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ABSTRACT

The Impact of Local Public Services and Geographical Cost of Living Differences on Poverty Estimates*

Despite a broad consensus on the need to take into account the value of public services and geographical cost of living differences when measuring poverty, there is little reliable evidence on how these factors actually affect poverty estimates. Unlike the standard approach in studies of the distribution of public services, this paper employs a method for valuing sector-specific local public services that allows for differences between municipalities in unit costs for providing public services. Furthermore, recipient frequencies in various demographic groups are used as the basis for determining the allocation of the value of these services on citizens of the municipalities. Geographical differences in living costs are taken into account by using municipal housing price indices or by replacing the country-specific poverty line with municipal-specific poverty lines. Applying Norwegian register data for the period 1993-2001, we find that disregarding the value of local public services and geographical cost of living differences yields a misleading picture of poverty.

JEL Classification: D31, H72, I30

Keywords: poverty, public services, in-kind transfers, geographical cost of living differences, housing price indices, municipal-specific poverty lines

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1. Introduction

The standard practice in most developed countries is to identify the poor on the basis of a poverty line defined as a specific fraction of the median cash income within a country.[1] Underlying the application of such a country-specific poverty line is the assumption that the cost of living is the same for everybody in the country. Yet simple common sense tells us that this cannot be the case. For example, housing prices in most developed countries differ significantly between rural and urban areas. Since housing prices normally tend to be lower in the former, the purchasing power of incomes in rural areas might be undervalued. In order to measure poverty or inequality in a country, it is therefore necessary to take into account price differences across regions. Two methods for dealing with this problem are discussed below. The direct method is to use a purchasing power index; the alternative, indirect method treats municipalities as separate units and assesses poverty on the basis of municipality-specific poverty lines.

Another basic shortcoming of the standard approach to poverty measurement is the omission of public in-kind benefits in income definitions, not least because about half of welfare state transfers in developed countries are in-kind benefits such as health insurance, education and other services (Atkinson et al, 2002, Garfinkel et al., 2006). Consequently, poverty estimates relying on a cash income measure might be biased. This bias is likely to carry over to comparative poverty studies, even if adjustments are made for differences in per capita expenditure on public services across countries, but not for variations in the provision of local public services within countries. For this reason, the Canberra Group (Expert Group on Household Income Statistics, 2001) and Atkinson et al. (2002) have expressed the need for more research in this field. Definition and measurement of public in-kind benefits require solutions of conceptual as well practical problems, which will be addressed in this paper.

Objective. The objective of this paper is to examine the impact of local government spending and geographical cost of living differences on the levels and trends over time of poverty, as well as on the geographic and demographic poverty profiles. Will extending the income measure with the value of local public services change the picture of poverty? And to what extent will poverty estimates be affected by incorporating cost of living differences across regions?

Local public services. In order to take into account the impact of local public services on poverty estimates, we draw on the approach proposed by Aaberge and Langørgen (2006) for valuing and

[1] A large body of empirical research on poverty employs such poverty lines. This approach is followed in the study of poverty on national levels and by region in the Nordic countries (Gustafsson and Pedersen, 2000). Furthermore, it is used

allocating public services on both an individual and a household basis. The valuation method for public services is derived from a structural model of spending behavior by local governments, where spending on different services is specified as a function of economic, social, demographic and geographic variables. Unlike the standard approach in studies of the distribution of public services, the method we use to value sector-specific local public services allows for differences between municipalities in terms of unit costs for providing public services. Furthermore, recipient frequencies in various demographic groups are used as the basis for determining the allocation of the value of these services on citizens of the municipalities. On this basis, an extended income measure, defined as the sum of cash income and the value of municipal in-kind benefits received by the household and the individual, is constructed.

Geographical cost of living differences. Extending the traditional cash income measure with in-kind benefits from local government spending is only half the job; disregarding geographical differences in the cost of living within a country may, nevertheless, yield a misleading picture of poverty. In particular, accounting for the large variation in housing costs between rural and urban areas is necessary to ensure that a given amount of income entails the same consumption potential across regions. In an attempt to transform the observed incomes into real incomes, we estimate a set of municipal housing price indices. On the basis of the distribution of real incomes within the country, a country-specific real income poverty line may be drawn and the poor identified.

This procedure takes account of geographical differences in housing costs, but not differences in other costs, and even for housing costs it assigns index values that may be in error for reasons ranging from substitution bias in the price indices to differences across areas in housing quality. Unfortunately, Norway – as is the case with most other countries – lacks credible data at a sufficiently disaggregated geographical level on housing-unit characteristics and local amenities, as well as on the price of non-housing goods. The binding constraint for transforming observed incomes into real incomes in an empirically sound manner can therefore be argued to be the data. A possible response to these problems, which is proposed by Mogstad et al. (2007), is to specify disaggregated poverty lines. The purpose of applying such disaggregated poverty lines is to provide a meaningful measure of poverty in a country with geographical cost of living differences when local price indices are too crude to produce sufficient comparability of income across areas. We follow this approach and specify a set of municipal-specific poverty lines according to the median income within each municipality. The poor are then defined as those whose income falls considerably short of the income of the 'representative' individual in their municipality.

to describe poverty patterns in the OECD countries (Atkinson et al., 1995; Forster and Pearson, 2002) and in the European Union (O'Higgins and Jenkins, 1990).

Data. This paper exploits a number of exceptionally rich Norwegian data sets. First of all, we use a household panel data set based on administrative registers covering the entire resident population of Norway in the years 1993–2001, a period that includes both a soaring boom and the start of a small recession. These household and demographic data are supplemented with detailed income data from the Tax Assessment Files. In addition, we rely on comprehensive sector-specific information on local government spending, detailed information about municipal characteristics, recipient statistics reported by local governments and sample surveys on the use of local public services. Furthermore, we utilise annual data on prices (per square metre) for the same type of house sold in the various municipalities as a proxy for the relative cost of housing across areas. Access to these unique data sources is critical for dealing with interpersonal differences within a country that arise due to variation in local public services and geographical cost of living. In principle, the level of geographical aggregation to make adjustments for these factors should be the local labour markets, which are approximated well by the 435 municipalities of Norway. By contrast, when data are collected from sample surveys, the scope for coping with such comparability problems is severely limited.[2]

The Norwegian case. Norway emerges as an interesting country for studying the impact of local public services and geographical cost of living differences on poverty estimates for reasons other than data quality. First of all, Norway is a relatively large country with a dispersed population, which has led to a divergent price pattern for basic goods such as housing across the 435 municipalities. As most of what we know about the impact of adjusting for geographical cost of living differences on poverty estimates comes from the United States, evidence from the institutional context of the generous Norwegian welfare state and centralized wage setting should be of interest.[3] Furthermore, Norway has a relatively large public sector where local governments play an important role in the provision of public services. In Norway, the central government has introduced an equalization programme in the grant system for local governments. However, important income components such as income from power plants and regional development transfers are not accounted for in the equalization scheme. Moreover, there is variation in local government spending across service sectors, as well as in spending priorities on different recipient groups (Aaberge and Langørgen, 2003). Consequently, some municipalities may be more effective than others in fighting poverty, either because they can provide a generally higher level of services or because they are targeting vulnerable groups.

[2] For example, the much-used Luxembourg Income Study database contains too few observations to deal with population heterogeneity within a country. Indeed, Aaberge (2001) demonstrates that when sampling errors are taken into account, the complete ranking of countries by inequality suggested in the OECD study by Atkinson et al. (1995) has to be replaced by ranking of countries in a few groups.

Outline. Section 2 outlines the approach used to value sector-specific local public services and to allocate services on an individual and a household basis. Section 3 discusses how we account for geographical differences in the cost of living. Section 4 describes the data and discusses definitional issues. Furthermore, this section contrasts the conventional cash income measure with the extended income measure and the real income measure. Section 5 presents empirical results showing the impact of local public services and geographical cost of living differences on poverty estimates. Section 6 concludes with a discussion of policy implications.

2. Local public services

As emphasized by Atkinson et al. (2002, p 103): 'As the level and distribution of individual services does affect comparisons across households and across countries where the extent of state provision differs, social transfers in kind should in principle be included in the definition of income'. Most studies of poverty, however, focus exclusively on cash income and omit the value of public services. Smeeding et al. (1993) suggest that 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'. The few studies that make any attempt to account for public in-kind benefits typically assume that the value of public services is equal to the expenditure in service production in a given area. This assumption is questionable, as local governments are known to differ with respect to unit costs for providing public services. Moreover, the value of the public services are usually allocated on the basis of a few demographic characteristics of the (potential) recipients, such as gender and age, disregarding important variation across areas and socioeconomic subgroups of the population.[4]

2.1 Valuing sector-specific local public services

As an alternative to setting the value of public services provided by local governments equal to their expenditure in service production, Aaberge and Langørgen (2006) propose a method for valuation that accounts for differences across areas in unit costs for providing local public services. The valuation method is derived from the cost structure of a behavioural model of local governments developed by Aaberge and Langørgen (2003), where spending on different services is specified as a function of economic, social, demographic and geographic variables. This model treats local governments as agents that maximize a Stone-Geary utility function subject to a budget constraint, which implies that the demand for local public services is described by a linear expenditure system (LES). Out-of-sample predictions suggest that the model simulates local government allocations rather well. In the model

[3] See, for example, Short (2001) and Jolliffe (2006) for studies of the impact of geographical cost of living adjustments on poverty estimates in the United States.

