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# Local governments, in-kind transfers, and economic inequality

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**Abstract:**
We examine how in-kind transfers provided by local governments affect economic inequality. The allocation of in-kind transfers to households and the adjustment for differences in needs are derived from a model of local government spending behavior. The model distinguishes between fixed and variable costs in production as well as mandatory programmatic spending components versus discretionary spending on different service sectors and target groups. To estimate the model, we combine Norwegian data from municipal accounts and administrative registers for the period 1982-2013. We find that economic inequality is considerably lower when taking in-kind transfers into account. While the poor benefit from receiving a relatively large share of public services, the equalizing effect of in-kind transfers tends to be smaller than the equalizing contribution from public cash transfers. When examining the time trends in inequality, we find that local governments attenuated the growth in cash income inequality by re-allocating in-kind transfers to low-income families. This reduction in inequality is mostly due to changes in spending priorities across service sectors and target groups, whilst the contribution from re-allocation of resources across municipalities is much smaller.

**Keywords:** Local government, economic inequality, public services, in-kind transfers

**JEL classification:** D31, H72, I30

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## Sammendrag

Vi undersøker hvordan fordelingen av individrettete kommunale tjenester påvirker økonomisk ulikhet. Verdsettingen, behovsjusteringen og allokeringen av kommunale tjenester til hushold er basert på en modell for kommunenes økonomiske atferd. Modellen allokerer bundne kostnader og frie disponible inntekter til ulike tjenesteytende sektorer og målgrupper, og den skiller mellom faste og variable kostnader i produksjonen. For å estimere modellen kombinerer vi data fra kommunale regnskaper og administrative registre for perioden 1982-2013. Vi finner at økonomisk ulikhet er betydelig lavere når vi tar hensyn til verdien av mottatte kommunale tjenester. Selv om de fattige mottar en relativt stor andel av de kommunale tjenestene, viser analysen at de kommunale tjenestene virker mindre utjevnende enn offentlige kontantoverføringer. Når vi undersøker utviklingen i ulikhet over tid, finner vi at kommunene har bidratt til å dempe økningen i inntektsulikhet gjennom reallokering av tjenester til lavinntektsfamilier. Denne reduksjonen i ulikhet skyldes for det meste endringer i prioriteringene mellom tjenestesektorer og målgrupper, og i mindre grad omfordeling av ressurser mellom kommunene.

## 1 Introduction

In countless articles and several books, Amartya Sen has broadened the economic frameworks for conceptualizing and measuring poverty, inequality and human development generally.[1] Importantly, focus is shifted from income inequality to economic inequality, taking "note of the heterogeneities of the individuals and of their respective nonincome circumstances" (Sen, 1997, p. 385). This shift in focus calls for broader measures of household resources that not only reflect cash income but also take account of the value of in-kind transfers provided by governments, such as subsidized health care and education. At the same time, it is necessary to acknowledge that people can differ greatly in their abilities to convert the same resources into economic well-being. For example, the elderly tend to utilize health services more often than younger people due to different health status, and children have a genuine need for education.

Constructing broader measures of household resources that reflect in-kind transfers and differences in needs has proven difficult for several reasons. While information about aggregate spending on public services is usually available at the national level, it can be difficult to access data on local government spending on public services. In federal systems, in-kind transfers are regularly administered by local governments, which tend to have substantial discretion in spending priorities across service sectors and demographic groups. Another key challenge is how to value and allocate in-kind transfers across people, especially since prices and individual recipients are often not observed (Smeeding et al., 1993; Aaberge and Langørgen, 2006). On top of this, the equivalence scales applied to cash income are not necessarily appropriate when including in-kind transfers, because the receipt of public services is likely to be associated with particular needs (Radner, 1997; Aaberge et al., 2010). These challenges have meant that existing empirical research rarely considers the role of in-kind transfers provided by local governments.[2]

In this paper, we examine how public services provided by local governments affect economic inequality by constructing a measure of household resources that reflects the value of in-kind transfers and differences in needs. Our paper departs from most previous studies in that a model of local government spending behavior is used to allocate in-kind transfers as well as to adjust for differences in needs. Our objective is to provide a detailed picture of the distribution of extended income over the past few decades. The term extended income denotes the sum of cash income and transfers in kind, where in-kind transfers reflect the amount of local public services received by different individuals and households. There are a number of key questions addressed. How does the distribution of extended income compare to the distribution of cash income? What is the relative importance of transfers in cash and in kind in attenuating inequality in market income? To what extent do local governments fight poverty and reduce inequality by targeting in-kind transfers to vulnerable groups?

To investigate these questions, we combine Norwegian data from municipal accounts and administrative registers for the period 1982-2013. Norway provides an attractive context for this study. By

[1] See e.g. Sen (1985, 1992, 1997) and the review article by Atkinson (1999) of Amartya Sen's contributions to welfare economics.

[2] Notable exceptions include Smeeding et al. (1993); Aaberge and Langørgen (2006); Garfinkel et al. (2006); Paulus et al. (2010); Aaberge et al. (2010); Burkhauser et al. (2012); Verbist et al. (2012); Armour et al. (2013) and Figari and Paulus (2015). However, most of these studies abstract from differences in needs, assume that the value of public services equals the expenditures in service production, and make strong assumptions about how in-kind transfers are allocated to households.

linking up individuals with other family members and their tax records, we are able to measure cash income at the household level. To estimate the model of local government spending behavior, we take advantage of detailed local government accounts and community characteristics for every Norwegian municipality. Norway is a sizable country with a dispersed population and relatively large public sector where local governments play an important role in the provision of public services. There is substantial variation in local government spending across service sectors and demographic groups (Aaberge and Langørgen, 2003). Consequently, some municipalities may be more effective than others in fighting poverty and reducing inequality, either because they can provide a generally higher level of services or because they are targeting vulnerable groups.

From the model of local government behavior, we derive an expenditure system that proves useful in explaining differences in spending of municipalities across goods and services and between population subgroups. The model distinguishes between fixed and variable costs in production as well as mandatory programmatic spending components versus discretionary spending on different service sectors and target groups. Our estimates suggest that economic inequality is considerably lower when taking in-kind transfers into account. In particular, the poor benefit from receiving a relatively large share of public services. However, the equalizing effect of in-kind transfers tends to be smaller than the equalizing contribution from public cash transfers. When examining the time trends in inequality, we find that local governments attenuated the growth in income inequality by re-allocating in-kind transfers to low-income families. This reduction in inequality is mostly due to changes in spending priorities across service sectors and target groups, rather than re-allocation of resources across municipalities.

Taken together, our findings may have implications for both policy and research. The omission of in-kind transfers from the standard definition of household income may call into question the validity of comparisons of economic well-being across population subgroups, over time, and between countries. Furthermore, this omission can have important policy implications given the wide range of policies that aim to fight poverty and reduce inequality. For these reasons, the Stiglitz-Sen-Fitoussi Commission stressed the importance of broadening the measures of household resources to reflect in-kind transfers and differences in needs.[3] Our study highlights that incorporating the value of in-kind transfers can be empirically important for measuring economic inequality and poverty.

Our paper is related to a large and growing literature on the trends in economic inequality. This literature documents a substantial widening of the wage structure over the past few decades. However, there is a debate over whether the growth in market income inequality translated into a marked increase in the disparities of economic well-being. Much of the debate revolves around how to measure the economic resources available to households. Using data on pre-tax market income, Piketty and Saez (2003) show that the top income shares in the U.S. have increased over the last three decades. This finding is broadly consistent with estimates of inequality in cash income, which consider the entire distribution and take cash transfers and taxes into account (see e.g. Burkhauser et al., 2012). However, as the tax burden levied on households represent a deduction from their economic resources, it is important to take account of the services which local governments provide to households through these taxes. This concern motivates recent work by Piketty et al. (2018), who try to construct a distributional national account. In doing so, they rely on national aggregates of spending on in-kind

[3]The recommendations of the commission are presented in Stiglitz et al. (2009). Broadly similar recommendations have been made by the Canberra Group (2001), OECD (2011), Atkinson et al. (2012), and Burkhauser et al. (2012).

transfers and public goods, making strong assumptions about how this expenditure is allocated across people and areas (such as allocating government expenditure to individuals proportionally to disposable income). Moreover, they abstract from differences in needs across people and heterogeneity in the efficiency and provision of in-kind transfers across areas. Our findings highlight that such approaches to constructing distributinonal national accounts may produce biased estimates of inequality and lead to misleading conclusions about the distributional effect of in-kind transfers. While these findings could be specific to Norway, it is important to note that local governments in other countries also have a key role in the provision of public services. Among OECD countries, for example, local government spending make up 39 percent of all public expenditure (OECD, 2017). The corresponding figure for Norway is 33 percent. After presenting our main results, we examine how the estimates from Norway change if we invoke additional assumptions needed to use the data available in many other OECD countries.

The remainder of the paper is organized as follows. Section 2 presents our data and discusses institutional details. In Section 3, we describe the model of local government spending behavior, present estimation results and model validation, and construct measures of extended income. Section 4 offers evidence on how public services provided by local governments affect economic inequality. Section 5 provides a counterfactual analysis of factors behind the time trend in inequality. Section 6 concludes.

## 2 Data and descriptive statistics

### *2.1 Data sources and income definitions*

Our analysis combines Norwegian data from municipal accounts and administrative registers for the period 1982-2013. For each year, we have access to administrative registers that contain records for each individual with demographic information (including gender, date of birth, marital status, family size and composition), socio-economic data (including income from various sources and education), and exact geographical identifiers. Our measure of cash income includes earnings, self-employment income, and all public cash transfers, from which taxes are subtracted.[4] We use the term extended income to denote the sum of cash income and the value of in-kind transfers provided through local public services. As described in detail later, the measurement of in-kind transfers is based on detailed local government accounts and community characteristics for every Norwegian municipality (of which there are more than 400).

These data have several advantages over those available in most other countries. First, there is no attrition from the original sample due to refusal by participants to consent to data sharing. In Norway, the tax records and municipal accounts are in the public domain. Second, all Norwegian citizens have to file a tax return (even if they have no income). As a consequence, our income data pertain to all individuals, and not only to workers or individuals who respond to income surveys. Third, most components of income are third-party reported, with little measurement error and without any top or bottom coding. And fourth, unique identifiers allow us to match spouses to one another and parents to children. As a result, we are able to measure income at the household level. While the Norwegian data have many advantages, there are some challenges as well. In particular, we do not have precise information about the allocation of in-kind transfers provided by the central government. This includes public hospitals, higher education, transportation, defense, police and administration. As a consequence, our paper focuses exclusively on the distributional effects of in-kind transfers provided by the local government.[5]

### *2.2 Institutional setting*

In Norway, the municipalities have been assigned a major role in the provision of public services. They are responsible for public provision of child care, education, long-term care, primary health care, social welfare, culture, infrastructure and administration. Legislation and regulation from the central government stipulate that different services are targeted to different population groups. Specifically, the municipal service sectors (functions of government) can be classified into four different types; (i) services targeted toward children, (ii) services targeted toward disabled and elderly people, (iii) general services to all residents, and (iv) means-tested social welfare services.

The services targeted towards children include primary and lower secondary education – providing

[4] Throughout the paper, we exclude capital income (and taxes on capital income) from our measure of cash income. This is because tax changes have affected the income reporting behavior of the tax payers, and made it difficult to construct a consistent measure of capital income over the entire period 1982-2013.

[5] Abstracting from in-kind transfers provided by the central government do not affect our estimates of inequality and poverty if households value these services proportionally to their extended incomes (which include cash income and the value of in-kind transfers provided through local public services).

mandatory education to children aged 6-15 (7-15 before 1998) – and child care which provides day-care facilities for children aged 1-5 (1-6 before 1998). Long-term care consists of care for the elderly and disabled. Local governments are responsible for health care provided by general practitioners, which is regarded as a general service. Other general services are the culture sector – taking responsibility for sports, arts, museums, libraries, cinemas and churches – and infrastructure which includes road maintenance, municipal housing and commercial development. Social welfare includes social assistance (means-tested cash transfers to disadvantaged families), and child welfare (child abuse cases, orphan homes, foster care and adoption services). Social assistance is the only cash transfer that is handled by local governments, and accounts for less than 8 percent of local government spending.

In Norway, the local governments have rather limited tax discretion. The vast majority of local tax revenues comes from income taxes and natural resource taxes (e.g. hydropower plants), but the tax bases as well as the tax rates are determined by the central government. These taxes should therefore be considered as an integrated element of the centralized system of financing, which combines local taxes with a system of fiscal equalization grants and other unconditional grants from the central government. However, local governments are allowed to collect user fees when providing infrastructure services, child care and some nursing services. To be consistent with the institutional setting, we therefore analyze the allocation of in-kind transfers net of user fees when defining the value of in-kind transfers.

In producing public services, local governments are constrained by regulations and laws enacted by the central government. The detailed rules and guidelines include numerous service standards, often related to staffing and personnel qualifications, entitlement legislation (under which citizens with particular needs enjoy a statutory right to particular services), and service pledges which articulate commitment to a basic code of conduct. Beyond the programmatic spending components that are effectively determined by the central government, local governments have considerable discretion in how to allocate spending across service sectors and demographic groups. The political power over discretionary spending is obtained by controlling a majority of seats in local government councils. Elections with proportional representation of political parties are held every fourth year. Norway has a multi-party system, which means that parties have to work together to form coalitions. The major division in shaping electoral preferences and in terms of local government alternatives has been along the left-right axis, namely between socialists and liberal or conservative parties.

### *2.3 Descriptive statistics*

Before turning to the model of local government behavior, we show a few important features of the Norwegian setting.

We begin by describing the spending pattern on local public services over time and across sectors. Figure 1 shows that the largest expenditure component is care for the elderly and disabled (long-term care), closely followed by education. These two sectors account, on average, for more than half of the total expenditure of municipalities. Taken together, local government spending has increased by 255 percent (after adjusting for inflation), from USD 2,320 per capita in 1982 to USD 8,283 per capita in 2013. The largest increases were in child care (from USD 90 per capita in 1982 to USD 1,186 per

capita in 2013) and long-term care for the elderly and disabled (from USD 318 per capita in 1982 to USD 2,701 per capita in 2013).

The changes over time in spending pattern could be driven by policy reforms, changes in population composition, and shifts in local governments' priorities between service sectors and demographic groups. Figure 2 summarizes the shifts in population composition by household types. The most important trend is the increasing proportion of single adult households (with or without children), whereas the proportion of individuals in nuclear families has decreased over time. This is reflecting a secular trend in postponement of marriage and childbearing, a higher rate of divorce, and more children born by single mothers.

Table 1 complements Figure 1 by showing the cross-sectional dispersion in local government spending per capita in 1982 and 2013, as measured by the Gini coefficient. In both years, there are fairly small differences across municipalities in per capita public spending on education. By comparison, there was considerable dispersion in municipal spending on the other services sectors in 1982. Over time, the spending patterns across municipalities have changed significantly. In 2013, for example, there is relatively little dispersion in municipal spending on child care, whereas municipal expenditure on infrastructure has become much more heterogeneous.

Taken together, the descriptive statistics illustrate the complexity in understanding the spending pattern of local public services over time, between groups, and across municipalities. In the next section, we propose a structural model of local government behavior to understand the mechanisms at work, laying out explicitly the underlying assumptions.

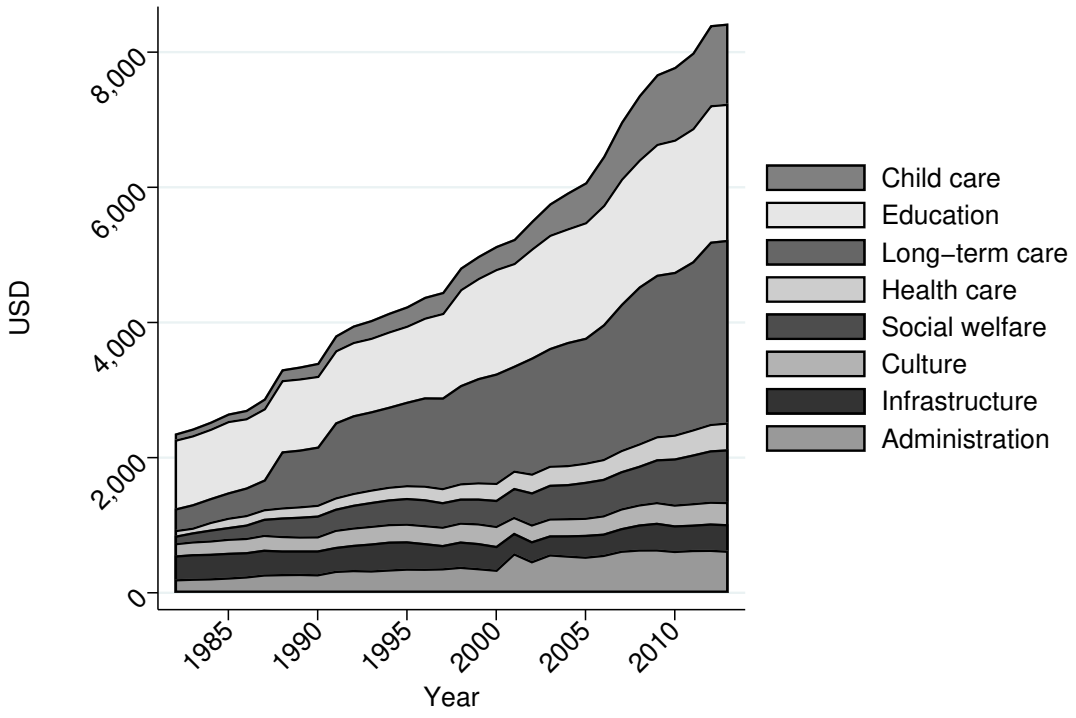


**Figure 1.** Mean municipal expenditure per capita by service sector

Note: This figure displays mean municipal expenditure per capita net of user fees for each service sector in the period 1982-2013. Average measures across municipalities are weighted by municipality size, and expressed in 2013 USD. Expenditures are adjusted using Norwegian Consumer Price Index and the average 2013 exchange rate of NOK 5.88 per USD is applied. The capital (Oslo) has responsibilities beyond municipal service provision and is therefore excluded from this figure.

