensures that aggregate income is equal to aggregate expenditure, i.e. $x_A + x_B = 2\bar{x}$, although the valuation of services on the municipality level differs from the corresponding expenditure.

## 2.1 A method for assessing variation in unit costs

For the purpose of empirical application some difficulties arise when average unit costs are assumed to form the basis of the valuation of public services. The major problem arises from lack of adequate measures for public output. When output is unobserved, we are neither able to observe unit costs. However, in this paper we propose a method for estimating variation in unit costs for public services based on municipal expenditure data for different services combined with observations of local economic, social, demographic and geographic variables. The expenditure data are assumed to be generated from a model specified as a linear expenditure system (LES) with eight service sectors

$$u_i = \alpha_i + \beta_i (y - \alpha) + \varepsilon_i, \quad i = 1,2,...,8. \qquad (2.1)$$
$$\sum_{i=1}^{8} \beta_i = 1, \qquad \alpha = \sum_{i=1}^{8} \alpha_i,$$

where $u_i$ is per capita expenditure on service sector i, y is per capita exogenous income of the local government,[2] the parameter $\alpha_i$ is called "subsistence expenditure", the parameter $\beta_i$ is the marginal budget share, and $\varepsilon_i$ 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 in school 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 either as affecting unit costs or output. Although these

[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 (2003).

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

$$\alpha_i = \boldsymbol{\alpha}_{i1}\mathbf{z}_{i1} + \boldsymbol{\alpha}_{i2}\mathbf{z}_{i2}, \quad i = 1,2,...,8, \tag{2.2}$$

where $\mathbf{z}_{i1}$ is a vector of variables that affect unit costs in service sector i, $\mathbf{z}_{i2}$ 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 based on data for 1998 are reported in Appendix B. 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. Child care
4. Health care
5. Social services
6. Care for the elderly and disabled
7. Culture
8. Infrastructure

An overview of the variables that affect unit costs and subsistence output in different service sectors is provided 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. This relationship is captured in the model by an index for small municipalities and 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.

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.

**Table 1. Variables affecting subsistence expenditures by type of variable and service sector**

| Variable type | Variable name | Included in sector |
|---|---|---|
| $z_{i1}$ Variables affecting unit costs | Index for small municipalities | 1, 2, 3, 4, 6 and 8 |
| | Inverse population size | 1 |
| | Person hours (average traveling time) | 2, 4 and 6 |
| | Population density | 2 |
| | Sewage purification degree | 8 |
| | Amount of snowfall | 8 |
| | Mentally disabled 7-15 years per capita | 2 |
| | Mentally disabled 16 years and above per capita | 6 |
| $z_{i2}$ Variables affecting subsistence output | Population share 0-5 years of age | 3 and 4 |
| | 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 per capita | 3 |
| | Unemployed 16-59 years per capita | 5 |
| | Divorced/separated 16-59 years per capita | 5 |
| | Foreigners from remote cultures per capita | 5 |
| | Dummy for urban municipalities | 5 |
| | Dummy for suburban municipalities | 7 |
| | Index for small municipalities | 5 |
| | Population density | 7 |

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

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.

As 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 child care and education as well.

The population share of mentally disabled is a variable that includes actual recipients rather than potential recipients. Local government expenditure increases with the number of mentally disabled because this group is entitled to municipal care. The distribution of mentally disabled on 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 mentally disabled does not mean that the local community gives rise to a high risk of becoming mentally disabled. If we assume that the number of mentally disabled affects subsistence output, it follows that total output and welfare in the local community increase with the number of mentally disabled. 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 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

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

where $u_i^*$ is the value of services in sector i, and $\bar{z}_{i1}$ is the weighted average of the variables that affect unit costs.[4] From (2.1) - (2.3) it follows that the value of local government service production in sector i equals

$$u_i^* = u_i - \boldsymbol{\alpha}_{i1}(\mathbf{z}_{i1} - \bar{\mathbf{z}}_{i1}), \quad i = 1,2,...,8. \tag{2.4}$$