[4] See, for example, Ruggles and O'Higgins (1981), Gemmell (1985), Smeeding et al. (1993), Ruggeri et al. (1994), Garfinkel et al. (2006) for studies of the redistributional impact of public services.

one may distinguish between variables that affect subsistence expenditures (minimum required costs) and variables that affect the spending preferences of local governments. Moreover, Aaberge and Langørgen (2006) assume that the subsistence expenditure term can be expressed as a linear separable function of unit costs and subsistence output factors. This paper employs a different specification, which accounts for the multiplicative relationship between unit costs, subsistence output and subsistence expenditure.

Model. As was demonstrated by Aaberge and Langørgen (2003), the LES proves helpful in explaining differences in the spending behaviour of Norwegian municipalities, provided that account is taken of heterogeneity in sector-specific subsistence expenditures and in the preferences for allocation of income on different services. This paper assumes that municipal data on expenditure are generated from a model specified as a LES with eight service sectors[5]

(2.1) $$u_i = \gamma_i \pi_i + \beta_i (y - \sum_{j=1}^{8} \gamma_j \pi_j), \quad i = 1,2,...,8, \quad \sum_{i=1}^{8} \beta_i = 1,$$

where u_i is per capita expenditure[6] on sector *i*, *y* is per capita exogenous income of the local government, subsistence expenditure $\gamma_i \pi_i$ in sector *i* is defined as the product of its subsistence output (or minimum required quantity) γ_i and unit cost π_i, and β_i is the marginal budget share of sector *i*.[7] Discretionary income is defined by exogenous incomes minus total subsistence expenditure ($y - \sum_{j=1}^{8} \gamma_j \pi_j$), which yields a measure of how much income the local government may dispose of after total subsistence expenditure has been covered.

Heterogeneity in the parameters of the model. By allowing the subsistence output parameters γ, the unit cost parameters π and the marginal budget share parameters β to vary with observed variables, we obtain a more flexible modeling framework than that provided by (2.1). However, in order to identify variation in unit costs, it is necessary to assume that certain variables affect unit costs but not

[5] The local government sectors consist of administration, education, childcare, health care, care for the elderly and disabled, social services, culture, and infrastructure.

[6] Expenditure includes wages to local government employees, purchases of goods and services for public provision and social assistance (cash transfers), but excludes interest payments.

[7] The model in Aaberge and Langørgen (2003) treats user fees and budget surplus as well as expenditures on eight service sectors as endogenous variables. Since user fees account for a small share of local public incomes, the model has been simplified by treating user fees as exogenous in the present paper. Moreover, the model for budget surplus is suppressed in the model description, although the estimated model includes budget surplus as one of the model sectors. In Norway, local government income consists largely of grants-in-aid from the central government and local income taxes. The central government determines the tax rate and the tax base of the income tax, and equalization transfers are designed to be mainly

subsistence output. This assumption helps to clarify the distinction between unit costs and service needs, and is also instrumental in identifying the model.[8] Specifically, we introduce the following specifications

(2.2)
$$\gamma_i = \gamma_{i0} + \sum_{k=1}^{r_i} \gamma_{ik} z_{ik}, \ i = 1,2,...,8,$$

and

(2.3)
$$\pi_i = \pi_{i0} \left[1 + \sum_{k=1}^{n_i} \pi_{ik} (p_{ik} - \overline{p}_{ik}) \right], i = 1,2,...,8,$$

where $\left(z_{i1}, z_{i2}, ..., z_{ir_i}\right)$ and $(p_{i1}, p_{i2}, ..., p_{in_i})$ are vectors of variables that affect subsistence output and unit prices in service sector *i*. For example, we assume that settlement pattern and economies of scale affect unit costs, which means that small municipalities with a dispersed population are expected to face relatively high unit costs in service provision. By contrast, the age structure of the population is assumed to affect the need for different services, such as childcare, education and care for the elderly, and is consequently assumed to yield heterogeneity in subsistence output parameters. Although these assumptions may appear restrictive, they are less restrictive than the standard approach, which ignores a possible variation in unit costs and presupposes that the introduced explanatory variables exclusively affect output.

Heterogeneity in marginal budget shares might be due to different preferences across municipalities for allocating discretionary income on service sectors. Thus the following parameter heterogeneity is introduced

(2.4)
$$\begin{aligned} &\beta_i = \beta_{i0} + \sum_{k=1}^{n} \beta_{ik} t_k, \ (i = 1,2,...,8), \\ &\sum_{i=1}^{8} \beta_{i0} = 1, \\ &\sum_{i=1}^{8} \beta_{ik} = 0, \ (k = 1,2,...,n), \end{aligned}$$

unaffected by local government choices. Thus, per capita income of the local government is treated as exogenous in this model.

where t_k is a taste variable that affects the preferences for allocating discretionary income. For example, the party composition of the local government council may influence such service priorities.

Measurement scale and estimation. Equation (2.3) is specified with variables measured as deviations from national average levels, where $\overline{p}_{ik}$ is the mean of variable k that affects unit costs in service sector *i*. Consequently, the parameter π_{i0} can be interpreted as the average price level in service sector *i*. However, it turns out that these price levels are not identified in the model. Subsistence outputs and unit costs are only identified up to a multiplicative constant, since multiplying unit costs by a constant and dividing subsistence output by the same constant cannot be traced from the reduced form parameters of the model. There exists no obvious scale of measurement for output and unit costs of local public services. Yet the two choices of scale are closely related, since expenditures are defined by the product of output and unit costs. An attractive method is to normalize the average price levels to 1 ($\pi_{i0} = 1, i = 1,2,...,8$), which means that unit cost π_i is defined as a price index with the average for the whole country equal to 1. Moreover, it follows that service outputs are measured in money terms and are interpreted as monetary values of output for an average price level. The normalization of prices imposes no restrictions on the model other than a choice of measurement scale for prices and outputs. These restrictions allow us to identify the model and to derive measures of price and output. Thus the model defined by equations (2.1)–(2.4) forms the basis for estimating the parameters defined by (2.2)–(2.4). The estimation results are presented in Appendix A; as demonstrated by Tables A.1–A.3, nearly all parameter estimates are statistically significant and of expected signs.

Valuation of public services. When assessing outputs as the value of sector-specific services, we divide observed expenditure by the price index reflecting the relative differences in unit cost for providing a service across municipalities

$$(2.5) \qquad u_i^* = \frac{u_i}{\pi_i}, \quad i = 1,...,8,$$

where u_i^* is output measured as the value of services in sector *i*. Note that the estimated value of services for a given municipality may exceed or fall below the municipality's expenditure, depending on the unit costs of the municipality. A high π_i implies that the municipality has a relatively high cost for providing a given level of service in sector *i* compared to other municipalities. In municipalities

[8] Aaberge and Langørgen (2003) used a different, more restrictive approach, replacing the subsistence expenditure terms with linear functions of observed municipality characteristics.

where π_i is higher (lower) than 1, the value of services is found to be below (above) the observed expenditures.

Equation (2.5) can be seen as an analogue to household equivalence scales. However, note that the scale proposed here depends on the income of the municipality, which is not common practice when employing household equivalence scales. In addition to adjusting for variations in unit cost, expenditure is also adjusted for regional variation in employers' social security tax rate. The value of municipal in-kind benefits is calculated net of user fees.

2.2 Allocating the value of sector-specific local public services

To allocate the value of public services on individual and household basis, we need to (a) select recipients of different services and (b) distribute the value of services among the selected recipients. To this end, we follow the approach proposed by Aaberge and Langørgen (2006). Below, we give a brief overview of the allocation methods and refer to Appendix B for a more detailed description.

The selection of recipients of the various service sectors is based on three different methods; direct identification, simulation, and an insurance-based approach. For certain services, we are able to identify the recipients exactly. In most cases, however, sample survey data have been used as the basis for estimating probability of being a recipient conditional on specific geographic, demographic and socioeconomic variables. When simulating recipients, we use the estimated probability equations to draw correct sector-specific numbers of recipients for each municipality. The simulated recipients may not necessarily be the same as the actual recipients, but as long as their relevant characteristics are taken into account a good approximation of the underlying distributional profiles of the value of public services should be obtained. When the recipients have been selected by simulation, the value of services is distributed equally among the selected recipients.

For some services, such as health care, we use a risk-related insurance benefit approach. Health care is viewed as an insurance benefit received by everyone covered by the insurance scheme regardless of actual use. However, the value of the service is allowed to vary with age, household type and gender in line with the probability of being a recipient. Thus differences in allocated in-kind benefits across people may arise from variation in either the probability of being a recipient or the economic situation and service sector priorities across local governments.

3. Geographical cost of living differences

The official poverty measures in most developed countries make no adjustment for population heterogeneity beyond using equivalence scales to account for differences in household size and composition, implicitly assuming that the cost of living is constant within the country. Empirical evidence shows, however, that prices of basic goods, such as housing, differ significantly between urban and rural areas within a country. This motivated the National Academy of Sciences Panel on Poverty and Family Assistance in the United States to release a report recommending that the official poverty measure should be revised (Citro and Michael, 1995). One of the main recommendations was that it was necessary to take into account geographical differences in cost of living when measuring poverty. In particular, it was emphasized that there were significant variations in housing costs across regions of the country and that housing expenditure is one of the main expenditures of most households. Following up on this recommendation, a set of housing price indices were estimated and used to adjust the poverty threshold.