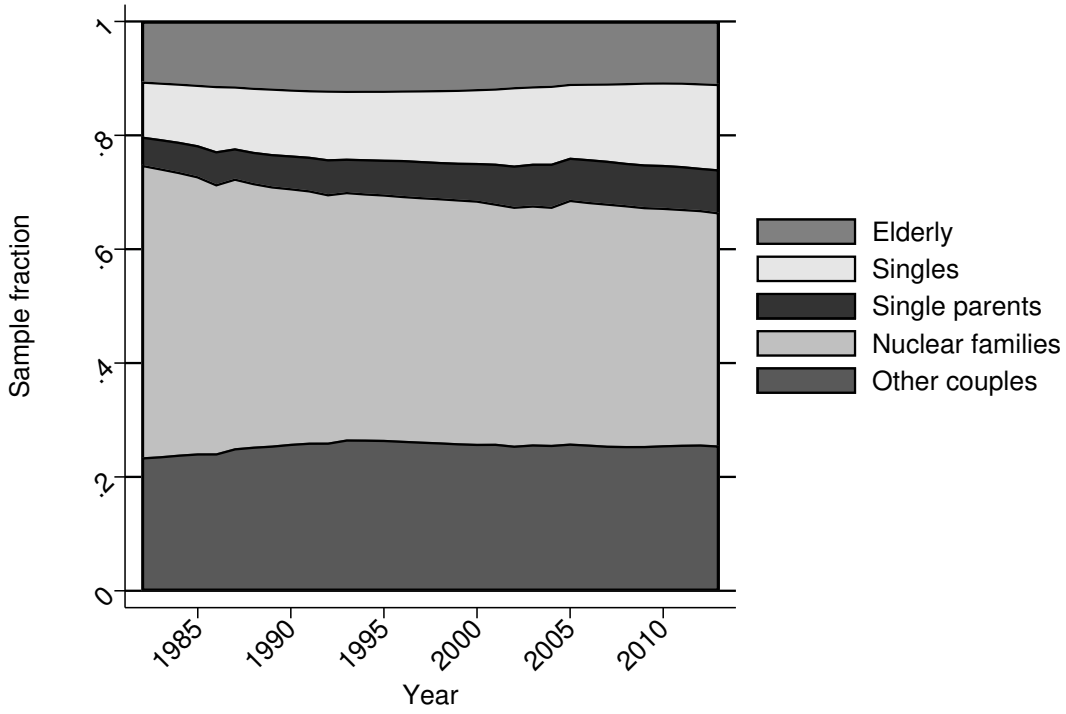


**Figure 2.** Population by household type
Note: This figure displays the fraction of individuals belonging to different household types in the period 1982-2013. The sample consists of all individuals residing in Norway each year. The household types are defined as follows: Elderly: households where the youngest is at least 67 years old; Singles: single person households less than 67 years old and without children; Single parents: single parents less than 67 years old with a child younger than 18 years; Nuclear families: couples with a child younger than 18 years; Other couples.

**Table 1.** Heterogeneity in municipal expenditure per capita by service sector

| | Gini coefficient in municipal expenditure per capita | |
|---|---|---|
| Sector | Year: 1982 | Year: 2013 |
| Child care | 0.37 | 0.12 |
| Education | 0.13 | 0.11 |
| Long-term care | 0.24 | 0.16 |
| Health care | 0.39 | 0.25 |
| Social welfare | 0.43 | 0.22 |
| Culture | 0.20 | 0.27 |
| Infrastructure | 0.25 | 0.39 |
| Administration | 0.22 | 0.32 |

Note: This table displays the Gini coefficient in municipal expenditure per capita net of user fees for each service sector in 1982 and 2013. The capital (Oslo) has responsibilities beyond municipal service provision and is therefore excluded from this table.

## 3 Measuring extended income

### *3.1 Model of local government spending*

We now derive an empirical model of local government spending behavior that can be microfounded in the probabilistic voting models of Lindbeck and Weibull (1987) and the lobbying models by Grossman and Helpman (1996, 2002). They argue that policies are tilted in favor of interest groups with many swing voters and/or groups that are able to organize as a lobby. To conform to the institutional setting, our model distinguishes between the mandatory programmatic spending components (assumed to be set exogenously by the central government) and the discretionary spending to different service sectors and target groups (endogenously determined by local governments).

*Objective function of the local government*

Standard models of probabilistic voting and/or lobbying assume that there are $K$ groups of agents, where each member of a specific group has the same economic preferences. The indirect utility of an agent belonging to interest group $k$ is a function of a vector of economic policies chosen by the political party in power. To choose between political parties, voters consider how they would allocate discretionary spending to $S$ different service sectors and $J$ different target groups. Let the utility $V_{km}$ of members of interest group $k$ residing in municipality $m$ be given by the following version of a Stone-Geary utility function,

$$V_{km} = \sum_{i=1}^{S} \sum_{j=1}^{J} \alpha_{ijk} log\left(x_{ijm} - \gamma_{ij}\right), \tag{1}$$

where $x_{ijm}$ is the production of service $i$ received by members of target group $j$ in municipality $m$. The parameter $\gamma_{ij}$ is interpreted as the minimum required expenditure per person of service $i$ targeted to group $j$, which is often called "subsistence" expenditure in the literature. These minimum expenditure parameters are supposed to capture the programmatic spending components for a given service and target group, determined by the central government. The parameter $\alpha_{ijk}$ is a taste parameter of interest group $k$ for allocating output to service sector $i$ and target group $j$. As discussed later, our model allows the interest groups for a given service to differ from the target groups for that service.

As highlighted by Acemoglu and Robinson (2006) and Persson and Tabellini (2002), the equilibrium policy in models of probabilistic voting and/or lobbying is equivalent to maximization of a weighted sum of the indirect utilities of the members of the population, where the weights depend on the political clout of different interest groups. Thus the political equilibrium corresponds to maximation of the following objective function of the local government in municipality $m$,

$$V_m = \sum_{k=1}^{K} \omega_k z_{km} V_{km} = \sum_{k=1}^{K} \omega_k z_{km} \sum_{i=1}^{S} \sum_{j=1}^{J} \alpha_{ijk} log\left(x_{ijm} - \gamma_{ij}\right), \tag{2}$$

where $\omega_k$ is the political weight assigned to interest group $k$ in the objective function and $z_{km}$ is the population proportion that belongs to interest group $k$ in municipality $m$. The latter term of equation

(2) is obtained by inserting for $V_{km}$ defined by (1).

To define the marginal budget shares for spending across target groups and service sectors, let the parameter $\beta_{ijm}$ be given by

$$\beta_{ijm} = \sum_{k=1}^{K} \omega_k \alpha_{ijk} z_{km}. \tag{3}$$

Inserting for (3) in (2) yields

$$V_m = \sum_{i=1}^{S} \sum_{j=1}^{J} \beta_{ijm} log\left(x_{ijm} - \gamma_{ij}\right). \tag{4}$$

The parameter $\beta_{ijm}$ can be interpreted as the marginal budget share for spending on target group $j$ in service sector $i$, where marginal budget shares are normalized to satisfy the adding-up constraint $\sum_{i=1}^{S} \sum_{j=1}^{J} \beta_{ijm} = 1$. Note that the target-group-specific marginal budget share ($\beta_{ijm}$) for service sector $i$ and target group $j$ depends on preferences ($\alpha_{ijk}$), political influence ($\omega_k$) and size ($z_{km}$) of the relevant interest groups.

*Cost structure*

Our model distinguishes between fixed and variable costs in production. We allow for economies of size in local government service production, arising from spreading fixed costs over a larger volume of output, thus reducing the average fixed cost per unit. Both fixed and variable costs of service production are allowed to vary across service sectors, whereas variable costs per unit of production are assumed to be constant for a given service sector. In order to distinguish between fixed and variable costs, we assume that expenditure per capita of municipality $m$ in service sector $i$ ($u_{im}$) is given by

$$u_{im} = c_{im} + x_{im},\ i = 1, ..., S, \tag{5}$$

where $c_{im}$ and $x_{im}$ are fixed and variable costs per capita in service sector $i$ for municipality $m$. The fixed costs are not considered to contribute to the production of services. As a result, the production $x_{im}$ in service sector $i$ equals variable costs and is allocated to target groups according to $(x_{i1m}, x_{i2m}, ..., x_{iJm})$ where

$$x_{im} = \sum_{j=1}^{J} x_{ijm} z_{jm},\ i = 1, ..., S, \tag{6}$$

and $z_{jm}$ is the population proportion that belongs to target group $j$.[6]

[6]Note that multiplication by $z_{jm}$ changes the normalization of $x_{ijm}$, since $x_{ijm}$ is measured per person of the target group subpopulation, whereas $x_{ijm}z_{jm}$ is measured per person of the entire local population. The population breakdown on $J$ target groups does not necessarily coincide with the partition on $K$ interest groups.

*Budget constraint*

The budget constraint requires total incomes (with fixed costs subtracted) to be allocated to spending on various service sectors. From definition (5) we get:

$$y_m = \sum_{i=1}^{S} u_{im} = \sum_{i=1}^{S} c_{im} + \sum_{i=1}^{S} x_{im}, \tag{7}$$

where $y_m$ is the income per capita received by local government $m$. The budget is not necessarily balanced. We treat any budget surplus as a residual sector of the model.

*Expenditure system*

By maximizing (4) subject to (6) and (7), the following expenditure system is obtained

$$x_{ijm} z_{jm} = \gamma_{ij} z_{jm} + \beta_{ijm} \left( y_m - \sum_{i=1}^{S} c_{im} - \sum_{i=1}^{S} \sum_{j=1}^{J} \gamma_{ij} z_{jm} \right), i = 1, ..., S, \ j = 1, ..., J, \tag{8}$$

where $\gamma_{ij} z_{jm}$ is minimum variable cost per capita in sector $i$ targeted to group $j$. Discretionary income is defined by $y_m - \sum_{i=1}^{S} c_{im} - \sum_{i=1}^{S} \sum_{j=1}^{J} \gamma_{ij} z_{jm}$, which represents the remaining amount of income when the local government has covered the fixed costs and minimum variable costs (expenditure needs).

The actual allocation of expenditures to target groups is not observed in the data, which means that the $\beta_{ijm}$ parameters are not directly identified. Since the available accounting data for municipalities are sector specific (but not target-group specific) we will use the following aggregate version of the equation system defined by (8) as the basis for estimating the model parameters,

$$\begin{aligned} u_{im} &= c_{im} + \sum_{j=1}^{J} x_{ijm} z_{jm} \\ &= c_{im} + \sum_{j=1}^{J} \gamma_{ij} z_{jm} + \beta_{im} \left( y_m - \sum_{i=1}^{S} c_{im} - \sum_{i=1}^{S} \sum_{j=1}^{J} \gamma_{ij} z_{jm} \right), \end{aligned} \tag{9}$$

where $\sum_{j=1}^{J} \gamma_{ij} z_{jm}$ is the minimum variable cost for service sector $i$, and $\beta_{im} = \sum_{j=1}^{J} \beta_{ijm}$ is the marginal budget share for sector $i$. From (3) it follows that the sector-specific marginal budget share $\beta_{im} = \sum_{k=1}^{K} \omega_k \alpha_{ik} z_{km}$ can be expressed as a weighted average of interest group preferences, where $\alpha_{ik} = \sum_{j=1}^{J} \alpha_{ijk}$ is a taste parameter of interest group $k$ for service provision in sector $i$.

*Allocation of in-kind transfers*

In cases where there is only one target group for a given service sector, the baseline version of our model assumes that in-kind transfers are allocated equally to all target group members in the same municipality (see Section 4.3 for a robustness check to this assumption). For many service sectors, however, there are several target groups. This is challenging because local government accounts give data on expenditure to different service sectors but do not provide direct information on the allocation

of sector-specific expenditure to different target groups.

To address this problem of missing data, we exploit that the minimum expenditures to different groups are identified as part of the spending model. Following Aaberge et al. (2010), we can then assume that the sector-specific discretionary income is allocated to target groups in the same proportion as the minimum expenditures,[7] i.e.

$$x_{ijm}z_{jm} = \frac{\gamma_{ij}z_{jm}}{\sum_{j=1}^{J}\gamma_{ij}z_{jm}}\left(u_{im} - c_{im}\right). \tag{10}$$

This means that estimates of the target-group-specific value of production ($x_{ijm}$) are determined by estimates of the minimum quantities ($\gamma_{ij}$), the variable costs ($u_{im} - c_{im}$) and the proportions of the population ($z_{jm}$) that belong to various target groups. Note, however, that the variable costs allocated to a specific sector and received by the actual target groups depend both on expenditure needs of target groups and the political influence of interest groups.

*Needs adjustment*

Equivalence scales are designed to reflect the cost of living of a household of a given size and demographic composition, relative to the cost of living of a reference household (usually a single adult). As argued by Radner (1997) and Aaberge et al. (2010), equivalence scales designed to account for needs and economies of scale in cash income are not necessarily appropriate when analyzing the distributional impact of public services and inequality in the distribution of extended income. For instance, the elderly tend to utilize health services more frequently than younger people due to differences in health status, whereas children have comparably higher needs for education. As a consequence, studies using the equivalence scales designed for cash income risk overestimating the equivalent incomes of groups with relatively high needs for public services.

To account for differences in needs of various services, we use the cost function approach to justify the following family of relative equivalence scales introduced by Aaberge et al. (2010):

$$NA_h = \frac{\sum_{i=0}^{S}\gamma_{ih}}{\sum_{i=0}^{S}\gamma_{ir}}, \tag{11}$$

where $\gamma_{0h}$ is the needs parameter of household $h$ for cash income and $\gamma_{ih}$ $(i = 1, 2, ..., S)$ is the needs parameter of household $h$ for public service $i$. The ratio $NA_h$ is the scale factor for household $h$ derived on the basis of the assessed needs parameters of household $h$ relative to a reference household $r$.[8] Accordingly, equivalent income for household $h$ is given by $C_h/NA_h$, where $C_h$ is the extended income of household $h$, i.e. the sum of cash income and the value of local public services that household $h$ enjoys. Equivalent income can be interpreted as the cost required for attaining the same welfare level for the reference household as household $h$ enjoys from extended income $C_h$. Individual needs parameters

[7] Sector-specific discretionary income is defined by discretionary income multiplied by the marginal budget share of service sector $i$. This approach secures that aggregation from target group to service sector level is consistent with the allocation of in-kind transfers.

[8] The reference household $r$ is defined as a single adult, 16-66 years of age, with no household characteristic that trigger extra expenditure needs.

are defined by minimum expenditure parameters which are primitives of the demand model (i.e. they are invariant to changes in the budget constraint of the municipality). Household needs parameters for publicly provided goods are defined by the sum of the needs parameters of the household members.

To measure the equivalent income of extended income, we also have to define the needs parameter ($\gamma_{0h}$) for cash income of each household. We follow much of the previous literature in using the EU scale to account for differences in needs of cash income for households who differ in size and composition.[9] One possibility is to use the poverty line in the distribution of equivalent income in a given year as a basis for determining the needs parameter for the reference group. Specifically, we set the needs parameter $\gamma_{0r}$ of cash income for the reference household equal to the EU definition of the poverty line (i.e. 60 percent of the median equivalent cash income). For households that are not of the reference type, the needs for cash income is assessed by $\gamma_{0h} = \gamma_{0r} EU_h$, where $EU_h$ is the official European Union scale for cash income pertaining to household $h$. Thus, the ratio between the needs for cash income for household $h$ and for the reference household $r$ defines the EU scale.

### *3.2 Empirical implementation*

Below, we describe the empirical specification, identification and estimation of the model.

#### *Empirical specification*

Our empirical model is described by the system of equations in (9), which accounts for spending on eleven service sectors, and treats the budget surplus (net operating result) as a residual sector. Thus, the model can be considered as an extended linear expenditure system.

As is clear from (9), the minimum variable costs (mandatory spending) of different service sectors depend on the size of the targeted population groups, whilst the marginal budget share parameters depend on the preferences, political influence and size of various interest groups. A target group is defined as a group of people considered to have equal needs for public services. The subpopulations that form the target groups are defined by age groups, refugee status, employment status, marital status and poverty status. By allowing the minimum expenditure parameters to vary across target groups, service sectors, and years, the empirical model accounts for different needs for public services between different demographic groups and over time.

The sector-specific marginal budget shares are specified as parametric functions of the size of the relevant interest groups. In line with previous evidence, we allow for differences in the demographic characteristics of recipients (target groups) and of interests groups supporting spending on a given service (see e.g. Rubinfeld, 1977; Poterba, 1998; Strömberg, 2006). The reason is twofold. First, the possibility of altruistic preferences means that voters may support spending on public services to people other than themselves. For example, parents with young children may support spending on education services, and adult children with aging parents may be in favor of spending on services that

[9] The EU scale assigns weight 1 to the household head, 0.5 to each member aged 14 and above and 0.3 to each member aged below 14. Some studies do not use equivalence scales or, equivalently, assume no economies of scale and no heterogeneity in needs (see e.g. Piketty et al., 2018).

are targeted towards the elderly. Second, an increase in government spending on one service sector or target group may crowd out spending on other service sectors or target groups. For instance, people who support increased spending on education services may be in favor of spending less on care for the elderly.

The fixed cost terms in the model equations are specified as linear parametric functions of inverse population size and other municipal characteristics. Fixed costs may account for diseconomies of population dispersion, which occur when there are long traveling distances within a municipal area of service. Thus, environmental factors such as traveling distances within a municipality will be assumed to affect fixed costs.

The minimum expenditure term in the equation for budget surplus (net operating result) is specified as a function of the (real) per capita income change and lagged income changes from the previous two years. This specification captures that local governments may use budget surplus or deficit to smooth service production over business cycles.

*Identification*

Our model is a linear expenditure system. Identification of this model is discussed in detail in Muellbauer (1974), Howe (1975) and Pollak and Wales (1978). In the absence of price variation, the marginal budget share parameters are exactly identified without any additional restrictions. However, identification of the other parameters require at least one exclusion restriction per variable that is included in the specification of minimum expenditures.

Table 2 lists included and excluded variables that affect minimum expenditures and fixed costs by sector. As shown in this table, our baseline model specification imposes two types of exclusion restrictions. First, we take advantage of institutional knowledge about target groups per service sector. As explained in the description of the model, socio-demographic variables are included to capture the cost of minimum requirements assigned to the relevant target groups of municipal services. Since regulations and laws enacted by the central government restrict service provision to recipients that fulfill certain criteria, we have direct information that identifies target groups and non-target groups across service sectors. As a consequence, if group $j$ is a non-target group in service sector $i$, the relevant exclusion restriction ($\gamma_{ij} = 0$) is imposed on the sector-specific minimum expenditure. For example, since only children in mandatory school-age are enrolled in school, it follows that other age groups are treated as non-target groups.

The second type of exclusion restrictions exploits that certain environmental factors are unlikely to matter for the cost of service production in all sectors. For instance, snowfall is assumed to induce additional costs only in road maintenance, since this service sector is responsible for snow clearing. By similar arguments, the length of municipal roads and sewage purification degree are assumed to increase fixed costs only in municipal road maintenance and water, sewage and refuse sector, respectively. Additionally, the effects of inverse population size and average traveling distance are excluded in service sectors where the estimated effects do not differ significantly from zero. Finally, there are no fixed costs associated with the net operating result. Therefore, the minimum net operating result is assumed to be independent of environmental cost factors.