Thus, in assessing the value of sector-specific services, observed expenditures are adjusted for the difference between estimated unit costs and average unit costs. In municipalities with unit costs that are higher (lower) than average, the value of services is defined to be below (above) 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 (2.4) captures variation in the output that can be supplied for a given budget due to different local production possibilities. Thus, the adjustment in (2.4) can be viewed as analogous to the use of household equivalence scales for adjusting household incomes according to size and composition of the households. Note, however, that the proposed municipal equivalence scale depends on the income of the municipalities, in contrast to what is common for household equivalence scales.[5]

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 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.

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

[5] An exception is provided by Aaberge and Melby (1998), who rely on LES to justify an income-dependent household equivalence scale.

**Table 2. Summary statistics for the ratio between the value of municipal services and expenditures by municipality size in 1998. Per cent**

| Municipality size | Number of municipalities | Mean | Minimum | Maximum | Standard deviation |
|---|---|---|---|---|---|
| Small: 0-4999 residents | 245 | 80.6 | 59.5 | 94.8 | 5.7 |
| Medium: 5000-19999 residents | 150 | 97.2 | 64.7 | 115.7 | 9.2 |
| Large: 20000 residents and above | 40 | 107.6 | 95.9 | 113.1 | 3.1 |
| All municipalities | 435 | 88.8 | 59.5 | 115.7 | 12.0 |

The valuation of total service production in different municipalities is reported in table 2. The applied method ensures that the total value of services equals total expenditures for all municipalities. However, the estimated value of services may exceed or fall below expenditures on the municipality level. 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. Valuated services vary between 59.5 percent and 115.7 percent of expenditures.

# 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:

- 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 Appendix A. The third step consists of aggregating benefits over family members. The common 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 in different families. An alternative to in-kind transfers is to purchase similar services in the private market or to provide services as internal household production. For instance, parents may benefit from a reduction in household work when children are taken care of in kindergartens. Thus, it doesn't seem plausible to assume that the primary recipients are the only beneficiaries. Therefore we apply the conventional assumption of equal distribution within families in the fifth step.

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 care, 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 care is shared as a public good within families, so a=0 for this sector.

Care for the elderly and disabled includes nursing and assistance in household work. While the individual recipient consumes nursing, assistance in 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.

It remains to spell out the details of the two first steps. The first concerns identification of recipients while the second determines the allocation of the value of municipal services on recipients. For some services we identify a subgroup of the population as recipients. 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. In this case age serves as a fairly accurate description of the recipients.

When direct identification of recipients is impossible we may use available data to estimate the probabilities of being recipient for different socio-demographic subgroups of the population. These probabilities may vary as a function of age, sex, family type, education level, private income and municipality. The estimation of probabilities is based on data or estimates for the number of recipients in different population groups by municipality. 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 then will appear to have rather high welfare compared to those who are in good health. To be meaningful this approach requires that the direct welfare loss associated with illness and disability is 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 recipient. Thus, the variation in in-kind transfers to persons derive either from variation in the probability of being recipient, or from variation in the economic situation and service sector priorities across local governments.

**Table 3. Distribution of different municipal services as a function of individual characteristics**

| | Age | Sex | Family type | Education level | Private income |
|---|---|---|---|---|---|
| Administration | | | | | |
| Education | x | | | | |
| Child care | x | | x | x | |
| Health Care | x | x | | | |
| Social care | x | | | | x |
| Care for the elderly and disabled | x | x | x | | |
| Culture | | | | x | |
| Infrastructure | | | | | |

The detailed methods for selecting recipients and distributing the value of services are discussed for eight different service sectors in Appendix A. We combine estimates of probabilities of being recipient with the assumption of a distribution within municipalities that is uniform for selected recipients or for 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.[6] The characteristics that are included in the analysis for different service sectors are shown in Table 3.