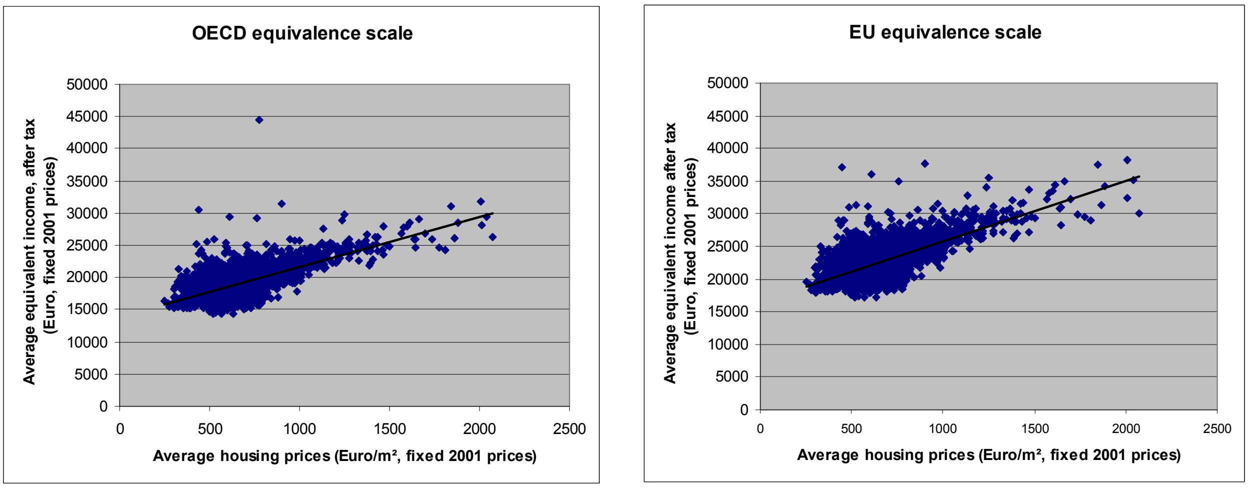
Over the last years, the U.S. panel's adjustment for geographical cost of living differences has been extensively discussed and criticized. Their view was that, although these indices contained inaccuracies, they were a marked improvement on the current measure, which makes no adjustment at all for geographical differences in the cost of living. Critics have argued, however, that even if incorporating geographical adjustments to poverty thresholds is appropriate in principle, the methods used to make these adjustments are too crude, primarily owing to a lack of credible data at a sufficiently disaggregated geographical level on housing-unit characteristics and local amenities, as well as on the prices of non-housing goods.[9]

Acknowledging the controversy surrounding the use of local housing price indices in the measurement of poverty, this paper not only takes into account geographical differences in the cost of living by estimating municipal price indices but also specifies municipal-specific poverty lines. Before discussing these approaches, however, we will briefly look at why it is necessary to adjust for geographical differences in the cost of living when measuring poverty.

Price–income relationship. Since the capacity of individuals to purchase goods that are not perfectly tradable depends on the level of resources of the other people around them due to the geographical pattern of competition, we would expect prices on certain goods, such as housing, to increase with the general income level in a municipality. In fact, Figure 3.1 shows a very strong correlation between average housing prices and the average (equivalent) income across the 435 municipalities in Norway, independent of the choice of equivalence scale. This indicates that the consumption potential of a given amount of income differs systematically between municipalities, which in turn suggests that studies disregarding regional price variation risk producing a misleading picture of poverty.

The positive correlation between income levels and housing prices across the municipalities fits well with the prediction of the Harrod-Balassa-Samuelson proposition that price levels on nontradable goods tend to rise with a country's per capita income.[10] The basic argument underlying this proposition is that rich areas appear to be relatively more productive in tradables than non-tradables. If the law of one price holds in the tradable sector, then interarea relative wages are determined by productivity differences in tradables. In rich areas, the producers of non-tradeable goods must set their prices relatively high to match the high wages in the tradable sector. This implies that both non-tradables and a representative basket of non-tradable and tradable goods will be more expensive in high-income areas compared to low-income areas.

Figure 3.1: Average housing prices and average income level by municipality in Norway, 1993-2001



Municipal price indices. To achieve full comparability of incomes within the country, a transformation of the observed incomes into real incomes is required. The data we have available for making this transformation is (a) individual observations of income and location for the entire population, (b) summary statistics for housing prices across municipalities and (c) average expenditure shares for the country as a whole used in the national consumer price index. In principle, the level of geographical

[9] See, for example, Short (2001), Iceland (2005) and Curran et al. (2006) for a discussion on the issue of adjusting for geographical cost of living differences in the measurement of poverty in the United States.

[10] See, for example, Rogoff (1996) for an introduction to the Harrod-Balassa-Samuelson theory and a survey of cross-country studies providing substantial support for the Harrod-Balassa-Samuelson proposition.

aggregation for determining the price indices should be the local labour markets, which are approximated well by the 435 municipalities of Norway.

Given the information available, the Symmetric Star method for multilateral comparison appears favourable.[11] A reason why is that it compares municipalities indirectly via the average municipality, or equivalently the country as a whole, and thereby ensures transitivity. Moreover, if we apply the Average Basket version of the Symmetric Star method we need information only about the price ratios between the municipalities and the expenditure shares of the average municipality, which corresponds to the expenditure shares used in the national consumer price index. This is attractive because we do not usually have credible data on municipality-specific expenditure shares due to small sample sizes in household budget surveys. Applying the Average Basket version of the Symmetric Star method, the price index between municipality *j* and *k* can be defined as

$$A_{jk} = \frac{\sum_{m=1}^{M} p_{mk} q_{ma}}{\sum_{m=1}^{M} p_{mj} q_{ma}} = \sum_{m=1}^{M} \left(p_{mk} / p_{mj} \right) s_{ma} , \tag{3.1}$$

where the price of commodity $m = 1, 2,\ldots, M$ supplied in municipality *j* is denoted p_{mj}, q_{ma} is the quantity of commodity *m* consumed in the average municipality *a* and s_{ma} is the corresponding expenditure share. From (3.1) it is clear that the price index between municipality *j* and *k* is defined as the ratio of the Laspeyres index for the average municipality *a* and municipality *k* and *j* respectively. The real income of an individual living in municipality *j* is given as the product of his or her observed income and the price index defined by (3.1).

Price index issues. As long as the municipalities differ exclusively in commodity prices and the chosen price index is a reasonable approximation of the true cost of living index, the distribution of real income will correspond to the underlying distribution of welfare. For several reasons, caution must be called for.

The price index defined by (3.1) accounts for geographical differences in housing cost, but not differences in other costs. For all other goods, we are forced to assume no geographic variation in prices due to lack of credible data. The same assumption is made by Short et al. (1998) and other studies of poverty in the United States that seek to adjust for geographical differences in the cost of living. This assumption is supported by Moulton (1995; p. 181) who notes that ‘the cost of shelter is the single most important component of interarea differences in the cost of living’. In fact, based on

[11] See Hill (1997) for a survey of multilateral methods to make comparisons of prices and quantities.

detailed price information for certain large metropolitan areas in the United States, Short (2001) reports that housing is the expenditure component with the largest geographic price variation, and adjusting for housing costs alone would represent a significant improvement in the measurement of poverty. As housing costs appear to be positively correlated with prices of other goods, the assumption of no geographic variation in non-housing goods can be argued to give downward-biased estimates of the actual differences in the cost of living across areas (Jolliffe, 2006).

Even for housing costs, the price index defined by (3.1) assigns index values that may be in error. Substitution bias in the price index is one reason.[12] Another is the difference across areas in housing quality: owing to data availability, this paper disregards the issue of housing quality beyond limiting the comparison to prices per square metre on detached houses sold in the same year. Malpezzi et al. (1998) examine the housing quality issue by applying hedonic methods to a number of metropolitan areas in the United States based on the 1990 census data with information about rents, neighborhood characteristics and contract conditions. When disregarding the quality issue (beyond limiting the comparison to two-bedroom apartments into which the occupant had moved within the last five years) Short (2001) shows that housing price indices are very similar to the quality-adjusted indices of Malpezzi et al. (1998). In terms of poverty rates, the comparison by Short (2001) indicates that adjusting for geographical variation in the cost of living improves the results, regardless of whether or not hedonic methods are used to deal with the issue of housing quality.

A final reason for exercising caution when it comes to using the local housing price indices is the question of whether the needs of individuals apply broadly to the entire country or differ according to region of residence. Arguably, an individual's commodity requirements depend on the circumstances of his or her reference group, which are, in turn, presumably influenced by the community to which he or she belongs. If one agrees with Sen (1984) that there is significant variability in commodity requirements within a given country, then the levels of welfare individuals can achieve for a given amount of income may depend on their region of residence even when price patterns and quality of goods are uniform within the country.

Municipal-specific poverty lines. Unfortunately, like most other countries, Norway lacks credible data at a sufficiently disaggregated geographical level on housing-unit characteristics and local amenities,

[12] Although the Average Basket version of the Symmetric Star method satisfies important index number tests, including the Weak Factor Reversal Test and the Average Test for price indices, there are problematic aspects related to the welfare basis of the constructed real income measures (Hill, 1997). First of all, the price index is subject to the Gerschenkron effect. This adverse effect arises because expenditure patterns are likely to change in response to changes in relative prices, since individuals presumably substitute consumption towards relatively cheaper goods. Furthermore, if preferences are non-homothetic, no unique, true measure of real income exists, since the cost of living index depends on the utility level of the individuals from the reference municipality (Neary, 2004). See also Koo et al. (2000) for evidence from the United States on substitution bias in regional cost of living indices.

as well as on the prices of non-housing goods. The binding constraint for dealing with the above price index issues may therefore very well be the data. A possible response to these problems is to specify municipality-specific poverty lines according to the median income within each municipality.[13] The purpose of applying such disaggregated poverty lines is to provide a meaningful measure of poverty in a country with geographical cost of living differences, when local price indices are too crude to produce sufficient comparability of income across areas. This is done by restricting the comparison of income to individuals who live in the same municipality and are thus likely to face similar price patterns and quality of goods, as well as share consumption habits. The poor are then defined as those whose income falls considerably short of the income of the 'representative' individual in their municipality.[14]

When employing municipal-specific poverty lines, one runs the risk of disregarding genuine income differences across areas. Indeed, the choice of whether and how to account for geographical differences in the cost of living involves trading off potential bias in the poverty estimates from relying on a country-specific poverty threshold assuming uniform cost of living within the country, employing imperfect local housing price indices to derive real income estimates, or specifying disaggregated poverty thresholds limiting the comparison of incomes to individuals who are residing in the same area.