**Table 2.** Inclusion and exclusion of variables that affect minimum expenditures and fixed costs by sector

| | Service sectors | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (0) | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| Target groups | | | | | | | | | | | | |
| All residents (constant term) | X | 0 | 0 | 0 | 0 | X | 0 | X | X | X | X | X |
| Age 1–5 | 0 | X | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Age 1–5 and parents working | 0 | X | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Age 6–15 | 0 | 0 | X | X | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Age 6–15 and parents working | 0 | 0 | 0 | X | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Age 0–66 | 0 | 0 | 0 | 0 | X | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Age 67–79 | 0 | 0 | 0 | 0 | X | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Age 80+ | 0 | 0 | 0 | 0 | X | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mentally disabled | 0 | 0 | 0 | 0 | X | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| High-need recipients | 0 | 0 | 0 | 0 | X | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Poor | 0 | 0 | 0 | 0 | 0 | 0 | X | 0 | 0 | 0 | 0 | 0 |
| Unemployed | 0 | 0 | 0 | 0 | 0 | 0 | X | 0 | 0 | 0 | 0 | 0 |
| Divorced | 0 | 0 | 0 | 0 | 0 | 0 | X | 0 | 0 | 0 | 0 | 0 |
| New refugees | 0 | 0 | 0 | X | 0 | 0 | X | 0 | 0 | 0 | 0 | 0 |
| Prior refugees | 0 | 0 | 0 | 0 | 0 | 0 | X | 0 | 0 | 0 | 0 | 0 |
| Environmental cost factors | | | | | | | | | | | | |
| Inverse population size | 0 | 0 | X | 0 | X | X | 0 | 0 | 0 | X | X | X |
| Traveling distance | 0 | 0 | X | 0 | X | X | 0 | 0 | 0 | 0 | 0 | 0 |
| Amount of snowfall | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | X | 0 | 0 | 0 |
| Length of municipal roads | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | X | 0 | 0 | 0 |
| Sewage purification degree | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | X | 0 | 0 |

| | | | | | |
|---|---|---|---|---|---|
| Sector (1) | Child care | Sector (5) | Health care | Sector (9) | Water, sewage and refuse |
| Sector (2) | Mandatory education | Sector (6) | Social welfare | Sector (10) | Other infrastructure |
| Sector (3) | Other education | Sector (7) | Culture | Sector (11) | Administration |
| Sector (4) | Long-term care | Sector (8) | Road maintenance | Sector (0) | Net operating result |

Note: This table displays the variables that are included to account for heterogeneity in minimum variable and fixed costs for the period 2002-2013. The included effects are denoted X, and the exclusion restrictions are denoted 0.

As is evident from Table 2, the baseline model is overidentified. This allows us to estimate a less restrictive version of the model. The less restrictive model only invokes the first type of exclusion restrictions - which are based on institutional knowledge about target groups - and includes the environmental cost factors in all service sectors. If the cost factors are relevant in all service sectors, we expect the less restrictive model to fit the data better than the baseline model. It is reassuring to find that the goodness of fit, as measured by the adjusted R-squared, differ little if anything between the baseline and less restrictive model.

*Estimation*

The system of equations in (9) is estimated based on detailed local government accounts and community characteristics of Norwegian municipalities for the period 1982 - 2013. The estimates are based on annual data, but for brevity we only report average estimates over four year periods. Expenditures are defined exclusive of user fees and employer payroll taxes, and are measured on a per capita basis in the model specification. The model is estimated simultaneously by the method of maximum likelihood, assuming that the error terms have a multinormal distribution (with mean zero and unrestricted covariance matrix). Parameter estimates are in general found to be statistically significant and of the expected sign.

Estimates for minimum expenditure parameters ($\gamma_{ij}$), fixed cost parameters ($c_{im}$), and marginal budget share parameters ($\beta_{im}$) are reported in Appendix A. The parameter estimates in Table A1 show the increase in minimum expenditure by service sector when a given target group is increased by one person.[10]

The parameter estimates displayed by Table A2 show the relationship between fixed costs and municipality characteristics. We find significant fixed costs in seven of the eleven service sectors. In most service sectors, there is a negative relationship between fixed costs per capita and population size. For the production of mandatory education, health care, and long-term care, the fixed costs per capita are higher for municipalities with more geographically dispersed population. Additionally, the fixed costs in municipal road maintenance depend on the length of municipal roads and the amount of snowfall during the year.

Parameter heterogeneity for marginal budget shares are reported in Table A3. The three basic interest groups are children aged 0-15, middle-aged 16-59, and elderly people aged 60 and above.[11] The marginal budget shares of the average municipality (which are accounted for by constant terms) tend to be rather stable over time. Consistent with family altruism, the marginal budget shares in education and in care for elderly increase in the proportion of children aged 0-15 with a grandparent residing in the same municipality. By contrast, this variable is negatively associated with discretionary spending on child care services, possibly because grandparents may serve as informal caregivers for toddlers and pre-school children.

[10] For the sake of comparability, parameter estimates are standardized by the year- and sector-specific mean expenditure per capita. This provides units that are independent of changes in prices and exchange rates over time.

[11] After including a constant term in the specification of marginal budget shares, the group of middle-aged is omitted and treated as a reference group. Moreover, we measure the population proportions of interest groups as deviations from yearly mean values, which allows us to interpret the constant terms as the marginal budget shares of the average municipality.

Estimates of the effects of income changes per capita on the minimum expenditure in the residual sector (net operating result) are reported in Table A4. The parameter estimates support the hypothesis that budget surpluses and deficits are used to attenuate variation in service production over the business cycle.

As shown in Table 3, our model provides a relatively good within-sample fit for most of the service sectors. Reassuringly, the fit is especially good for large service sectors such as long-term care, mandatory education, and child care. One may, however, be concerned about overfitting and spurious correlations, especially in our setting with a relatively large number of explanatory variables. To assess this, we use the parameter estimates to predict spending behavior of local governments in the subsequent year. We use the simulated out-of-sample $R^2$ as a summary measure of out-of-sample prediction performance (for further explanation of this method, we refer to Appendix B). Table 3 compares in-sample and out-of-sample $R^2$ estimates in four-year averages of the data. It is reassuring to find that, in many cases, the out-of-sample prediction performance is as good as the within-sample fit. The overall impression from the out-of-sample comparison is that the model predicts local government allocations rather well, at least from one period to the next.

### *3.3 Descriptive results*

By aggregating over service sectors and municipalities in equation (5) we obtain national averages of fixed costs and variable costs per capita for the period 1982 - 2013, as displayed in Figure 3. The fixed costs (which do not contribute to the value of the service production) account for 10.9 percent of total per capita costs in 1982. This share falls to 4.6 percent in 2013. Figure 3 shows that total fixed costs do not change much over time, while variable costs have more than tripled from 1982 to 2013.[12] This increase in variable costs translates to a growth in the value of in-kind services per capita, from USD 2,121 in 1982 to USD 7,861 in 2013.

There is considerable variation in how much in-kind services that different individuals receive, both across demographic groups, between municipalities, and over time. Figure 4 displays per capita values of in-kind transfers received by different household types.[13] The results show that elderly and families with children receive more public services than single adults and other families, and that these differences have become more pronounced over time. Figure 5 complements by showing percentiles in the distribution of in-kind transfers (per capita) across municipalities. The median value has more than tripled, from USD 1,921 per capita in 1982 to USD 8,458 per capita in 2013. There is also considerable dispersion across municipalities in the per capita values of in-kind transfers. In 2013, for example, in-kind transfers per capita were USD 4,094 higher in a municipality at the 90th percentile as compared to a municipality at the 10th percentile.

[12] Service sectors with relatively high fixed cost such as infrastructure and long-term care are partly funded by user fees (paid with cash income by users). Over time, there has been a considerable increase in user fees. However, this increase does not translate into a growth in fixed costs because we measure local government expenditure net of user fees (to avoid double counting in the construction of extended income). To directly examine the impact of excluding user fees from the calculation of fixed costs, we have re-estimated the model including user fees in local government spending. The results show that fixed costs inclusive of user fees are indeed growing over time, as one might expect.

[13] In-kind transfers are first assigned to individuals (based on individual and household characteristics), after which benefits are aggregated (like other income components) across members within the household. This means that we are incorporating transfers to elderly even if they live in households with younger relatives. In such cases, however, the

**Table 3.** $R^2$ estimates within-sample and out-of-sample by service sector

| Sector | Estimates | 1982-1985 | 1986-1989 | 1990-1993 | 1994-1997 | 1998-2001 | 2002-2005 | 2006-2009 | 2010-2013 |
|---|---|---|---|---|---|---|---|---|---|
| Child care | Within-sample | 0.48 | 0.51 | 0.61 | 0.62 | 0.63 | 0.59 | 0.67 | 0.75 |
| | Out-of-sample | 0.44 | 0.48 | 0.54 | 0.59 | 0.59 | 0.56 | 0.65 | 0.74 |
| Mandatory education | Within-sample | 0.77 | 0.72 | 0.76 | 0.73 | 0.76 | 0.82 | 0.80 | 0.79 |
| | Out-of-sample | 0.76 | 0.69 | 0.73 | 0.68 | 0.75 | 0.81 | 0.78 | 0.78 |
| Other education | Within-sample | 0.05 | 0.07 | 0.17 | 0.22 | 0.25 | 0.28 | 0.32 | 0.42 |
| | Out-of-sample | 0.03 | 0.05 | 0.11 | 0.20 | 0.03 | 0.26 | 0.30 | 0.39 |
| Long-term care | Within-sample | 0.54 | 0.68 | 0.80 | 0.82 | 0.85 | 0.86 | 0.87 | 0.86 |
| | Out-of-sample | 0.55 | 0.64 | 0.77 | 0.82 | 0.84 | 0.85 | 0.86 | 0.85 |
| Health care | Within-sample | 0.27 | 0.42 | 0.38 | 0.51 | 0.59 | 0.66 | 0.72 | 0.71 |
| | Out-of-sample | 0.26 | 0.39 | 0.35 | 0.49 | 0.58 | 0.65 | 0.71 | 0.69 |
| Social welfare | Within-sample | 0.53 | 0.58 | 0.51 | 0.52 | 0.50 | 0.51 | 0.51 | 0.54 |
| | Out-of-sample | 0.53 | 0.51 | 0.48 | 0.51 | 0.43 | 0.50 | 0.47 | 0.52 |
| Culture | Within-sample | 0.37 | 0.43 | 0.47 | 0.45 | 0.46 | 0.52 | 0.53 | 0.47 |
| | Out-of-sample | 0.37 | 0.41 | 0.38 | 0.43 | 0.43 | 0.50 | 0.50 | 0.46 |
| Road maintenance | Within-sample | 0.29 | 0.43 | 0.53 | 0.57 | 0.57 | 0.57 | 0.61 | 0.68 |
| | Out-of-sample | 0.23 | 0.36 | 0.52 | 0.55 | 0.54 | 0.56 | 0.55 | 0.64 |
| Other infrastructure | Within-sample | 0.31 | 0.42 | 0.55 | 0.40 | 0.44 | 0.51 | 0.50 | 0.47 |
| | Out-of-sample | 0.29 | 0.38 | 0.50 | 0.38 | 0.41 | 0.47 | 0.47 | 0.46 |
| Administration | Within-sample | 0.67 | 0.70 | 0.70 | 0.72 | 0.72 | 0.79 | 0.84 | 0.84 |
| | Out-of-sample | 0.67 | 0.68 | 0.67 | 0.72 | 0.66 | 0.78 | 0.82 | 0.84 |

Note: This table displays four-year averages of $R^2$ estimates by service sector. The out-of-sample $R^2$ uses parameter estimates from the previous year. The out-of-sample $R^2$ in the first row does not include estimates for 1982. This explains why the out-of-sample $R^2$ is larger than the within-sample $R^2$ in some sectors in the first row. See Appendix B for details.

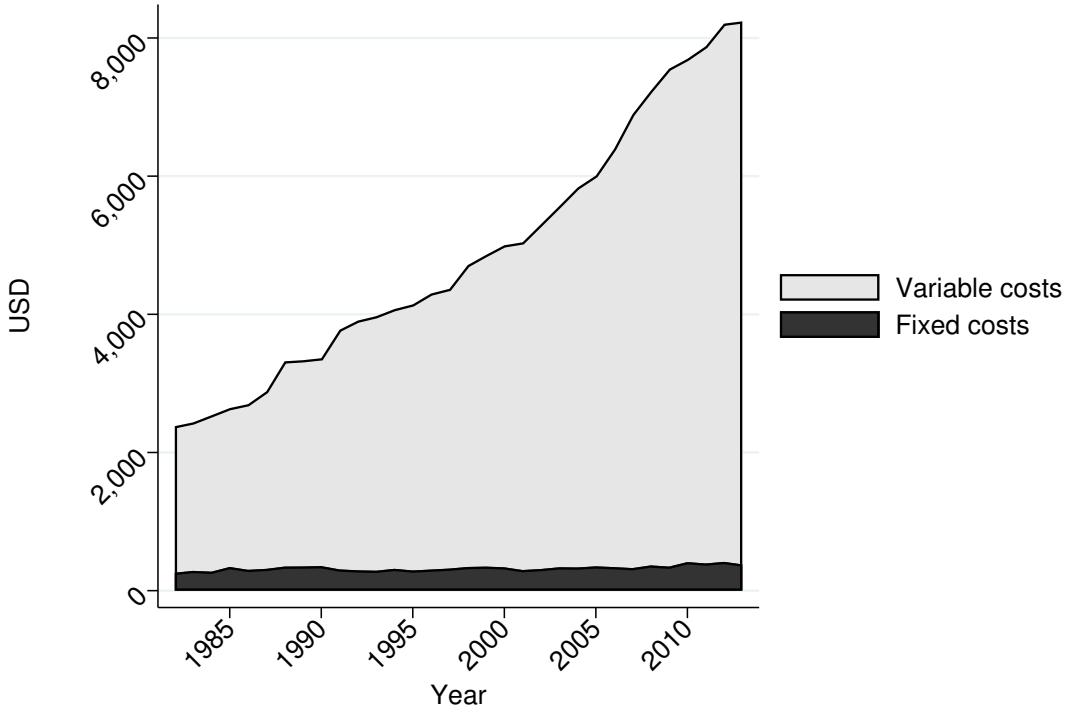


**Figure 3.** Variable cost and fixed costs per person

Note: This figure displays estimates of per capita fixed costs and variable costs in the period 1982-2013. Average measures across municipalities are weighted by municipality size, and expressed in 2013 USD. Expenditures are adjusted using Norwegian Consumer Price Index and the average 2013 exchange rate of NOK 5.88 per USD is applied.

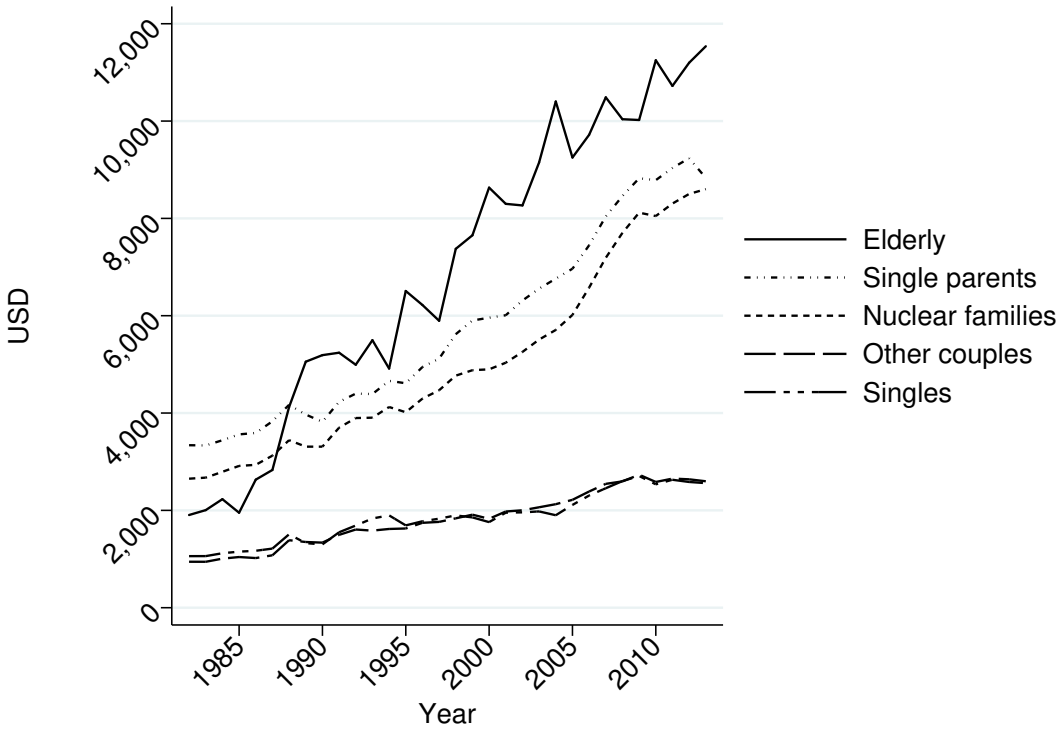


**Figure 4.** Value of in-kind transfers per capita by household type

Note: This figure displays per capita values of municipal in-kind transfers received by different household types in the period 1982-2013. Values of in-kind transfers are expressed in 2013 USD. The values are adjusted using Norwegian Consumer Price Index and the average 2013 exchange rate of NOK 5.88 per USD is applied. The household types are defined as follows: Elderly: households where the youngest is at least 67 years old; Singles: single person households less than 67 years old and without children; Single parents: single parents less than 67 years old with a child younger than 18 years; Nuclear families: couples with a child younger than 18 years; Other couples.

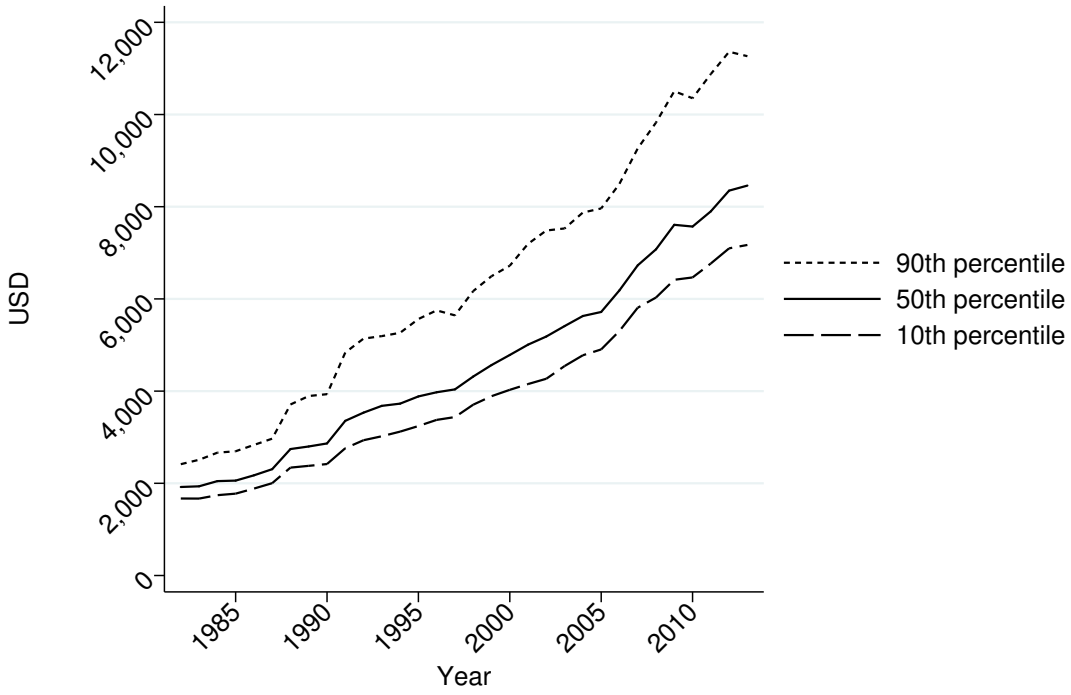


**Figure 5.** Value of in-kind transfers per capita by municipality

Note: This figure displays the median, the 10th percentile, and 90th percentile in the distribution of in-kind transfers (per capita) across municipalities in the period 1982-2013. Values of in-kind transfers are expressed in 2013 USD. The values are adjusted using Norwegian Consumer Price Index, and the average 2013 exchange rate of NOK 5.88 per USD is applied. The municipalities are not weighted by size.