# 4. Distribution of in-kind benefits by age, family type and education level

Based on the methods for valuation and allocation of services on individuals described in Sections 2 and 3 we are able to examine the relationship between in-kind benefits and different socio-demographic characteristics. Table 4 displays mean values of municipal in-kind benefits by age and service sector. The mean values for all age groups show that care for the elderly and disabled and education are the major service sectors. In-kind benefits are closely related to age in child care, education, care for the elderly and disabled, and social care. For other service sectors the impact of age on the distribution of benefits is modest. Due to the assumption that in-kind benefits are shared equally within families, we find that benefits in child care and education services are enjoyed by parents as well. Similarly younger persons who live together with elderly persons enjoy benefits from care for the elderly. Moreover, younger persons do also receive a personal insurance against the risk of disablement. However, the value of such insurance increases with age. As the results in Table 4

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

demonstrate, total in-kind benefits are relatively low in the age-group 16-66 years. This is due to the fact that the basic local government services are primarily reserved for children and elderly.

**Table 4. Mean municipal in-kind benefits for persons by age and service sector, NOK 1998**

| | 0-5 years | 6-15 years | 16-66 years | 67-79 years | 80 years and above | All age-groups |
|---|---|---|---|---|---|---|
| Administration | 1 800 | 1 800 | 1 800 | 1 800 | 1 800 | 1 800 |
| Education | 6 000 | 22 200 | 5 000 | 0 | 0 | 6 600 |
| Child care | 8 500 | 1 800 | 1 300 | 0 | 0 | 1 800 |
| Health care | 1 100 | 1 100 | 1000 | 1 300 | 1 200 | 1 100 |
| Social care | 1 800 | 1 700 | 2 000 | 400 | 300 | 1 700 |
| Care for the elderly and disabled | 1 400 | 1 500 | 2 500 | 22 900 | 92 400 | 8 100 |
| Culture | 1 400 | 1 400 | 1 400 | 1 300 | 1 200 | 1 400 |
| Infrastructure | 2 300 | 2 300 | 2 300 | 2 400 | 2 500 | 2 300 |
| Total | 24 400 | 33 800 | 17 500 | 30 100 | 99 400 | 24 800 |

The assumption of equal sharing of benefits within families implies that there are both a direct and an indirect effect of benefits on the members of the family. For instance, the value of education services received by a family depends on the number of children in school age in the family and is enjoyed by every family member. By contrast, if education services were privately provided then the family would have to finance the education of the children and all family members would suffer from a loss in income.

**Table 5. Mean municipal in-kind benefits for persons by age and family type, NOK 1998[*]**

| | 0-5 years | 6-15 years | 16-66 years | 67-79 years | 80 years and above |
|---|---|---|---|---|---|
| Single without children | - | - | 12 200 | 47 600 | 121 300 |
| Single with children | 30 100 | 39 500 | 22 100 | - | - |
| Couple without children | - | - | 11 900 | 18 400 | 51 200 |
| Couple with children | 23 400 | 32 000 | 20 300 | - | - |

[*] - means that the group includes zero or few observations.

Table 5 displays mean values of total municipal in-kind benefits by age and family type. The results show that mean in-kind benefits are particularly high for single elderly above 80 years of age. Recall that single elderly have a higher probability than married elderly to receive care for the elderly. Moreover, the single elderly do not share their benefits with younger family members. Persons without children receive particularly low in-kind benefits in the age-group 16-66 years, since such families are

not eligible for child care and education services. Children with a lone parent receive higher benefits than children in families of a couple with children. This is due to a higher probability of receiving child care for children 0-5 years with a lone parent. Moreover, the value of in-kind benefits is shared by more individuals in larger families.