4. Data, definitional issues, and the income measures

Below, we provide an overview of the data as well as of the definitions and assumptions made in the empirical analysis. Furthermore, this section contrasts the conventional cash income measure with the extended income measure and the real income measure.

4.1 Population of study

The main data source is a panel data set based on administrative registers with household, geographic, and demographic information for the entire resident population of Norway for the period 1993–2001.[15] Table 4.1 shows the population composition by demographic and geographic characteristics, and

[13] Mogstad et al. (2007) used a similar approach based on regional-specific poverty lines.
[14] The justification of using municipality-specific poverty lines can be traced back to Sen (1979, p. 291) who argued 'First, if the pattern of consumption behaviour has no uniformity there will be no specific level of income at which the "typical" consumer meets his or her minimum needs. Second, if prices facing different groups of people differ, e.g. between social classes or income groups or localities, then poverty thresholds will be group-specific, even when uniform norms and uniform consumption habits are considered. These are real difficulties and cannot be wished away.'
[15] People who die or emigrate over the year are excluded from the population of study. Students and wealthy individuals are not counted as poor. Because we lack credible data on wealth, an individual is classified as wealthy if he or she is registered

demonstrates that the population composition stayed relatively stable throughout the period and that roughly two out of three people live in urban municipalities, excluding the capital Oslo. Furthermore, it is clear that nearly three-quarters of the population live as couples. In addition, it is evident that the share of immigrants in the population is increasing.

Table 4.1 Composition of population of study by centrality, household type and ethnic origin

Characteristic		1993	1996	1999
Centrality	Rural	23%	23%	22%
	Urban	66%	66%	67%
	Oslo	11%	11%	11%
Household type	Single parents	10%	10%	10%
	Couples with children	56%	56%	55%
	Couples without children	17%	17%	18%
	Singles, 67 years and above	6%	6%	6%
	Singles, 45-66 years	4%	4%	4%
	Singles, 44 years and below	7%	7%	7%
Ethnic origin	Immigrant	4%	5%	6%
	Norwegian	96%	95%	94%
Population size (million)		4.2	4.3	4.3

4.2 Methodological assumptions

Equivalence scales. The economic unit in this paper is the household. When analysing poverty among households of varying size and composition, it is necessary to adjust the measure of cash income to enable comparison across individuals. In most poverty studies, interpersonal comparison of cash income is achieved by using equivalence scales. This study employs the widely used EU equivalence scale to normalize the cash income measure, which gives the first adult the weight 1, with each additional adult given the weight 0.5 and each child the weight 0.3. The robustness of the poverty estimates to the choice of equivalence scale is examined by the use of the OECD scale, where the weight of the first adult in the household is set to 1, with each additional adult given the weight of 0.7, and each child the weight 0.5.

The nature of some public services implies that neither of the above equivalence scales is suitable for application to the municipal in-kind benefits. The benefits derived from social care, administration and infrastructure are considered to be collective goods. This means that the consumption of the good is independent of household size; household members consume collectively the benefits from these

with equivalent gross financial capital greater than or equal to a threshold of three times the median (equivalent) cash income.

services. In comparison, culture is considered to be a private good. For example, subsidies given to sports activities and youth centres in the community are not collectively enjoyed by members of the household beside the recipient; consequently there are no economies of scale. The same argument can be argued to apply for childcare, education, and health care.

Most of the services can be classified as either collective or private goods. An exception is care for the elderly and disabled. The recipient of care consumes nursing. In addition, he or she receives assistance in housework, which also yields benefits for the other household members. Thus this service is considered to be in part a private but also a collective good, and so an equivalence scale is relevant. In this case, we employ an equivalence scale when allocating the value of care for the elderly and disabled on household members.

Accounting period of income. It is well known that data on annual income may provide a misleading picture of the consumption possibilities of individuals and, consequently, also the extent of poverty in a society. The reasons for this range from transitory income shocks and life-cycle factors to institutional issues such as the accounting and tax rules for income from self-employment and financial assets.[16] As a way of reducing the measurement problem of fluctuating annual income and obtaining a reliable estimate of the economic resources available for consumption and saving (that is, future consumption), the accounting period of income is extended from one to three years. On this basis, poverty lines are drawn.[17] An accounting period of three years corresponds to what was done in the 2002 Poverty White Paper in Norway (Ministry of Social Affairs, 2002).

Poverty thresholds. We follow common practice in most developed countries and specify a set of poverty thresholds as a certain fraction of the median equivalent income. Specifically, we will focus on a set of poverty thresholds defined as 60 per cent of the median equivalent disposable income, with equivalent income calculated in accordance with the EU scale. However, recognizing the inherent arbitrariness of specifying an exact poverty threshold, it can be instructive to apply other thresholds to evaluate the robustness of the results. Moreover, by applying multiple thresholds one can obtain a fuller picture of the problem of poverty in a society. Thus we will supplement the analysis with poverty thresholds defined as 50 percent of the median equivalent disposable income, employing the OECD scale to calculate the equivalence income. For brevity, let the first type of poverty threshold be called *EU poverty lines* and the second type of poverty threshold be called *OECD poverty lines*.

Similar sample selection criteria are regularly employed in official poverty statistics in Norway.

[16] See Fjærli and Aaberge (2000) and Saez and Chetty (2003), who provide empirical evidence of tax-dependent income reporting behaviour that has a strong impact on assessments of annual income.

[17] When decomposing poverty with respect to demographic characteristics such as age and household types of income, we use the state in the first year of the three-year period.

Below, we will focus attention on the results based on the EU poverty lines. The results based on the OECD poverty lines are displayed in Appendix C. In general, the choice between using EU and OECD poverty lines has a significant impact on the level of poverty, but does not influence the trend over time or the poverty profile. More importantly, the impact of local public services and geographical cost of living differences is robust regardless of whether we let EU or OECD poverty lines form the basis of the analysis.

4.3 Income measures

Traditionally, income is defined in the economic literature as the maximum expenditure possible without depleting net wealth. Because of poor data on net wealth there is usually no room for undertaking empirical analyses based directly on this definition.

Cash income. In most developed countries, poverty studies are typically based on a cash income measure. As illustrated in Table 4.2, the cash income measure used in this paper incorporates earnings, self-employment income, capital income, public cash transfers and taxes. We derive the cash income measure based on income data from the Tax Assessment Files, which are collected from tax records and other administrative registers, rather than interviews and self-reporting methods. The coverage and reliability of Norwegian income data are considered to be very high, as is documented by the fact that the quality of such national datasets of income received the highest rating in a data quality survey in the Luxembourg Income Study database (Atkinson et al., 1995).

Table 4.2 Definition of cash income

Market income	=	Employment income (earnings, self-employment income)
	+	Capital income (interest, stock dividends, sale of stocks)
Total income	=	Market income
	+	Public cash transfers (e.g. old-age pension, unemployment and disability benefits, child benefits and single parents benefits, social assistance)
Cash income	=	Total income – taxes

Extended income. Although cash income is acknowledged to be a suitable indicator of individuals' economic resources and to be in close agreement with international recommendations (see Expert Group on Household Income Statistics, 2001), it fails to take into account all relevant income components, most notably perhaps the value of public services. To incorporate the value of local public services into the definition of income, we employ the model for valuing local public services discussed in Section 2.1. The empirical specification of the model relies on a sector classification of the local government accounts in Norway. This classification is defined by the following eight service sectors:

(1) Administration

(2) Education: municipalities are responsible for ten years of primary education

(3) Child care: municipalities subsidize private and provide municipal kindergartens

(4) Health care: municipalities subsidize health services provided by general practitioners

(5) Social services: municipalities provide social assistance (cash transfers), child protection and alcohol abuse protection

(6) Care for the elderly and disabled: municipalities provide nursing homes and home care (assistance to housework and nursing) for elderly and disabled

(7) Culture: municipalities subsidize sports, arts, museums, libraries, cinemas and churches

(8) Infrastructure: municipalities are responsible for sewage and refuse collection, water supply and maintenance of public roads

The linear expenditure system defined by equations (2.1)–(2.4) provides a simultaneous treatment of the eight service sectors, which in some cases are shown to be affected by the same exogenous variables. The estimation of the model is based on detailed local government accounts and community characteristics for Norwegian municipalities in 1998.[18] Definitions of the variables that affect unit costs, subsistence outputs and marginal budget shares, as well as estimates of the associated parameters, are shown in Appendix A.

Table 4.3 Summary statistics of the sector-specific price indices, 1998

Service sector	Minimum	Maximum	Median	Standard deviation
Administration	0.93	2.48	1.09	0.42
Education	0.92	2.00	1.10	0.16
Childcare	0.88	2.38	1.15	0.25
Health care	0.81	3.42	1.26	0.45
Social services	1	1	1	0
Care for the elderly and disabled	0.81	3.82	1.09	0.26
Culture	1	1	1	0
Infrastructure	0.72	1.79	1.10	0.26

An attractive aspect of our model for valuing public services is that we allow for differences between municipalities in the cost of providing the same standard of services. Dividing observed expenditure

[18] The model is estimated on a per capita basis by the maximum likelihood method where the error terms were assumed to have a multivariate normal distribution with mean vector 0 and unrestricted covariance matrix. See Aaberge and Langørgen (2003) for an extensive assessment of model specification. Note that the majority of the variables included in the model are also used as compensation criteria in the Norwegian cost-equalizing formula for intergovernmental grants.

by the price index (2.3) the value of sector-specific services is given by (2.5). The price index reflects the relative differences in unit costs for providing services across municipalities and is normalized such that the average for the whole country is equal to 1. Table 4.3 shows summary statistics for the distribution of sector-specific price indices.