During the period 1982-2013, Norway experienced a large growth in GDP. In Figure 6, we compare the aggregate values relative to GDP of i) in-kind transfers provided by the local governments, ii) payments to old-age pension from the central government iii) other public cash transfers, and iv) other public in-kind transfers. We find that municipal in-kind transfers have become an increasingly important component of aggregate production over time, making up 4.4 percent of GDP in 1982 and 7.5 percent in 2013. By contrast, there has been little if any change in public old-age pensions and in spending on other public cash and in-kind transfer programs measured as shares of GDP.

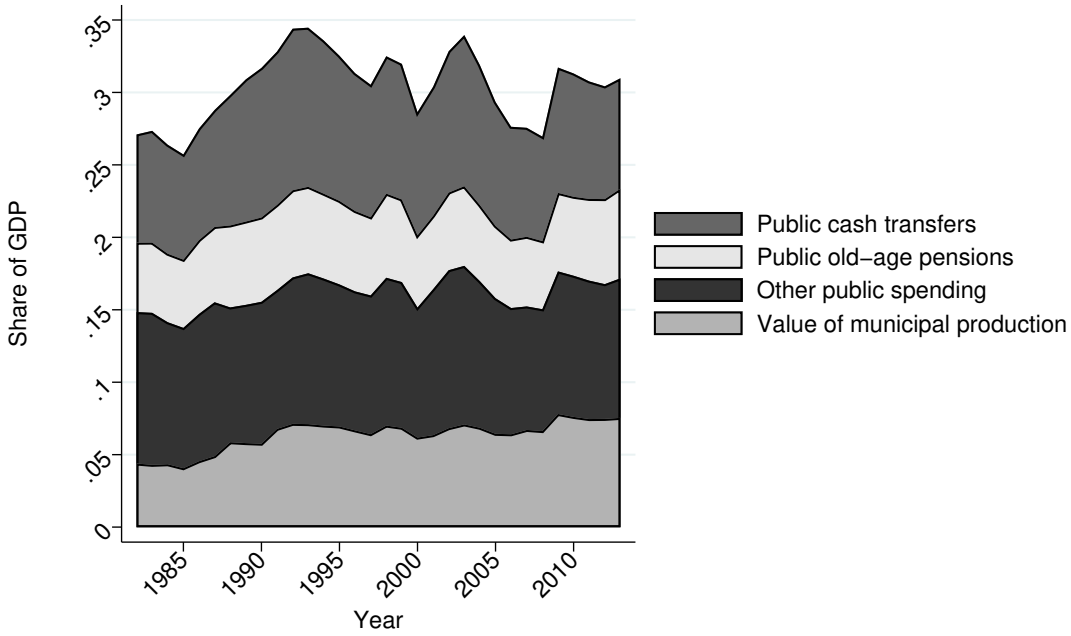


**Figure 6.** Public transfers in cash and in kind as shares of GDP
Note: This figure displays the aggregate values relative to GDP of local government in-kind transfers, other public in-kind transfers, old-age pensions and other public cash transfers in the period 1982-2013, derived from the national accounts.

In Figure 7, we decompose the aggregate values of in-kind transfers by service sector. Child care, mandatory education and long-term care are three important public services. Taken together, they account for 71 percent of total municipal production in 2013. Over time, long-term care and child care services are becoming increasingly important, whereas the relative spending on education has declined. To describe who receives the different types of public service, we decompose the sector-specific in-kind transfers by target groups. The target groups are usually defined by age and, in many cases, also by some other characteristic. For example, mandatory education provides education for all children aged 6-15 years (7-15 years before 1998). By comparison, child care services depend on age of the child and the employment status of the parents. As shown in Appendix Figure A1, child care services were initially targeted at working parents, but since the late 1990s, all children aged 1-6 years were eligible for subsidized child care, regardless of parental employment. The shares of long-term care production

household is classified as "other couples".

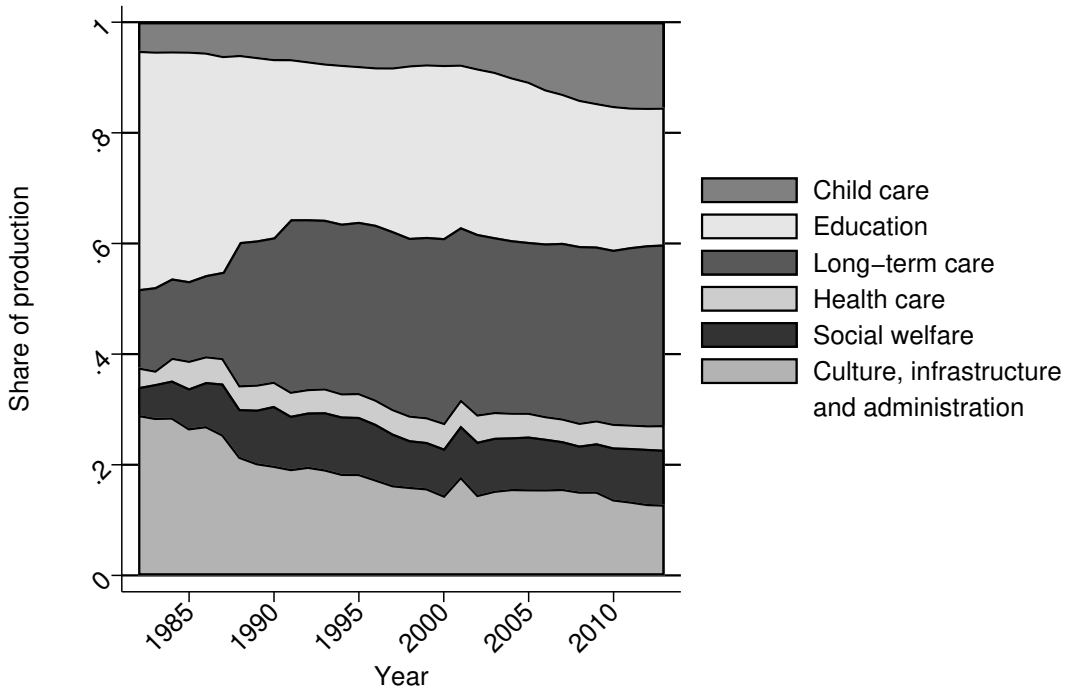


**Figure 7.** In-kind transfers by service sector as shares of total municipal production
Note: This figure displays the fraction of total municipal in-kind transfers provided by different service sectors in the period 1982-2013. Average values of production across municipalities are weighted by municipality size.

allocated to different target groups are displayed in Appendix Figure A2. The elderly receive much of the long-term care production. After 1991, the mentally disabled are included as a target group in the model, as local governments were given responsibility for services to this group. In the late 1990s, the central government granted more funding to local governments that targeted individuals with severe disabilities (high-need recipients), in need of intensive care.

## 4 In-kind transfers and economic inequality

This section examines the impact of in-kind transfers on economic inequality.

### *4.1 Distribution of cash income versus extended income*

Figure 8 displays the evolution of inequality in cash income and extended income, as measured by the Gini coefficient.[14] We consider the distribution of individual equivalent income, using equivalence scales to compare across households of different size, composition and needs. In particular, we follow the conventional approach and apply the EU scale to define equivalent income for cash income. By contrast, our proposed equivalent income measure for extended income employs the NA scale. To assess the importance of choice of equivalence scales, we also provide results for extended household income when the EU scale is used to account for differences in needs both for cash income and in-kind transfers.

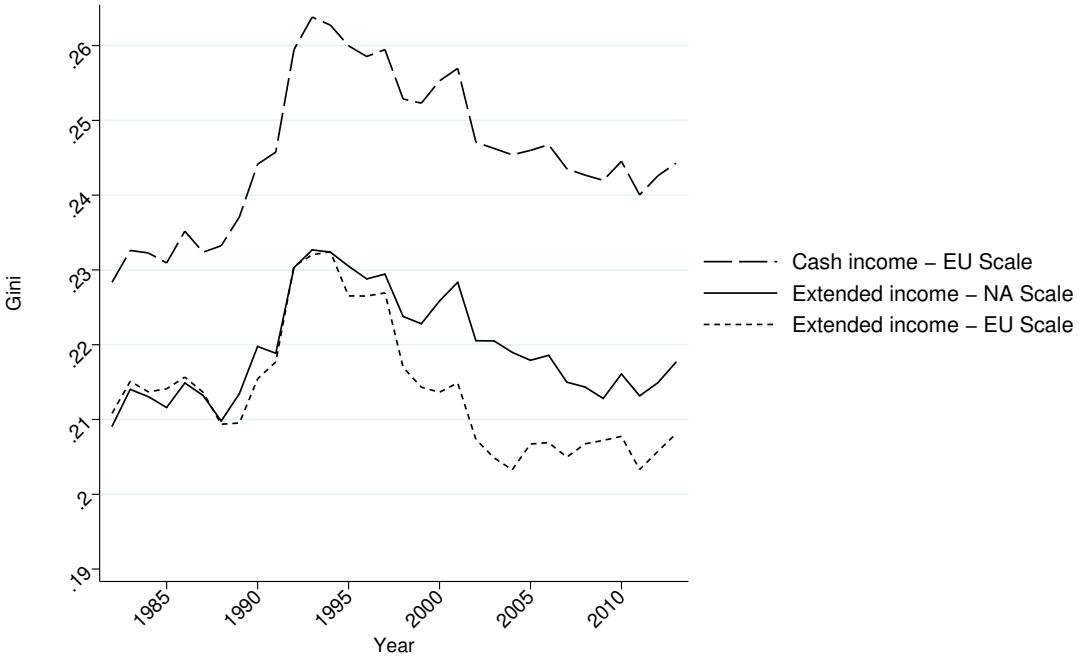


**Figure 8.** Gini coefficient in the distribution of cash income and extended income
Note: The solid gray line displays the Gini coefficient for the distribution of household cash income when applying the EU equivalence scale. The solid black line displays the Gini coefficient for the distribution of household extended income when applying the NA equivalence scale. The dashed line displays the Gini coefficient for the distribution of household extended income when applying the EU equivalence scale. The sample consists of all individuals residing in Norway each year in the period 1982-2013.

The results show that the inequality in cash income, as measured by the Gini coefficient, increased during the 1980s and into the early 1990s. After the peak in inequality in 1993, inequality declined. In

[14] In Appendix C, we perform robustness checks to the choices of inequality index. The results are broadly similar if we apply other inequality measures.

2013, the Gini coefficient in cash income was 7.0 percent (1.6 percentage points) higher than in 1982. Extending the income measure to incorporate the value of in-kind transfers reduces the Gini coefficient by somewhere between 8.0 and 12.1 percent (or 1.9 to 3.1 percentage points). Put into perspective, this reduction in the Gini coefficient corresponds to introducing a 8 to 12 percent proportional tax on cash income and then redistributing the derived tax revenue as equal sized amounts to the individuals. By way of comparison, how one accounts for differences in needs matters less for the estimates of inequality: Until the early 1990s, the Gini coefficients in extended income do not differ appreciably depending on whether we use the EU scale or the NA scale. After 1993, we find that adjusting for differences in needs for public services attenuates some of the differences between the estimated inequality in extended income and cash income.

Focusing attention on the lower part of the income distribution, we also find that poverty estimates are substantially lower for extended income than for cash income measure. According to the EU definition, the poverty line is defined as 60 percent of the median equivalent income (see Atkinson et al., 2012). We use the population share with incomes below this poverty line, or the headcount ratio, as our measure of poverty. The time trend in poverty is displayed in Figure 9. When including public in-kind transfers in the income measure, poverty estimates are reduced by 3.6 - 5.2 percentage points. In 2013, for example, the relative reduction in poverty is 4.4 percentage points when accounting for the value of in-kind transfers.

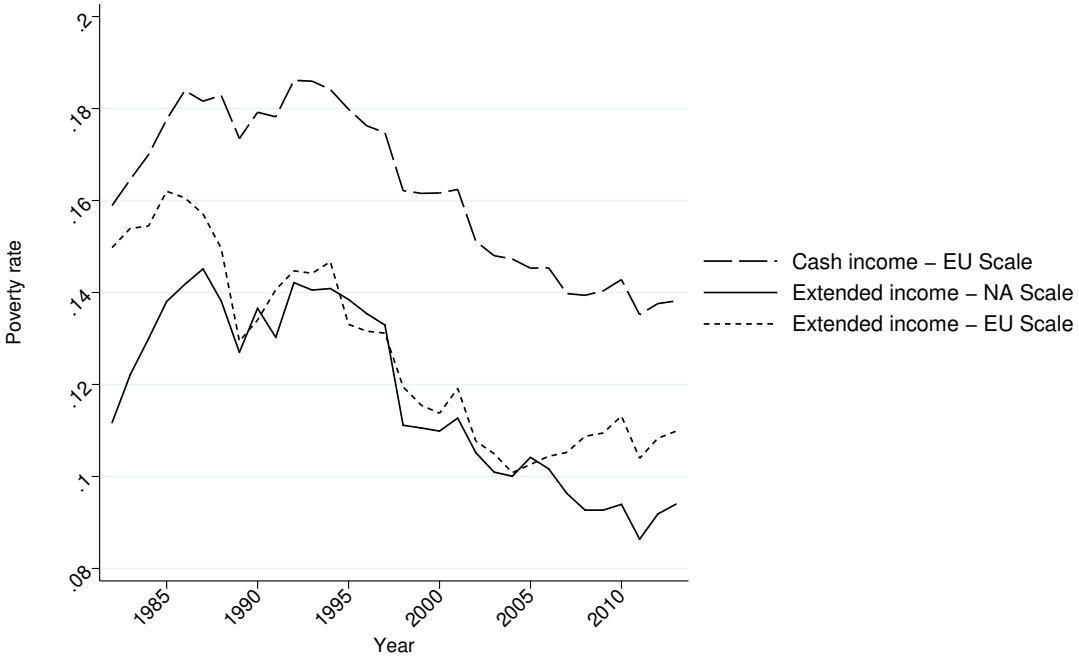


**Figure 9.** Poverty rate in the distribution of cash income and extended income
Note: The solid gray line displays the share of individuals below the EU poverty line in the distribution of household cash income when applying the EU equivalence scale. The solid black line displays the share of individuals below the EU poverty line in the distribution of household extended income when applying the NA equivalence scale. The dashed line displays the share of individuals below the EU poverty line in the distribution of household extended income when applying the EU equivalence scale. The EU poverty line is 60 percent of the median income. The sample consists of all individuals residing in Norway each year in the period 1982-2013.

Figure 10 breaks down the analysis of distributional differences according to five distinct interest groups. In particular, this figure reports inequality and poverty estimates for each of these groups. The Gini coefficient is estimated within each group, whereas the poverty threshold is the same for all groups (after adjusting for differences in household size and composition through the equivalence scale). The poverty rate in cash income is relatively high among elderly and single parents. However, these groups accrue considerable in-kind benefits, lowering the poverty rate significantly. While taking into account in-kind transfers reduces inequality within each group, the reduction is most pronounced for single parents.

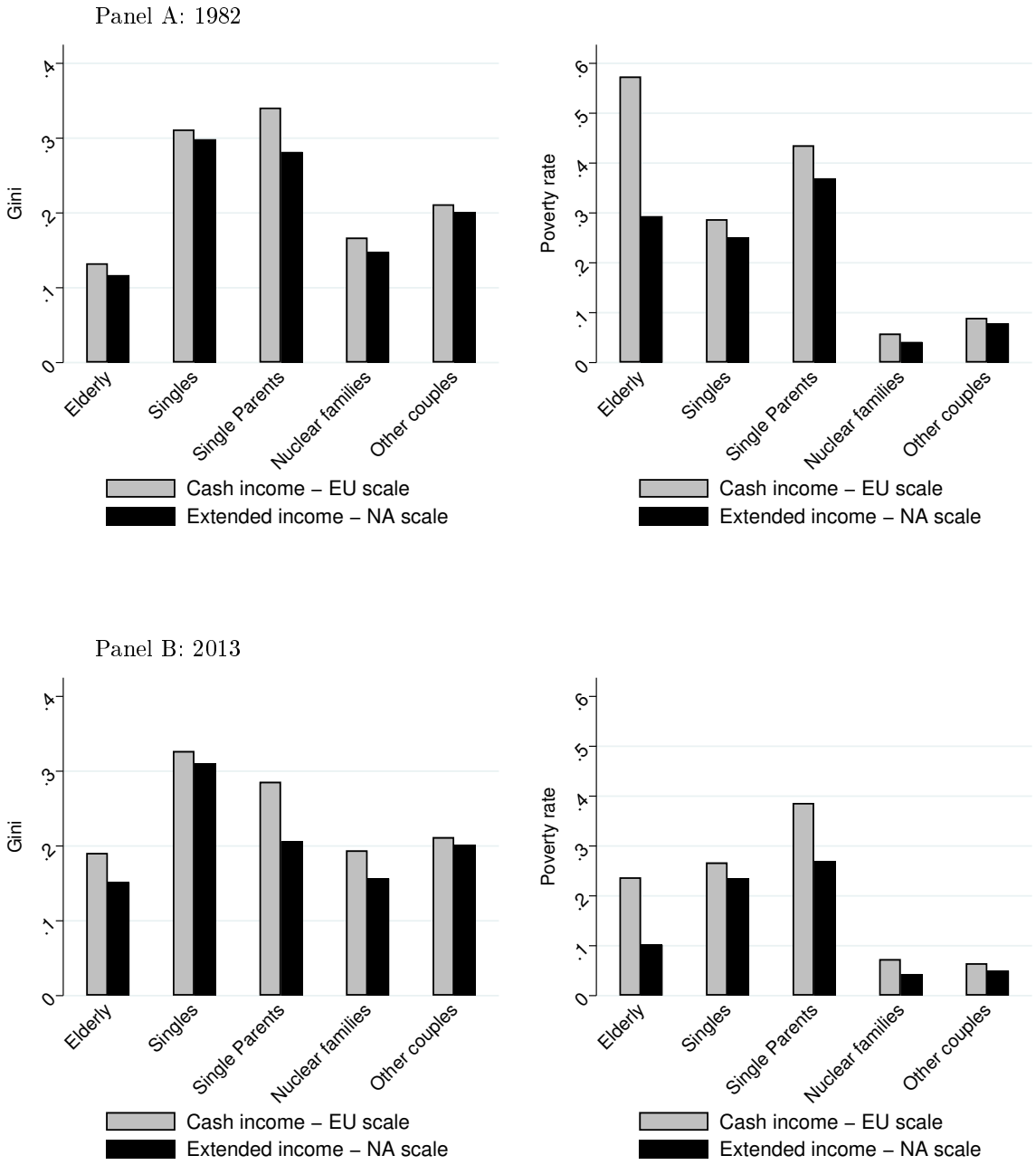


**Figure 10.** Gini coefficient and poverty rate estimates by household type

Note: The figure displays the Gini coefficient and the share of individuals below the EU poverty line in the distribution of household cash income and extended income for various household groups. The Gini coefficient is estimated within each group, whereas the poverty threshold is the same for all groups. The household groups are defined as follows: Elderly: households where the youngest is at least 67 years old; Singles: single person households less than 67 years old and without children; Single parents: single parents less than 67 years old with a child younger than 18 years; Nuclear families: couples with a child younger than 18 years; Other couples. The sample consists of all individuals residing in Norway in 1982 and 2013.