**Table 6. Mean municipal in-kind benefits for persons 30-39 years by education level and service sector, NOK 1998**

| | Primary school or below | Secondary school | Higher education |
|---|---|---|---|
| Administration | 1 800 | 1 800 | 1 800 |
| Education | 10 400 | 10 000 | 7 500 |
| Child care | 1 800 | 2 800 | 5 300 |
| Health care | 1 000 | 1 000 | 1 100 |
| Social care | 2 600 | 2 100 | 1 900 |
| Care for the elderly and disabled | 1 700 | 1 600 | 1 500 |
| Culture | 1 200 | 1 300 | 1 700 |
| Infrastructure | 2 300 | 2 300 | 2 300 |
| Total | 22 800 | 23 000 | 23 000 |

The education level in the population decreases with age and captures a cohort effect. Since a relatively high share of the elderly has lower education, we find that those with lower education on average receive quite high benefits from care for the elderly. In order to separate education and cohort effects, we have computed mean in-kind benefits for the age-group 30-39 years in Table 6. We find that those with higher education receive relatively low benefits from education and high benefits from child care. This is partly explained by the fact that the highly educated tend to postpone child bearing while taking their education, which means that they on average have younger children than those with lower education. Moreover, children of the highly educated have a relatively high probability to receive child care benefits when they are in preschool age. Benefits from social care decrease with the education level, since education and income is positively correlated, and higher income yields a lower probability to receive social care. Benefits from culture services, however, increase with the education level, as the highly educated use culture services more frequently. Although the average values of the different services vary by education level, the total in-kind benefits from local public services are almost constant across education levels for the age-group 30-39 years.

# 5. Inequality in the distribution of in-kind benefits

The national distribution of in-kind benefits is affected by the central government's transfer program for municipalities as well as the spending behavior of local governments. Municipal incomes in Norway include grants-in-aid from the central government, local government taxes and user fees. Both the tax rate and the tax base for income taxes are determined by the central government. Thus, apart from user fees, the choice set for local governments is given exogenously as a function of total incomes and local unit costs. However, local governments have discretion to determine the distribution of in-kind benefits on service sectors, persons and families. Thus, the transfer program introduced by the central government may affect inequality between municipalities, whereas the spending behavior of local governments has an impact on the inequality within municipalities.

## 5.1 Inequality between and within municipalities

Inequality between municipalities arises when the per capita in-kind benefits differ between municipalities. The mean and inequality in the distribution of per capita in-kind benefits are reported in Table 7. Note that municipalities in the right tail of the distribution are in general small municipalities, which means that outliers are weighted more heavily when the standard deviation is computed on the municipal level rather than on the individual level. The within inequality component is measured by the Gini-coefficient for each municipality. A summary of the results is displayed in Table 7. The mean value of the Gini-coefficients equals 0.369, which suggests a rather high inequality compared to the inequality in the distribution of private incomes in Norway.

**Table 7. Summary statistics for the mean and Gini-coefficient of the municipal-specific distributions of in-kind benefits, 1998**

| | Mean | Minimum | Maximum | Standard deviation |
|---|---|---|---|---|
| Municipal per capita in-kind benefit (NOK) | 27 000 | 15 500 | 123 400 | 9 800 |
| Gini-coefficient (Within inequality) | 0.369 | 0.183 | 0.608 | 0.058 |

Similar results by size of municipality are reported in Table 8, which shows that in-kind benefits are on average higher in small municipalities compared to medium and large municipalities. Inequality in the overall distribution of in-kind benefits is also slightly higher in small municipalities.

For further analysis of the distribution between and within municipalities we utilize the following decomposition of in-kind benefits

(5.1) $$u^*_{jk} = \bar{u}^*_j + (u^*_{jk} - \bar{u}^*_j),$$

where $u^*_{jk}$ is the total value of municipal in-kind benefits for person k in municipality j, and $\bar{u}^*_j$ is the average in-kind benefit for persons in municipality j. In the computation of average in-kind benefits we have assumed no economies of scale at the family level. This component captures the remaining inequality when differences within municipalities are removed, and thus identifies the contribution to inequality that arises from variation in fiscal capacities and unit costs across municipalities.[7] Inequality in the distribution of the internally equalized in-kind benefit is displayed in the last column of Table 8, and is found to be rather low compared to within as well as overall inequality. Decomposition of the Gini-coefficient by the two components in equation (5.1) shows that the between component contributes to only 5 percent of the inequality in the national population. However, for small municipalities the between component contributes to 15 percent of the inequality. Higher inequality among small municipalities is explained partly by high tax revenue from hydroelectric power plants in some of the small municipalities, and partly by the central government grant system, which discriminates between small municipalities depending on their geographical location.

