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TABLE OF CONTENTS

The distributional impact of public services in European countries

(Rolf AABERGE, Audun LANGØRGEN and Petter LINDGREN[1])

Abstract: The purpose of this paper is to study the impact of including the value of public health care, long-term care, education and childcare on estimates of income inequality and financial poverty in 23 European countries. The valuation of public services and the identification of target groups rely on group-specific accounting data for each of the 23 countries. To account for the fact that the receipt of public services like education and care for the elderly is associated with particular needs, we introduce a theory-based common equivalence scale for European countries, termed the needs-adjusted EU scale (or NA scale). Even though the ranking of countries by estimates of overall inequality and poverty proves to be only slightly affected by the choice between the conventional EU scale and the NA scale, poverty estimates by household types are shown to be significantly affected by the choice of equivalence scale.

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1. Introduction

Most analyses of the income distribution are still solely concerned with cash income and ignore the impact of public services, despite the fact that the tax burden levied on households is justified by the in-kind as well as cash transfers which governments provide through these taxes. Moreover, differences in the size and composition of the public sector introduce a profound comparability problem between countries when public in-kind transfers are not accounted for in the analysis of income distribution. Thus, the inclusion of public welfare services contributes to a more complete picture of the income distribution and the redistribution mechanisms of modern welfare states, in particular because publicly funded welfare services constitute around half of the welfare states' transfers to individuals and households (Atkinson et al. 2002; Garfinkel et al. 2006). During the recent years a number of studies have, however, included public welfare services to produce a more accurate comparison of people's material well-being.[(2)]

This paper focuses attention on the distribution of extended income, where extended income is defined by the sum of disposable cash income and the value of public services received by different households. In a previous study Aaberge, Langørgen and Lindgren (2010b) accounted for the effect of primary and secondary education and health care services, while the present study also includes the value of early childhood education and care (ECEC services) and long-term care (care for the elderly and disabled). The previous study was restricted to 17 European countries for which 2006 EU-SILC data and OECD expenditure data on primary and secondary education and health care services were available. Extensions of the data sets have made it possible to include 23 countries in the present study. The additional six countries are Italy, the UK, Greece, Slovenia, Ireland and Iceland. Moreover, the dataset is also extended with observations from 2009, which allows us to study the evolvement of income inequality and poverty from 2006 to 2009. This period is of particular interest due to the financial crisis that started in 2008. To sum up the empirical contribution of this paper; we include four public welfare benefits; ECEC, education, health care and long-term care for 23 European countries in the two years 2006 and 2009.

Assessing the value of public services enjoyed by different households cannot be achieved without relying on various basic assumptions. First, since most public services are produced by public institutions we only observe expenditures and not prices. Thus, this study draws on standard practice by assuming that the total value of these services is equal to the total costs of producing them. Secondly, again in accord with standard practice we allocate the average costs of producing services to beneficiaries. To this end, we use the national spending data on childcare, education, health care and long-term care provided by OECD. The recipients are classified by gender and age group, and individuals are assumed to receive the average benefit in their respective groups of each public service, while the average benefit is allowed to vary across countries. The value of public services received by a given household is the aggregate of the values received by different household members.

The importance of accounting for needs and economies of scale in households when analysing the distributional impact of public services is universally acknowledged. However, since equivalence scales designed to account for needs and economies of scale in cash income are not necessarily appropriate for public services, it is required to relax the assumption that the relative needs of different subgroups remain unchanged when the definition of income is extended to include the value of public services. To this end, Aaberge, Bhuller, Langørgen and Mogstad (2010a) and Aaberge et al. (2010b) introduced theory-based equivalence scales for extended income. These equivalence scales, denoted the needs-adjusted (NA) scales, can be expressed as a weighted average of the EU scale and a non-cash income (NC) scale accounting for public services. The NA scale assigns higher weights to children and the elderly compared to the EU scale, because children and the elderly have higher needs for basic public welfare services like education and health care.

[(2)] For previous studies on the impact of in-kind benefits on the income distribution, see O'Higgins and Ruggles (1981), Gemmell (1985), Smeeding (1986), Smeeding et al. (1993), Evandrou et al. (1993), Ruggeri et al. (1994), Slesnick (1996), Antoninis and Tsakloglou (2001), Aaberge and Langørgen (2006), Garfinkel et al. (2006), Callan et al. (2008), Paulus et al. (2010), Aaberge et al. (2010a), Aaberge et al. (2010b), Vaalavuo (2011), Koutsampelas and Tsakloglou (2012) and Verbist et al. (2012).

In the present paper we propose a simplified representation of the NA scale, denoted the SNA scale, which solely depends on the number of household members in different age groups. Thus the SNA scale can be computed for any micro-dataset with household information that includes the age of household members. Moreover, it is demonstrated that the SNA scale is highly correlated with the NA scale, and therefore can be considered as an appropriate approximation of the NA scale.

When the EU scale is replaced with the NA scale in the analysis of extended income, the results presented in this paper show that the change in income inequality and poverty is modest. For most countries inequality estimates become higher and poverty estimates smaller when the EU scale is replaced with the NA scale. However, decomposition by household type reveals that the choice of equivalence scale has a significant impact on poverty estimates of subgroups. For single adults with children, poverty rates show to be significantly higher when using the NA scale, whereas the poverty is lower for single non-elderly adults without children. Thus, using the EU scale rather than the NA scale might create a different picture of poverty in a society. In particular, poverty rates appear to be underestimated among single adults with children when using the EU-scale for adjusting extended income, because the EU scale ignores that such households have high needs for public services. Similarly, poverty rates among single adults (below 75 years) without children are overestimated when adjusting extended income by the EU scale rather than by the NA scale.

The paper is organised as follows. Section 2 provides a discussion of the theoretical foundation for needs-adjusted (NA) equivalence scales and presents a theory-based common equivalence scale for European countries. Section 3 discusses empirical methods, and present estimation results for the NA scale and SNA scale. Section 4 displays the results of the empirical analysis of income inequality and poverty in 23 European countries. A brief conclusion is provided in Section 5. For more detailed information of data and empirical methods we refer to Appendix A, while Appendix B provides sensitivity analysis for the SNA scale and for choice of inequality measure.

2. Needs for public services and equivalence scales

By adjusting for differences in needs, equivalence scales justify interpersonal comparability of incomes across heterogeneous households, and thus play an important role in analysis of income inequality and financial poverty. While theoretically justified equivalence scales can be derived from the cost functions of households with different demographic characteristics, most empirical analyses typically use more pragmatic scales adjusting crudely for differences in household size and composition (see e.g. Coulter et al., 1992). However, as argued by Radner (1997) equivalence scales designed to account for needs and economies of scale in cash income are not necessarily appropriate when analysing an income concept that includes the value of public services. For instance, the elderly tend to utilise health services more frequently than younger people due to differences in health status, whereas children have comparably higher needs for education.[3] As a consequence, studies using equivalence scales designed for cash income risk overestimating the equivalent incomes of groups with relatively high needs for public services.

A contribution of this paper is to relax the assumption that the relative needs of different subgroups remain unchanged when the definition of income is changed. However, we rely on the previous literature on income inequality and financial poverty by applying the much used EU scale to account for heterogeneity of needs for cash income.[4] 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. Scale economies in consumption are used as justification for assigning a higher weight to the first adult of the household. Jointly consumed goods, such as cars and housing, are assumed to contribute to economies of scale. The relatively low weight that is given to children in the EU scale is due to the fact that children generally consume small quantities of basic goods, such as food and beverages. Thus, it is implicitly assumed that children have smaller needs for private consumption goods than adults. Even if this assumption is correct for consumption of goods financed by cash income, the picture may change when we extend the needs concept to include needs for public education services. Thus, if the weight 0.3 is considered appropriate for children when analysing the distribution of cash income, it makes sense to increase the weight for children when income is extended to include public childcare and education expenditures. This proposition is based on the assumption that children are in needs of childcare and education, and that the children and the associated household members should not suffer economically when they belong to a household with high needs for childcare and education services. This means that the value of childcare and education services allocated to households with children should be adjusted for the childcare and education needs of children. Moreover, higher needs for health care and elderly care among the elderly means that the equivalence scale should differentiate between adults in different age groups when the income definition includes public health care and care for the elderly.

2.1. Needs-adjusted equivalence scale

The purpose of this section is to provide a brief presentation of a needs-adjusted EU equivalence scale proposed by Aaberge, Langørgen and Lindgren (2013). The needs-adjusted EU equivalence scale is designed to deal with situations where the income concept is extended to include public in-kind transfers. The first step of designing a common needs-adjusted EU scale for European countries consists of estimating needs-adjusted scales for each of the European countries that is included in this study. Next, the country-specific needs-adjusted scales are assigned to all households in the total population of the countries in the study. Finally, the common scale is determined by the average of the country-specific needs-adjusted equivalence scales for every household in all countries. A more detailed presentation of this method for deriving a common needs-adjusted EU scale is given below.

[3] The equivalence scales estimated by Jones and O'Donnell (1995) and Zaidi and Burchardt (2005) show that the disabled have relatively high needs for non-cash as well as cash income.

[4] The EU scale is also called the modified OECD scale in the literature.

Let H be the number of households in the European countries that are included in this study, and let $\boldsymbol{\gamma}_{hk} = (\gamma_{0hk}, \gamma_{1hk}, ..., \gamma_{Shk})$ be a vector of good-specific needs parameters, where γ_{ihk} ($i = 0,1,...,S$, $h = 1,2,...,H$ and $k = 1,2,...,K$) is a measure of the need for service i targeted to household h derived from the public service and living standard prevailing in country k.

In line with the approach of Aaberge et al. (2010a, 2010b), we use the cost function approach to justify the following family of relative equivalence scales:

$$NA_{hk} = \frac{\gamma_{+hk}}{\gamma_{+rk}}, \; h = 1,2,...,H \,, \tag{2.1}$$

where γ_{+hk} and γ_{+rk} is the total need of extended income of household h and the reference household r, as evaluated by the needs parameters of country k. Thus, NA_{hk} is the scale factor for household h derived on the basis of the assessed needs parameters for country k, Accordingly, equivalent income is given by C_h / NA_{hk}, 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.

It follows from (2.1) that the NA_{hk} scale admits the following decomposition:

$$NA_{hk} = \theta_{rk} CI_h + (1 - \theta_{rk}) NC_{hk} \tag{2.2}$$

where $CI_h = \gamma_{0hk} / \gamma_{0rk}$ is the equivalence scale for cash income,[5] $NC_{hk} = (\gamma_{+hk} - \gamma_{0hk}) / (\gamma_{+rk} - \gamma_{0rk})$ is the scale for non-cash income, and $\theta_{rk} = \gamma_{0rk} / \gamma_{+rk}$ is the weight assigned to cash income in the composite NA scale for extended income. This weight is equal to the ratio between the needs for cash income and the needs for extended income of the reference household r. As demonstrated by expression (2.2) the NA_{hk} scale can be considered as a cash income scale that is adjusted for the needs of public services.

Since the scale for public services differs across countries the composite equivalence scale (2.1) for extended income will also vary across countries. However, to justify comparison of extended income distributions across countries it is required to derive a common equivalence scale on the basis of the available country-specific scales. As indicated by Ebert and Moyes (2003) a common scale for extended income should satisfy the conditions of unit consistency and reference independence. Unit consistency means that the equivalence scale is invariant with respect to changes in measurement unit or currency for any country. This condition implies that measures of inequality and poverty are independent of the choice of scale of measurement for a given country. Reference independence means that measures of (relative) inequality and poverty are independent of choice of reference household for the definition of the equivalence scale.

As demonstrated by Aaberge, Langørgen and Lindgren (2013) the following equivalence scale satisfies the conditions of unit consistency and reference independence:

[5] The equivalence scale for cash income is common for all countries.

$$NA_h = \frac{\sum_{k=1}^{K} w_k \frac{\gamma_{+hk}}{\gamma_{++k}}}{\sum_{k=1}^{K} w_k \frac{\gamma_{+rk}}{\gamma_{++k}}}, \quad h = 1, 2, ..., H. \tag{2.3}$$

where $\gamma_{++k} = \sum_{h=1}^{H} \gamma_{+hk}$ and $w_k, k = 1, 2, ..., K$ are country-specific weights that are constant and independent of the needs parameters and the reference household.

Choosing $w_l > 0$ and $w_k = 0$ for all $k \neq l$ means that country l is treated as a reference country, i.e. the NA scale derived for country l is applied for all countries. An alternative approach is to give all countries equal weights or to weight countries by the proportion of the total population. The method chosen in the present paper is to weight each country by population size. This method assigns higher weights to the service standards of larger countries than of smaller countries.

2.2. Relative versus absolute equivalence scales

The purpose of an equivalence scale is to convert household incomes into comparable individual-specific incomes (equivalent incomes). Equivalence scales might be absolute or relative. A relative scale provides the rate at which one Euro for one household translates into the Euro amount that will produce the same well-being for another household. Thus, if household h enjoys income y_h, and m_h is the conversion rate from the reference household to household h, then the reference household needs income y_h / m_h to obtain the same level of well-being as (members of) household h enjoys. Thus, y_h / m_h is defined as the equivalent income of household h, and it follows that the relative scale is given by the ratio of income to equivalent income. By contrast, an absolute equivalence scale is given by the difference between income and equivalent income, which means that the reference household needs income $y_h - c_h$ to attain the same level of well-being as household h, where c_h is the absolute scale or additive conversion factor from the reference household to household h.

An equivalence scale is said to be exact if it does not depend on income. Exact scales are the ones commonly used. The equivalence scale defined by (2.3) satisfies *relative equivalence scale exactness* (Lewbel, 1989, Blackorby and Donaldson, 1993).[6] Thus, the use of an exact relative equivalence scale for extended income means that the need for public services constitutes a share of extended income that is depending on household type, but not on the level of income.