*4.2 Contribution by income source*

Extended income can be expressed as the sum of total cash income and the value of public services, while cash income can be divided into four main income components; market income, public old-age pension, other public cash transfers, and taxes.

Following Rao (1969), the Gini coefficient ($G$) admits the following decomposition,

$$G = \sum_{j=1}^{5} v_j(G) = \sum_{j=1}^{5} \frac{\mu_j}{\mu} \kappa_j, \tag{12}$$

where $\mu_j$ is the mean of income component $j$, $\mu$ is the overall mean income, and the ratio $\mu_j/\mu$ is the income share of component $j$. The concentration coefficient $\kappa_j$ can be interpreted as the conditional Gini coefficient of component $j$ given the rank order in extended income. The inequality contribution $v_j(G)$ is the product of the income share and the concentration coefficient. If the mean of an income component is positive ($\mu_j > 0$), then a negative value of the concentration coefficient represents an equalizing contribution from the income component. A positive concentration coefficient implies that the contribution is disequalizing. A third case appears when $\kappa_j = 0$, which corresponds to the case where an equal amount of component $q$ is received by every individual. The inequality share ($\tau_j$) of an income component is defined by

$$\tau_j = \frac{\mu_j}{\mu} \frac{\kappa_j}{G}. \tag{13}$$

The decomposition method (12) is applied for the five income components - market income, public old-age pension, other public cash transfers, direct taxes and local public services. Taken together, the income share $\mu_j/\mu$, the concentration coefficient $\kappa_j$, and the inequality share $\tau_j$ describes the distributional impact of different income components.

The decomposition results for extended income are displayed in Figure 11. Market incomes are shown to be the dominating income component with a clear disequalizing effect on the distribution of extended income. Since taxes are a negative income component, it follows from the positive concentration coefficient that the progressive nature of the tax system makes the distribution of extended income more equal. The equalizing contribution of in-kind transfers tends to be smaller than the equalizing contribution of all public cash transfers (including public old-age pension). Over the last decade, however, public pension has become less equalizing, reflecting that fewer elderly are located in the lower part of the extended income distribution.

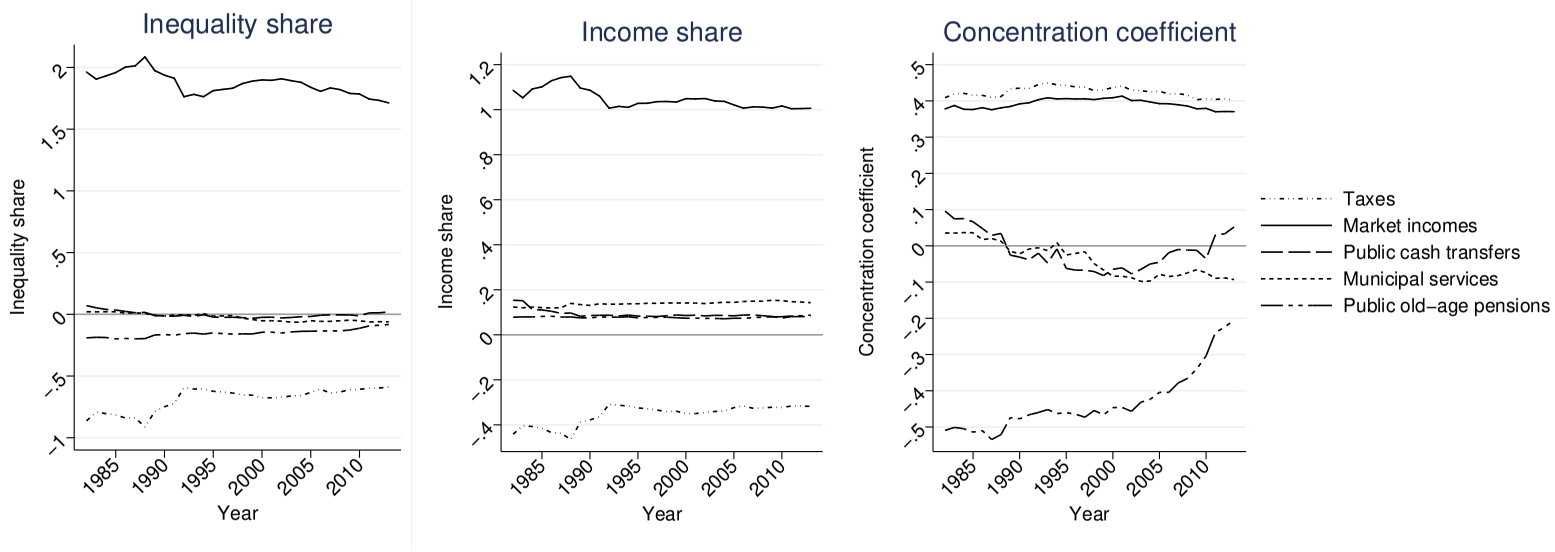


**Figure 11.** Factor decomposition of extended income

Note: These graphs display results from the factor decomposition of household extended income, as explained in Section 4.2. Extended income is the sum of market income, public cash transfers, taxes and the value of municipal services. The sample consists of all individuals residing in Norway each year in the period 1982-2013.

### *4.3 Specification checks and sensitivity analysis*

Below, we discuss and empirically assess a number of key assumptions behind our analysis of the distributional effects of in-kind transfers.

*Valuation of in-kind transfers*

As typical in distributional studies of extended income, we have assumed that the market value of the public services is equal to the cost of providing them. There are several limitions with this production cost approach. First, the government may impose quantity constraints in the household's consumption of public services. The extent to which this issue creates bias in the valuation of in-kind transfers depends on whether these transfers are infra-marginal or extra-marginal. In cases where in-kind transfers are infra-marginal, recipients may correct for allocative inefficiencies by topping up with private purchases. Thus, to justify the treatment of in-kind transfers as nondistorting and fungible with cash income, we may assume that transfers are infra-marginal. If, on the other hand, transfers were extra-marginal and binding, the consequences of public over-provision would be attenuated if recipients respond by reducing the consumption of substitutes and increasing the consumption of complements.[15] Indeed, the evidence presented in Cunha (2014), Fraker et al. (1995), Hoynes and Schanzenbach (2009), Moffitt (1989) and Slesnick (1996) suggest relatively small consumption distortions from in-kind transfers.

The second problem with the production cost approach is that it abstracts from heterogeneity across areas and service sectors in the efficiency of production activities in the public sector. In our baseline model, the only step we take to address this concern is by distinguishing between fixed and variable costs in production, thereby allowing for (but not imposing) economies of scale. We now perform two robustness checks of the sensitivity of inequality and poverty estimates to additional heterogeneity in productive efficiency.

The first robustness check utilizes estimates of local government efficiency, reported by the Norwegian Advisory Commission on Local Government Finances.[16] These estimates are based on detailed survey data on the quality and quantity of service production across municipalities. Efficiency is measured as the ratio between quality-adjusted total output and available resources. The average Efficiency Index (weighted by municipality size) is close to 1 and the standard deviation is 0.068. To account for variation in cost efficiency across municipalities, we scale the observed local government spending with the value of the Efficiency Index in each municipality. Appendix Figure A3 shows that our estimates of inequality and poverty in Norway do not change materially if we adjust for differences in cost efficiency.

The second robustness check takes advantage of existing research on public sector efficiency in developed countries. Angelopoulos et al. (2008) employ a stochastic production frontier model to estimate Technical Efficiency (TE) of the public sector in a number of developed countries over the period 1995-2000. The basic idea of this methodology is to compare the government's performance in

[15] These predictions were first formalised in the theory of rationing (Tobin and Houthakker, 1950; Neary and Roberts, 1980; Deaton, 1981).

[16] For details, we refer to the final report from the Norwegian Advisory Commission on Local Government Finances (2010). See also Borge et al. (2008) who use the efficiency estimates to study public service provision in Norway.

service production to the associated expenditure that the government allocates to these sectors. The estimate of TE for the public sector in Norway is found to be 0.86, where efficiency on the frontier is equal to 1. As a robustness check, we multiply local government spending by 0.86, thereby deflating the value of the in-kind transfers in accordance with the estimated inefficiency in service production. Appendix Figure A3 shows that our estimates of inequality and poverty in Norway are nearly unaffected if we adjust for public sector inefficiency.

While the robustness of our results is reassuring, it is worth noting that our valuation of public services capture (at best) the corresponding market value of these services. To construct extended income, we add the measured value of these services to the cash income available for household consumption of goods traded in the market. Inferring the true economic value of goods and services is difficult, even for market goods. The observed market prices correspond to *marginal* willingness to pay, whereas the consumer surplus is the difference between the (unobserved) highest price a consumer is willing to pay and the actual market price of the good. In line with much of the existing literature on economic inequality, we therefore focus on the household's cash and extended income as opposed to the economic value of the (market and nonmarket) goods and services the household may consume.[17]

*Residential mobility*

In spatial equilibrium models, local government in-kind transfers can be understood as a type of local amenity, as discussed in Moretti (2011). The incidence of this amenity depends on the cost of reallocation or mobility. If mobility costs are high - as we have assumed - the incidence of local public spending will fall on recipients, who enjoy economic rents from increases in the quantity or quality of publicly provided services. By contrast, if mobility costs are low, more of the incidence may fall on individuals other than the recipients, such as landowners.

To examine this issue, we investigate whether people move in response to changes in local government spending. To address concerns about reverse causality and correlated unobservables, we take advantage of the instrumental variable proposed in Borge et al. (2015). This study is based on the observation that much variation in revenues among Norwegian local governments can be explained by revenues collected from hydropower production. In particular, the authors obtain a plausibly exogenous measure of the income available for public service provision by instrumenting the variation in local government revenue by interactions between topology and precipitation. Following Borge et al. (2015), the outcome equation is given by:

$$v_{mt} = \beta y_{mt} + \lambda w_{mt} + \kappa_m + \delta_t + \varepsilon_{mt}, \tag{14}$$

where $y_{mt}$ is per capita revenue (USD 1,000) of local government $m$ in year $t$, $w_{mt}$ is a vector of controls for observable characteristics, and $\kappa_m$ and $\delta_t$ denote a full set of fixed effects for municipality and year. The outcome variable ($v_{mt}$) of interest in Borge et al. (2015) is an index of local government efficiency.

[17] An alternative approach would be to infer willingness to pay by estimating a model of household demand. This requires, however, that we observe market prices. Thus, this is only feasible for (the subset of) market goods (for which we have plausibly exogenous variation in prices), which prevents us from obtaining an overall measure of the economic value of all market and nonmarket goods and services.

We simply replace their outcome by a measure of residential mobility, defined by the net inflow of movers to municipality $m$ in year $t$ as a percentage of the total residential population. Otherwise our specification is identical to their model.[18] The first stage of the IV model is given by the regression of municipal per capita revenue on the instrument, while including the same set of controls and fixed effects as in the outcome equation.

Estimation results from the analysis of residential mobility are reported in Appendix Table A5. Columns (1) and (2) show that both OLS and IV coefficients for total revenue are insignificant and small in magnitude. For example, the point estimate in column (1) implies that a one standard deviation increase in per capita revenue (approximately USD 3,300) of the local government increases the net inflow of movers by 0.3 percentage points. To investigate the possibility of delayed response, we include the first lag of per capita revenue instead of concurrent municipal revenue in Columns (3) and (4). Accordingly, the first stage in Column (4) is modified by including the first lag of the instrument. We find that the coefficients for lagged per capita revenue also are small and insignificant. Taken together, the estimates in Appendix Table A5 suggest little response in residential mobility to variation across areas in local government revenue.

While it is reassuring to find that people do not seem to move significantly in response to changes in local government spending, we cannot rule out that some of the incidence of local public spending fall on individuals other than recipients. We therefore perform another specification check, adjusting for cost-of-living differences across areas. This adjustment captures the idea that local amenities, such as generous public services, could be offset by higher cost of housing (see e.g. Moretti (2013)). Specifically, we employ a region-specific CPI defined by

$$CPI_{rt} = q_t HPI_{rt} + (1 - q_t)\,, \tag{15}$$

where $HPI_{rt}$ is the local housing price index for region $r$ in year $t$, and $q_t$ is the weight that is given to housing consumption in the yearly Norwegian CPI.[19] Following Moretti (2013), we assume that the cost of nonhousing goods and services do not vary across areas. We employ a classification of Norway in 7 main areas, where each area is further subdivided between urban and rural municipalities, which yields a breakdown of the country in 14 regions. The local HPI is defined by the average price per square meter by year and region in the resale market for owner-occupied housing. Household real incomes are measured by deflating nominal incomes by the local CPI.

Appendix Figure A4 displays the level and evolution of inequality and poverty in nominal and real incomes for cash income and extended income measure. We find that inequality is slightly lower when differences in the cost of housing across areas are taken into account, whereas the poverty estimates barely move. Our results indicate that high-income households tend to live in areas with relatively high cost of housing, which makes the upper part of the real income distributions more compressed than the nominal income distributions.

[18] We thank Borge, Parmer and Torvik for sharing their data and code. For more details about the specification, see Borge et al. (2015) Table 2, Columns 5 and 6.

[19] For extended income measure, the weight of housing in CPI is scaled down by the proportion of cash income in extended income.

*Allocation and utilization of infrastructure and cultural activities*

While our model devotes considerable attention to distributing local government spending across target groups, within these groups it is assumed that the spending is allocated evenly on a per-capita basis. This is reasonable for many programs, such as child care, education, and health care. However, for general spending on public goods, such as that on infrastructure and cultural activities, the proper distribution of spending within population groups is less obvious. For example, when distributing federal spending in the U.S., Congressional Budget Office (2013) shows the results when spending is distributed both by population and by market income within broad population groups. In a similar fashion, we now perform a robustness check for assumptions about the allocation (or utilization) of infrastructure and cultural activities.

In the main specification of our model, we assume an equal allocation of spending on infrastructure and cultural activities within each municipality. In the alternative allocation, we examine how the results change if we let utilization be higher among more affluent families by assuming that in-kind transfers are allocated proportional to the market income of each household. We find that these alternative assumptions matter little if anything for the estimates of inequality and poverty in the population. The reason is that these service sectors make up relatively little of local government spending. Additionally, the estimates of poverty and inequality within groups do not depend strongly on the alternative assumptions about how the services in these sectors are allocated within the population groups.

### *4.4 Comparing our findings to results from a simplified procedure*

Our paper combines Norwegian data from municipal accounts and administrative registers to estimate a model of local government spending behavior which distinguishes between fixed and variable costs in production as well as mandatory programmatic spending components versus discretionary spending on different service sectors and target groups. We believe the access to these data sources presents a rare opportunity to learn about how in-kind transfers provided by local governments affect economic inequality and poverty.

A natural question is what lessons can one draw from the Norwegian case to other countries. Due to data availability, it is not possible to give a definite answer to this question. In most countries, one only observes the aggregate spending (at the national level) on different service sectors. On top of this, there tends to be little information about composition of recipients in dimensions other than age. What we can do, however, is to analyze how the estimates from Norway change if we invoke additional assumptions needed to use the data available in other countries. In particular, we can compare our main findings to those we obtain if we do not use the model of local government spending but rather assume:

i) The recipients are classified by age only, whereas characteristics other than age are ignored in the allocation of in-kind transfers

ii) Within an age group, the in-kind transfer per person is constant across municipalities (for a given year)

iii) The equivalence scale for in-kind transfers does not differ from the equivalence scale for cash income (the EU scale)

By combining (i) - (iii), we rely on the type of information about public in-kind transfers that is available for EU countries and many other countries around the world.[20] Figure 12 compares inequality in extended income based on this simplified procedure to our main findings where we do not invoke assumptions i)-iii). While the time trends are quite similar, the levels of inequality differ. In particular, using the simplified procedure understates the inequality in extended income by about 1.5 percentage points (6 percent).

To understand what causes these differences, Figure 12 also reports estimates of inequality based on intermediate cases between the benchmark and the simplified procedure. As a first step, we use the EU scale (invoke assumption iii)) while maintaining the benchmark procedure for allocating in-kind transfers (i.e. we do not invoke assumptions i) and ii)). We find that the choice of equivalence scale matters little for the estimates of inequality during the 1980s. Towards the end of the 1990s, however, the use of the EU scale produces lower estimates of inequality. In this period, the central government decided that subsidized child care services should be available to all parents, and not only single parents or families with working parents. The NA scale captures this change in the minimum required expenditure or needs through the time-varying minimum expenditure parameters. By comparison, the EU scale does not distinguish between mandatory programmating spending components (set by the central government to reflect minimum required expenditure and needs) and discretionary spending to different service sectors and target grups (endogenously determined by local governments). As a result, changes in mandatory programmating spending on child care services during the 1990s are misinterpreted as local governments changing their priorities of discretionary spending towards low income families.

The second intermediate case we consider invokes assumption iii) and uses the simplified procedure for allocation of child care services. All other in-kind transfers are allocated with the benchmark procedure. Since the recipients of child care services are classified by age only, the simplified procedure misses heterogeneity within age groups. In particular, it fails to capture the disequalizing allocation of child care spending within age groups and, therefore, understates the inequality in extended income as compared to the case where child care services are allocated using the benchmark procedure.

[20] For example, Aaberge et al. (2017) try to incorporate in-kind transfers in a measure of economic inequality in 23 European countries. To this end, they make use of household income data from the EU-SILC survey in combination with data on the national spending data on child care, education, health care and long-term care provided by OECD. Taken together, these data sources offer information about government expenditure on various service sectors as well as the age compositon of receipients for certain services. The recipients are classified by age, and individuals within a given age group are assumed to receive the same level of in-kind transfers.

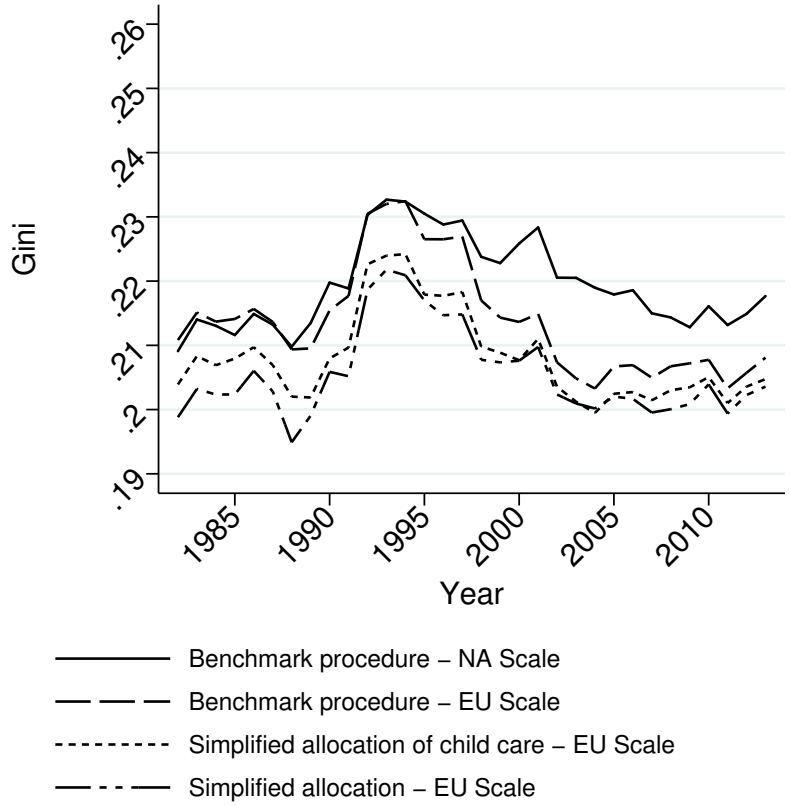


**Figure 12.** Inequality in extended income using the benchmark and simplified procedures
Note: This figure displays the Gini coefficient for the distribution of household extended income using our benchmark procedure and a simplified procedure when recipients are classified by age only and the equivalence scale for in-kind transfers does not differ from the equivalence scale for cash income (the EU scale) The dashed line displays inequality estimates from an intermediate case when extended income is derived using our benchmark procedure and the EU scale is applied to cash income and in-kind transfers. The dotted line displays inequality estimates from an intermediate case using the EU scale and the simplified procedure to allocate child care services. The sample consists of all individuals residing in Norway each year in the period 1982-2013.