Table 4.4. Summary statistics for the ratio of the estimated value of municipal services to the observed expenditures by municipality size, 1998 (per cent)

Municipality size	Number of municipalities	Mean	Minimum	Maximum	Standard deviation
Small: fewer than 5000 residents	245	79.9	50.4	108.4	9.5
Medium: 5,000 – 20,000 residents	150	99.7	71.9	109.3	6.0
Large: at least 20,000 residents	40	105.4	96.6	110.1	2.9
All municipalities	435	89.1	50.4	110.1	13.2

Table 4.5. Expenditure and valued services by sector (Euro, fixed 2001 prices)*

	1993-1995				1996-1998				1999-2001			
	Expenditure		Valued services		Expenditure		Valued services		Expenditure		Valued services	
Sector	Mean per capita	Perc. share	Mean per capita	Perc. share	Mean per capita	Perc. share	Mean per capita	Perc. share	Mean per capita	Perc. share	Mean per capita	Perc. share
Administration	339	10	243	9	361	9	259	8	434	10	308	9
Education	893	25	724	26	985	25	801	26	1157	26	943	26
Child care	271	8	209	7	311	8	240	8	328	7	255	7
Health care	175	5	121	4	196	5	136	4	226	5	157	4
Care for the elderly and disabled	1035	29	833	30	1194	30	964	31	1378	31	1116	31
Social services	178	5	92	3	177	4	93	3	199	4	116	3
Culture	192	5	185	7	200	5	193	6	208	5	202	6
Infrastructure	468	13	388	14	538	14	443	14	570	13	470	13
All sectors	3552	100	2796	100	3962	100	3129	100	4499	100	3567	100

* The means are computed on the basis of observations of the municipalities. Consequently, variation in population size across the municipalities is not accounted for, which explains why the overall mean of valued services differs from the overall expenditure mean.

Summary information on the proportion of valued service production to total expenditure by municipality size is displayed in Table 4.4. It is clear that the value of services in small and sparsely populated municipalities tends to be lower than the actual expenditure. The results are interpreted as economies of scale, owing largely to the fact that smaller municipalities use a larger share of their economic resources on administration in most of the service sectors. Valued services vary between approximately 50 and 110 percent. Note that the national average falls below 100 percent simply because municipalities with different population sizes are given equal weight, which means that weights per capita are higher in smaller municipalities.

Table 4.5 shows expenditure and valued services by sector. We see that the largest expenditure component is care for the elderly and disabled, closely followed by education. These two sectors account on average for more than half of the total expenditure of municipalities. Furthermore, note that the proportion of expenditure is relatively stable, with only small variations throughout the period.

In order to construct a measure of extended income that incorporates the value of municipal in-kind benefits for all individuals in each year of the period 1993–2001, we allocate the assessed values of sector-specific public services in each municipality on its inhabitants according to the method outlined in Section 2.2 and described in more detail in Appendix B. The allocation of municipal in-kind benefits on households and individuals is based on six different data sources:

(1) Local government accounts that provide sector-specific expenditure and fees on the municipal level
(2) Demographic, social and geographic characteristics, which affect the subsistence expenditures of the municipalities and thus also the value of services
(3) Number of recipients of different services by age and gender on the municipal level
(4) Prices for childcare and care for the elderly and disabled reported by municipalities
(5) Individually based register information on cash income, age, gender, household type and location
(6) Data from sample surveys providing information on the use of public services on an individual and a household basis

Extended income is defined as the sum of cash income and the value of in-kind benefits.

Table 4.6 Mean cash income, municipal in-kind benefits and extended income by centrality, household type and ethnic origin. EU scale. (Euro, fixed 2001 prices)

Characteristic		1993–1995 Cash income	1993–1995 Municipal in-kind benefits	1993–1995 Extended income	1996–1998 Cash income	1996–1998 Municipal in-kind benefits	1996–1998 Extended income	1999–2001 Cash income	1999–2001 Municipal in-kind benefits	1999–2001 Extended income
Centrality	Rural	20,537	3,732	24,269	22,190	4,095	26,285	24,583	4,598	29,180
	Urban	22,305	3,326	25,631	24,321	3,712	28,033	27,071	4,206	31,277
	Oslo	24,535	4,069	28,604	27,012	4,376	31,388	30,363	4,785	35,148
Household type	Single parents	19,827	3,681	23,508	21,238	4,085	25,323	23,394	4,647	28,040
	Couples with children	23,646	3,258	26,904	25,842	3,613	29,455	28,662	4,118	32,780
	Couples without children	22,568	2,638	25,206	24,731	2,926	27,657	28,095	3,203	31,297
	Singles, 67 years and above	13,446	10,390	23,835	14,487	11,646	26,133	16,578	13,252	29,830
	Singles, 45–66 years	19,469	2,111	21,580	21,055	2,402	23,457	23,384	2,760	26,144
	Singles, 44 years and below	20,490	2,454	22,945	22,436	2,607	25,042	24,948	2,859	27,807
Ethnic origin	Ethnic Norwegians and immigrants from Western countries	22,295	3,491	25,786	24,328	3,865	28,193	27,117	4,353	31,470
	Non-Western immigrants	15,490	3,830	19,320	17,593	4,082	21,675	20,423	4,411	24,834
General population		22,137	3,499	25,636	24,134	3,868	28,002	26,889	4,355	31,244

Table 4.6 provides a decomposition of the mean extended income with respect to cash income and municipal in-kind benefits, where municipal in-kind benefits are defined as the (equivalent) value of municipal services minus user fees. The table shows that elderly singles on average earn relatively low cash income, while couples and singles under the age of 67 earn relatively high cash income. On the other hand, elderly singles receive the highest level of municipal benefits, whereas young singles receive the lowest level of benefits. Furthermore, single parents receive a higher level of in-kind

benefits than couples with children. If we take a look at centrality we see that Oslo has the highest average level of extended income. We see that rural municipalities have the lowest level of average cash income, while urban municipalities have the lowest level of in-kind benefits. Moving on to ethnic origin, it is clear that the Non-Western immigrant groups have an average cash income significantly lower than the average cash income of the general population.

Real income. Because the essential purpose of the real income transformation carried out in this paper is to permit comparison of incomes between individuals living in different municipalities, we are particularly concerned about population heterogeneity that might be systematically correlated with the general income levels across the municipalities. Thus accounting for variation in housing prices across the municipalities is critical for obtaining reliable estimates of real incomes. To this end, we use annual data on prices per square metre of detached houses sold in the various municipalities as a proxy for the price ratios for housing in the price index defined by (3.1).[19] For all other goods we assume no variation in prices across the municipalities, since we lack credible data sources.

Table 4.7. Summary statistics for the municipal-specific private consumption price indices 1993, 1997 and 2001*

Year	Minimum	Maximum	Median	Standard deviation
1993	0.82	1.01	0.88	0.02
1997	0.82	1.00	0.87	0.02
2001	0.78	1.00	0.84	0.03

* Price indices are constructed with Oslo as the base municipality. Results for other years in the period 1993–2001 are similar.

What remains in order to use (3.1) to achieve estimates of real incomes is to determine the weights for housing versus non-housing goods for the average municipality or equivalently for the country as a whole. To this end, we use data on expenditure shares obtained from the Norwegian household budget survey; these data also form the basis for determining the weights in the national consumer price index.[20] In the period 1993–2001, the share of housing-related expenditure in aggregate household consumption expenditure ranged from about 22 to 26 per cent (excluding mortgage payments). Since there are 435 municipalities and we have access to annual information about prices and expenditure shares on housing for nine years, altogether 3,915 municipal-specific price indices are estimated on the basis of (3.1). Summary statistics for the municipal-specific private consumption price indices are

[19] One could argue that it would be more appropriate to use rental prices rather than real estate prices. However, detailed data on local levels for rental prices are not available in Norway. Moreover, most people in Norway are owners rather than renters. In any case, Norwegian survey data indicate that the geographical pattern for real estate prices largely mirrors that of rental prices (see Belsby et al., 2005).

[20] The household budget survey is based on personal interviews and detailed accounting in a representative sample of private households across the country. See Statistics Norway (2002) for a detailed description of the household budget survey.

shown in Table 4.7. The results confirm that there is substantial variation in housing prices across areas.

Note that this paper does not assume that housing prices are the same within each municipality. Indeed, there are considerable price differences on housing also within certain municipalities, in particular across the various neighbourhoods of Oslo. However, as long as individuals are not required to live in a certain neighbourhood to participate in the local labour market, individuals from the same municipality can be argued to face the same prices although the prices of the goods they actually consume may vary due to, say, differences in purchasing power.

Table 4.8 provides a comparison of mean cash and real income across the municipalities. As expected, accounting for geographical differences in the cost of living boosts the income of rural areas relative to Oslo. This turns out to be the case, on average, also for urban areas. When it comes to differences across demographic subgroups in mean cash and real income, no clear pattern can be found.