In contrast to the approach used in this paper, Callan and Keane (2009) choose to exclude the value of primary and secondary education from the measure of extended income. By treating primary and secondary education as "a social need" along with assuming that needs and provision of public services are equal, Callan and Keane (2009) claim that adding the value of public services to cash income do not affect income inequality. A concern with this method is that the governments in different countries may provide different service standards, which means that the absolute "social need" for cash income is not constant across countries. Thus one may question the cross-country comparability of cash incomes as a measure of material well-being when the extent of in-kind transfers varies substantially across countries.

Paulus et al. (2010) account for needs of public services by adopting a "fixed cost" approach, which means that the needs of recipients of education and health care are assumed to be equal to a specific sum of money. This approach is equivalent to using an absolute equivalence scale for public services, since the needs for public services is assumed to be equal to a fixed cost which is independent of income. However, when the fixed cost approach for non-cash income is combined with an exact relative equivalence scale for cash income, the resulting combined scale depends on the income level of the

[6] This property is termed independence of base utility by Blundell and Lewbel (1991).

households.

Table 1 displays two alternative extended incomes for two different households associated with an exact relative equivalence scale and an income-dependent scale of the type proposed by Paulus et al. (2010). As an illustration consider a household consisting of an adult aged 70 and another household of an adult aged 80. Assume then that the two households have equal cash incomes, which according to the EU scale means that cash income does not contribute to inequality in well-being. For simplicity the extended income is normalised to 100 for the 70 years old person in Situation 1. Furthermore, assume that the two households are equally well off in Situation 1 where non-cash income is 20 for the 70 years old individual and 40 for the 80 years old individual. By treating 20 and 40 as absolute needs levels for non-cash income, the conversion rate of the combined scale proposed by Paulus et al. (2010) becomes equal to [((80+40)/80)/((80+20)/80)]=6/5 which is equal to the conversion rate of the exact relative scale ((120/100)=6/5). Thus, in Situation 1 the two scales agree that the 70 years old individual and the 80 years old individual enjoy the same well-being level.

Next, assume that the cash and non-cash income of the 70 years old are multiplied by 10, whereas only the cash income of the 80 years old increases by a factor of 10. Then the following question arises: how much more non-cash income would the 80 years old need to be equally well off as the 70 years old? Using the exact relative equivalence scale implies that the 80 years old individual needs 1,000 * (6/5) – 800 = 400 in non-cash income in this case, which means that Situation 2 preserves equality in well-being between the two individuals. By contrast, the income-dependent equivalence scale proposed by Paulus et al. (2010) requires 1,000 *[(840/800)/(820/800)] – 800 = 224 in non-cash income to make the well-being levels of the 80 and 70 years old individuals equal (Situation 3 of Table 1). Thus, the difference in non-cash income between the two households is only slightly affected by the huge rise in cash as well as non-cash income.

Table 1: Incomes in three different situations for two different households

	Situation 1		Situation 2		Situation 3	
Age of single household	**70**	**80**	**70**	**80**	**70**	**80**
Cash income	80	80	800	800	800	800
Non-cash income	20	40	200	400	200	224
Extended income	100	120	1,000	1,200	1,000	1,024

However, if the risk of getting ill is twice as high when the age increases from 70 to 80 years, then the government has to spend twice as much money per person on persons aged 80 than on persons aged 70 in order to provide equal treatment of the two groups. In this case it is plausible to assume that Situation 2 preserves equality, which means that the 80 years old is worse off than the 70 years old in Situation 3.

Paulus et al. (2010) argue that public services such as education and health care are necessary goods with recipient needs that are little affected by income. However, if this is the case then it might be difficult to explain why richer countries provide public services of better quality than poorer countries. Moreover, in countries where education and health care are private market goods, richer households demand considerably more extensive services than poorer households.

The combination of a relative scale for cash income and an absolute scale for non-cash income also raises the question of whether necessary market goods such as food, clothes and housing should be treated similarly as public services like education and health care. Since the use of relative and absolute equivalence scales have very different implications, it is required to provide a normative justification for using a relative scale for cash income and an absolute scale for non-cash income. Finally, we question whether it is coherent to use an absolute scale for non-cash income in combination with a measure of relative income inequality and a poverty measure based on a relative poverty threshold (60 per cent of the median equivalent income).

As is demonstrated by Aaberge, Langørgen and Lindgren (2013) the theoretical basis underlying the methods used in this paper ensure that measures of equivalence scales, welfare, inequality and poverty can be considered as a unified framework that secures internal consistency between different parts of the methodology and has a transparent normative justification.

2.3. Estimation method

Aaberge et al. (2010a) used detailed accounting data of municipalities as a basis for estimating the NA scale for local public services in Norway. Minimum quantity parameters for different service sectors and target groups are considered as measures of the local governments' assessment of the need of different services for different population subgroups. The justification for this approach is that the estimated minimum quantities can be considered as a result of central government regulations, expert opinion, or a consensus among local governments about how much spending the different target groups need, given the budget constraint of the municipalities. Moreover, it is assumed that the social planner uses the same functional form for measuring the welfare produced by public services as is used by local governments to decide the spending on public services.

Except for the Nordic countries, detailed municipal accounting data are in general not available. Thus, in order to estimate needs parameters for European countries we have to rely on less informative data like the national mean public spending targeted to different population subgroups defined by age and gender. Average spending per person received by the different target groups of public services, such as children and the elderly, is used as indicators of the population groups' need for childcare, education, health care and long-term care. The mean in-kind transfers received by different target groups are assumed to reflect the relative needs of the target groups. Since the estimated need parameters for public services are referring to individuals, household specific need parameters are obtained by simply aggregating the need parameters of the individuals in each household.

We use the EU scale to account for differences in needs of cash income for households who differ in size and composition and the median of the distribution of equivalent income in a given country as a basis for determining the needs parameter for the reference group. Thus, the needs parameter of cash income for the reference household in country k is defined by

$$\gamma_{0rk} = median\left(\mathbf{x}_{0k}^{EU}\right), \tag{2.4}$$

where $\mathbf{x}_{0k}^{EU}$ is the vector of equivalent cash incomes in country k using the EU scale to make cash incomes comparable across heterogeneous households. Note that the vector $\mathbf{x}_{0k}^{EU}$ includes one component for each individual in country k. This means that $median(\mathbf{x}_{0k}^{EU})$ is the median equivalent cash income in country k.[7]

For households that are not of the reference type we use the chosen EU scale to assess the need for cash income in the following way:

$$\gamma_{0hk} = \gamma_{0rk} EU_h, \tag{2.5}$$

where EU_h is the EU scale for cash income pertaining to household h. Thus, the size of the needs for cash income for household h relative to the reference household r is equal to the EU scale. Note that the country-specific needs parameters of cash income are used as a basis for assessing the weights of the equivalence scale defined by (2.2).

[7] In this study the reference household type is defined by childless single male adults of age 35-44 years.

3. Empirical implementation

This section presents the empirical implementation of the methods for allocating the value of public services to individuals, and the methods used for evaluating the income distribution. Section 3.1 describes the population of study. Section 3.2 gives an account of data and methods for valuation of public services. Section 3.3 describes the allocation of the value of public services to individuals. Section 3.4 reports estimates for the needs-adjusted equivalence scale and moreover introduces a simplified version of the needs-adjusted scale as a function of the number of household members belonging to different age groups. Different income definitions are discussed in Section 3.5, while inequality measures, poverty thresholds and a needs index are defined in Section 3.6.

3.1. Population of analysis

This study relies on the EU-SILC 2007 and 2010 cross-sectional data. The data sets refer to the year the data was collected (2007, 2010), although the income data were earned in 2006 and 2009. However, the demographic information refers to 2007 and 2010. We assume that the household composition was the same in 2006 (2009) as in 2007 (2010). The data provides access to cross-sectional data for 29 European countries: 27 EU member states as well as Norway and Iceland. The results in this study concern 21 EU countries, plus Norway and Iceland. Six EU-SILC countries were omitted from the study due to limited data on public services.[8] A lack of participation in the OECD data systems is the reason for not including all the countries reporting data to EU-SILC.

In order to provide some basic information of demographic characteristics of the countries in question, Table 2 shows the population composition for each country by household types. Since children and the elderly are important recipients of public services, we have classified households in the following way:

1. We distinguish between households with adults in the age groups 18-64, 65-74 and 75 years and above
2. We distinguish between households with 1, 2 or 3 or more adult household members (18 years and above)
3. We distinguish between households with or without children (at least 1 child below 18 years of age)

For households with adults in the age group 18-64 years we specify households with 1 or 2 adults combined with households with or without children to form the following four household types: Single adult without children, couple without children, single adult with children and couple with children. For the two elderly age groups we specify single and couple households without children. For households with 3 or more adults we do not specify the age of the adults, but we distinguish between households with or without children. The residual type “Other households” includes households with 2 adults that belong to different age groups, or with 1 or 2 elderly adults in households with children.

Table 2 shows the country-specific distributions of individuals by household type. A fairly large share of the households is constituted by 2 adults below 65 years of age with one or more children. In particular, this household type is rather common in the Nordic countries and in Ireland, Luxembourg and the Netherlands. Households with 3 or more adults are rather common in Estonia, Greece, Hungary, Italy, Poland, Portugal, Slovenia, Slovak Republic and Spain. Denmark, Finland, Germany, Norway and Sweden have relatively high shares of single adults aged 18-64 without children, while Denmark, Iceland, Ireland, Norway and UK have high shares of single adults with children.

[8] These countries are Bulgaria, Cyprus, Latvia, Lithuania, Malta and Romania.

Table 2: Population of study by household type and country. Percent of individuals, 2009

	Household type										
Age of adults	**18-64**		**18-64**		**65-74**		**75+**		**18+**		**Other**
Number of adults	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**3+**	**3+**	**1-2**
Children	**No**	**No**	**Yes**	**Yes**	**No**	**No**	**No**	**No**	**No**	**Yes**	**No/Yes**
Austria	10	13	3	28	3	4	3	2	17	12	5
Belgium	9	16	5	30	2	4	4	2	12	10	5
Czech Republic	5	14	3	30	2	3	3	2	21	11	6
Denmark	15	17	6	34	3	4	4	2	3	6	5
Estonia	8	14	3	29	3	3	4	1	16	12	6
Finland	11	19	4	34	3	4	4	3	6	7	6
France	10	17	5	32	2	3	4	3	9	8	5
Germany	13	17	4	27	4	7	2	2	11	6	7
Greece	3	9	1	33	1	2	2	2	29	8	9
Hungary	5	13	3	26	2	3	2	1	21	18	7
Iceland	8	12	7	38	2	3	3	2	10	12	4
Ireland	4	12	8	39	2	3	2	1	12	12	5
Italy	7	10	3	28	2	3	4	3	22	12	7
Luxembourg	8	13	3	35	2	3	2	2	17	11	4
Netherlands	10	18	3	36	2	4	3	2	9	7	5
Norway	12	16	8	36	2	4	4	2	4	6	5
Poland	4	10	1	23	2	2	3	1	24	26	4
Portugal	2	10	2	29	2	3	3	3	24	15	6
Slovakia	4	9	1	21	3	2	2	1	31	21	5
Slovenia	5	10	2	29	2	3	3	2	23	14	6
Spain	4	12	1	31	1	3	2	3	26	12	6
Sweden	11	17	5	35	3	5	5	3	5	6	6
UK	7	16	6	33	3	3	4	2	11	10	5

Source: EU-SILC, EUROSTAT. Note: Children are defined as aged below 18 years. EU-SILC cross-sectional weighting is used to produce estimates for the population. Students are omitted from the population.

3.2. The value of public services

Analyses of extended income normally assume that the value of public services is equal to the cost of providing them (Ruggles and O'Higgins, 1981; Gemmell, 1985; Smeeding et al., 1993; Evandrou et al, 1993; Ruggeri et al, 1994; Paulus et al, 2010). Aaberge and Langørgen (2006) question this assumption by demonstrating that local governments provide public services at different costs. Furthermore, the production cost approach disregards differences in quality and efficiency in the service production, and does not account for the possible welfare losses when the government imposes quantity constraints in the consumption of public services. Nevertheless, the production cost approach might provide a useful benchmark by offering an estimate of the value of public services, whereas the standard approach simply ignores the impact of public services on welfare.

We have chosen to include four publicly financed services: health services, long-term care, education and early childhood education and care (ECEC). While Aaberge et al. (2010b) focused on the distributional impact of education and health services, this study extends the analysis by also including long-term care and ECEC services based on OECD data. The data are net public expenditure, and thus the households' out-of-pocket payments and other financial sources beyond government sources are excluded.

The OECD System of Health Accounts provides expenditure data on health and long-term care. In the System of Health Accounts long-term care spending comprises both health and social support services to

people suffering from chronic conditions and disabilities who need care on an ongoing basis. Since the reporting practices of the allocation of long-term care spending between the health and social components may differ between countries, we have chosen to include total spending on both components to facilitate comparability across countries. For Greece, Ireland, Italy and the UK, the OECD data do not allow for splitting between health and long-term care. Instead, estimates for these countries are based on Oliveira Martins et al. (2006) who report expenditures for both health services and long-term care as shares of GDP. The relative size of health and long-term care from that study is utilised here.

Education expenditure is available from the Education Database at OECD Statistics. The data is separated into primary, lower secondary and upper secondary education. This enables us to identify the value of three levels of basic education in European countries. The data also includes information on pre-primary education, but we have instead included pre-primary education as part of the ECEC services.

The OECD Family Database provides public expenditure on childcare and pre-primary education as a share of each country's gross domestic product (GDP). As the OECD also offers GDP data, these data are combined to calculate the value of ECEC services in millions of the national currency. A limitation is that the Family Database does not provide a separation between different types of public financial support for ECEC services. Consequently, in-kind transfers are mixed with cash transfers and support through the tax system in the figures for public spending on ECEC services. In some countries this may lead to double counting of benefits, for instance in the United Kingdom where many parents pay for private childcare and are partly reimbursed through the tax system.