## 5 Local government spending and the evolution in inequality

In this section, we use the model of local government spending to quantify the factors behind the changes in the distribution of extended income over time.

### *5.1 Factors behind the time trend in inequality*

We now examine the factors behind the changes in the distribution of extended income over time. In particular, our aim is to disentangle the contribution from (i) changes in spending behavior of local governments, and (ii) changes in population size and composition which affect the spending required to maintain a given output per person in different target groups.

As described in detail in Appendix D, we try to disentangle the impact of these two types of changes by constructing counterfactual alternatives where municipal priorities are kept constant as in the base year, while population size and composition are allowed to vary over time according to the development actually observed. Specifically, we consider the following counterfactual scenarios where we in each year:

CF1: Hold priorities within municipalities (across target groups and service sectors) fixed as in the base year

CF2: Hold priorities between municipalities fixed as in the base year (hold fixed each municipality's per capita production relative to the national average)

CF3: Hold priorities within and between municipalities fixed as in the base year

For each counterfactual alternative, we obtain a counterfactual distribution of extended income which can be compared to the actual distribution of extended income. Figures 13 and 14 show these results. We begin by comparing the counterfactual distribution under CF3 to the actual distribution. This comparison allows us to draw inference about the joint contribution of changes in priorities within and between municipalities. When priorities across target groups, service sectors and municipalities are kept fixed from 1982 to 2013 (CF3), the Gini coefficient in 2013 is about 6.3 percent (1.5 percentage points) higher than what we actually observe. This suggests that changes in spending priorities had an economically significant impact on economic inequality. Indeed, the reduction in the Gini coefficient corresponds to introducing a 6.3 percent proportional tax on cash income and then redistributing the derived tax revenue as equal sized amounts to the individuals.

Next, we compare the counterfactual distributions under CF1 and CF2 to the actual distribution. The former (latter) comparison is informative about the contribution of changes in priorities within (between) municipalities, conditional on the priorities between (within) municipalities. Comparing across the counterfactual income distributions, we can see that much of the reduction in inequality and poverty can be attributed to changes in priorities across target groups and service sectors.[21] By

[21] The reduction in inequality is mostly due to increased spending on long-term care in the 1980s, and on child care after 2000.

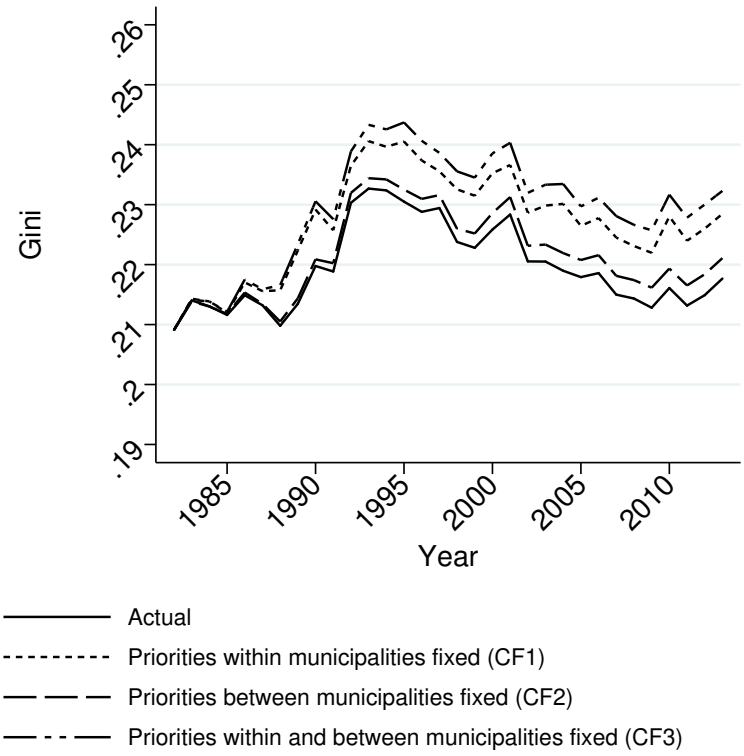


**Figure 13.** Gini coefficient when municipal priorities are fixed as in 1982
Note: This figure displays measures of the Gini coefficient for actual and counterfactual distributions of household extended income. The solid black line displays the Gini for the actual distribution. The dotted black line displays the Gini following from the first counterfactual alternative, i.e. the priorities within municipalities are set as in 1982. The dashed black line displays the Gini following from the second counterfactual alternative, i.e. the priorities between municipalities are set as in 1982. The solid gray line displays the Gini following from the third counterfactual alternative, i.e. the priorities within and between municipalities are set as in 1982. The sample consists of all individuals residing in Norway each year in the period 1982-2013.

comparison, changes in priorities across municipalities contribute much less to reducing inequality and poverty estimates.

### *5.2 Robustness to the order of the decomposition*

As in most decomposition methods, our approach abstracts from general equilibrium effects and it is not accounting for labor market responses of individuals to changes in local government spending. A second general concern with this type of decomposition is that the sequence of counterfactuals can influence the results as CF1 through CF3 are evaluated cumulatively. To address this issue, we investigate the robustness to i) changing the order for fixing priorities, and ii) changing the years for fixing priorities. It is reassuring to find that the results are relatively robust to these changes.

Consider first robustness check i). By comparing the counterfactual distributions under CF1 and CF2 to the actual distribution and adding these contributions together, we obtain similar changes in inequality and poverty as the joint contribution (CF3) of changes in priorities within and between

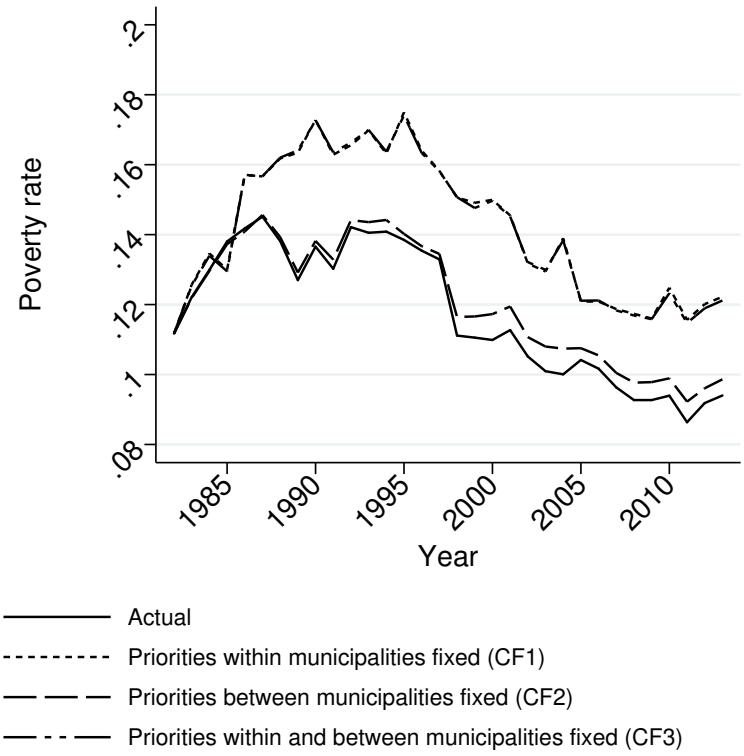


**Figure 14.** Poverty rate when municipal priorities are fixed as in 1982
Note: This figure displays the share of individuals below the EU poverty line in actual and counterfactual distributions of household extended income. The EU poverty line is 60 percent of the median income. The solid black line displays the share of poor for the actual distribution. The dotted black line displays the share of poor following from the first counterfactual alternative, i.e. the priorities within municipalities are set as in 1982. The dashed black line displays the share of poor following from the second counterfactual alternative, i.e. the priorities between municipalities are set as in 1982. The solid gray line displays the share of poor following from the third counterfactual alternative, i.e. the priorities within and between municipalities are set as in 1982. The sample consists of all individuals residing in Norway each year in the period 1982-2013.

municipalities. This suggests that the components are approximately additive, and as a result, the order for fixing priorities do not lead to dramatically different conclusions about the contribution of changes in priorities within and between municipalities.

Moving to robustness check ii), Appendix Figures A5 and A6 display the estimates of inequality and poverty when the base year is 2013 (last year of our data) instead of using 1982 as the base year (first year of our data). These figures show that the key conclusion do not depend on the choice of base year: Changes in spending priorities within municipalities (across target groups and service sectors) is most important in explaining the reduction in inequality and poverty.

## 6 Conclusion

The work of Amartya Sen highlights the importance of incorporating the value of in-kind transfers in analysis of inequality and when considering the distributional impact of public policy. However, this has proven difficult for several reasons. While information about aggregate spending on public services is usually available at the national level, it can be difficult to access data on local government spending on public services. In federal systems, in-kind transfers are regularly administered by local governments, which tend to have substantial discretion in spending priorities across service sectors and demographic groups. Another key challenge is how to value and allocate in-kind transfers across people, especially since prices and individual recipients are often not observed. On top of this, the equivalence scales applied to cash income are not necessarily appropriate when including in-kind transfers, because the receipt of public services is likely to be associated with particular needs. These challenges have meant that existing empirical research rarely consider the role of in-kind transfers provided by local governments.

In this paper, we examined how in-kind services provided by local governments affect economic inequality. The allocation of in-kind transfers to households, and adjustment for differences in needs were derived from a model of local government spending behavior. The model distinguished between fixed and variable costs in production as well as mandatory programmatic spending components versus discretionary spending on different service sectors and target groups. To estimate the model, we combined Norwegian data from municipal accounts and administrative registers for the period 1982-2013. We found that economic inequality is considerably lower when taking in-kind transfers into account. In particular, the poor benefit from receiving a relatively large share of public services. However, the equalizing effect of in-kind transfers tends to be smaller than the equalizing contribution from cash transfers. This is not because cash transfers are more important as a share of total income, but rather the redistributive way in which they are allocated. When examining the time trends in inequality, we found that local governments attenuated the growth in earnings inequality by re-allocating in-kind transfers to low-income families. This reduction in inequality is mostly due to changes in spending priorities across service sectors and target groups, whilst the contribution from re-allocation of resources across municipalities is much smaller.

Taken together, our findings may have implications for both policy and research. In particular, our study highlights that incorporating the value of local public services is important for describing the distribution of economic well-being and how it evolves over time. Our paper also suggests that in-kind transfers provided by local governments are an important but largely ignored mechanism of attenuation to changes in the wage structure.

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# A Additional tables and figures

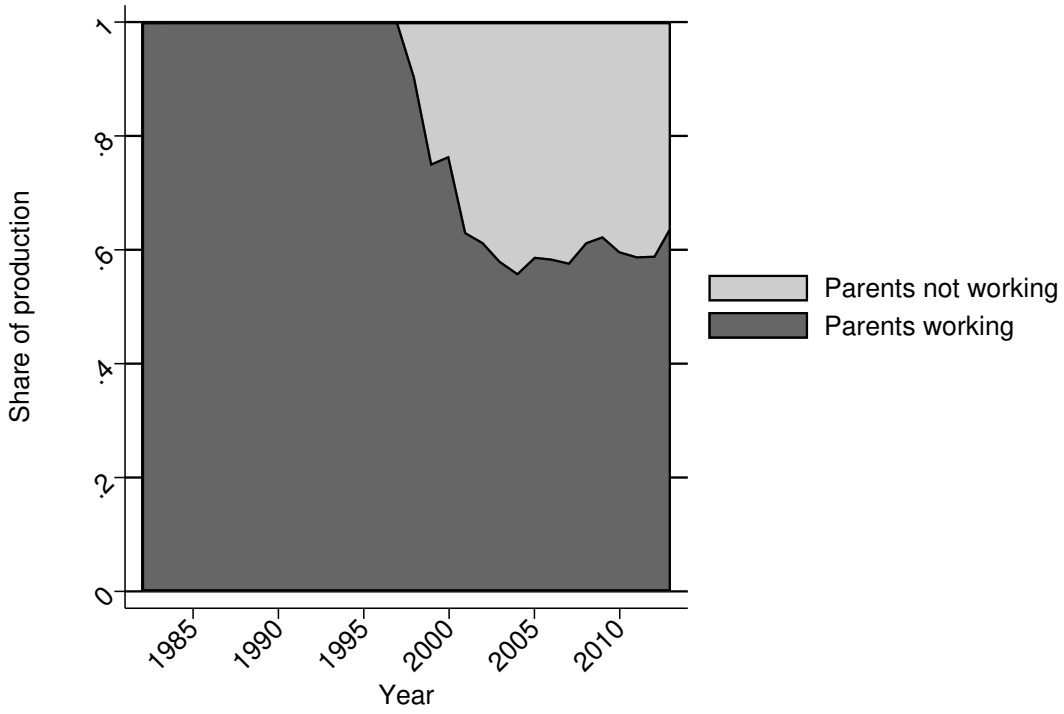


**Figure A1.** Share of production by target group: Child care
Note: This figure displays how the production of child care is allocated to different target groups in the period 1982-2013. Average shares of production across municipalities are weighted by municipality size. "Parents working" include pre-school children of parents who work full time. "Parents not working" include all other pre-school children.

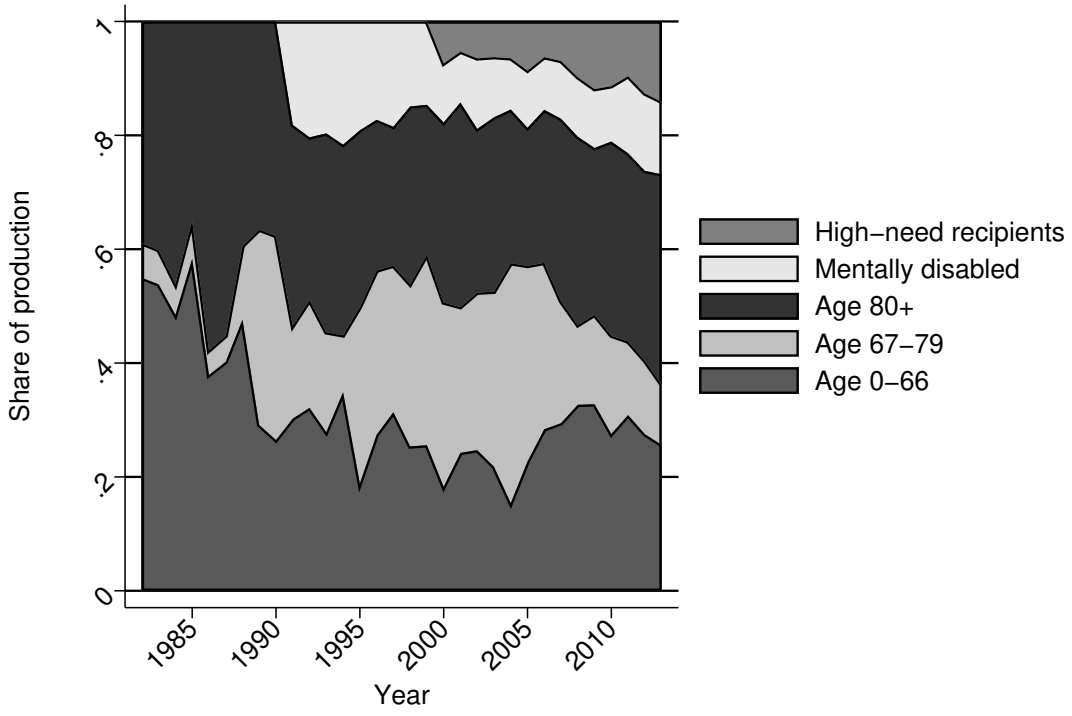


**Figure A2.** Share of production by target group: Long-term care

Note: This figure displays how the production of long-term care is allocated to different target groups in the period 1982-2013. Average shares of production across municipalities are weighted by municipality size. The population is divided into three age groups (0-66, 67-79, 80+). The mentally disabled and high-need recipients are included as target groups after 1991 (2000), when local governments were given extended responsibilities and funding for these groups.

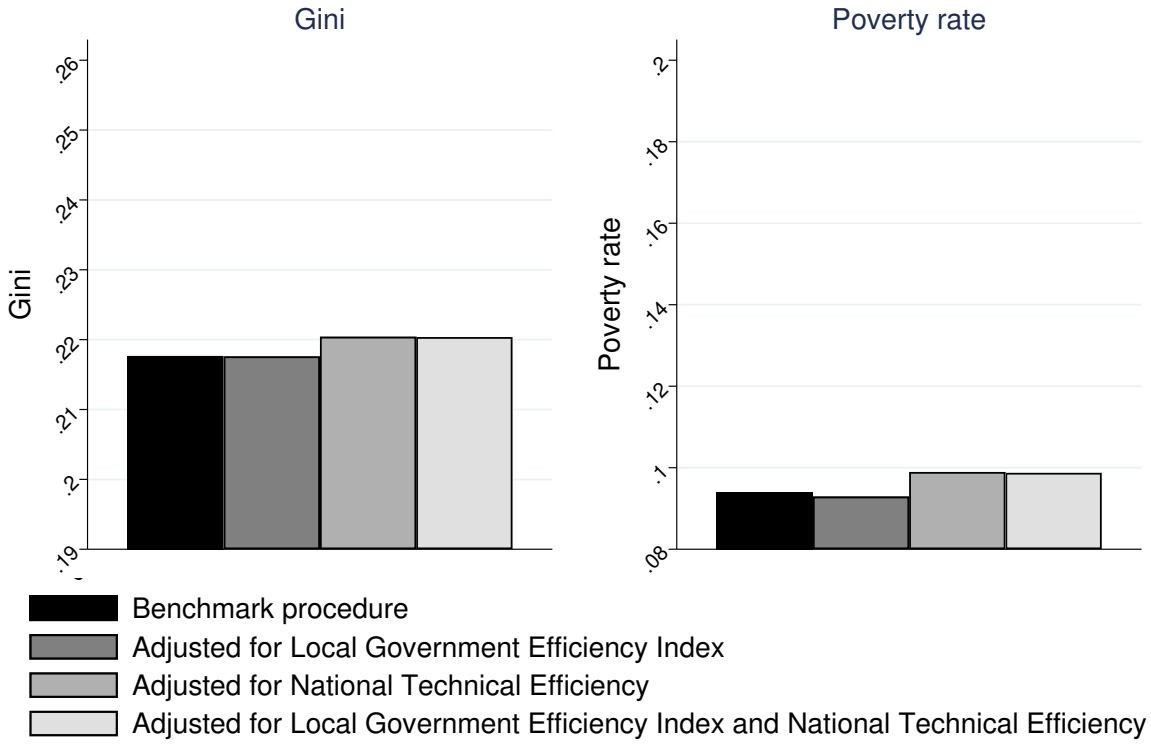


**Figure A3.** Gini coefficient and poverty rate adjusted for estimates of public sector efficiency, 2013
Note: The figure displays the Gini coefficient and the share of individuals below the EU poverty line in the distribution of household extended income, and shows how these measures are affected by adjusting for differences in cost efficiency between municipalities and the Technical Efficiency (TE) of the public sector. The sample consists of all individuals residing in Norway in 2013.