**Table 8. Population, average in-kind benefits, and Gini-coefficient for the distribution of in kind benefits on persons by municipality size, 1998**

| Municipality size | Population | Mean in-kind benefits (NOK) | Gini-coefficient (Overall inequality) | Gini-coefficient (Between inequality) |
|---|---|---|---|---|
| Small: 0-4999 residents | 626 528 | 26 900 | 0.405 | 0.144 |
| Medium: 5000-19999 residents | 1 482 136 | 23 700 | 0.384 | 0.071 |
| Large: 20000 residents and above | 2 308 779 | 24 900 | 0.393 | 0.058 |
| All municipalities | 4 417 443 | 24 800 | 0.393 | 0.081 |

## 5.2 Decomposition by service sector

The priorities between different service sectors are largely affected by local government policies, but to some extent also by national regulations and the income level of different local governments. The priorities between different recipients within a given service sector are mainly determined by local bureaucratic officials. However, the detailed allocations are subject to national regulations and control

[7] For an analysis of fiscal disparities between Norwegian municipalities, see Langørgen and Aaberge (1999).

by the local and national political system. Thus, the distribution of in-kind benefits is a complicated process, which involves several decision levels. However, it is useful to divide the decision process into two different stages. In the first stage priorities *between* service sectors are determined, while the second stage determines priorities *within* service sectors. To study the impact of the two stages on the distribution of in-kind benefits, we define total in-kind benefits as the sum of sector-specific in-kind benefits

$$u^* = \sum_{i=1}^{8} u_i^* , \tag{5.2}$$

where $u^*$ is total in-kind benefit. Note that subscripts for person and municipality are suppressed in equation (5.2), so $u_i^*$ is in-kind benefit in service sector i. As demonstrated by Rao (1969) the Gini-coefficient (G) admits the following decomposition

$$G = \sum_{i=1}^{8} v_i(G) = \sum_{i=1}^{8} \frac{\mu_i}{\mu} \gamma_i , \tag{5.3}$$

where $\mu_i / \mu$ is the ratio between the means of $u_i^*$ and $u^*$ respectively, which is denoted the factor share (or income share) of component i. The concentration coefficient $\gamma_i$ can be interpreted as the conditional Gini-coefficient of component i given the rank order in total in-kind benefit $u^*$. The product of the income share and the concentration component is denoted the inequality contribution $v_i(G)$. The relative inequality contribution $v_i(G)/G$ is denoted the inequality share.

Note that $\gamma_i$ is a measure of interaction between $u_i^*$ and $u^*$. Assume for example that $\mu_i > 0$. Then a negative value of $\gamma_i$ expresses negative interaction, which means that component i gives an equalizing contribution to total inequality. A positive value of $\gamma_i$ expresses positive interaction, which means that component i gives a disequalizing contribution to total inequality. The case $\gamma_i = 0$ corresponds to a situation where every person receives an equal amount of component i. Thus, component i gives a neutral contribution to total inequality.

**Table 9. Decomposition of the Gini-coefficient for the distribution of in-kind benefits by service sector**

| | Inequality share | Income share | Concentration coefficient |
|---|---|---|---|
| Administration | 0.005 | 0.073 | 0.025 |
| Education | 0.365 | 0.266 | 0.539 |
| Child care | 0.090 | 0.072 | 0.487 |
| Health care | 0.006 | 0.044 | 0.055 |
| Social care | -0.000 | 0.070 | -0.002 |
| Care for the elderly and disabled | 0.499 | 0.326 | 0.601 |
| Culture | 0.004 | 0.056 | 0.030 |
| Infrastructure | 0.032 | 0.094 | 0.135 |

The results for the decomposition of the Gini-coefficient for in-kind benefits by service sector in Table 9 show that the two largest service sectors, education and care for the elderly and disabled, have high concentration coefficients as well as high inequality shares. Moreover, the concentration coefficient is also high for child care, although child care accounts for a minor share of total spending. Thus, the contributions from these three services are highly disequalizing and explain the high level of inequality in the distribution of municipal services. Administration, health care, social care, culture and infrastructure services are distributed more evenly across individuals.