Aaberge and Langørgen (2006) and Aaberge et al. (2010a) account for regional differences in public service provision. This is enabled by detailed accounting data for Norwegian municipalities. Due to data limitation, it is not possible to account for spending differences across geographical regions within the European countries.

3.3. Allocation of public services

Who receives what of public services is an outcome of government decisions. The governments are assumed to target public services to specific subpopulations based on evaluation of relative needs for public services associated with different demographic characteristics. Children are provided education services because they need to develop their skills, while the elderly need to receive health-care and long-term care due to their high likelihood of becoming ill or disabled. Since both the selection of recipients and the amount of public services are decided by the government, it is important to account for the targeting policies of different governments. Different welfare regimes may have consequences for economic inequality when countries provide different levels of public services.

Education and childcare services – the actual consumption approach

Two methods are used to assess the value of public services per receiver. Either the value is based on actual consumption or on the probability to use the service. In the former case, the ex post perspective, the value consumed by each individual forms the basic measurement unit. This method is applied for the value of education and ECEC services. Enrolment numbers in each education level (primary, lower secondary and upper secondary) is accessible from OECD. Total expenditure divided by the enrolment number provides an estimate of the value received per pupil. We assume that participants at a given education level and country receive an equal share of the value. In the EU-SILC data, actual participation in education institutions is only known for people aged 16 years or above. For younger children, however, education participation is largely compulsory and we therefore assume 100 percent participation rates for these children. All three education levels are seen as necessary for acquiring the required skills to participate actively in a developed society. Thus, people that are in the age-group for which education is targeted but do not participate will thus have a need for education that is not fulfilled. Older persons that do in fact participate in one of the education levels acquire a value that they do not seem to need at the time.[9]

(9) Several of these data challenges are rooted in the methodological choice of analysing only one year. By applying a perspective of such a short time span as a year, we are not able to account for inter-temporal planning and adjustment. In a life-cycle perspective, on the other hand, the understanding of income, needs, and public services can be tackled in a less rigid manner.

A limitation of the data is that information on participation in public or private education is not accessible. Thus, it is assumed that every pupil in a certain education level receives the same amount of government funding, irrespective of whether or not the person actually participates in publicly funded schooling.

Our method assumes that the value of childcare and pre-primary education is allocated to users only. The calculation from total public expenditure to per hour value is based on actual participation. Since there are no reliable data on children's total use of childcare and pre-primary education in European countries, we have assumed that total use in a country equals a weighted sum of the individual participation rates in the EU-SILC data. The EU-SILC data include variables that provide information about the average hours of participation per week in childcare and pre-primary schooling. We estimate the public expenditure per hour per week given to children in each country, and allocate this value multiplied by the number of hours attended in ECEC services to the actual recipients registered in the EU-SILC. The EU-SILC data do not distinguish between children in private and public ECEC institutions, which means that we allocate benefits to all children receiving ECEC services, irrespective of whether or not the child actually participates in publicly funded childcare or pre-primary education.

Probability to use health care and long-term care – the insurance approach

Health and long-term care services are treated as insurance arrangements, i.e. the value is assessed on an ex ante basis, which means that it is the probability to consume rather than the actual use of the service that matters. Such a view has been applied by Smeeding (1986), Smeeding et al. (1993), Aaberge and Langørgen (2006), Aaberge et al. (2010a; 2010b) and Paulus et al. (2010). The probability of receiving health and long-term care services depends on demographic characteristics – age and gender. The European Commission have established user profiles by age and gender for both health and long-term care services.[10] By combining these user profiles with population data, the relative provision to each citizen is established. Multiplication with the total expenditure gives the individual health and long-term care insurance. Since the probability of using health and long-term care services differs across individuals by age and gender, the allocation procedure is carried out separately for health services and long-term care. It is important to note that the probability of using health and long-term care is solely determined by demographics. For instance, we assume that the value of the health premium is unaffected by the individuals' position in the income distribution.[11]

Heterogeneous population

Since individuals' needs of education, childcare, health care and long-term care depend on age and gender, we classify the population into target groups defined by age and gender. The following age groups are employed by EU-SILC: 0-17 years, 18-24 years, 25-34 years, 35-44 years, 45-54 years, 55-64 years, 65-74 years and 75 years and above. We find it required to introduce a more detailed classification for children and infants. The reason is that government expenditures per person to different levels of education (primary, lower secondary and upper secondary) vary. Moreover, the participation rate in ECEC services varies by age. Children in pre-education age are divided into three target groups: 0 year, 1-2 years and 3 years to primary education age. Since the age intervals for attending different education levels vary between countries, the age group classification is allowed to vary between countries to take into account the features of different education systems. Table 3 shows the 14 age groups used in this study. When the age groups are combined with gender (males and females), the classification includes 28 different target groups.

[10] See European Commission, 2010, pp. 111-12.

[11] We rely on this simplification despite the fact that empirical evidence from European countries suggests that there is positive relationship between the health conditions and the income levels of individuals.

Table 3: Age groups in the study

Category	Age group
1	0 year
2	1-2 years
3	3 years - education age
4	Primary education age
5	Lower secondary education age
6	Upper secondary education age (17 years and below)
7	Upper secondary education age (18 years and above)
8	18-24 years, but not in upper secondary education age
9	25-34 years
10	35-44 years
11	45-54 years
12	55-64 years
13	65-74 years
14	75 years and above

3.4. Estimation and simplified representation of the NA scale

To estimate the NA scale as outlined in Section 2, it is not sufficient to have data on household size and composition. It is also required to estimate the γ-parameters that account for the relative needs for cash income and public services as a function of household characteristics. As explained in section 2.3 these estimates are based on median disposable cash income and on spending levels as well as spending profiles by age and gender for different public services. Since the computational complexity may reduce the practicability and therefore prevent utilisation of the NA scale, we develop a simplified representation of the NA scale, termed the SNA scale. The SNA scale requires only data for household size and composition by age groups, and is easily computed for any dataset with household information that includes age of the household members. The SNA scale is computed in the same way as the EU scale, except that the SNA scale includes several age groups and moreover assigns weights to the age groups that differ from the EU scale.

The SNA scale is derived from a linear regression (OLS) of the NA scale on the number of household members in different age groups:

$$NA_h = \alpha_0 + \sum_{j=1}^{8} \alpha_j n_{hj} + \varepsilon_h , \qquad (3.1)$$

where NA_h is the estimated NA scale for household h (included in the EU-SILC sample), n_{hj} is the number of members of household h in age group j, and ε_h is the error term in the regression. The SNA scale is defined as the predicted NA scale from the regression model (3.1), i.e. $SNA_h = \hat{\alpha}_0 + \sum_{j=1}^{8} \hat{\alpha}_j n_{hj}$, where $\hat{\alpha}_j$ are parameter estimates (j=0,1,…,8). Some of the age groups in Table 3 have been merged in the regression model, which is why the model in (3.1) includes only 8 different age groups. The SNA scale is also simplified in the sense that it does not distinguish between females and males, since it turns out that the effect of gender on the NA scale is modest.(12)

Economies of scale in household consumption are captured by a positive estimate for the constant term

(12) The NA scale is estimated based on 28 target groups (14 age groups times 2 genders). When all 28 target groups are included in the regression model for the NA scale, we find that the model explains 100% of the variation in the NA scale. Thus the reduction in the number of target groups is the reason why the SNA scale is not an exact representation of the NA scale.

α_0 in the regression equation (3.1), while a zero estimate for the constant term implies that there are no economies of scale. When a similar regression as (3.1) is performed with the EU scale on the left hand side, the parameter α_0 is estimated equal to 0.5, since the first adult is assigned a weight 1, which is 0.5 higher than the weight of other adults in the EU scale.[13] However, since the NA scale is normalised to 1 for the reference household type, we impose the restriction $\alpha_0 = 1 - \alpha_r$, where r is the age group of the (single) reference household type.[14] This restriction secures that the SNA scale is equal to 1 for the reference household type.[15]

In order to allow for flexibility we have estimated the NA scale and the SNA scale for each of four different public services, and also for different combinations of the public services that are included in the present paper. This procedure also provides information about the contribution of different public services to the SNA scale.

Table 4: SNA scale estimation results, including different public services in the scale, 2009

Variable	ECEC	Education	Health care	Long-term care	Education and health care	All 4 services
Constant	0.50	0.50	0.46	0.50	0.46	0.46
0-3 years	0.39	0.30	0.33	0.30	0.33	0.41
3 years to education age	0.56	0.30	0.33	0.30	0.33	0.57
Education age (below 14 years)	0.30	0.67	0.34	0.30	0.69	0.69
Education age (above 13 years)	0.50	0.95	0.53	0.50	0.95	0.95
Above education age - 54 years	0.50	0.50	0.54	0.50	0.54	0.54
55-64 years	0.50	0.50	0.60	0.50	0.60	0.60
65-74 years	0.50	0.50	0.67	0.51	0.67	0.69
75 years and above	0.50	0.50	0.75	0.57	0.75	0.86
R^2 adjusted	1.000	1.000	0.999	1.000	0.999	0.999

The estimation results are reported in Table 4. As a measure of model fit R^2-adjusted shows that the goodness of fit is almost perfect for the six different models for different combinations of public services. The results show that children and elderly are given higher weights in the SNA scale than in the EU-scale, depending on which public services are included in the NA scale. Including childcare and education increases the weights of children, while including long-term-care and health-care increases the weights of the elderly. The model estimates for the SNA scale displayed in Table B.1 of Appendix B are based on data for 2006. By comparing with Table 4, we find that the estimation results do not change much from 2006 to 2009.

[13] Furthermore, the parameter estimate for adults is 0.5 and the parameter estimate for children is 0.3 in a similar regression with the EU scale on the left hand side.

[14] While the reference household type for the NA scale includes single males aged 35-44 years, the reference household type for the SNA scale is broader by including single households of both genders above education age to 54 years of age.

[15] When health care is included in the definition of extended income, the estimate of α_0 is below 0.5. This owes to the fact that health care is the most important service received by the reference household. A positive need for public services for the reference household implies that economies of scale are less important in the NA scale than in the EU scale, since the NC scale does not include economies of scale.

Table 5: Equivalence scales, non-cash incomes include ECEC, education, health care and long-term care, 2009

Type	Age	EU	NC	NA	SNA
Single male	**18-24**	1.00	0.82	0.99	1.00
	25-34	1.00	0.81	0.99	1.00
	35-44	1.00	1.00	1.00	1.00
	45-54	1.00	1.37	1.03	1.00
	55-64	1.00	2.01	1.07	1.06
	65-74	1.00	3.32	1.16	1.15
	75+	1.00	5.50	1.31	1.32
Single female	**18-24**	1.00	0.82	0.99	1.00
	25-34	1.00	1.11	1.01	1.00
	35-44	1.00	1.15	1.01	1.00
	45-54	1.00	1.43	1.03	1.00
	55-64	1.00	1.86	1.06	1.06
	65-74	1.00	3.08	1.14	1.15
	75+	1.00	5.91	1.33	1.32
Couple	**18-24**	1.50	1.64	1.51	1.54
	25-34	1.50	1.93	1.53	1.54
	35-44	1.50	2.15	1.54	1.54
	45-54	1.50	2.80	1.59	1.54
	55-64	1.50	3.87	1.66	1.66
	65-74	1.50	6.41	1.83	1.84
	75+	1.50	11.42	2.18	2.18
Couple, 1 child:	**0**	1.80	3.57	1.92	1.95
	1-2	1.80	4.57	1.99	1.95
	3 - education age	1.80	6.54	2.12	2.11
	Primary education	1.80	7.84	2.21	2.23
	Lower secondary education	1.80	8.61	2.26	2.23
	Upper secondary education	2.00	9.25	2.49	2.49
Couple, 2 children:	**0**	2.10	5.00	2.30	2.36
	1-2	2.10	6.99	2.43	2.36
	3 - education age	2.10	10.93	2.70	2.68
	Primary education	2.10	13.54	2.88	2.92
	Lower secondary education	2.10	15.08	2.98	2.92
	Upper secondary education	2.50	16.35	3.44	3.45
Single mother, 1 child:	**0**	1.30	2.57	1.39	1.41
	1-2	1.30	3.57	1.45	1.41
	3 - education age	1.30	5.54	1.59	1.57
	Primary education	1.30	6.84	1.68	1.69
	Lower secondary education	1.30	7.61	1.73	1.69
	Upper secondary education	1.50	8.25	1.96	1.95
Single mother, 2 children:	**0**	1.60	3.73	1.77	1.82
	1-2	1.60	5.99	1.90	1.82
	3 - education age	1.60	9.93	2.17	2.14
	Primary education	1.60	12.54	2.35	2.37
	Lower secondary education	1.60	14.08	2.45	2.37
	Upper secondary education	2.00	15.35	2.91	2.90

Note: Household types with children in lower secondary education level include only children below 14 years of age. The age group 18-24 years includes only persons above secondary education age.

Table 5 displays the EU, NC, NA and SNA scales by household types when including all four public services in the definition of extended income. While the EU scale takes into consideration economies of scale and give different weights to children and adults in the household, the NC scale shows the estimated needs for public welfare services within the household. The NA scale accounts for the needs of childcare, education, health care and long-term care as well as for the needs of cash income. Thus the NC scale and the NA scale are relatively high for households with elderly people or with children. Furthermore, the SNA scale is an approximation of the NA scale that can be easily applied by scholars interested in examining the distribution of extended income when services such as childcare, long-term care, health care and/or education are included in the analysis. The SNA scale is computed by using the weights for age groups that are reported in the last column of Table 4.