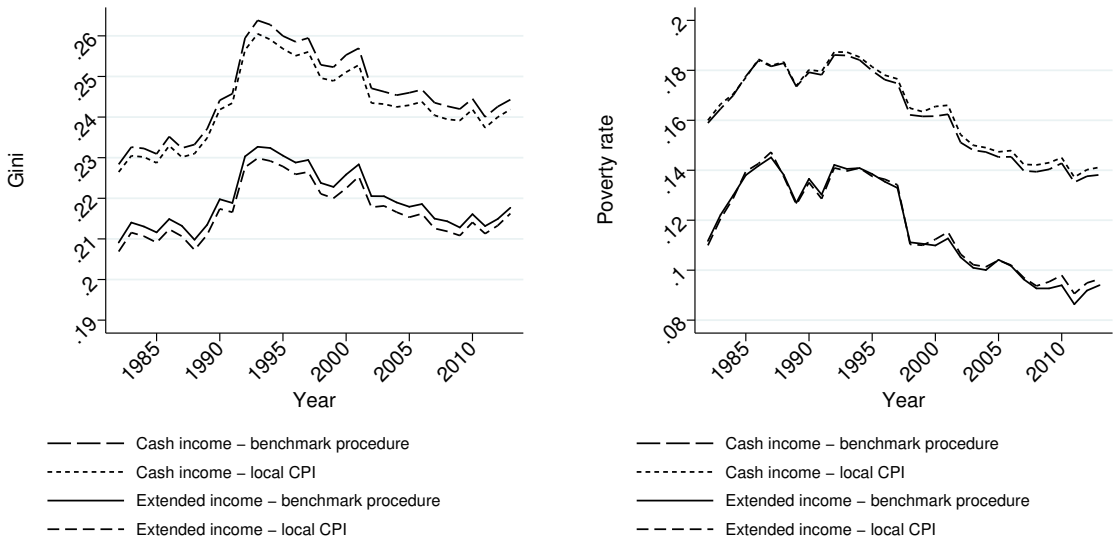


**Figure A4.** Gini coefficient and poverty rate in the distribution of cash income and extended income when adjusting for geographical differences in cost of living

Note: This figure displays the Gini coefficient and the share of individuals below the EU poverty line in the distribution of household cash income and extended income when adjusting for geographical differences in cost of living (see Section 4.3). The sample consists of all individuals residing in Norway each year in the period 1982-2013.

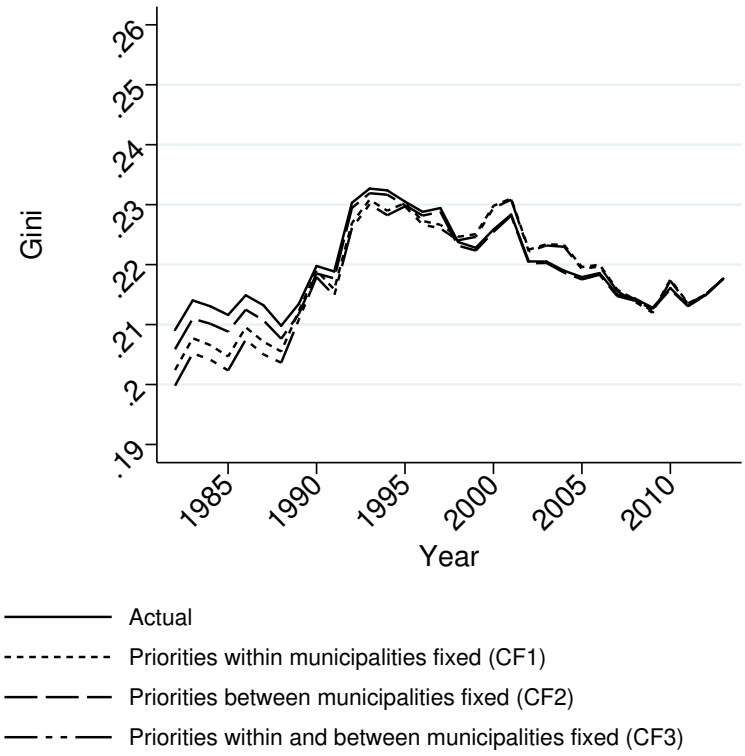


**Figure A5.** Gini coefficient when municipal priorities are fixed as in 2013

Note: This figure displays measures of the Gini coefficient for actual and counterfactual distributions of household extended income. The solid black line displays the Gini for the actual distribution. The dotted black line displays the Gini following from the first counterfactual alternative, i.e. the priorities within municipalities are set as in 2013. The dashed black line displays the Gini following from the second counterfactual alternative, i.e. the priorities between municipalities are set as in 2013. The solid gray line displays the Gini following from the third counterfactual alternative, i.e. the priorities within and between municipalities are set as in 2013. The sample consists of all individuals residing in Norway each year in the period 1982-2013.

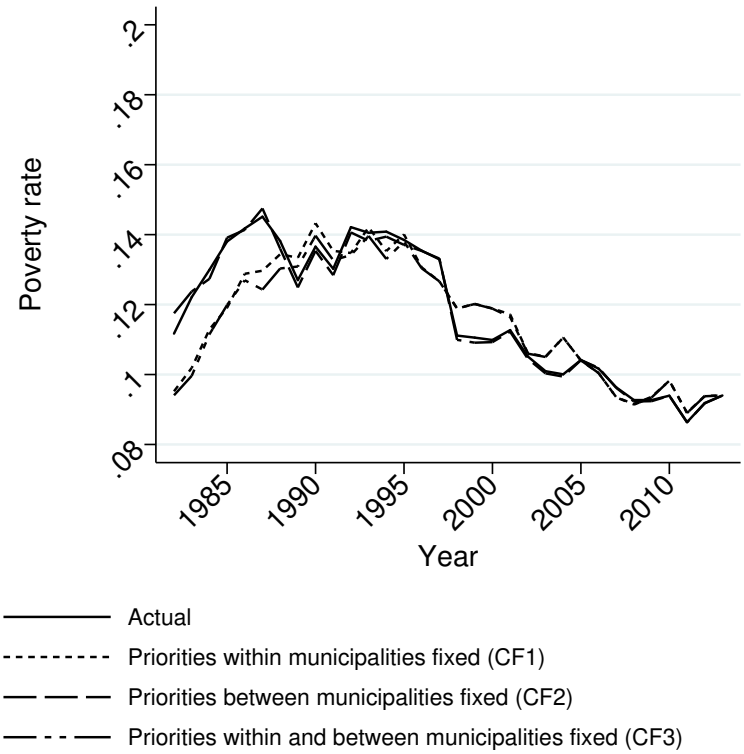


**Figure A6.** Poverty rate when municipal priorities are fixed as in 2013

Note: This figure displays the share of individuals below the EU poverty line in actual and counterfactual distributions of household extended income. The EU poverty line is 60 percent of the median income. The solid black line displays the share of poor for the actual distribution. The dotted black line displays the share of poor following from the first counterfactual alternative, i.e. the priorities within municipalities are set as in 2013. The dashed black line displays the share of poor following from the second counterfactual alternative, i.e. the priorities between municipalities are set as in 2013. The solid gray line displays the share of poor following from the third counterfactual alternative, i.e. the priorities within and between municipalities are set as in 2013. The sample consists of all individuals residing in Norway each year in the period 1982-2013.

**Table A1.** Estimates of minimum expenditure parameters

| Sector | Target group | 1982–1985 | 1986–1989 | 1990–1993 | 1994–1997 | 1998–2001 | 2002–2005 | 2006–2009 | 2010–2013 |
|---|---|---|---|---|---|---|---|---|---|
| Child care | Age 1–5 | 0 | 0 | 0 | 0 | 3.02 | 7.72 | 10.86 | 12.82 |
| | | | | | | (1.45) | (.81) | (.67) | (.80) |
| | Age 1–5 and parents working | 47.30 | 32.47 | 26.38 | 17.16 | 22.49 | 18.67 | 13.01 | 6.76 |
| | | (8.87) | (4.85) | (2.68) | (2.62) | (3.53) | (2.34) | (1.55) | (1.46) |
| Mandatory education | Age 6–15 | 3.93 | 4.89 | 5.35 | 5.36 | 5.12 | 5.23 | 5.40 | 5.71 |
| | | (.26) | (.23) | (.24) | (.24) | (.23) | (.19) | (.18) | (.21) |
| Other education | Age 6–15 | 4.94 | 5.71 | 5.21 | 2.71 | 2.17 | 1.56 | 1.33 | 3.08 |
| | | (.70) | (.53) | (.66) | (1.26) | (1.30) | (1.30) | (1.49) | (1.38) |
| | Age 6–15 and parents working | 0 | 0 | 0 | 3.68 | 4.78 | 5.50 | 4.78 | 1.12 |
| | | | | | (2.42) | (2.80) | (2.65) | (2.59) | (1.83) |
| | New refugees | 0 | 0 | 1.83 | 8.32 | 16.82 | 39.40 | 52.34 | 49.78 |
| | | | | (1.26) | (6.32) | (5.59) | (5.33) | (6.14) | (5.29) |
| | Prior refugees | 0 | 0 | 11.49 | 9.56 | 8.13 | 0 | 0 | 0 |
| | | | | (8.55) | (7.84) | (5.33) | | | |
| Long-term care | Age 0–66 | .36 | .26 | .22 | .20 | .17 | .17 | .25 | .22 |
| | | (.12) | (.11) | (.10) | (.10) | (.10) | (.08) | (.08) | (.11) |
| | Age 67–79 | .36 | .84 | 1.38 | 1.45 | 2.04 | 2.74 | 1.72 | 1.09 |
| | | (.12) | (.47) | (.8) | (.76) | (.76) | (.77) | (.84) | (1.07) |
| | Age 80+ | 7.64 | 8.16 | 6.12 | 4.52 | 4.88 | 4.37 | 4.73 | 5.41 |
| | | (2.78) | (1.81) | (1.27) | (1.1) | (1.14) | (.93) | (.87) | (1.00) |
| | Mentally disabled | 0 | 0 | 31.57 | 36.45 | 24.24 | 21.64 | 20.33 | 24.36 |
| | | | | (3.61) | (4.77) | (4.66) | (3.84) | (3.64) | (3.43) |
| | High-need recipients | 0 | 0 | 0 | 0 | 28.39 | 63.5 | 61.32 | 68.68 |
| | | | | | | (7.54) | (13.49) | (9.53) | (10.36) |
| Health care | All residents | .37 | .47 | .50 | .43 | .47 | .53 | .50 | .49 |
| | | (.12) | (.08) | (.07) | (.07) | (.07) | (.06) | (.05) | (.06) |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Social welfare | Poor | 0 | 1.09 | 2.85 | 5.31 | 4.04 | 5.70 | 6.10 | 5.41 |
| | | 0 | (1.48) | (1.89) | (1.72) | (1.52) | (1.39) | (1.42) | (1.53) |
| | Unemployed | 11.94 | 4.99 | 5.13 | 4.06 | 3.13 | 2.37 | 7.38 | 1.69 |
| | | (5.30) | (3.88) | (2.99) | (3.01) | (3.64) | (1.94) | (4.11) | (2.86) |
| | Divorced | 29.18 | 26.63 | 16.27 | 10.65 | 10.76 | 7.78 | 7.22 | 8.9 |
| | | (3.50) | (2.46) | (2.26) | (1.89) | (1.61) | (1.28) | (1.20) | (1.30) |
| | Non-western immigrants | 50.15 | 20.97 | 6.91 | 0 | 0 | 0 | 0 | 0 |
| | | (7.61) | (4.56) | (1.52) | | | | | |
| | New refugees | 0 | 0 | 4.37 | 17.78 | 18.21 | 16.06 | 22.01 | 26.62 |
| | | | | (1.50) | (4.06) | (4.31) | (3.13) | (3.63) | (3.34) |
| | Prior refugees | 0 | 0 | 15.6 | 22.87 | 19.01 | 9.76 | 5.10 | 1.78 |
| | | | | (5.79) | (7.30) | (4.21) | (3.41) | (2.59) | (2.62) |
| Culture | All residents | .66 | .59 | .57 | .45 | .57 | .62 | .62 | .59 |
| | | (.07) | (.07) | (.06) | (.07) | (.08) | (.07) | (.07) | (.07) |
| Road maintenance | All residents | .31 | .26 | .22 | .13 | .14 | .26 | .23 | -.03 |
| | | (.12) | (.08) | (.08) | (.08) | (.09) | (.09) | (.09) | (.09) |
| Water, sewage and refuse | All residents | -.15 | -.36 | -.65 | -.92 | -.95 | -.83 | -.72 | -.74 |
| | | (.03) | (.04) | (.05) | (.07) | (.07) | (.08) | (.08) | (.10) |
| Other infrastructure | All residents | .50 | .39 | .35 | .47 | .43 | .33 | .35 | .34 |
| | | (.09) | (.09) | (.08) | (.08) | (.09) | (.13) | (.11) | (.11) |
| Administration | All residents | .45 | .45 | .45 | .41 | .41 | .44 | .42 | .38 |
| | | (.06) | (.05) | (.05) | (.05) | (.07) | (.07) | (.06) | (.06) |

Note: This table displays four-year averages of estimates of minimum expenditure parameters measured in units of year- and sector-specific mean expenditure per capita. Four-year averages of standard errors are in parentheses. Parameter estimates are set to zero in some cases where they are insignificant. Before 1998 the target age group for child care is 1–6 years, and the target age group for education is 7–15 years.

**Table A2.** Estimates of fixed cost parameters

| Sector | Environmental cost factor | 1982–1985 | 1986–1989 | 1990–1993 | 1994–1997 | 1998–2001 | 2002–2005 | 2006–2009 | 2010–2013 |
|---|---|---|---|---|---|---|---|---|---|
| Mandatory education | Inverse population size | .61 | .55 | .45 | .41 | .32 | .26 | .17 | .17 |
| | | (.06) | (.05) | (.06) | (.05) | (.05) | (.04) | (.05) | (.05) |
| | Traveling distance | .12 | .08 | .09 | .07 | .10 | .09 | .10 | .10 |
| | | (.01) | (.01) | (.01) | (.01) | (.01) | (.01) | (.02) | (.02) |
| Long-term care | Inverse population size | .65 | .62 | .39 | .25 | .19 | .13 | .05 | .08 |
| | | (.12) | (.10) | (.07) | (.06) | (.06) | (.06) | (.06) | (.07) |
| | Traveling distance | .05 | .06 | .01 | .01 | .02 | .04 | .04 | .04 |
| | | (.02) | (.02) | (.02) | (.01) | (.02) | (.02) | (.02) | (.02) |
| Health care | Inverse population size | 1.11 | .98 | .63 | .58 | .53 | .57 | .78 | .67 |
| | | (.20) | (.15) | (.15) | (.12) | (.13) | (.10) | (.11) | (.10) |
| | Traveling distance | .07 | .07 | .10 | .08 | .10 | .12 | .08 | .09 |
| | | (.05) | (.04) | (.04) | (.03) | (.03) | (.03) | (.03) | (.04) |
| Road maintenance | Amount of snowfall | .07 | .07 | .07 | .09 | .09 | .08 | .04 | .11 |
| | | (.02) | (.02) | (.02) | (.02) | (.02) | (.02) | (.03) | (.02) |
| | Length of municipal roads | 1.72 | 3.08 | 2.99 | 2.54 | 2.42 | 2.06 | 2.53 | 3.46 |
| | | (.42) | (.31) | (.32) | (.29) | (.28) | (.35) | (.33) | (.36) |
| Water, sewage and refuse | Inverse population size | .22 | .39 | .55 | .50 | .60 | .43 | .02 | .12 |
| | | (.07) | (.11) | (.13) | (.14) | (.16) | (.19) | (.24) | (.26) |
| | Sewage purification degree | .04 | .09 | .14 | .18 | .12 | .10 | .08 | -.02 |
| | | (.02) | (.03) | (.04) | (.05) | (.06) | (.06) | (.07) | (.08) |
| Other infrastructure | Inverse population size | .57 | .78 | .90 | 1.16 | .86 | .35 | .45 | .41 |
| | | (.15) | (.16) | (.16) | (.17) | (.17) | (.22) | (.21) | (.21) |
| Administration | Inverse population size | 1.24 | 1.29 | 1.14 | .95 | .92 | .91 | 1.03 | 1.19 |
| | | (.08) | (.10) | (.12) | (.09) | (.12) | (.09) | (.12) | (.12) |

Note: This table displays four-year averages of estimates of fixed cost parameters measured in units of year- and sector-specific mean expenditure per capita. Four-year averages of standard errors are in parentheses.