Table 4.8. Mean cash income and real income by centrality. EU scale. (Euro, 2001 prices)

Characteristic		1993–1995		1996–1998		1999–2001	
		Cash income	Real income	Cash income	Real income	Cash income	Real income
Centrality	Rural	20,537	23,460	22,190	25,446	24,583	29,454
	Urban	22,305	24,730	24,321	26,962	27,071	30,767
	Oslo	24,535	24,600	27,012	27,097	30,363	30,498

5. Empirical results

This section examines the impact of accounting for local public services and geographical differences in the cost of living on poverty estimates based on EU poverty lines (See Appendix C for poverty profiles based on OECD poverty lines).

The level and trend over time of poverty. Table 5.1 shows poverty estimates for the years 1993–2001, a period that includes both a soaring boom and the start of a small recession. The economic fluctuations are mirrored in our results by a decreasing trend in poverty. Our results also show that accounting for geographical cost of living differences does not affect the overall poverty level much. In contrast, the effect of incorporating public in-kind benefits into the income measure is striking. In general, the poverty rates are cut in half. In comparison, accounting for local public services has a modest impact on income inequality estimates.[21]

Table 5.1. Poverty rates, 1993–2001. EU poverty lines

	Country-specific thresholds		Real income thresholds		Municipal-specific thresholds	
	Cash income	Extended income	Cash income	Extended income	Cash income	Extended income
1993–1995	9.1	4.4	9.2	4.5	8.9	4.2
1996–1998	8.8	4.0	8.8	4.0	8.5	3.7
1999–2001	7.9	3.5	8.0	3.7	7.7	3.4

Geographic poverty profile. Table 5.2 summarizes poverty results for municipalities by centrality. For brevity and without loss of generality, we present poverty profiles only for the period 1999–2001. The results show that incorporating public services into the income measure decreases the poverty rates in rural areas relative to urban areas and, especially, compared to Oslo. Furthermore, it is clear that the common practice of using a country-specific poverty line based on a cash income measure leads to upward-biased poverty rates in rural areas, as we underestimate the standard of living afforded by a given level of income for inhabitants of rural municipalities. Taking into consideration cost of living differences across areas highlights the fact that poverty in Norway is mostly a problem of the capital Oslo, which is overrepresented by subgroups prone to poverty such as Non-Western immigrants. Note that the choice between using housing price indices and municipal-specific poverty lines does not matter in terms of the upward-biased poverty rates in rural areas when cost of living differences are ignored; employing housing price indices, however, gives a higher prevalence of poverty in Oslo.

Table 5.2. Poverty rates by centrality, 1999–2001. EU poverty lines

	Country-specific thresholds		Real income thresholds		Municipal-specific thresholds	
Centrality	Cash income	Extended income	Cash income	Extended income	Cash income	Extended income
Rural	9.8	3.8	7.8	2.8	7.2	2.5
Urban	7.1	3.2	7.0	3.2	7.3	3.3
Oslo	9.1	4.7	14.5	8.1	11.3	6.3

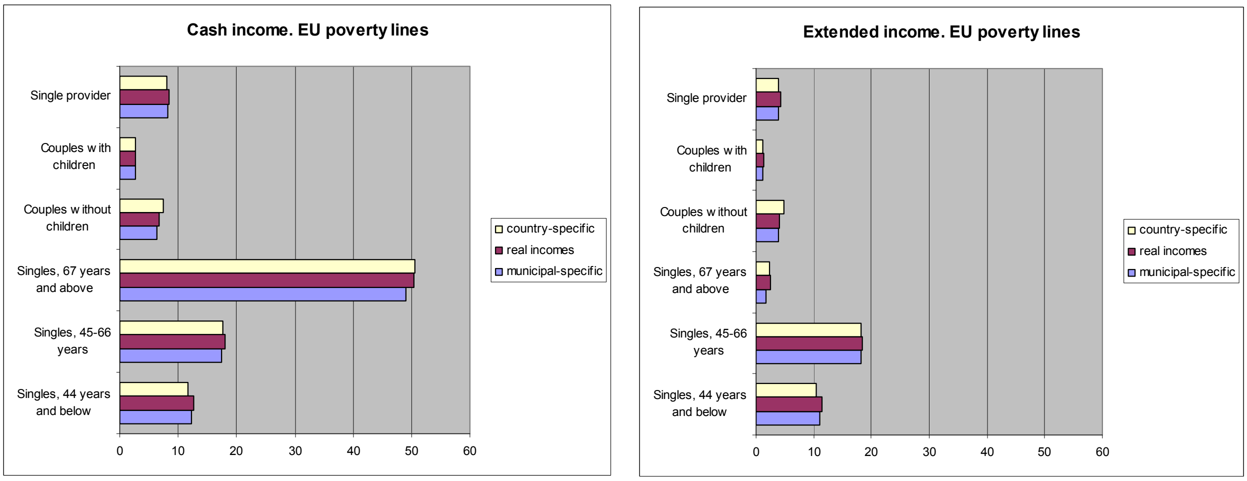
The United States experience is remarkably similar. For example, Short (2001) finds that adjusting for geographical differences in the cost of living by means of local housing price indices has little impact on the national poverty rates, but gives a complete reversal of the geographic poverty profile in the

[21] In 1998, for example, the Gini coefficent based on cash income is 0.23, while the Gini coefficient defined over extended income is 0.20. See also Aaberge and Langørgen (2006) for a study of the effects of using an extended income measure in an analysis of inequality in a single year.

United States. With no adjustment for cost of living differences, the prevalence of poverty is higher in rural areas than in urban areas. When indices are used to adjust for cost of living differences, poverty rates are higher in urban areas than in rural areas.

Demographic poverty profile. Figure 5.1 shows the effect of accounting for local public services and geographical cost of living differences on poverty rates by household type. When focusing on cash income, the poverty rates are rather high among elderly (mostly female) singles, due to the fact that the poverty thresholds exceed the guaranteed minimum pension. However, as elderly people receive a high level of publicly provided care and health services, their poverty rates drop radically when we focus on extended income. The same is true for households with children, since they are major recipients of services such as education and childcare. Due to the age structure and the relatively high fertility rate of Non-Western immigrants, their poverty rates also decline considerably when in-kind benefits are taken into account. The group that benefits the least from public services, in the sense of experiencing the smallest decrease in poverty when local public services are added to cash income, is singles in the pre-retirement phase. This finding comes as no surprise, as singles in this age group have usually completed their education and have few if any children living at home, while demand for municipal care for the elderly and disabled is still not pressing. We also find that taking into consideration cost of living differences across areas increases the level of poverty among Non-Western immigrants. An important reason is that the majority of the Non-Western immigrants in Norway live in cities, predominately Oslo, where housing prices are relatively high.

Figure 5.1. Poverty rates by household type, 1999-2001. EU poverty lines



Sensitivity analysis. The standard practice for valuation of public services in analyses of the distribution of extended income is to assume that the value of public services equals the observed expenditures of public authorities. This practice ignores any variation in unit costs for providing public services. By contrast, the present paper utilizes estimated price indices to compute deflated expenditure in different local public service sectors. Thus it is of interest to employ the non-deflated cost approach to examine whether or not our results are sensitive to the choice of valuation method. Poverty rates based on the non-deflated cost approach are shown in Appendix D. By comparing Table D.1 with Tables 5.1 and C.3, it is evident that the national poverty rates based on extended income are almost unaffected by the choice of valuation method. However, by comparing Table D.2 with Tables 5.2 and C.4, it is clear that poverty is downward-biased in rural areas and upward-biased in urban areas when the non-deflated cost approach is used, provided that poverty estimates are derived from country-specific thresholds or real income thresholds. This result is due to the fact that unit costs for local public services are generally higher in rural areas than in urban areas. When poverty estimates are derived from municipal-specific thresholds, the choice of valuation method does not affect the geographical poverty profile.

6. Conclusion

The standard practice in most developed countries is to identify the poor on the basis of a poverty line defined as a specific fraction of the median cash income within a country. Underlying the application of such a country-specific poverty line are the assumptions that the cost of living is the same for everyone and that the distribution of public services mirrors the distribution of cash income. However, as demonstrated in this paper these assumptions are not valid, since housing prices and the supply of municipal services differ substantially between rural and urban areas. Moreover, we show that disregarding the role played by local public services and geographical cost of living differences within a country yields a misleading picture of poverty. We may suspect that this finding is applicable to other countries where government expenditure on public services makes up a substantial share of total government transfers and/or there are cost of living differences across regions.

We find that extending the traditional cash income measure with in-kind benefits from local public services cuts poverty levels in half. Poverty is reduced among all household types and especially among households with children and elderly singles. Households with children are major recipients of services such as education and childcare, while elderly people receive much care and health services. Altogether, the results suggest that local public services in Norway are effective in fighting poverty. In comparison, taking into consideration local public services has a modest impact on income inequality estimates.

Accounting for geographical cost of living differences does not affect the national poverty level much, but changes the picture of the poor population in Norway considerably. In particular, the common practice of disregarding variations in housing prices within a country is shown to overestimate the poverty rates in rural areas. Interestingly, the United States experience is remarkably similar (see, for example, Short, 2001). This evidence from two of Esping-Andersen's (1990) highly differentiated worlds of welfare capitalism raises the question of the extent to which the pattern of transfers from the central government to rural municipalities – which is apparent in most OECD-countries – is appropriate given today's picture of poverty.

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Appendix A. Estimation results of the model of local government spending

The linear expenditure system provides a simultaneous treatment of the eight service sectors, which in some cases are shown to be affected by the same exogenous variables. The estimation of the model defined by (2.1)–(2.4) is based on detailed local government accounts and community characteristics for 435 Norwegian municipalities in 1998. The model accounts for spending on eight service sectors, and in the estimation we also include the budget surplus (operating result) as a sector in the model. The budget surplus is treated as a residual sector, which means that the model is representing an extended linear expenditure system. The explanatory variables in the model have been selected based on theoretical considerations and extensive testing of hypotheses (see Aaberge and Langørgen, 2003).