3.5. Income definitions

We consider four different combinations of income definitions and equivalence scales in this study. First, we use the standard approach combining cash income and the EU equivalence scale. Furthermore, extended income is combined with three different equivalence scales. For the sake of comparison the EU scale is used in combination with extended income, since many studies have used the cash income equivalence scale also for making comparisons across heterogeneous households in the analysis of extended income. However, using the extended income in combination with the NA scale has a more convincing theoretical justification. Thus, we provide empirical evidence on the potential bias in inequality and poverty estimates when using EU scale rather than the NA scale for analysing the distribution of extended income. Finally, we include the combination of extended income with the SNA scale as a test of the sensitivity of the empirical results by replacing the NA scale with the SNA scale. Table 6 displays the different combinations of income definitions and equivalence scales used in this study.

Table 6: Definitions of equivalent income

Income definition	Equivalence scale	Equivalent income definition
Cash income	EU scale	Cash income (EU)
Extended income	EU scale	Extended income (EU)
Extended income	NA scale	Extended income (NA)
Extended income	SNA scale	Extended income (SNA)

The EU-SILC variable disposable income (HY020) is used as a measure of cash income.[16] The disposable income variable is defined by the sum of earnings, self-employment income, capital income, public cash transfers, imputed rent and subtracted income taxes. Note that this variable also includes non-cash components, such as non-cash employee income, imputed rent[17] and value of home produced goods for household consumption. Table 7 presents country-specific relative distributions of extended income by income components. The results show that while cash income is by far the most important income component in all countries, there are significant differences in relative cash income. Note also that health insurance and education account for a major share of in-kind transfers from the government to the households.

[16] Disposable income in national currency is defined by HY020 (disposable income in Euros) * HX010 (Exchange rate) * HY025 (Inflation factor)

[17] Imputed rent is defined as the value of owning your dwelling or having access to below-market or free-of-rent dwelling, and is estimated as the market rent.

Table 7: Mean extended income shares by income components and country. Percent, 2009

Country	Cash income	ECEC	Education	Health care	Long-term care
Austria	77.4	0.8	7.5	12.4	1.9
Belgium	76.4	2.0	7.1	11.7	2.8
Czech Republic	77.8	1.1	7.0	13.6	0.6
Denmark	72.4	3.3	8.5	12.2	3.7
Estonia	78.0	1.0	9.1	11.3	0.5
Finland	77.7	2.3	7.0	9.8	3.2
France	76.6	2.1	6.6	12.3	2.5
Germany	78.4	1.0	5.9	13.5	1.2
Greece	79.6	0.3	6.4	13.2	0.5
Hungary	77.5	1.9	8.4	11.7	0.6
Iceland	76.0	2.2	9.6	10.1	2.2
Ireland	73.2	0.7	11.6	13.3	1.2
Italy	77.0	1.6	7.5	12.1	1.8
Luxembourg	72.7	1.4	9.2	16.5	0.1
Netherlands	72.9	1.6	8.0	12.2	5.2
Norway	74.6	2.2	10.0	9.8	3.4
Poland	78.9	1.1	8.1	11.0	0.9
Portugal	75.7	0.9	8.0	15.1	0.3
Slovakia	77.4	1.1	7.1	14.3	0.1
Slovenia	79.4	1.2	7.7	10.1	1.6
Spain	74.5	1.4	7.5	15.0	1.6
Sweden	72.5	3.1	7.4	12.1	4.9
UK	75.5	2.3	8.4	12.5	1.3

Source: EU-SILC, OECD.

3.6. Measuring inequality and poverty

This section discusses and presents the methods for measuring inequality and poverty. Moreover, the relationship between needs and income is explored.

Inequality

Empirical analyses of inequality in income distributions are normally based on the Lorenz curve. To summarise the information content of the Lorenz curve and to achieve rankings of intersecting Lorenz curves the standard approach is to employ the Gini coefficient, which is equal to twice the area between the Lorenz curve and its equality reference. However, since a single measure of inequality cannot capture all aspects of the inequality exhibited by a Lorenz curve, we supplement the information provided by the Gini coefficient by applying two closely related measures of inequality discussed by Aaberge (2007). Together with the Gini coefficient these two measures form Gini's Nuclear Family of inequality measures. Whilst it can be shown that the Gini coefficient normally pays particular attention to changes that occur in the middle part of the income distribution, the two alternative measures of inequality are shown to be particular sensitive to changes that occur in the lower part and the upper parts of the income distribution, respectively. This sensitivity test ensures that a broader understanding of the distribution of income is acquired.[18] For inequality estimates based on the two alternative inequality measures, see Appendix B.

[18] See Aaberge (2007) for further details.

At-risk-of-poverty

In most studies of poverty in developed countries, an understanding of poverty or at-risk-of-poverty as a relative phenomenon is usually applied. This perspective is based on the fact that people compare their material situation with other citizens. They consequently adjust their expectations and demands for material well-being relative to the people in the same society. This paper follows such reasoning and applies a relative poverty threshold to measure whether people are at-risk-of poverty or not. According to the EU method, 60 percent of the median equivalent income is the at-risk-of-poverty line, see Atkinson et al. (2002). Each country has its own poverty line. As an aggregate measure of the at-risk-of poverty in different countries we use the head-count ratio defined by the share of *individuals* who live in a household with income below the poverty line.

Correlations between incomes and needs

To analyse the relationship between needs and income a needs index is used. We define the *needs index* by the NC scale divided by the number of household members for different household types. The needs index provides information on the needs per person for public services in households of different size and composition. Thus, the needs index shows how much non-cash income each individual needs to be equally well off as the reference individual, where the non-cash income need for the reference person is normalised to 1. The resulting needs index shows that the highest needs for non-cash income are found among the elderly above 75 years of age and families with children in secondary school age. To shed light on the relationship between needs and income, we provide estimates of the Spearman's ρ and Pearson's r. While Pearson's r measures the linear relationship between two variables, Spearman's ρ measures the monotonic relationship. A perfect monotonic association gives a ρ equal to 1. Spearman's ρ is based on the ranks of the variables and is thus less sensitive to outliers than r.

Household weights

When estimating the Gini coefficient and other measures of inequality in a heterogeneous population, there are different methods for weighting different household types. The standard approach, favoured for instance by Shorrocks (2004), assigns a weight given by household size (number of household members) to each household. This means that the unit of analysis is given by individuals, and the Lorenz curve is defined over the population of individuals and equivalent incomes assigned to individuals. An alternative method is proposed by Ebert (1997) where household needs as measured by the equivalence scale are used to weight the households. This means that the unit of analysis is given by "equivalent adults". Ebert and Moyes (2003) and Shorrocks (2004) argue that the two weighting methods are supported by different ethical principles. In this paper we follow the standard approach weighting households by their size which means that individuals are treated as the unit of analysis. For a comparison with results based on households weighted by their needs, we refer to Aaberge et al. (2013).

In this paper statistics on income distribution are generally calculated on the basis of equivalent incomes allocated to individuals, using cross-sectional sampling weights available in the EU-SILC data set. The purpose of weighting is to reduce biases in the estimation in order to draw inference from the EU-SILC sample to the whole population. For obtaining population estimates, respondents are given weights which are inversely proportional to the probability of being selected. Moreover, the sample weights are adjusted to counterbalance non-response. However, we do not have full information on how these weights are constructed in each country, because the national statistical institutions are not obliged to provide full details.

4. Empirical results

This section examines the impact on income inequality and poverty estimates of accounting for non-cash income from public services, while accounting for differences in needs for such services across individuals and households.

Income inequality

Table 8 shows that cash income inequality is low in Slovenia, Sweden and Norway and high in Estonia, Greece, Italy, Poland, Portugal, Spain and UK – the Gini coefficient shows a difference of around ten percentage points. By replacing cash income (EU) with extended income (EU), the estimates of inequality become significantly smaller in all countries. When extended income (NA) is used as income definition, however, the inequality is slightly higher than when extended income (EU) is used. Hence, some of the equalising effect of public services is offset when we adjust for needs for public services. Table 8 shows that the SNA scale produces estimates that are rather close to the estimates based on the NA scale. Note that the 2008 financial crisis does not appear to have had an unambiguous short run effect on income inequality in European countries, since inequality increases or is unchanged in some countries whereas it decreases in other countries.

Table 8: Gini-coefficient for the distribution of income by income definition and country

Country	Cash income (EU)		Extended income (EU)		Extended income (NA)		Extended income (SNA)	
	2006	2009	2006	2009	2006	2009	2006	2009
Austria	0.261	0.260	0.207	0.207	0.213	0.211	0.214	0.212
Belgium	0.262	0.261	0.208	0.206	0.213	0.210	0.213	0.210
Czech Republic	0.252	0.248	0.196	0.193	0.208	0.205	0.209	0.205
Denmark	0.240	0.248	0.186	0.191	0.184	0.191	0.185	0.193
Estonia	0.328	0.312	0.271	0.257	0.283	0.264	0.282	0.263
Finland	0.259	0.252	0.209	0.204	0.213	0.206	0.214	0.207
France	-	0.295	-	0.238	-	0.241	-	0.241
Germany	0.298	0.289	0.244	0.234	0.254	0.243	0.254	0.244
Greece	0.343	0.328	0.281	0.273	0.289	0.281	0.290	0.281
Hungary	0.255	0.240	0.199	0.191	0.203	0.196	0.203	0.196
Iceland	0.278	0.255	0.218	0.202	0.221	0.206	0.222	0.207
Ireland	0.313	0.328	0.243	0.247	0.257	0.261	0.257	0.261
Italy	0.321	0.310	0.255	0.247	0.264	0.258	0.265	0.258
Luxembourg	0.274	0.277	0.217	0.210	0.218	0.215	0.219	0.215
Netherlands	0.271	0.252	0.207	0.193	0.213	0.196	0.214	0.197
Norway	0.232	0.228	0.178	0.175	0.180	0.177	0.182	0.179
Poland	0.320	0.311	0.261	0.255	0.269	0.265	0.269	0.265
Portugal	0.366	0.335	0.290	0.263	0.298	0.272	0.298	0.273
Slovakia	0.246	0.260	0.188	0.202	0.204	0.218	0.204	0.218
Slovenia	0.226	0.238	0.187	0.198	0.188	0.198	0.188	0.198
Spain	0.312	0.332	0.248	0.261	0.259	0.269	0.259	0.270
Sweden	0.232	0.238	0.170	0.181	0.173	0.181	0.174	0.182
UK	0.328	0.328	0.263	0.258	0.276	0.266	0.277	0.267

Note: France is treated as missing in 2006 due to a break in time series.

At-risk-of-poverty

Table 9 displays the at-risk-of-poverty rates in European countries, according to four different income definitions in 2006 and 2009. A person is defined as at-risk-of-poverty if he or she has lower income than 60 percent of the median income. By replacing cash income (EU) with extended income (EU), the estimated number of people who is at-risk-of-poverty is significantly reduced. Furthermore, when we adjust extended income by the NA scale, the results show an even lower at-risk-of-poverty rate in most countries, where Spain and the Slovak Republic make exceptions.

We find that poverty estimates based on extended income measure do not change much when the NA scale is replaced by the SNA scale. Moreover, the ranking of countries by the poverty headcount is rather insensitive to changes in the income measure. For all definitions Czech Republic, Iceland and Netherlands are found to have a low poverty rate, while Estonia, Greece, Italy, Poland, Portugal, Spain and the UK have relatively high poverty rates. Most countries experience a rise in poverty from 2006 to 2009, irrespective of the income definition that is used.

Table 9: At-risk-of-poverty by income definition and country. Percent

Country	Cash income (EU)		Extended income (EU)		Extended income (NA)		Extended income (SNA)	
	2006	2009	2006	2009	2006	2009	2006	2009
Austria	11.8	11.9	7.5	7.2	5.6	5.3	5.7	5.4
Belgium	15.1	14.6	9.0	9.7	7.3	7.4	7.4	7.3
Czech Republic	9.5	8.9	5.0	5.1	4.8	4.8	4.8	4.7
Denmark	10.5	12.4	8.1	9.4	5.2	6.8	5.2	6.8
Estonia	19.6	15.7	14.5	12.1	14.1	11.1	14.3	11.1
Finland	12.5	12.8	8.8	9.2	5.9	6.6	5.8	6.5
France	-	12.8	-	7.5	-	6.5	-	6.6
Germany	14.7	15.5	10.6	10.6	9.3	8.8	9.2	8.8
Greece	20.5	20.0	12.7	13.1	12.5	13.1	12.4	13.2
Hungary	12.2	12.1	7.2	6.4	5.6	5.0	5.6	5.0
Iceland	9.5	9.0	6.2	6.7	3.7	5.0	3.6	5.1
Ireland	16.5	15.2	9.2	9.6	7.0	6.6	7.1	6.4
Italy	19.7	18.1	11.6	11.4	11.5	11.0	11.5	11.1
Luxembourg	13.4	14.5	8.2	8.5	5.9	6.2	6.0	6.3
Netherlands	9.8	9.6	6.2	6.6	4.2	4.3	4.2	4.3
Norway	11.2	10.0	8.4	7.4	6.6	5.2	6.5	5.1
Poland	17.3	17.4	11.4	11.4	10.3	10.9	10.4	10.7
Portugal	18.2	18.0	10.0	9.3	9.4	9.3	9.4	9.3
Slovakia	10.5	12.0	5.3	7.1	5.9	7.6	6.0	7.5
Slovenia	10.8	12.7	7.7	9.2	6.2	7.8	6.1	7.7
Spain	19.7	20.6	11.2	12.8	11.8	12.8	11.7	12.6
Sweden	10.1	12.5	7.5	8.9	5.3	6.4	5.4	6.5
UK	18.8	17.1	11.3	11.3	10.6	9.3	10.6	9.4

Note: France is treated as missing in 2006 due to a break in time series.

Tables 10, 11 and 12 display estimated poverty rates for individuals belonging to different household types according to three different income definitions. For cash income adjusted by EU scale Table 10 shows that the poverty rates in most countries are rather high for single adults. This is the case for all age groups and in particular for single adults with children.

By comparing Table 11 with Table 10 we find that poverty estimates based on extended income (EU scale) for childless adults below 65 years are higher in most countries compared to poverty estimates based on a cash income measure (EU scale). By contrast, poverty estimates are lower for households with children and for households with elderly 75 years and above when using the extended income measure. Thus, the cash income measure provides a relatively high estimate of poverty for households who receive extensive public services.