The indicated large inequality in the distribution of in-kind benefits - largely due to the contribution from basic welfare services like education and care for the elderly and disabled - 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.

# 6. Inequality in the distribution of extended income

Public in-kind benefits increase the economic welfare of the recipients. However, our knowledge of the relationship between in-kind benefits and private incomes and its impact on income inequality is rather limited. To study this subject 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 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.

**Table 10. Mean value and Gini-coefficient for the distribution of extended income by municipality size**

| | Small: 0-4999 | Medium: 5000-19999 | Large: 20000 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 |

The summary information for the distribution of extended income in Table 10 shows that the mean extended income is increasing with municipality size. Moreover, inequality in the distribution of extended income is increasing with municipality size. The inequality in the distribution of extended income is considerably lower than the inequality in the distribution of municipal in-kind benefits, see Table 8. To get a better understanding of the relationship between private incomes and public in-kind transfers, we will decompose the inequality in the distribution of extended income by the following six components

1. Market incomes
2. Social assistance
3. National cash transfers
4. Taxes
5. Municipal user fees
6. Municipal services

**Table 11. Decomposition of the Gini-coefficient for the distribution of extended income by 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 | -0.126 | 0.219 | -0.102 |
| Taxes | -0.530 | -0.309 | 0.303 |
| Municipal user fees | 0.003 | -0.032 | -0.017 |
| Municipal services | -0.016 | 0.147 | -0.019 |

Market incomes include salaries, income from self-employment and capital incomes. 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 national government. Municipal user fees are treated similarly as taxes, which means that municipal services as a component of extended income

include services that are financed by user fees. The results from the decomposition are displayed in Table 11.

Market incomes are the dominating component, and have 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 are equalizing. Social assistance and central government cash transfers are also equalizing, and more strongly for social assistance than for national cash transfers. Concentration coefficients 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. The major conclusions from Table 11 are also valid for subpopulations formed by residents in small, medium and large municipalities. However, market incomes and taxes are relatively high in large municipalities, while factor shares for national cash transfers and the value of municipal services are high in small municipalities. For more details, see Appendix C.

**Table 12. Decomposition of the Gini-coefficient for the distribution of extended income by 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 |
| Child care | 0.000 | 0.011 | 0.004 |
| Health care | -0.000 | 0.005 | -0.016 |
| Social care | -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 |

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 11 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 12. The purpose is to analyze the

interaction between extended income and different municipal services. We find that the contribution from social care is equalizing. The value of care for the elderly and disabled is weakly equalizing, whereas the value of education and culture is weakly disequalizing. The contributions to income inequality from the remaining municipal service sectors are approximately neutral. Note that these contributions are rather different from the various sector-specific contributions to inequality in the marginal distribution of in-kind transfers.

**Table 13. 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 |

To provide more detailed information of the decomposition of the inequality in the distribution of extended income, mean values of different income components by decile are reported in Table 13. 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, it seems 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 neither targeted 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.

**Table 14. 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 |

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

The percent of valued municipal services that originates from different service sectors is reported for each decile group in Table 14. 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 12. The low value of municipal services in the first, ninth and tenth decile groups in Table 13 is first and foremost due to low benefits from education, child care and care for the elderly and disabled. These three services sectors account for shares of valued services that 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 not very 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 frequency of low extended incomes among the elderly and families with children. For detailed results on the age composition of different income groups, see Table C.4 in Appendix C. 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 disequalising.

# 7. 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, and can be viewed as analogous to the use of household equivalence scales for adjusting household incomes according to size and composition of the households.