The service sectors in the model are as follows:

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

Note that the parameters in Tables A.1–A.3 are estimated simultaneously by the method of maximum likelihood. Estimated coefficients for variables that affect unit costs are displayed in Table A.1. The estimated parameters in Table A.1 are the basis for the valuation of services, see equation (2.5) and the construction of price indices in equation (2.3) and Table 4.3. The estimated unit costs are in most service sectors a decreasing function of population size, which is captured by the two indicators for small municipalities. This is taken as proof of economies of scale. It is found that scale economies are exhausted at 5,000 residents. An important reason for smaller municipalities to have higher unit costs is that they use a larger share of resources on administration in most of the service sectors, including central administration.

Table A.1 Estimates of unit cost parameters*

	1	2	3	4	5	6	7	8
Children 0–5 years with basic or supplementary benefits			49.36 (1.95)					
Children 6–15 years with basic or supplementary benefits		12.46 (2.88)						
Mentally disabled persons 16 years and above						75.21 (21.29)		
Distance to center of municipal sub-district		0.11 (7.82)	0.19 (4.40)	0.19 (3.17)		0.07 (3.26)		
Distance to neighboring basic unit		0.15 (3.06)		0.65 (3.01)				
Indicator for small municipalities 0–2,000 residents	4.77 (5.42)			1.80 (1.26)		0.41 (0.89)		
Indicator for small municipalities 0–5,000 residents	2.32 (5.48)	0.60 (5.30)	1.23 (3.78)	1.50 (3.44)		0.44 (2.91)		1.83 (3.77)
Sewage purification degree								0.27 (3.13)
Amount of snowfall								0.05 (1.90)
R^2 adjusted	0.84	0.80	0.65	0.63	0.47	0.86	0.64	0.73

* T-statistics are in parentheses. The column numbers refer to service sectors in the simultaneous model.

We find that greater dispersion of the local settlement pattern increases subsistence expenditure in education, health care, childcare, and care for the elderly and disabled. The estimated positive relationships are attributed to unit costs, interpreted as reflecting costs of providing services on a decentralized level. For example, when it comes to care for the elderly and disabled, travel time of the staff between client homes increases with dispersion, and thus sparsely populated municipalities have higher unit costs. To capture dispersion of settlement in the municipality, we use explanatory variables defined as the distances to the centre of the municipal sub-district and the neighbouring basic unit.

Local government infrastructure services include sewage disposal and snow removal. Local variation in the requirements for sewage purification comes from national environmental regulations and is assumed to affect unit costs in sewage disposal. Moreover, the costs to keep roads open in each municipality depend on the amount of snowfall and thus unit costs are assumed to increase with the amount of snowfall.

Local government expenditures is shown to increase with the share of mentally disabled, as this group is entitled to municipal care. The distribution of the mentally disabled across municipalities is to a large extent driven by the fact that some municipalities are appointed as host communities for the mentally disabled. To avoid that being a host community for the mentally disabled increase the total output and welfare in the municipality, we assume that the share of mentally disabled affects unit costs. The same type of assumption has been made in relation to children of pre-school and school age who receive basic or supplementary benefits due to disablement. These children are found to increase unit costs in childcare and education services.

Table A.2 Estimates of subsistence output parameters*

	1	2	3	4	5	6	7	8
Constant	174	151	-30	100	-62	477	105	292
	(11.29)	(2.60)	(0.82)	(10.19)	(3.15)	(8.55)	(11.77)	(8.68)
Population share 1–5 years of age			1,207					
			(2.81)					
Population share 6–12 years of age		2,998						
		(5.50)						
Population share 13–15 years of age		7,596						
		(6.97)						
Population share 67–79 years of age						-451		
						(0.81)		
Population share 80–89 years of age						5,617		
						(4.59)		
Population share 90 years of age and above						22,018		
						(5.61)		
Full-time employed women 20-44 years of age per capita			1,585					
			(4.64)					
Refugees domiciled less than five years ago per capita					4,424			
					(5.50)			
Unemployed 16–59 years of age per capita					837			
					(1.18)			
Divorced/separated 16–59 years of age per capita					1,141			
					(4.65)			
Population share of the poor					524			
					(1.56)			
Urban municipality criterion					20			
					(5.47)			
R^2 adjusted	0.84	0.80	0.65	0.63	0.47	0.86	0.64	0.73

*All pecuniary amounts are in Euro, fixed 2001 prices. T-statistics are in parentheses. The column numbers refer to service sectors in the simultaneous model.

Estimated coefficients for variables that affect subsistence outputs are displayed in Table A.2. The age structure is assumed to affect subsistence outputs in education, childcare and care for the elderly. Primary schools are compulsory for children 6–15 years of age, which means that provision increases as a function of the number of children in this age group. It is found that children aged 13–15 years receive more extensive services than children aged 6–12 years. This difference is mainly explained by the fact that the former have more lessons and more teachers with higher qualifications.

Although kindergartens differ from primary education by not being compulsory, the demand for childcare is found to increase with the population share in the age group 1–5 years and the share of employed women in the group 20–44 years of age. Higher demand for childcare is assumed to increase the subsistence output of childcare services.

The output in care for the elderly and disabled is treated as an insurance benefit received regardless of the actual use of services. This is in accordance with Smeeding et al. (1993). Just as in the private insurance market, the public provision of insurance increases as a function of risk and coverage. Risk is defined as the probabilities that citizens will become recipients, and coverage is described as the service standards that different types of client can expect to receive. Since elderly people have a higher probability of becoming recipients of health-related services, output is higher for the elderly than for young people (given the level of coverage). Subsistence output in care for the elderly is highest for the elderly 90 years and above.

The value of services in the social care sector, which consists mainly of cash transfers to disadvantaged groups, is defined by expenditure. Consequently, the explanatory variables of the social service sector, determined as the population shares of disadvantaged groups, are assumed to affect subsistence output but not unit costs.

Table A.3 Estimates of marginal budget share parameters*

	1	2	3	4	5	6	7	8
Constant	0.18	0.11	-0.01	0.06	0.02	0.27	0.00	0.19
	(7.41)	(3.61)	(0.54)	(3.28)	(1.01)	(5.51)	(0.11)	(5.13)
Share of socialists in municipal council	0.003	0.036	0.070	-0.020	0.029	0.069	0.021	-0.008
	(0.16)	(1.45)	(4.15)	(1.32)	(2.01)	(1.69)	(1.77)	(0.25)
Average education level for persons 30–59 years	-0.025	0.007	0.019	-0.005	-0.007	-0.054	0.029	0.008
	(2.76)	(0.54)	(2.23)	(0.67)	(0.90)	(2.93)	(5.34)	(0.51)
Share of population in densely populated areas	-0.047	-0.027	0.040	0.010	0.004	0.035	-0.002	-0.011
	(4.17)	(1.82)	(3.50)	(1.29)	(0.41)	(1.45)	(0.22)	(0.66)
R^2 adjusted	0.84	0.80	0.65	0.63	0.47	0.86	0.64	0.73

* T-statistics are in parentheses. The column numbers refer to service sectors in the simultaneous model.

Estimated coefficients for variables that affect marginal budget shares are displayed in Table A.3. Three variables are included in the analysis: socialist share in the municipal council, education level and population density. A high socialist share is found to increase the supply of childcare and social care. Municipalities with a high education level are found to give a high priority to childcare and culture, and a low priority to administration and care for the elderly and disabled. Densely populated municipalities give a high priority to childcare and a low priority to administration.

Appendix B: Sector-specific allocation of the value of public services on an individual and a household basis

Below, we describe how recipients are selected and the value of services distributed among recipients in the various service sectors.

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

For most services, we lack data to identify the recipients exactly. An important exception is primary *education*, since it is compulsory for children 6–15 years of age. The value of municipal education services and user fees is assumed to be distributed uniformly among all children in this age group.

The *childcare* sector consists of both municipal and private kindergartens. Since local governments subsidize private kindergartens, they are included in the analysis of in-kind transfers. First, we use data on cash-for-care benefits – which is a cash transfer to parents with small children who are not using municipal (subsidized) kindergartens – to exclude a subgroup of households from the population of potential recipients.[22] Next, the population of potential recipients is divided into subgroups according to four criteria: age of the child, household type, education level of the parents and municipality of residence. From summary statistics we know the number of children in kindergartens by age and municipality. For information on household type and education level we utilize a national survey that includes 5,000 households where the type of childcare is reported for each child. This information is used to estimate the total number of children in kindergartens by household 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 household type and education level. Estimation of the simultaneous distribution by age, household type, education level and municipality of residence is

[22] The cash-for-care benefits were introduced in August 1998. In the period 1999–2001, the children of households receiving more than half the maximum cash-for-care benefits are excluded from the population of potential recipients.

based on a log-linear model where the second-order interaction component is equal to zero. The model was introduced by Birch (1963), and the maximum likelihood estimation method is called 'iterative proportional fitting' or 'raking'. From each subgroup, the estimated number of children in kindergartens is selected by random drawing. Thus the four criteria 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 among the selected recipients. Conforming to standard practice in kindergartens, user fees are means-tested against household gross income.[23]

County governments or the central government runs hospitals, but municipalities subsidize *health services* provided by general practitioners.[24] This paper treats municipal health services as insurance benefits. For information on age and gender distribution of the patients we utilize a national survey that includes 5,000 households. Respondents were asked whether they had visited a general practitioner in the last fourteen days before the interview. This information forms the basis for estimating an age and gender-specific probability of visiting a doctor. The value of health care and user fees in each municipality is distributed among individuals in proportion to their probability of being recipients.