Table 10: At-risk-of-poverty for cash income measure (EU scale) by household type and country. Percent, 2009

	Household type									
Age of adults	**18-64**		**18-64**		**65-74**		**75+**		**18+**	
Number of adults	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**3+**	**3+**
Children	**No**	**No**	**Yes**	**Yes**	**No**	**No**	**No**	**No**	**No**	**Yes**
Austria	18.5	7.3	28.0	10.4	24.7	7.2	22.7	16.3	3.9	12.7
Belgium	17.7	10.4	37.3	14.9	17.5	19.9	22.8	26.3	8.2	17.3
Czech Republic	16.9	4.0	45.1	9.6	19.6	0.0	18.8	0.5	2.8	9.5
Denmark	15.4	3.5	17.1	6.1	20.1	9.5	29.7	33.6	3.4	7.6
Estonia	33.0	14.1	52.0	18.4	30.3	0.5	27.3	0.0	11.6	20.5
Finland	28.4	7.4	27.7	9.1	30.8	4.3	40.9	8.5	7.7	13.1
France	14.3	6.4	38.9	12.7	11.9	3.8	16.8	10.3	8.3	20.6
Germany	27.1	9.5	43.4	11.7	23.0	9.4	15.8	7.7	5.2	11.6
Greece	21.7	21.0	30.0	25.5	25.7	14.4	35.7	27.8	15.0	33.2
Hungary	17.6	9.8	29.4	17.9	9.8	2.5	6.2	1.4	6.0	23.0
Iceland	20.3	4.7	31.8	10.5	5.5	0.9	21.6	0.0	2.3	2.8
Ireland	31.2	12.1	30.9	15.3	9.6	5.8	12.6	6.7	6.3	16.1
Italy	19.4	11.8	37.4	19.4	29.8	8.5	25.9	12.7	10.2	24.8
Luxembourg	19.2	7.9	49.0	22.0	6.9	3.4	8.1	2.7	11.2	27.2
Netherlands	7.6	3.1	19.9	5.4	5.3	2.4	5.1	3.3	2.3	6.4
Norway	18.1	3.1	33.2	5.4	18.0	0.8	35.3	0.8	3.3	7.1
Poland	30.4	14.1	42.5	25.4	27.9	7.8	18.5	3.5	13.5	25.7
Portugal	25.6	17.5	51.0	21.0	28.6	13.7	38.7	29.8	10.7	25.1
Slovakia	20.7	7.2	36.3	17.1	13.3	1.8	16.2	1.6	4.7	19.2
Slovenia	36.6	9.2	46.7	10.9	43.7	8.0	50.2	10.9	5.2	7.4
Spain	23.9	15.1	48.3	27.7	25.9	23.3	30.9	29.4	14.5	30.1
Sweden	21.0	6.6	39.3	8.3	28.8	4.3	34.8	9.9	5.1	13.5
UK	26.9	11.7	34.3	15.7	27.5	20.6	30.7	24.3	10.3	19.4

Table 11: At-risk-of-poverty for extended income measure (EU scale) by household type and country. Percent, 2009

	Household type									
Age of adults	**18-64**		**18-64**		**65-74**		**75+**		**18+**	
Number of adults	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**3+**	**3+**
Children	**No**	**No**	**Yes**	**Yes**	**No**	**No**	**No**	**No**	**No**	**Yes**
Austria	24.0	8.5	5.3	3.0	19.8	1.4	1.1	0.0	3.0	1.8
Belgium	28.6	12.7	7.6	5.0	10.8	4.3	1.9	0.0	9.3	8.7
Czech Republic	21.6	4.6	13.0	3.0	7.1	0.0	1.1	0.0	2.1	2.1
Denmark	25.0	4.8	2.4	1.9	19.2	1.4	1.2	0.0	3.1	4.1
Estonia	42.1	15.0	5.5	4.9	46.2	0.5	25.8	0.0	8.3	3.9
Finland	36.7	9.7	3.7	2.9	32.5	1.7	0.3	0.0	5.8	1.5
France	20.2	7.8	5.4	2.9	10.0	1.3	1.7	0.5	8.3	5.9
Germany	31.7	10.3	11.8	3.2	19.3	3.3	2.7	0.4	3.8	2.4
Greece	25.5	23.1	9.2	12.4	20.7	2.5	18.9	0.7	14.0	13.1
Hungary	21.2	11.0	2.6	3.2	6.6	1.0	2.3	0.0	7.2	6.2
Iceland	34.4	6.8	11.1	3.1	5.5	0.9	0.0	0.0	2.4	0.0
Ireland	47.0	15.5	5.1	4.7	8.1	3.7	5.6	3.3	7.7	2.3
Italy	22.8	13.2	18.4	6.9	27.0	4.0	7.1	1.5	9.4	12.3
Luxembourg	27.9	9.6	3.8	4.9	3.1	1.1	1.9	0.0	10.5	7.6
Netherlands	15.8	4.3	3.1	1.2	2.2	0.2	0.2	0.0	2.7	2.0
Norway	30.5	4.9	6.6	1.9	13.2	0.4	0.0	0.0	4.2	1.7
Poland	36.2	14.4	7.1	8.0	26.8	0.9	13.2	0.4	12.2	9.8
Portugal	29.5	18.6	4.4	4.7	26.5	2.2	17.4	0.9	10.2	8.8
Slovakia	20.2	7.1	11.4	4.9	4.1	0.0	4.5	1.6	4.0	9.4
Slovenia	46.5	11.7	5.4	2.3	43.3	4.8	25.7	1.4	5.0	2.6
Spain	27.4	16.0	15.2	12.0	13.2	4.8	7.3	0.6	12.6	16.1
Sweden	32.6	10.2	7.8	3.0	27.2	1.8	0.0	0.0	5.0	4.1
UK	38.0	17.3	4.7	4.7	22.7	9.2	2.1	0.0	11.1	9.3

Table 12: At-risk-of-poverty for extended income measure (NA scale) by household type and country. Percent, 2009

	Household type									
Age of adults	**18-64**		**18-64**		**65-74**		**75+**		**18+**	
Number of adults	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**3+**	**3+**
Children	**No**	**No**	**Yes**	**Yes**	**No**	**No**	**No**	**No**	**No**	**Yes**
Austria	14.7	5.4	8.6	3.2	10.1	1.8	2.2	0.0	1.2	4.2
Belgium	14.0	7.7	11.5	7.9	5.7	4.3	2.1	0.6	6.5	8.8
Czech Republic	9.2	2.5	20.3	4.7	2.8	0.0	6.7	0.0	1.5	3.9
Denmark	13.4	3.0	3.4	2.1	7.5	1.1	1.2	0.0	2.4	4.4
Estonia	30.0	10.9	12.3	5.9	24.7	0.5	56.2	0.0	7.2	6.1
Finland	24.9	5.4	7.6	4.5	15.6	1.1	0.5	0.0	5.1	4.0
France	11.6	4.4	11.5	4.9	6.8	1.3	3.8	0.8	6.1	6.9
Germany	22.8	6.6	17.6	4.7	12.8	3.1	5.2	0.4	2.4	3.3
Greece	17.6	16.8	20.8	15.0	16.6	2.5	29.5	8.0	11.4	16.9
Hungary	13.4	7.3	5.0	4.2	3.7	1.0	4.4	0.0	4.2	5.8
Iceland	16.0	4.7	16.4	4.3	1.4	0.0	1.0	0.0	2.0	1.1
Ireland	20.6	8.4	5.3	6.0	6.1	3.2	5.8	5.6	3.4	2.0
Italy	17.1	8.9	23.0	8.7	19.2	3.9	19.2	4.4	7.1	14.3
Luxembourg	15.9	5.1	6.0	5.6	3.1	1.1	2.5	0.0	6.2	7.2
Netherlands	6.3	2.1	4.6	1.6	2.2	0.2	0.2	0.0	1.0	2.5
Norway	17.6	2.4	9.3	2.6	4.2	0.4	0.0	0.0	2.3	1.2
Poland	25.7	10.2	15.6	11.5	20.4	0.9	22.7	3.5	9.6	13.0
Portugal	20.6	14.3	9.0	6.9	20.9	2.5	28.2	3.0	7.2	12.7
Slovakia	13.2	5.2	25.5	8.6	2.0	0.0	13.8	1.6	3.1	11.8
Slovenia	31.4	6.9	8.9	3.0	34.3	4.8	41.0	7.6	3.2	3.5
Spain	20.4	12.8	27.1	15.5	10.4	5.6	13.2	5.8	10.1	19.6
Sweden	19.2	5.7	16.9	3.4	8.2	1.6	0.0	0.0	2.8	5.8
UK	26.5	11.6	8.6	6.2	15.6	9.2	3.4	0.0	7.2	9.3

Table 12 displays poverty estimates based on extended income adjusted by the NA scale. Replacing the EU scale with the NA scale for adjusting extended income does only have a minor effect on the overall poverty estimates for most countries. However, by disaggregating the overall poverty estimates by household type Tables 11 and 12 show that poverty estimates based on extended income are significantly overestimated for childless single adults below 75 years when the EU scale is used as a method for needs adjustment. However, for single adults with children we find that poverty is underestimated when using the EU scale rather than the NA scale. This type of counteracting effects for subgroups explain why the overall poverty estimates are less sensitive to whether we use the EU scale or the NA scale.

By comparing Tables 10 and 12 we find that poverty estimates for households with children and elderly households are significantly overestimated by not taking into account the distribution of public services. In most countries the overestimation of poverty based on cash income measure is rather large for single adults with children and for elderly single adults. By comparing Table 12 and Table B.2 in Appendix B we find that the SNA scale provides an appropriate approximation of the NA scale even when we consider poverty of households by types.

Needs and income

The needs index is defined by the NC scale divided by household size, and is a measure of a household's relative needs for public services. A high needs index implies that the household has high needs for public services. Table 13 reports the estimates of two correlation coefficients for different countries. Spearman's ρ and Pearson's r are used to measure the association between different income measures and the needs index. The results show that there is a negative association between an individual's needs and her/his position in the income distribution, independent of whether income is defined by cash income or extended income. Thus, a main feature of European income data is that higher needs for public services corresponds to lower income. The negative correlation is relatively strong for the Czech Republic and Slovakia. In most countries the negative correlation is stronger for cash income than for extended income.

Table 13: Correlations between income measures and needs index by country, 2009

	Cash income (EU)		Extended income (NA)	
	Pearson's r	Spearman's rho	Pearson's r	Spearman's rho
Austria	-0.14	-0.20	-0.13	-0.16
Belgium	-0.17	-0.21	-0.15	-0.16
Czech Republic	-0.22	-0.33	-0.24	-0.34
Denmark	-0.17	-0.27	-0.11	-0.21
Estonia	-0.22	-0.22	-0.23	-0.20
Finland	-0.15	-0.22	-0.13	-0.18
France	-0.05	-0.11	-0.08	-0.13
Germany	-0.12	-0.18	-0.14	-0.19
Greece	-0.14	-0.17	-0.18	-0.19
Hungary	-0.14	-0.15	-0.16	-0.15
Iceland	-0.11	-0.18	-0.11	-0.16
Ireland	-0.23	-0.29	-0.22	-0.22
Italy	-0.14	-0.20	-0.18	-0.22
Luxembourg	-0.12	-0.17	-0.11	-0.11
Netherlands	-0.17	-0.24	-0.10	-0.15
Norway	-0.20	-0.29	-0.12	-0.17
Poland	-0.14	-0.16	-0.17	-0.17
Portugal	-0.16	-0.23	-0.18	-0.22
Slovakia	-0.20	-0.29	-0.24	-0.35
Slovenia	-0.11	-0.12	-0.14	-0.13
Spain	-0.16	-0.18	-0.17	-0.17
Sweden	-0.19	-0.28	-0.09	-0.14
UK	-0.17	-0.26	-0.16	-0.20

Overlap between poverty and material deprivation

The material deprivation rate is an indicator in EU-SILC that expresses the inability to afford some items considered by most people to be desirable or even necessary to provide an adequate life, see Guio et al. (2012). The indicator adopted by the Social protection committee measures the percentage of the population that cannot afford at least three of nine specified items. According to the EU definition material deprivation refers to a state of economic strain and durables strain, defined as the enforced inability (rather than the choice not to do so) to pay unexpected expenses, afford a one-week annual holiday away from home, a meal involving meat, chicken or fish every second day, the adequate heating of a dwelling, durable goods like a washing machine, colour television, telephone or car, being confronted with payment arrears (mortgage or rent, utility bills, hire purchase instalments or other loan payments).

As a concept, material deprivation is close to the concept of poverty, but differs in the way lack of resources is defined and measured. Whereas the relative poverty measures in this study identify the poor as those who have less than 60 percent of the median income, the materially deprived are identified as those who report themselves as not being able to afford some specific items.

The at-risk-of-poverty definition (cash and extended) is objective, in the sense that it is derived from measurement of income. By contrast, the measure of material deprivation is based on respondent's reporting a perceived lack of items, and whether they believe a lack of important societal items is due to a lack of resources or due to other reasons.

Since the items included in the material deprivation rate are the same for all European countries, it does not take into account that living standards differ substantially across countries. Different living standards means that the items that are customary or necessary for a citizen "to appear in public without shame", may differ across countries. The EU-SILC implementation of material deprivation is absolute in its emphasis on people's access to items. It is expected that the access to for instance a telephone increases when the general affluence in a society increases. The implementation does not take into account the fact that norms for what is a minimum of resources required to enable societal participation are different from country to country, and dependent on the countries' level of economic development. On the other hand, measures of financial poverty in developed countries are normally defined relative to the general living standard (60 per cent of the median equivalent income). Thus, when the average level of living differs significantly between countries, comparisons of estimates based on relative and absolute measures of poverty and deprivation should be viewed with some caution.