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 child care 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.

One of the main findings is that there is high inequality in the marginal distribution of municipal in-kind benefits. The high inequality is to a large extent due to inequality in the distribution of in-kind benefits *within* municipalities, while the inequality *between* municipalities in average in-kind benefit for local residents is comparably low. The contributions from three service sectors (education, child care and care for the elderly and disabled) are highly disequalizing and explain the high level of inequality in the distribution of municipal services.

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 distribution of municipal services is high, the contribution of municipal services to inequality in the distribution of extended income is approximately neutral. This result is explained by relatively low frequencies of poor and rich families that include children and elderly people. Thus, families that receive important municipal services like primary education and care for the elderly are more frequently located in the central part of the distribution of extended income.

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## Appendix A

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 are 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 are assumed to be distributed uniformly on all children in the age-group 6-15 years.

***Child care***

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 5000 families, where the type of child care 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 are 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 child care 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 is 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 predictions 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 5000 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 on 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 5000 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 on 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 recipient increases with age, and that the elderly women have a higher probability than elderly men. Furthermore, elderly who are single have a higher probability than elderly who are married. These results refer to averages, since the probability also varies across municipalities.

While the selection of recipients in child care 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 is 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 recipient. 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 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 5000 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 on the municipal level, we do not account for variation in demand

between persons with the same education level. User fees are distributed on 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 on 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.

**Appendix B**

**Table B. Estimates of parameter heterogeneity for subsistence expenditures, 1998***

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| Constant | 0,47<br>(4,28) | -0,65<br>(1,39) | -0,56<br>(1,98) | 0,05<br>(0,15) | 0,58<br>(5,12) | -0,39<br>(1,03) | 0,47<br>(4,41) | 0,15<br>(0,56) |
| Population share 0-5 years of age | | | 16,68<br>(4,62) | 1,25<br>(0,37) | | | | |
| Population share 6-15 years of age | | 37,57<br>(10,20) | | | | | | |
| Population share 67-79 years of age | | | | | | 8,39<br>(5,23) | | |
| Population share 80-89 years of age | | | | 1,50<br>(0,59) | | 31,88<br>(5,23) | | |
| Population share 90 years and above | | | | 1,50<br>(0,59) | | 167,9<br>(5,14) | | |
| Children 0-5 years with lone mother/father per capita | | | 16,87<br>(2,04) | | | | | |
| Mentally disabled 7-15 years per capita | | 181,3<br>(2,16) | | | | | | |
| Mentally disabled 16 years and above per capita | | | | | | 476,7<br>(51,58) | | |
| Foreigners from remote cultures per capita | | | | | 20,71<br>(4,01) | | | |
| Divorced/separated 16-59 years per capita | | | | | 9,02<br>(4,84) | | | |
| Unemployed 16-59 years per capita | | | | | 8,20<br>(1,57) | | | |
| Person hours (average traveling time) | | 1,93<br>(7,32) | | 0,58<br>(5,60) | | 0,95<br>(2,30) | | |
| Population density | | -0,83<br>(3,33) | | | | | 0,05<br>(0,40) | |
| Dummy for urban municipalities | | | | | 0,33<br>(3,61) | | | |
| Dummy for suburban municipalities | | | | | | | -0,08<br>(1,31) | |
| Index for small municipalities | 0,88<br>(4,40) | 1,56<br>(4,65) | 0,58<br>(3,04) | 0,63<br>(3,96) | -0,34<br>(3,39) | 1,47<br>(3,51) | | 1,54<br>(3,84) |
| Population inverted (thousands) | 1,15<br>(8,24) | | | | | | | |
| Sewage purification degree | | | | | | | | 0,57<br>(3,51) |
| Amount of snowfall (meters) | | | | | | | | 0,09<br>(1,74) |
| $R^2$ | 0,84 | 0,77 | 0,59 | 0,62 | 0,43 | 0,86 | 0,62 | 0,75 |

* The dependent variables are per capita expenditures in eight different service sectors. Thousands of Norwegian kroner are used as unit of measurement. T-statistics are in parentheses. Number of observations = 426.