The *social care* sector consists of social assistance (which is a cash transfer to disadvantaged households), child protection and alcohol abuse protection. From administrative register data, we know the distribution of social assistance among individuals and households.[25] However, the distribution of expenditure for child protection and alcohol abuse protection is unobserved. We assume that the distribution of these in-kind benefits mirror the distribution of social assistance. Based on the observed recipient frequencies for social assistance by age and income level, we compute the probability of receiving social assistance. These probabilities are utilized to derive a distribution for social care services in-kind. Each household receives a share of the value of social care 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 households receive more than rich households, and elderly people receive less than young adults. Within each municipality, we assume that households belonging to the same income and age group receive equal in-kind benefits from social services. User fees are distributed according to the same weights as in-kind benefits.

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[23] The distribution of user fees is based on a sample of 105 municipalities which have reported standardized user fees for three different levels of household gross income. The data are used in a regression of user fees on household income and local government income. The user fees are found to increase with household income and decrease with local government income. The model is used to predict user fees for all children who have been selected as recipients. 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.

[24] Health care provided by public hospitals is not included in the analysis of public in-kind benefits in the present paper.

[25] Thus, social assistance is treated as cash income instead of an in-kind benefit in the analysis.

The *care for elderly and disabled* sector consists of nursing homes and home care (assistance with housework and nursing). This paper treats the municipal services of care for the elderly and disabled as insurance benefits. From summary statistics we know the number of recipients by age group, gender and municipality. For information on household type we utilize a national survey which includes 5,000 households. This information is used to estimate the total number of elderly and disabled recipients by household type. Thus the available data provide information on the marginal distribution of recipients by age, gender and municipality of residence, and also estimates of the marginal distribution by household type. Estimation of the simultaneous distribution by age, gender, household type and municipality of residence is based on a log-linear model where the second-order interaction component is equal to zero. This is used to derive estimates of the probability of being a recipient by age, gender, household type and municipality of residence. The value of care for the elderly and disabled in each municipality is distributed among individuals in proportion to their probability of being recipients. This means that all individuals receive in-kind benefits, but the amounts depend on the likelihood of being a recipient and the economic situation and priorities of each local government. User fees are distributed according to similar weights as services.[26]

Municipalities subsidize *cultural* activities like sports, arts, museums, libraries, cinemas and churches. The frequencies of participation in the different types of activity 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 into groups according to education and the average index of demand is computed for each education level. Average demand is found to increase with education level. The value of cultural services in each municipality is distributed among individuals in proportion to the average demand by education level. For a given education level and a given municipality, individuals are assumed to receive the same amount of in-kind benefits. All members of a given household receive the same level of services, which is determined by the highest education level in the household. User fees are distributed to people according to the same weights as services.

[26] Unfortunately, we have no information about 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. To derive estimates for all municipalities in Norway, we compute the average user fee per month by household income. The average user fee is weighted by the probability of being a recipient. This weighted average user fee gives an estimate of the fee for each person, and after aggregation over persons within each municipality we derive the share of fees paid by each person. The estimates are calibrated against the sum of user fees reported in the local government accounts.

Municipalities are responsible for several *infrastructure* services, including 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 households. Thus, for a given municipality, each household receives the same transfer.

Appendix C: Empirical results based on the OECD equivalence scale and poverty lines

Table C.1 Mean cash income, municipal in-kind benefits and extended income by centrality, household type and ethnic origin. OECD scale. (Euro, fixed 2001 prices)

		1993–1995			1996–1998			1999–2001		
Characteristic		Cash income	Municipal in-kind benefits	Extended income	Cash income	Municipal in-kind benefits	Extended income	Cash income	Municipal in-kind benefits	Extended income
Centrality	Rural	17,121	3,673	20,794	18,550	4,033	22,582	20,594	4,519	25,113
	Urban	18,702	3,279	21,981	20,415	3,657	24,072	22,750	4,138	26,888
	Oslo	21,334	4,024	25,357	23,412	4,317	27,728	26,328	4,732	31,060
Household type	Single parents	16,807	3,631	20,438	18,030	4,029	22,059	19,823	4,582	24,405
	Couples with children	18,856	3,211	22,067	20,603	3,558	24,161	22,828	4,050	26,878
	Couples without children	19,936	2,536	22,472	21,840	2,806	24,647	24,803	3,071	27,873
	Singles, 67 years of age and above	13,435	10,388	23,823	14,479	11,645	26,123	16,568	13,251	29,819
	Singles, 45–66 years of age	19,323	2,109	21,432	20,910	2,400	23,310	23,215	2,757	25,972
	Singles, 44 years and less	19,862	2,448	22,310	21,844	2,601	24,445	24,306	2,852	27,158
Ethnic origin	Ethnic Norwegians and Western immigrants	18,756	3,441	22,197	20,494	3,807	24,301	22,877	4,284	27,161
	Non-Western immigrants	12,858	3,796	16,654	14,529	4,044	18,573	16,844	4,364	21,207
Total population		18,620	3,449	22,069	20,322	3,814	24,136	22,672	4,287	26,958

Table C.2 Mean cash income and real income by centrality. OECD scale (Euro, fixed 2001 prices)

Characteristic		1993–1995		1996–1998		1999–2001	
		Cash income	Real income	Cash income	Real income	Cash income	Real income
Centrality	Rural	17,121	19,557	18,550	21,271	20,594	24,674
	Urban	18,702	20,733	20,415	22,630	22,750	25,854
	Oslo	21,334	21,389	23,412	23,485	26,328	26,443
All		18,620	20,533	20,322	22,417	22,672	25,661

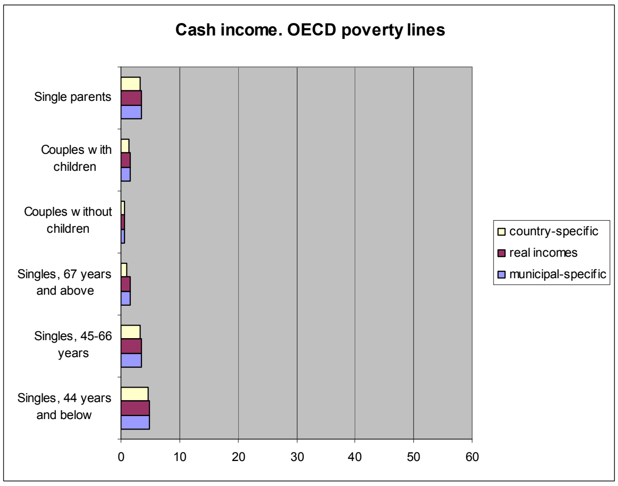
Table C.3 Poverty rates, 1993–2001. OECD poverty lines

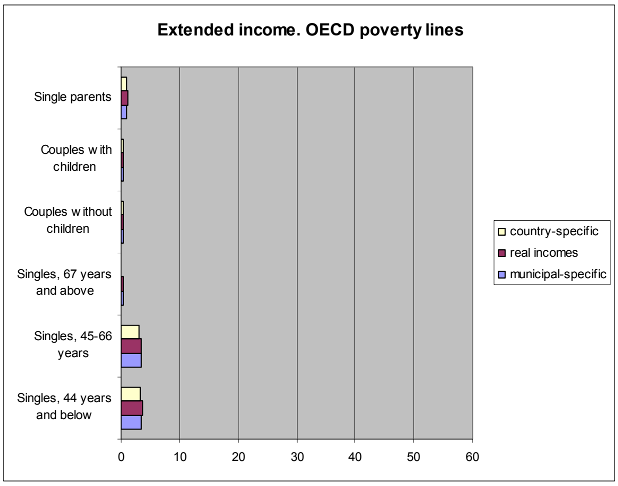
	Country-specific thresholds		Real income thresholds		Municipal-specific thresholds	
	Cash income	Extended income	Cash income	Extended income	Cash income	Extended income
1993–1995	1.9	1.0	2.1	1.1	2.2	1.1
1996–1998	1.8	0.8	1.9	0.9	1.9	0.8
1999–2001	1.7	0.7	1.9	0.8	1.8	0.8

Table C.4 Poverty rates by centrality, 1999–2001. OECD poverty lines

	Country-specific thresholds		Real income thresholds		Municipal-specific thresholds	
Centrality	Cash income	Extended income	Cash income	Extended income	Cash income	Extended income
Rural	1.5	0.5	1.2	0.5	1.0	0.4
Urban	1.5	0.6	1.5	0.7	1.6	0.6
Oslo	3.6	1.6	5.7	2.6	5.0	2.4

Figure C.1 Poverty rates by household type, 1999-2001. OECD poverty lines





Appendix D: Empirical poverty results when in-kind benefits are not adjusted for unit cost variation in municipal service production

Table D.1 Poverty rates based on cash income plus municipal expenses, 1993–2001

	Country-specific thresholds		Real income thresholds		Municipal-specific thresholds	
Year	EU	OECD	EU	OECD	EU	OECD
1993–1995	4.4	1.0	4.5	1.1	4.2	1.1
1996–1998	3.9	0.8	4.0	0.9	3.8	0.8
1999–2001	3.5	0.7	3.7	0.9	3.5	0.8

Table D.2 Poverty rates based on cash income plus municipal expenses by centrality, 1999–2001

	Country-specific thresholds		Real income thresholds		Municipal-specific thresholds	
Centrality	EU	OECD	EU	OECD	EU	OECD
Rural	3.1	0.5	2.3	0.4	2.5	0.4
Urban	3.4	0.6	3.4	0.7	3.3	0.6
Oslo	4.9	1.7	8.7	2.7	6.3	2.5