Table 14: Overlap between material deprivation and persons at-risk-of-poverty by income definition and country. Percent, 2009

	Incidence of poverty and material deprivation by combination							
Cash income (EU) poverty	**Yes**	**Yes**	**Yes**	**No**	**Yes**	**No**	**No**	**No**
Extended income (NA) poverty	**Yes**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**No**
Material deprivation	**Yes**	**No**	**Yes**	**Yes**	**No**	**No**	**Yes**	**No**
Austria	2.5	2.8	2.3	0.0	4.3	0.0	5.8	82.3
Belgium	3.3	4.0	2.5	0.0	4.7	0.0	6.6	78.7
Czech Republic	2.9	1.9	1.8	0.0	2.4	0.0	10.6	80.4
Denmark	1.3	5.3	1.0	0.1	4.8	0.1	3.6	83.9
Estonia	5.3	4.6	3.4	0.4	2.5	0.9	13.6	69.5
Finland	2.2	4.1	1.3	0.0	5.1	0.3	4.7	82.3
France	3.0	3.6	2.3	0.0	4.0	0.0	7.4	79.7
Germany	4.1	4.7	2.1	0.0	4.7	0.0	4.9	79.6
Greece	8.1	5.0	3.7	0.0	3.3	0.0	12.1	67.8
Hungary	3.8	1.0	6.0	0.1	1.2	0.1	30.5	57.3
Iceland	0.9	4.1	0.6	0.0	3.4	0.0	4.9	86.1
Ireland	2.0	4.6	3.1	0.0	5.5	0.0	14.4	70.4
Italy	4.7	6.3	2.5	0.0	4.6	0.0	8.9	73.0
Luxembourg	1.3	4.9	0.8	0.0	7.5	0.0	1.9	83.6
Netherlands	1.1	3.2	1.5	0.0	3.8	0.0	4.5	85.8
Norway	1.5	3.4	0.8	0.1	4.3	0.2	2.8	86.9
Poland	6.4	4.3	3.8	0.1	3.0	0.1	18.6	63.7
Portugal	4.5	4.8	4.0	0.0	4.7	0.0	14.4	67.6
Slovakia	4.9	2.5	2.4	0.0	2.1	0.0	18.0	70.0
Slovenia	3.5	4.3	1.9	0.0	3.0	0.0	11.0	76.2
Spain	3.9	8.8	2.1	0.0	5.6	0.0	7.5	71.9
Sweden	1.0	5.3	0.9	0.0	5.2	0.1	1.9	85.5
UK	2.6	6.5	2.1	0.2	5.9	0.1	8.3	74.4

Note: Students are omitted from the population.

Table 14 displays a breakdown of the population into groups with different types of overlap between material deprivation and poverty measures based on cash income (EU scale) or extended income (NA scale). Note that the total rate of material deprivation can be calculated by adding figures in columns number one, three, four and seven in Table 14.

Besides people who is neither poor nor deprived, the results show that most people are defined as poor under both income definitions and deprived (first column), poor under both income definitions but not deprived (second column), only poor under cash income definition and not deprived (fifth column), or only deprived (seventh column). The table also shows significant differences between countries. The group which is deprived but not poor is relatively large in Hungary, Ireland, Poland, Portugal and Slovakia, whereas this group constitutes small proportions in wealthy nations like the Nordic countries, Germany, Luxembourg and the Netherlands. In this respect, then, there are systematic differences between richer and poorer countries that may reflect the difference between the use of relative poverty measures and a measure of material deprivation which focuses more on absolute needs.

5. Conclusion

This study analyses the distributional impact of public welfare services in 23 European countries by using an equivalence scale that accounts for differences in needs of public services; i.e. the scale accounts for the fact that different public services are associated with needs profiles that differ from the profile exhibited by the EU scale for cash income. Thus, the commonly used equivalence scales should be adjusted to make extended incomes comparable across household types.

The most common income definitions for analysing income inequality and poverty are disposable cash income and extended income, normally adjusted by the EU scale. However, both income definitions prove to be biased as measures of economic living standards in a community where the welfare state provides substantial transfers in-kind to the households. These biases arise due to the fact that cash income is obtained by subtracting taxes used to finance public welfare services but without including the value of received services, while using the EU scale equates needs for public services and needs for cash income. A major aim of this study is to account for economies of scale in private consumption as well as for heterogeneity in needs for publicly funded services by using a theoretically justified needs-adjusted equivalence scale (NA scale). The NA scale reflects the fact that elderly have relatively high needs for health care and long-term care and children for childcare and education.

The empirical analysis shows how inequality and poverty estimates differ when using the NA scale rather than the EU scale for adjusting extended income by needs. Even though the ranking of countries by estimates of overall inequality and poverty is only slightly affected by the choice between the EU scale and the NA scale, poverty estimates by household types are shown to be significantly affected by the choice of equivalence scale. Reliable information of the origin of income inequality and poverty is however crucial for the design of welfare and tax systems in European countries.

The empirical results show that households with single adults below 65 years (with or without children) are exposed to a relatively high risk of poverty when needs for public services are accounted for. Elderly couples 65 years and above are at low risk of poverty in most European countries. For elderly single adults 65 years and above the risk of poverty varies considerably between European countries, depending on the level of public cash and in-kind transfers to the elderly.

6. References

Aaberge, R. (2007): "Gini's Nuclear Family", Journal of Economic Inequality, 5, 305-322.

Aaberge, R., Bhuller, M., Langørgen, A., Mogstad, M. (2010a): "The Distributional Impact of Public Services when Needs differ", Journal of Public Economics, 94, 549-562.

Aaberge, R., Langørgen, A. (2006): "Measuring the Benefits from Public Services: the Effects of Local Government Spending on the Distribution of Income in Norway", Review of Income and Wealth, 52, 61-83.

Aaberge, R., Langørgen, A., Lindgren, P. (2010b): "The Impact of Basic Public Services on the Distribution of Income in European Countries", In Atkinson, A. B. and E. Marlier (eds.): Income and Living Conditions in Europe. Eurostat, Luxembourg.

Aaberge, R., Langørgen, A., Lindgren, P. (2013): Equivalence Scales and the Distributional Impact of Public Services, Mimeo.

Antoninis, M., Tsakloglou, P. (2001): "Who Benefits from Public Education in Greece? Evidence and Policy Implications", Education Economics, 9, 197-222.

Atkinson, A. (1970): "On the Measurement of Inequality", Journal of Economic Theory, 2, 244-263.

Atkinson, A, Cantillon, B., Marlier, E., Nolan, B. (2002): Social Indicators: The EU and Social Inclusion. Oxford University Press. Oxford.

Blackorby, C., Donaldson, D., 1993. Adult-equivalence Scales and the Economic Implementation of Interpersonal Comparisons of Well-Being. Social Choice and Welfare, 10, 335–361.

Blundell, R. and Lewbel, A. (1991): "The Information Content of Equivalence Scales", Journal of Econometrics, 50, 49-68.

Callan, T., Keane, C. (2009): "Non-Cash Benefits and the Distribution of Economic Welfare", The Economic and Social Review, 32, 49-71.

Callan, T., Smeeding, T., Tsakloglou, P. (2008): "Short-Run Distributional Effects of Public Education Transfers to Students in seven European Countries", Education Economics, 16, 275-288.

Coulter, F.A.E., Cowell, F.A., Jenkins, S.P. (1992): "Differences in Needs and Assessment of Income Distributions", Bulletin of Economic Research, 44, 77-123.

Ebert, U. (1997): "Social Welfare when Needs Differ: An Axiomatic Approach", Economica, 64, 233-244.

Ebert, U. and Moyes, P. (2003): "Equivalence Scales Reconsidered", Econometrica, 71, 319-343.

European Commission (2010): "The 2009 Ageing Report: economic and budgetary projections for the EU-27 Member States (2008-2060)", European Economy series. Available at: http://ec.europa.eu/economy_finance/publications/publication14992_en.pdf.

Evandrou, M., Falkingham, J., Hills, J., Le Grand, J., (1993): "Welfare Benefits In Kind and Income Distribution", Fiscal Studies 14, 57–76.

Garfinkel, I., Rainwater, L., Smeeding, T. (2006): "A Re-Examination of Welfare States and Inequality in Rich Nations: how In-Kind Transfers and Indirect Taxes Change the Story", Journal of Policy Analysis and Management, 25, 897-919.

Gemmell, N., (1985): "The Incidence of Government Expenditure and Redistribution in the United Kingdom", Economica, 52, 335–344.

Guio, A-C., Gordon, D., Marlier, E. (2012): "Measuring Material Deprivation in the EU. Indicators for the whole Population and Child-Specific Indicators", Eurostat, Luxembourg.

Jones, A., O'Donnell, O., (1995): "Equivalence Scales and the Costs of Disability", Journal of Public Economics 56, 273–289.

Koutsampelas, C. and P. Tsakloglou (2012): "The Distribution of Full Income in Greece", IZA Discussion Papers 6396, Institute for the Study of Labor (IZA).

Lewbel, A. (1989): "Household Equivalence Scales and Welfare Comparisons", Journal of Public Economics, 39, pp. 377-391.

OECD (2011): "The Distributive Impact of Publicly Provided Services", Divided We Stand: Why Inequality keeps rising, OECD Publishing, 309-341.

Oliveira Martins, J., de la Maisonneuve, C., Bjørnerud, S. (2006): "Projections of OECD Health and Long-Term Care Public Expenditures". Available at: http://ssrn.com/abstract=2005171 or http://dx.doi.org/10.2139/ssrn.2005171.

Osier, G., Museux, J-M., Seoane, P., Verma, V. (2006): "Cross-Sectional and Longitudinal Weighting for the EU-SILC Rotational Design", Eurostat.

Paulus, A., Sutherland, H., Tsakloglou, P. (2010): "The Distributional Impact of In Kind Public Benefits in European Countries", Journal of Policy Analysis and Management, 29, 243-266.

Radner, D. (1997): "Noncash Income, Equivalence Scales, and the Measurement of Economic Well-Being", Review of Income and Wealth, 43, 71-88.

Ruggeri, G., Van Wart, D., Howard, R., (1994): "The Redistributional Impact of Government Spending in Canada", Public Finance, 49, 212–243.

Ruggles, P., O'Higgins, M. (1981): "The Distribution of Public Expenditures and Taxes among Households in the United Kingdom", Review of Income and Wealth, 27, 298-326.

Shorrocks, A. (2004): "Inequality and Welfare Evaluation of Heterogeneous Income Distributions", Journal of Economic Inequality, 2, 193-218.

Slesnick, D. (1996): "Consumption and Poverty: How Effective are In-Kind Transfers?" Economic Journal, 106, 1527-1545.

Smeeding, T.M. (1986): "Non-Money Income and the Elderly: the Case of the Tweeners", Journal of Policy Analysis and Management, 5, 707-724.

Smeeding, T.M., Saunders, P., Coder, J., Jenkins, S., Fritzell, J., Hagenaars, A.J.M., Hauser, R., Wolfson, M. (1993): "Poverty, Inequality, and Family Living Standards Impacts across Seven Nations: The Effect of Noncash Subsidies for Health, Education and Housing", Review of Income and Wealth, 39, 229-256.

Vaalavuo, M. (2011): "Towards and Improved Measure of Income Inequality. The Impact of Public Services on Income Distribution – An International Comparison", European University Institute, Doctoral Thesis, Florence.

Verbist, G., Förster, M. and Vaalavuo, M. (2012): "The Impact of Publicly Provided Services on the Distribution of Resources: Review of New Results and Methods", OECD Social, Employment and Migration Working Papers, No. 130, OECD Publishing.

Wolff, P, Montaigne, F., Gonzales, G.R. (2010): "Investing in Statistics: EU-SILC", in Atkinson, A. and E. Marlier (Eds.), Income and Living Conditions in Europe. Eurostat, Luxembourg.

Zaidi, A., Burchardt, T., (2005): "Comparing Incomes when Needs Differ: Equalization for the Extra Costs of Disability in the U.K.", Review of Income and Wealth 51, 89–114.

7. Appendix A: Total value and allocation of public services

While Aaberge et al. (2010b) studied the impact of education and health services only, this study extends the analysis by also including long-term care and ECEC services (Early Childhood Education and Care). Moreover, 6 additional countries are studied, including large countries such as Italy and the UK, while the other new countries are Greece, Iceland, Ireland and Slovenia. Public expenditure on the four different welfare services are reported by OECD in the Education Database, The Family Database and the System of Health Accounts.