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

**Appendix C**

**Table C.1. Decomposition of the Gini-coefficient for the distribution of extended income in small municipalities***

| | Inequality share | Income share | Concentration coefficient |
|---|---|---|---|
| Market incomes | 1.666 | 0.899 | 0.356 |
| Social assistance | -0.006 | 0.003 | -0.342 |
| National cash transfers | -0.179 | 0.237 | -0.145 |
| Taxes | -0.477 | -0.271 | 0.337 |
| Municipal user fees | 0.007 | -0.035 | -0.036 |
| Municipal services | -0.011 | 0.167 | -0.013 |

* The table includes the population in 245 municipalities where each has less than 5 000 residents.

**Table C.2. Decomposition of the Gini-coefficient for the distribution of extended income in medium size municipalities***

| | Inequality share | Income share | Concentration coefficient |
|---|---|---|---|
| Market incomes | 1.726 | 0.962 | 0.353 |
| Social assistance | -0.009 | 0.004 | -0.463 |
| National cash transfers | -0.180 | 0.219 | -0.161 |
| Taxes | -0.520 | -0.299 | 0.342 |
| Municipal user fees | 0.005 | -0.030 | -0.035 |
| Municipal services | -0.022 | 0.145 | -0.030 |

* The table includes the population in 150 municipalities where each has between 5 000 and 20 000 residents.

**Table C.3. Decomposition of the Gini-coefficient for the distribution of extended income in large municipalities***

| | Inequality share | Income share | Concentration coefficient |
|---|---|---|---|
| Market incomes | 1.651 | 0.992 | 0.393 |
| Social assistance | -0.014 | 0.006 | -0.541 |
| National cash transfers | -0.099 | 0.214 | -0.109 |
| Taxes | -0.534 | -0.325 | 0.387 |
| Municipal user fees | -0.001 | -0.031 | 0.003 |
| Municipal services | -0.003 | 0.144 | -0.005 |

* The table includes the population in 40 municipalities where each has 20 000 residents or more.

**Table C.4. Percent of population in different age and family groups by deciles of extended income, 1998**

| Age | 0-5 | 6-15 | 16-66 | | 67-79 | | 80 and above | Total |
|---|---|---|---|---|---|---|---|---|
| Family type* | | | Single | Couple | Single | Couple | | |
| 1. decile | 7.6 | 5.7 | 48.5 | 14.9 | 8.5 | 11.1 | 3.7 | 100.0 |
| 2. decile | 9.4 | 9.6 | 29.0 | 21.5 | 11.3 | 14.8 | 4.4 | 100.0 |
| 3. decile | 10.3 | 12.6 | 28.4 | 27.2 | 8.4 | 8.6 | 4.5 | 100.0 |
| 4. decile | 10.7 | 15.1 | 24.4 | 34.0 | 5.0 | 5.7 | 5.2 | 100.0 |
| 5. decile | 10.3 | 16.0 | 21.1 | 39.7 | 3.1 | 4.2 | 5.7 | 100.0 |
| 6. decile | 9.5 | 16.3 | 17.3 | 46.2 | 2.1 | 3.3 | 5.4 | 100.0 |
| 7. decile | 8.3 | 15.9 | 14.0 | 52.7 | 1.4 | 2.8 | 4.9 | 100.0 |
| 8. decile | 6.8 | 14.3 | 11.5 | 59.7 | 1.0 | 2.4 | 4.4 | 100.0 |
| 9. decile | 5.2 | 11.8 | 10.0 | 67.6 | 0.7 | 2.0 | 2.6 | 100.0 |
| 10. decile | 4.4 | 10.1 | 9.1 | 72.4 | 0.6 | 2.1 | 1.2 | 100.0 |
| All | 8.3 | 12.7 | 21.3 | 43.6 | 4.2 | 5.7 | 4.2 | 100.0 |

* Lone mothers and fathers are included in the family type of singles.