**Table A3.** Estimates of marginal budget share parameters

| Sector | Interest group | 1982–1985 | 1986–1989 | 1990–1993 | 1994–1997 | 1998–2001 | 2002–2005 | 2006–2009 | 2010–2013 |
|---|---|---|---|---|---|---|---|---|---|
| Child care | Constant | .03 | .05 | .07 | .10 | .09 | .07 | .05 | .04 |
| | | (.00) | (.01) | (.01) | (.01) | (.01) | (.01) | (.01) | (.01) |
| | Age 0–15 | -.37 | -.22 | .12 | .28 | .20 | -.02 | .02 | .19 |
| | | (.15) | (.14) | (.21) | (.18) | (.19) | (.26) | (.36) | (.37) |
| | Age 60+ | -.29 | -.12 | .07 | .11 | .12 | .00 | -.13 | -.17 |
| | | (.07) | (.06) | (.09) | (.09) | (.10) | (.13) | (.17) | (.15) |
| | Age 0–15 with grandparent | -.19 | -.23 | -.31 | -.13 | -.04 | -.27 | -.31 | -.35 |
| | in same municipality | (.10) | (.09) | (.16) | (.16) | (.16) | (.19) | (.22) | (.21) |
| Mandatory | Constant | .18 | .13 | .14 | .13 | .14 | .16 | .15 | .15 |
| education | | (.02) | (.01) | (.01) | (.01) | (.01) | (.01) | (.01) | (.01) |
| | Age 0–15 | -.17 | -.93 | -.33 | -.16 | -1.17 | -1.57 | -1.15 | -.29 |
| | | (.53) | (.44) | (.46) | (.41) | (.51) | (.54) | (.59) | (.60) |
| | Age 60+ | -.44 | -.49 | -.32 | -.09 | -.59 | -.87 | -.35 | .01 |
| | | (.24) | (.18) | (.18) | (.18) | (.24) | (.25) | (.26) | (.25) |
| | Age 0–15 with grandparent | .76 | .78 | .24 | .27 | .58 | .57 | .57 | .30 |
| | in same municipality | (.33) | (.30) | (.32) | (.29) | (.32) | (.32) | (.34) | (.32) |
| Other education | Constant | .02 | .02 | .04 | .05 | .04 | .02 | .02 | .02 |
| | | (.01) | (.00) | (.01) | (.01) | (.01) | (.00) | (.00) | (.00) |
| | Age 0–15 | -.19 | -.26 | -.10 | -.20 | -.30 | -.28 | -.33 | -.32 |
| | | (.16) | (.15) | (.25) | (.25) | (.26) | (.21) | (.21) | (.18) |
| | Age 60+ | -.13 | -.04 | -.05 | -.20 | -.11 | -.13 | -.08 | -.07 |
| | | (.07) | (.06) | (.09) | (.11) | (.13) | (.10) | (.09) | (.08) |
| | Age 0–15 with grandparent | .00 | -.04 | -.26 | -.23 | .05 | .06 | .20 | .12 |
| | in same municipality | (.11) | (.10) | (.18) | (.19) | (.18) | (.15) | (.13) | (.11) |
| Long-term care | Constant | .06 | .09 | .17 | .22 | .24 | .21 | .24 | .24 |
| | | (.02) | (.02) | (.02) | (.02) | (.02) | (.02) | (.02) | (.03) |
| | Age 0–15 | -.85 | -1.3 | -1.67 | -.83 | -.33 | .78 | -.41 | -.94 |
| | | (.42) | (.43) | (.68) | (.52) | (.65) | (.81) | (.93) | (1.12) |
| | Age 60+ | .11 | -.07 | -.01 | .14 | .06 | .33 | .57 | .05 |
| | | (.26) | (.26) | (.38) | (.35) | (.38) | (.42) | (.47) | (.53) |
| | Age 0–15 with grandparent | .51 | .73 | 1.27 | .94 | .65 | .45 | 1.01 | .51 |
| | in same municipality | (.28) | (.33) | (.50) | (.39) | (.45) | (.52) | (.60) | (.72) |
| Health care | Constant | .03 | .03 | .04 | .05 | .06 | .06 | .05 | .06 |
| | | (.01) | (.01) | (.01) | (.01) | (.01) | (.01) | (.01) | (.01) |
| | Age 0–15 | -.10 | -.26 | -.12 | -.25 | -.13 | -.56 | -.87 | -.66 |
| | | (.21) | (.18) | (.28) | (.17) | (.22) | (.28) | (.29) | (.36) |
| | Age 60+ | -.17 | -.17 | -.03 | -.08 | -.01 | -.26 | -.30 | -.17 |
| | | (.10) | (.09) | (.13) | (.09) | (.13) | (.15) | (.15) | (.17) |
| | Age 0–15 with grandparent | .06 | .24 | .06 | .15 | .20 | .34 | .53 | .45 |
| | in same municipality | (.13) | (.12) | (.21) | (.15) | (.16) | (.20) | (.18) | (.22) |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Social welfare | Constant | .00 | .01 | .00 | .00 | .01 | .03 | .03 | .03 |
| | | (.01) | (.01) | (.01) | (.01) | (.01) | (.01) | (.01) | (.01) |
| | Age 0–15 | -.18 | -.12 | -.30 | -.41 | -.50 | -.78 | -.58 | -.53 |
| | | (.18) | (.20) | (.29) | (.27) | (.29) | (.40) | (.41) | (.48) |
| | Age 60+ | -.07 | -.12 | -.13 | -.18 | -.28 | -.55 | -.40 | -.26 |
| | | (.09) | (.09) | (.13) | (.12) | (.14) | (.19) | (.18) | (.22) |
| | Age 0–15 with grandparent | .09 | .10 | .27 | .19 | .53 | .39 | .34 | .42 |
| | in same municipality | (.13) | (.15) | (.23) | (.21) | (.23) | (.3) | (.27) | (.33) |
| Culture | Constant | .05 | .06 | .08 | .09 | .08 | .07 | .07 | .07 |
| | | (.01) | (.01) | (.01) | (.01) | (.01) | (.01) | (.01) | (.01) |
| | Age 0–15 | -.75 | -.60 | -.14 | .11 | .09 | -.13 | -.25 | -.03 |
| | | (.21) | (.20) | (.22) | (.20) | (.21) | (.24) | (.27) | (.28) |
| | Age 60+ | -.38 | -.22 | -.09 | -.04 | .00 | -.09 | -.13 | -.09 |
| | | (.10) | (.08) | (.10) | (.09) | (.11) | (.11) | (.11) | (.12) |
| | Age 0–15 with grandparent | -.12 | -.01 | -.23 | -.27 | -.19 | -.11 | -.11 | -.15 |
| | in same municipality | (.12) | (.12) | (.17) | (.15) | (.15) | (.17) | (.18) | (.19) |
| Road | Constant | .03 | .02 | .02 | .02 | .02 | .02 | .03 | .03 |
| maintenance | | (.01) | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) | (.01) |
| | Age 0–15 | .15 | .01 | -.03 | .00 | .07 | .17 | .28 | .35 |
| | | (.21) | (.13) | (.13) | (.11) | (.14) | (.18) | (.18) | (.22) |
| | Age 60+ | .14 | -.04 | -.05 | -.04 | .03 | .18 | .14 | .09 |
| | | (.09) | (.05) | (.05) | (.04) | (.06) | (.08) | (.07) | (.09) |
| | Age 0–15 with grandparent | -.03 | -.04 | .14 | .15 | .04 | .00 | -.12 | -.22 |
| | in same municipality | (.14) | (.09) | (.11) | (.09) | (.10) | (.12) | (.12) | (.14) |
| Water, sewage | Constant | .01 | .02 | .03 | .03 | .01 | .00 | .00 | .00 |
| and refuse | | (.01) | (.01) | (.01) | (.01) | (.01) | (.01) | (.01) | (.01) |
| | Age 0–15 | .30 | .36 | .34 | .56 | .39 | .61 | .53 | .59 |
| | | (.25) | (.27) | (.31) | (.26) | (.30) | (.41) | (.36) | (.34) |
| | Age 60+ | .19 | .14 | .10 | .20 | .10 | .27 | .25 | .32 |
| | | (.13) | (.12) | (.13) | (.12) | (.15) | (.19) | (.19) | (.17) |
| | Age 0–15 with grandparent | -.10 | .03 | .25 | .32 | .15 | .00 | -.08 | -.12 |
| | in same municipality | (.13) | (.14) | (.21) | (.20) | (.21) | (.28) | (.22) | (.22) |
| Other | Constant | .08 | .08 | .11 | .06 | .07 | .10 | .09 | .09 |
| infrastructure | | (.01) | (.01) | (.01) | (.02) | (.01) | (.01) | (.01) | (.01) |
| | Age 0–15 | -.32 | -.43 | -.24 | -.36 | -.02 | .02 | .17 | .39 |
| | | (.30) | (.29) | (.41) | (.43) | (.46) | (.51) | (.46) | (.46) |
| | Age 60+ | -.09 | -.07 | 0.00 | -.09 | .11 | .23 | .16 | .21 |
| | | (.14) | (.12) | (.19) | (.21) | (.22) | (.25) | (.24) | (.20) |
| | Age 0–15 with grandparent | .11 | .32 | .50 | .32 | -.01 | -.06 | .18 | .28 |
| | in same municipality | (.20) | (.20) | (.30) | (.33) | (.30) | (.33) | (.31) | (.30) |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Administration | Constant | .06 | .06 | .08 | .10 | .12 | .15 | .15 | .13 |
| | | (.01) | (.01) | (.01) | (.01) | (.01) | (.01) | (.01) | (.01) |
| | Age 0–15 | -.15 | -.39 | .09 | -.04 | .20 | .12 | .10 | .24 |
| | | (.19) | (.20) | (.29) | (.23) | (.40) | (.49) | (.54) | (.62) |
| | Age 60+ | -.12 | -.11 | .02 | .13 | .31 | .48 | .17 | .39 |
| | | (.08) | (.11) | (.14) | (.12) | (.22) | (.26) | (.29) | (.32) |
| | Age 0–15 with grandparent | -.13 | -.05 | -.61 | -.47 | -.50 | -.38 | -.45 | -.43 |
| | in same municipality | (.12) | (.14) | (.25) | (.18) | (.28) | (.35) | (.28) | (.33) |

Note: This table displays four-year averages of estimates of the political influence of interest groups on the marginal budget shares of different service sectors. Four-year averages of standard errors are in parentheses. Population proportions of interest groups are measured as deviations from yearly mean values across municipalities. Hence, constant terms provide estimates of the marginal budget shares of the average municipality.

**Table A4.** Effects of income changes on the net operating result

| | 1982–1985 | 1986–1989 | 1990–1993 | 1994–1997 | 1998–2001 | 2002–2005 | 2006–2009 | 2010–2013 |
|---|---|---|---|---|---|---|---|---|
| Contemporaneous | .59 | .6 | .45 | .56 | .54 | .57 | .6 | .48 |
| income change | (.06) | (.06) | (.06) | (.05) | (.05) | (.05) | (.05) | (.06) |
| Previous year's | .37 | .41 | .17 | .31 | .36 | .29 | .43 | .26 |
| income change | (.06) | (.06) | (.05) | (.06) | (.06) | (.05) | (.06) | (.07) |
| Income change | .17 | .21 | .03 | .13 | .12 | .15 | .23 | .09 |
| two years ago | (.05) | (.06) | (.04) | (.06) | (.05) | (.05) | (.06) | (.06) |

Note: This table displays four-year averages of estimates of how change in income affect net operating results. Four-year averages of standard errors are in parentheses. Per capita income changes are measured as deviations from yearly mean values across municipalities.

**Table A5.** The effect of total revenue on residential mobility

| | (1) OLS | (2) IV | (3) OLS | (4) IV |
|---|---|---|---|---|
| Panel a) First stage | | | | |
| Coefficient on instrument | | 0.009 | | 0.009 |
| Standard error | | (0.003)*** | | (0.003)*** |
| Panel b) Outcome equation | | | | |
| Coefficient on per capita revenue | 0.086 | 0.328 | 0.034 | 0.386 |
| Standard error | (0.146) | (0.681) | (0.143) | (0.613) |
| Specification with lags | No | No | Yes | Yes |
| N | 2579 | 2579 | 2165 | 2165 |

Note: Columns (1) and (2) show OLS and IV coefficients for total revenue (USD 1,000) and Columns (3) and (4) show OLS and IV coefficients for lagged total revenue (USD 1,000). The analysis uses data for 2001-2007, as the instrument is available only for this period.

## B $R^2$ out of sample

We estimate expenditures out of sample by inserting parameter estimates from year $b$ (base period) into (9) when the right-hand-side variables are from year $t$:

$$\hat{u}_{imt}(b) = \hat{c}_{imt}(b) + \sum_{j=1}^{J} \hat{\gamma}_{ijb} z_{jmt} + \hat{\beta}_{imt}(b) \left( y_{mt} - \sum_{i=1}^{S} \hat{c}_{imt}(b) - \sum_{i=1}^{S} \sum_{j=1}^{J} \hat{\gamma}_{ijb} z_{jmt} \right), \tag{B1}$$

where

$$\hat{c}_{imt}(b) = \sum_{l} \hat{\phi}_{ilb} q_{lmt}, \tag{B2}$$

$$\hat{\beta}_{imt}(b) = \hat{\beta}_{i0b} + \sum_{k} \hat{\beta}_{ikb} \left( z_{kmt} - \bar{z}_{kt} \right), \tag{B3}$$

where $q_{lmt}$ is fixed cost variable $l$ of municipality $m$ in year $t$, and $\hat{\phi}_{ilb}$ is a corresponding parameter estimate for sector $i$ in the base year $b$. Futhermore, the marginal budget share constant term estimate of sector $i$ in year $b$ is denoted $\hat{\beta}_{i0b}$, whereas the marginal budget share parameter of interest group $k$ in service sector $i$ is denoted $\hat{\beta}_{ikb}$ when estimated on data for year $b$. The population proportions of interest groups are measured as deviations from yearly mean values ($\bar{z}_{kt}$), which implies that constant terms account for the marginal budget shares of the average municipality.

We use $R^2$ to evaluate how much of the expenditure variation in a given year that is captured by the out of sample estimates:

$$R^2_{it}(b) = 1 - \frac{\sum_{m=1}^{M} \left( u_{imt} - \hat{u}_{imt}(b) \right)^2}{\sum_{m=1}^{M} \left( u_{imt} - \bar{u}_{it} \right)^2}, \tag{B4}$$

where

$$\bar{u}_{it} = \frac{1}{M} \sum_{m=1}^{M} u_{imt}. \tag{B5}$$

Table 3 displays four-year averages of the within-sample $R^2_{it}(t)$ and the out-of-sample $R^2_{it}(t-1)$ when using parameter estimates from the previous year ($b = t-1$) to predict expenditures in year $t$.

## C Sensitivity to choice of inequality measure

To complement the information of inequality provided by the Gini coefficient we employ two closely related rank-dependent measures of inequality ($C_1$ and $C_3$) discussed by Aaberge (2007) and defined by

$$C_k = 1 - \frac{1}{\mu}\int_0^1 p_k(u)F^{-1}(u)du, \tag{C1}$$

where

$$p_k(u) = \begin{cases} -logu, & k = 1 \\ \\ \frac{k}{k-1}\left(1 - u^{k-1}\right), & k = 2, 3, \end{cases} \tag{C2}$$

and $\mu$ and $F^{-1}(u)$ denote the mean and the left inverse of $F$. Whilst it can be shown that the Gini coefficient ($C_2$) tends to pay most attention to changes that occur in the middle part of the income distribution, the two alternative measures of inequality are shown to be particularly sensitive to changes that occur in the lower part ($C_1$) and the upper part ($C_3$) of the income distribution.

As shown in Figure C1, the evolution of cash and extended income inequality described by $C_1$ and $C_3$ are similar to the results for the Gini coefficient given by Figure 8. However, the difference in cash income inequality and extended income inequality is somewhat larger for the measure that is most sensitive to changes in the lower part of the income distribution.


**Figure C1.** Estimates of the inequality measures $C_1$ and $C_3$ in the distribution of cash income and extended income

Note: The solid gray lines display the $C_1$ and $C_3$ in the distribution of household cash income when applying the EU equivalence scale. The solid black lines display the $C_1$ and $C_3$ in the distribution of household extended income when applying the NA equivalence scale. The sample consists of all individuals residing in Norway each year in the period 1982-2013.

## D Decomposition method

We start with a decomposition of municipal production. In each year $t$, we aggregate in-kind transfers across service sectors for each target group, across target groups within municipalities, and across municipalities:

$$x_{jmt} = \sum_{i=1}^{S} x_{ijmt},\ j = 1, ..., J, \tag{D1}$$

where $x_{ijmt}$is the average production value of service $i$ for members of target group $j$ in municipally $m$.

$$x_{mt} = \sum_{j=1}^{J} x_{jmt} z_{jmt}, \tag{D2}$$

$$x_t = \sum_{m=1}^{M} \frac{n_{mt}}{n_t} x_{mt}, \tag{D3}$$

where $n_{mt}$ is the population size of municipality $m$ in year $t$ and $n_t$ is the total population of the country in year $t$. Note that $x_{jmt}$ is the production value per member of target group $j$ living in municipality $m$, $x_{mt}$ is the production value per capita in municipality $m$ and $x_t$ is the production value per capita in Norway.

Based on equations (D1), (D2) and (D3), we next define two proportions which describe the allocation of municipal production at different levels of aggregation:

1. The share of production in municipality $m$ allocated to target group $j$,

$$s_{1jmt} = \frac{x_{jmt} z_{jmt}}{x_{mt}},\ j = 1, ..., J,\ m = 1, ..., M, \tag{D4}$$

2. The share of total municipal output produced by municipality $m$,

$$s_{2mt} = \frac{n_{mt} x_{mt}}{n_t x_t},\ m = 1, ..., M, \tag{D5}$$

Let $A_{jmt}$ denote the aggregate value of production received by target group $j$ in municipality $m$ in year $t$. By inserting (D4) and (D5) in $A_{jmt}$ we find that $A_{jmt}$ admits the following decomposition,

$$A_{jmt} = n_{mt} x_{jmt} = s_{1jmt} s_{2mt} n_t x_t, \tag{D6}$$

from which it follows that the production value per recipient in target group $j$ is given by $x_{jmt} = A_{jmt}/n_{mt} z_{jmt}$. Note that $n_{mt} z_{jmt}$ is the number of members of target group $j$ in municipality $m$ in year $t$. Thus, the actual value of production received by target group $j$ in municipality $m$ in year $t$ has been decomposed multiplicatively by the two proportions (D4) and (D5).

For (D4) and (D5), we define counterfactual alternatives where municipal priorities are kept as in base year $b$, while population size and composition are as in year $t$. For (D4), which pertains to allocations to target groups (and service sectors), the counterfactual is given by

$$s_{1jmt}(b) = \frac{x_{jmb} z_{jmt}}{x_{mt}(b)} = \frac{x_{jmb} z_{jmt}}{\sum_{j=1}^{J} x_{jmb} z_{jmt}}, \tag{D7}$$

where $s_{1jmt}(b)$ is the counterfactual share in year $t$ of production in municipality $m$ allocated to target group $j$ when year $b$ is defined as the base year, and $x_{mt}(b) = \sum_{j=1}^{J} x_{jmb} z_{jmt}$ is the counterfactual per capita production in municipality $m$ with production per person in different target groups as in year $b$ and population as in year $t$.

For (D5), regarding allocation to municipalities, the counterfactual is given by

$$s_{2mt}(b) = \frac{n_{mt} x_{mt}(b)}{n_t x_t(b)} = \frac{n_{mt} \sum_{j=1}^{J} x_{jmb} z_{jmt}}{n_t \sum_{m=1}^{M} (n_{mt}/n_t) \sum_{j=1}^{J} x_{jmb} z_{jmt}}, \tag{D8}$$

where $x_t(b) = \sum_{m=1}^{M} (n_{mt}/n_t) \sum_{j=1}^{J} x_{jmb} z_{jmt}$ is the counterfactual municipal per capita production in the whole country with production per person in different target groups as in year $b$ and population as in year $t$.

By combining the actual shares in (D4) and (D5) with the counterfactual shares in (D7) and (D8), we can define different counterfactual scenarios. By focussing on changes in priorities within and between municipalities, we may study both the partial impact of each factor and their combined effect on the distribution of extended incomes. Thus we define the following counterfactual alternatives:

$$CF1_{jmt} = s_{1jmt}(b) s_{2mt}(t) n_t x_t, \tag{D9}$$

$$CF2_{jmt} = s_{1jmt}(t) s_{2mt}(b) n_t x_t, \tag{D10}$$

$$CF3_{jmt} = s_{1jmt}(b) s_{2mt}(b) n_t x_t. \tag{D11}$$

For each counterfactual alternative, we obtain a counterfactual distribution of extended income which can be compared to the actual distribution of extended income.

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