Table A.1: Public spending on welfare services, in percent of GDP, 2009

Country	ECEC			Education				Health	Long-term care			Total
	Child-care	Pre-school	Sum	1	L2	U2	Sum	Health Care	Health	Social	Sum	Sum
Austria	0.3	0.0	0.3	1.0	1.4	1.4	3.9	6.9	1.2	0.0	1.2	12.3
Belgium	0.2	0.6	0.8	1.5	0.8	2.1	4.3	6.3	1.9	0.0	1.9	13.3
Czechia	0.1	0.3	0.4	0.7	1.0	1.0	2.7	6.2	0.3	0.0	0.3	9.6
Denmark	0.8	0.5	1.3	2.1	1.2	1.7	5.1	6.9	2.5	0.0	2.5	15.7
Estonia	0.0	0.3	0.3	1.5	1.0	1.4	4.0	5.0	0.2	0.0	0.2	9.5
Finland	0.7	0.2	0.9	1.3	1.2	1.7	4.2	5.7	0.8	1.3	2.1	12.9
France	0.4	0.6	1.0	1.2	1.3	1.4	3.9	7.6	1.1	0.6	1.7	14.1
Germany	0.1	0.3	0.4	0.7	1.3	1.0	3.0	7.8	1.0	0.0	1.0	12.2
Greece	0.1	0.0	0.1	1.2	0.7	0.7	2.6	5.6	0.2	0.0	0.2	8.5
Hungary	0.1	0.5	0.6	0.9	1.0	1.0	2.9	4.7	0.3	0.0	0.3	8.5
Iceland	0.2	0.7	0.9	2.5	1.1	1.4	5.0	6.2	1.7	0.0	1.7	13.8
Ireland	0.3	0.0	0.3	2.3	1.1	1.1	4.5	6.1	0.7	0.0	0.7	11.6
Italy	0.2	0.5	0.6	1.2	0.8	1.2	3.2	6.1	1.1	0.0	1.1	11.0
Luxembourg	0.4	0.0	0.4	1.4	0.9	0.9	3.2	5.8	0.8	0.0	0.9	10.3
Netherlands	0.3	0.4	0.7	1.5	1.3	1.1	3.9	6.8	2.7	1.1	3.7	15.2
Norway	0.7	0.3	1.0	1.9	0.9	1.7	4.5	5.5	2.4	0.0	2.4	13.3
Poland	0.0	0.3	0.3	1.6	0.9	1.0	3.5	4.5	0.4	0.0	0.4	8.6
Portugal	0.0	0.4	0.4	1.6	1.3	1.3	4.2	6.8	0.1	0.0	0.1	11.4
Slovakia	0.1	0.3	0.4	0.8	0.9	1.1	2.7	5.9	0.0	0.0	0.0	9.0
Slovenia	0.0	0.5	0.5	1.6	0.9	1.3	3.8	5.6	0.7	0.2	0.9	10.7
Spain	0.5	0.0	0.5	1.3	1.1	0.8	3.1	6.3	0.7	0.1	0.7	10.6
Sweden	0.6	0.5	1.1	1.7	1.1	1.6	4.4	7.0	0.7	3.0	3.7	16.2
UK	0.4	0.7	1.1	1.8	1.1	1.7	4.6	7.2	1.0	0.0	1.0	13.9

Source: OECD. The OECD data for ECEC expenditure as a hare of GDP refer to the year 2007. The education sector includes 1: Primary education, L2: Lower secondary education and U2: Upper secondary education.

Table A.1 reports the public spending on different services as share of GDP in 2009. The table shows that there are substantial differences in public spending on welfare services among European countries. In Belgium, Denmark, France, Iceland, the Netherlands, Norway, Sweden and the UK, public spending's share of GDP constitute over 13 percent. In Czech Republic, Estonia, Greece, Hungary, Poland and the Slovak Republic, however, public spending counts for less than 10 percent. We also provide the public spending data for 2006 in Table A.2. The data for ECEC expenditure refer to the year 2007. As an approximation we apply 2007 ECEC expenditure shares of GDP to the years of analysis which are 2006 and 2009.

Table A.2: Public spending on welfare services, in percent of GDP, 2006

Country	ECEC			Education				Health	Long-term care			Total
	Child-care	Pre-school	Sum	1	L2	U2	Sum	Health care	Health	Social	Sum	Sum
Austria	0.3	0.0	0.3	1.0	1.3	1.2	3.5	6.4	1.0	0.0	1.0	11.3
Belgium	0.2	0.6	0.8	1.4	0.9	1.6	4.0	5.4	1.6	0.0	1.6	11.8
Czechia	0.1	0.3	0.4	0.6	1.0	1.1	2.7	5.4	0.2	0.0	0.2	8.7
Denmark	0.8	0.5	1.3	1.9	1.1	1.8	4.8	5.9	2.0	0.0	2.0	14.1
Estonia	0.0	0.3	0.3	1.2	0.9	1.2	3.2	3.5	0.1	0.0	0.1	7.1
Finland	0.7	0.2	0.9	1.3	1.1	1.5	3.9	5.1	0.8	1.0	1.8	11.7
France	0.4	0.6	1.0	1.1	1.3	1.3	3.8	7.4	1.1	0.4	1.6	13.7
Germany	0.1	0.3	0.4	0.7	1.3	0.8	2.7	7.0	0.9	0.0	0.9	11.0
Greece	0.1	0.0	0.1	1.2	0.7	0.7	2.6	5.7	0.2	0.0	0.2	8.6
Hungary	0.1	0.5	0.6	1.1	1.1	1.1	3.3	5.3	0.2	0.0	0.2	9.4
Iceland	0.2	0.7	0.9	2.6	1.1	1.4	5.2	5.6	1.8	0.0	1.8	13.5
Ireland	0.3	0.0	0.3	1.6	0.9	0.9	3.3	4.9	0.6	0.0	0.6	9.0
Italy	0.2	0.5	0.6	1.2	0.9	1.3	3.4	5.7	1.0	0.0	1.0	10.7
Luxembourg	0.4	0.0	0.4	1.8	0.8	0.8	3.4	4.5	1.0	0.1	1.1	9.4
Netherlands	0.3	0.4	0.7	1.4	1.2	1.0	3.5	6.1	1.3	2.2	3.4	13.8
Norway	0.7	0.3	1.0	1.7	0.8	1.5	3.9	4.8	1.9	0.0	1.9	11.6
Poland	0.0	0.3	0.3	1.7	0.9	1.1	3.7	3.7	0.4	0.0	0.4	8.1
Portugal	0.0	0.4	0.4	1.5	1.1	1.0	3.6	6.3	0.1	0.0	0.1	10.3
Slovakia	0.1	0.3	0.4	0.5	0.7	0.8	2.0	4.9	0.0	0.2	0.2	7.4
Slovenia	0.0	0.5	0.5	1.4	1.2	1.4	4.0	5.0	0.6	0.2	0.8	10.3
Spain	0.5	0.0	0.5	1.1	1.1	0.6	2.8	5.2	0.5	0.0	0.6	9.0
Sweden	0.6	0.5	1.1	1.7	1.1	1.5	4.3	6.3	0.7	2.8	3.5	15.2
UK	0.4	0.7	1.1	1.5	0.8	1.5	3.8	6.0	0.9	0.0	0.9	11.8

Source: OECD. The OECD data for ECEC expenditure as a hare of GDP refer to the year 2007. The education sector includes 1: Primary education, L2: Lower secondary education and U2: Upper secondary education.

A.1. EU-SILC data

The EU-SILC database has been collected annually since 2003. The data comes both as cross-sectional and longitudinal data. Since we are investigating incomes on a yearly basis, we have here used the cross-sectional data. The EU-SILC surveys contain many variables, on an individual level and a household level. This study uses income data (gross income, net income), education participation data (ECEC participation, education and student status), and demographic data (country, age, gender, household composition).

The EU-SILC data provide information about the demographic, economic and social living conditions of a sample of households in European countries. To estimate population figures, the individuals and households in the sample are given a design weight, which is the inverse of the household inclusion probability. With these design weights in hand, unbiased estimates are obtained given that there is full response rate in the surveys. Due to non-response, however, the weight of each respondent has to be adjusted to reduce estimation bias. The weights are also trimmed to avoid extreme values that can influence the variance.[19] EU-SILC data provides weights both on an individual and a household level. We use the variable 'Personal cross-sectional weight' (RB050) on an individual level and the variable 'Household cross-sectional weight' (DB090) when it is necessary to use weights on a household level. These weights are applied whenever the EU-SILC survey is used to identify characteristics (demographic, economic) of the national populations, e.g. in the calculation of poverty rates, inequality coefficients, and

[19] For more information, see Osier et al. (2006).

correlation as well as in the NA scale. When calculating the value of childcare and pre-primary education services, however, we use 'Children cross-sectional weight for child-care' (RL070) which is a specific variable meant for identifying the use of childcare in the national populations from the EU-SILC sample.

EU-SILC variables 'Total household gross income' (HY010) and 'Total disposable household income' (HY020) are used as income measures in our study. Income is multiplied with the 'Change rate' (HX010; the income variables are expressed in Euro) and a 'Within-household non-response inflation factor' (HY025). This non-response inflation factor is used to estimate the cash income of households where information on income is lacking due to non-response. This multiplication is in accordance with the guidelines from EU-SILC. A few of the countries – Estonia (January 1, 2011), Slovenia (January 1, 2007) and Slovakia (January 1, 2009) studied have recently changed their currency into Euro. This has contributed to a challenge to transfer all public expenditure and household income to the same currency. The problems stem from the fact that the OECD expenditure data are not consistent regarding currency (when the unit is millions of national currency). We have therefore manipulated the income definitions and public expenditures to secure comparability.[20]

Gross and disposable incomes are defined as a sum of several income variables (labour income, capital income, pension, imputed rent, etc.). Each of these income variables can be provided as gross (pre-tax) and net (post-tax). While a number of countries offer both gross and net income variables, most countries provide only either gross or net income variables.[21] It is therefore not possible to decompose the gross income and net income into all its elements for all countries. This affects our ability to decompose the inequality measure in the income elements. In Aaberge, Langørgen and Lindgren (2013), results from a decomposition of extended income into taxes, cash incomes and public services is reported. We are left with no ability to separate the effects of market income and public cash transfers on inequality. For our purposes, the optimal structure of EU-SILC is a provision of net variables on an income variable level for all countries involved. Such an implementation facilitates a detailed understanding of the impact of taxation and public cash transfers on the income distribution. Note also that we treat the difference between gross income (HY010) and net income (HY020) as tax.

To enable calculations of inequality measures, e.g. the Gini coefficient, we use bottom-coding for negative incomes. We assume that people with negative cash incomes have zero cash income, since negative incomes make no sense as a measure of material living standard. This assumption facilitates estimation of inequality measures such as the Gini coefficient. Furthermore, it has no impact on the at-risk-of-poverty estimates.

Each year's EU-SILC data provides demographic and participation information for the current year, but the income data refers to the previous year. For the UK, however, the income year period is from the 1st of April to the 31st of March.[22] The UK and Irish income data is treated as if it referred to the previous year only. Since we analyse 2009 (2006), the 2010 (2007) EU-SILC cross-sectional data is used for the study.

Students in tertiary education are taken out of the population after calculating the equivalence scales for each household.[23] Thus, the household's income is shared with the students, but the students do not affect the poverty or inequality estimates. The reason is that students' low cash income is temporary and their investment in education yields a higher return in the future.[24] Thus, their current low income situation is not assumed to reflect a poverty or inequality problem. The opposite assumption would imply that the government could effectively fight poverty by reducing the enrolment of students, and that the

[20] Estonia (09): income in euro, education (incl. pre-primary) divided by HX010 (15.64) to transform to euro; Estonia (06): income in euro, education expenditure (incl. pre-primary) divided by HX010 (15.64) to transform to euro; Slovakia (06): health and long-term care multiplied by HX010 (37.234) to transform to Slovakian currency; Slovenia (06): education (incl. pre-primary) divided by HX010 (240) to transform to euro.

[21] EUROSTAT has attempted to develop a common practice among the countries. The data set for 2012 has a unified approach in terms of gross and net income variables.

[22] Two countries, Ireland and the United Kingdom, use a sliding reference period for income and taxes on income and social insurance contributions, see Wolff et al. (2010).

[23] All people above upper secondary education age participating in post-secondary non-tertiary and tertiary education (ISCED level 4 and 5) are taken out of the data.

[24] Again, the fact that we use one year as the analytical period instead of a life-cycle perspective make us unable to capture the full economic value of being a student.

poverty problem is relatively high in countries with a high share of students.

A.2. EUROSTAT population and GDP data

Since the EU-SILC data is a sample based on surveys, the data does not include the total population in different countries. EUROSTAT provides data on the total population by country and year. For the elder cohorts, data are only accessible for certain countries for the age groups 75-79 years, 80-84 years and 85 years and above. The elder age group in this study includes people aged 75 years and above. We are unable to perform a more detailed analysis of the older cohorts due to the fact that the EU-SILC data categorises all persons over 79 years old as 80 years old.

We make use of GDP numbers for several reasons in this study. First, GDP in millions of national currency facilitates a transformation of expenditure data in percent of GDP to real numbers. Second, whenever expenditure data lacks for 2009 (2006), figures from former years are inflated with GDP growth from the former year to produce estimates for 2009 (2006).[25]

A.3. OECD aggregate expenditure data

The OECD provides national expenditure data for different publicly provided services. These data are used to estimate public expenditures in each of the European countries. The expenditure data are described below.

ECEC expenditure

A database called the Family Database is made available by the OECD. The database consists of "cross-national indicators of family outcomes and family policies across the OECD countries".[26] Public services constitute one of the four pillars of the database. The expenditure data fall in two categories: childcare and pre-primary education. Some countries do only register numbers for one of the categories. Since we expect the countries to have difficulty to apply the same definition of childcare and pre-primary education we do not utilise the separation between childcare and pre-primary education spending in this study.

The spending data is gross public expenditure and includes tax reliefs but excludes out-of-pocket payments. This study seeks to include public financing of in-kind services only, but this expenditure concept is not available in the Family Database, which comprises all types of financial support (in cash, in-kind or through the tax system) for families with children partaking in formal day-care services or in pre-primary education facilities.

To make the spending on childcare comparable across countries, the family database covers public expenditure on children aged 0-5 years, regardless of the compulsory age of entry into primary school. This means that the public expenditure in the Family Database is adjusted in countries where children start primary school before or after the age of 5. In Denmark, Estonia, Finland, Poland and Sweden, children begin primary school at the age of 7. The database numbers are adjusted down to not include expenditure on these 6 years olds. In the Netherlands and the UK, however, the numbers are adjusted up to take into account children aged 5 who are in primary school. Formal schooling for children aged 5 years in these countries have comparable hours to childcare for children aged 5 years where schooling starts after age 5. We have accounted for these adjustments of the expenditure data by reversing the adjustments made in the Family Database for 5 and 6 years olds. In countries where children begin primary school at the age of 7, we have imputed higher childcare spending, while the opposite is done for countries where primary education is compulsory also for 5 years old children.

[25] Greece education data is inflated from 2005 to 2006 and 2009, while total health expenditure is inflated from 2007 to 2009; Luxembourg social and health-related long-term care data is inflated from 2008 to 2009; Slovakian social long-term care is inflated from 2007 to 2009.

[26] http://www.oecd.org/document/4/0,3746,en_2649_34819_37836996_1_1_1_1,00.html.

Education expenditure

In the OECD Education Database, education expenditure is accessible.[27] Expenditure can be classified by financer, level of education and the unit. Here, we are interested in government-financed education expenditure only, and in millions of national currency. The data can be separated according to the International Standard Classification of Education Levels (ISCED): Primary education (ISCED level 1), lower secondary education (ISCED level 2) and upper secondary education (ISCED level 3).[28] For Slovenia and Spain, it has been difficult to separate the education levels and they report expenditure on only two levels.[29] Furthermore, only 2005 data is available for Greece. To calculate 2009 (2006) education expenditure data, the GDP growth from 2005 to 2009 (2006) is utilised.

Health care and long-term care expenditure

The OECD offers public expenditure data on health and long-term care. The System of Health Accounts provides a separation of the expenditure into financer and functions and the ability of combining these two variables. The System of Health Accounts enables therefore access to general government expenditure on health care, medical long-term care and social long-term care services. We define health care services as function HC.1 to HC.7 except HC.3 ('Long-term nursing care'). Health services are constituted by 'Services of curative and rehabilitative care' (HC.1 and HC.2), 'Ancillary services to health care' (HC.4), 'Medical goods' (HC.5), 'Prevention and public health services' (HC.6), and 'Health administration and health insurance' (HC.7). Since we seek to construct purely consumption based expenditure concepts, we have chosen not to include HC.R.1 ('Capital formation of health care providers').[30]

Medical long-term care is defined as function HC.3, while social long-term care is defined as function HC.R.6.1 'Social services of LTC (LTC other than HC.3)'. This latter category is a sub-classification under function HC.R.6 'Administration and provision of social services in kind to assist living with disease and impairment'. While medical long-term care (or long-term health care) is provided to help persons with basic activities of daily living (ADL), social long-term care is more focused on lower-level, instrumental activities of daily living (IADL). The difference is rather ambiguous (which is reflected in the countries' placement of expenditure into these two categories), but a classification document mentions help with 'bathing, dressing, eating, getting in and out of bed or chair, moving around and using the bathroom', as well as help with 'wound dressing, pain management, medication, health monitoring, prevention, rehabilitation or services of palliative care' as ADL (long-term health care) and 'help with activities of home making, meals, etc. transport and social activities' as IADL (social long-term care).[31]

While most countries provide data on long-term health care only, several countries have also provided data on social long-term care (Finland, France, the Netherlands, Poland, Slovenia, Spain and Sweden). We interpret this difference in reporting as a classification problem (i.e. that the other countries were not able to separate between the two definitions of long-term care), and that the sum of long-term health care and social long-term care in the System of Health Accounts comprises the total expenditure on long-term care in the European countries.

For Greece, Ireland, Italy and the United Kingdom, however, disaggregated information on the separation of health care and long-term care is not available. Overall health expenditures are accessible for these countries as well, but the current situation is that specific data on public expenditure on long-term care are not available for the above-mentioned countries. This lack of long-term care expenditure represents an empirical challenge to the study. Oliveira Martins et al. (2006) report numbers for both health services and long-term care as share of GDP in several countries for 2005. Since the System of Health Accounts

[27] UNESCO-OECD-Eurostat (UOE) data collection on education statistics, compiled on the basis of national administrative sources, reported by Ministries of Education or National Statistical Offices.

[28] ISCED level 0 is pre-primary education, which we have treated under ECEC.

[29] While Slovenia includes primary education expenditure as part of the lower secondary education, Spain includes upper secondary education expenditure together with the expenditures on lower secondary education.

[30] The total expenditure on health services in the UK include HC.R.1.

[31] From "Guidelines for estimating long-term care expenditure in the joint 2006 SHA Data Questionnaire", available at: http://www.oecd.org/health/healthpoliciesanddata/37808391.pdf.

provides total health expenditure for all countries, we are using only the relative size of health care and long-term care for Greece, Ireland, Italy and the UK from this study. We operate therefore with two methods for separating total health expenditure into health care and long-term care expenditure in this study: i) The System of Health Accounts, ii) Oliveira Martins et al. (2006) for the countries missing long-term care data. Table A.3 shows the relative share of health care and long-term care in Greece, Ireland, Italy and the UK (Oliveira Martins et al. 2006).

Table A.3: Share of total health expenditure on health care and long-term care, percent

Country	Health care	Long-term care
Greece	96.1	3.9
Ireland	89.4	10.6
Italy	84.7	15.3
UK	87.5	12.5

Source: Oliveira Martins et al. (2006). Long-term care includes both health services and social services.

A.4. User data

While the aggregate expenditure data provides macro figures on expenditure, for the purpose of allocation it is necessary to utilise data that account for the individual use of public services. Below we discuss the user data included in the present study. As discussed in Section 3, we calculate an insurance value for the health and long-term care consumption, regardless of actual use, while the education and childcare services are allocated to the actual users.

ECEC utilisation

For ECEC services, we assume that the average participation rates in childcare and pre-primary education in the EU-SILC data is representative for each country when controlled for the specific childcare weight (RL070). Since the participation rate increases with age, we have calculated the average participation rates in three age groups: 0 year, 1-2 years and 3 years and up to compulsory primary education age (see Table 3). For a discussion of different systems of childcare and pre-primary education in European countries, see Vaalavuo (2011).

EU-SILC contains variables on the participation (hours in a normal week) in formal ECEC institutions: 'Education at pre-school' (RL010), 'Education at compulsory school' (RL020), 'Child care at centre-based services' (RL030) and 'Child care at day-care centre' (RL040). The sum of these variables constitute the number of hours a child normally spends in formal ECEC institutions. The reason RL020 is included in the sum is that we have simplified the identification of primary education participation to all children in an age within the compulsory age for schooling. Children may start primary education before the compulsory age, and thus the sum of RL010, RL030 and RL040 (and omission of RL020) does not reflect the actual time spent in formal institutions.

Our methodology implies that we exclude informal care, such as 'Child care by a professional child-minder at child's home or at child-minder's home' (RL050) and 'Child care by grand-parents, others household members (outside parents), other relatives, friends or neighbours' (RL060). We are only considering formal institutional care and omit therefore other types of childcare.

The value of childcare received is estimated based on the average number of hours of attendance per week, h_{gjk}, for individual g, in age group j, in country k:

(A.1) $$u_{Cgjk} = h_{gjk} \frac{u_{Ck}}{\sum_j \sum_g w_{gjk} h_{gjk}},$$

where u_{Ck} is total expenditure on ECEC services in country k and w_{gjk} is the weight (RL070) assigned to child g in age group j in country k. Thus the denominator on the right-hand side in (A.1) is the estimated total number of hours received by children in ECEC services. Thus, the value of ECEC services u_{Cgjk} received by child g in country k is assumed to equal the average spending per hour per week in country k multiplied by the number of hours per week received by child g. The more a child uses ECEC services, the greater the value of the service provided by the government.

Table A.4: Public spending on ECEC per person by age and country, in percent of GDP per capita, 2009

Country	0 year	1-2 years	3 years to education age
Austria	0.0	2.1	8.4
Belgium	4.0	8.5	16.4
Czech Republic	0.0	1.0	11.8
Denmark	12.3	27.0	17.3
Estonia	0.1	3.0	7.1
Finland	0.7	12.4	20.8
France	7.7	10.3	18.2
Germany	1.4	6.0	12.0
Greece	0.1	0.9	3.0
Hungary	0.0	4.0	18.4
Iceland	0.2	10.4	14.6
Ireland	0.9	1.9	5.6
Italy	1.4	6.0	16.5
Luxembourg	2.0	3.4	7.2
Netherlands	7.0	9.4	18.4
Norway	1.7	14.4	15.5
Poland	0.3	1.2	10.7
Portugal	2.0	5.5	8.9
Slovakia	0.0	2.0	15.7
Slovenia	0.5	7.5	11.6
Spain	2.0	5.8	11.0
Sweden	6.6	15.1	19.5
UK	3.5	12.8	31.4
Austria	0.0	2.1	8.4

In table A.4, the spending per child in different age groups is reported as a share of GDP per capita. In general, the value of ECEC services increases with age. As when ECEC expenditure per child is expressed as a share of GDP per capita, Denmark, Finland, France, Hungary, Netherlands, Sweden and the UK constitute the countries with the highest spending per child.

Education utilisation

The value of education services per pupil is defined by

$$\frac{u_{Ejk}}{r_{Ejk}} \quad \text{(A.2)}$$

where the public expenditure in the education level received by target group j in country k, u_{Ejk}, is divided by the number of pupils in target group j, r_{Ejk}. The number of pupils in different education levels is accessible from the OECD.[32] As with the expenditure data, the number of pupils can be separated according to the ISCED level in which they participate.

Table A.5: Public spending on education per person by age and country, in percent of GDP per capita, 2009

Country	Primary education	Lower secondary	Upper secondary
Austria	26.3	30.8	30.5
Belgium	22.0	25.4	25.4
Czech Republic	15.8	25.5	22.9
Denmark	28.9	27.2	35.2
Estonia	27.9	31.2	34.6
Finland	20.5	31.4	25.1
France	18.4	26.3	33.0
Germany	17.8	21.7	30.0
Greece	22.6	21.0	21.0
Hungary	22.2	23.9	19.5
Ireland	20.7	27.5	31.9
Iceland	27.2	26.1	17.2
Italy	25.0	27.4	25.9
Luxembourg	19.2	22.2	21.6
Netherlands	18.9	27.5	25.9
Norway	21.6	23.0	34.2
Poland	26.3	23.4	21.2
Portugal	22.0	26.5	27.8
Slovakia	18.7	16.0	20.1
Slovenia	30.7	30.7	25.6
Spain	20.7	26.4	31.4
Sweden	24.4	25.7	28.1
UK	25.1	27.1	31.1

The actual age intervals that children participate in the different education levels vary between the countries. The European Commission provides information about which ages children spend in different education levels.[33] In most countries, children born in the same year belong to the same school age. In some countries, however, children have to reach the required age before the 1st of September. EU-SILC data on birth date is not specified but the quarter of the year one is born is reported in the survey. In order to simplify, we assume that children born before 1st of October (or after 30th of September the preceding year) belong to the same education generation. Moreover, to keep the number of target groups low, the school year is assumed to start 1st of January. For children participating in a given education level we allocate benefits equal to a whole year of education.

[32] UNESCO-OECD-Eurostat (UO) data collection on education statistics, compiled on the basis of national administrative sources. Reported by Ministries of Education or National Statistical Offices.

[33] See http://www.eurydice.org.

Health care utilisation

The European Commission has calculated age and gender profiles for health care utilisation. The profiles are defined as health consumption by gender and per person in annual age groups (0 year, 1 year, 2 years, etc.) as a percentage of GDP per capita. To simplify the calculation of the NA scale, we have divided the population into 24 target groups (12 age groups times 2 genders). Thus, expenditure per person as a percentage of GDP per capita are aggregated to represent the average spending profiles per person within each of the 24 target groups, where the average is taken over annual age groups using the population shares of the age groups as weights.[34]

The aggregate spending per person in different target groups as a share of GDP per capita is used to estimate expenditure per person in different target groups as follows:

$$\frac{u_{Hjk}}{n_{jk}} = \frac{p_{Hjk}}{\sum_j n_{jk} p_{Hjk}} u_{Hk}, \tag{A.3}$$

where u_{Hjk} is total health care spending allocated to target group j in country k, and n_{jk} is the number of persons in target group j in country k. Spending per person in target group j as a percentage of GDP per capita is denoted p_{Hjk} and u_{Hk} is OECD total health care expenditure in country k. Note that we use the definition $p_{Hjk} = u_{Hjk} / (n_{jk} gdp_k)$, where gdp_k is defined as GDP per capita in country k. Thus the method is based on removing the GDP per capita in the denominator of p_{Hjk} by reducing the fraction in (A.3). Iceland is not covered in the data. We have assumed that the Icelandic health user profiles are a weighted average of its Nordic neighbours – Denmark, Norway, Sweden and Finland.[35]

[34] For the elder age group, data are not specified for annual age groups. Instead, the average is taken over the three groups 75-80 years, 80-85 years and 85 years and above.

[35] We have not taken into consideration the differences in population size among the Nordic countries.

Table A.6: Public spending on health care per person by age and country, in percent of GDP per capita, 2009

Country	0-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75+ years
Austria	3.2	4.0	4.4	6.2	9.6	13.8	19.5
Belgium	2.7	3.6	4.2	5.6	8.5	13.1	17.5
Czech Republic	3.1	3.4	3.9	5.7	9.5	12.9	16.7
Denmark	3.6	4.3	5.0	6.1	8.7	13.1	19.7
Estonia	3.4	3.7	3.7	4.5	6.5	9.0	12.5
Finland	3.2	3.3	3.5	4.5	7.1	10.3	17.0
France	3.4	4.7	6.6	8.2	9.6	13.2	20.0
Germany	4.1	4.7	5.0	6.3	9.0	14.0	20.4
Greece	2.7	3.4	3.9	4.9	6.8	10.6	15.2
Hungary	1.8	2.1	2.7	5.1	7.8	10.3	12.2
Ireland	3.7	4.2	4.8	6.2	8.7	13.4	19.8
Iceland	3.2	4.6	4.8	6.2	8.9	13.4	20.2
Italy	3.4	3.6	3.8	5.0	7.8	12.0	14.1
Luxembourg	3.2	3.8	4.8	6.4	9.7	14.6	20.7
Netherlands	3.6	5.2	5.2	6.6	8.6	12.8	18.2
Norway	2.1	3.4	3.4	4.6	8.0	12.7	19.6
Poland	2.5	3.1	3.0	4.9	6.9	9.6	9.4
Portugal	3.3	5.3	5.2	5.6	8.0	12.3	18.8
Slovakia	3.1	3.4	4.1	6.5	10.2	14.2	14.4
Slovenia	3.6	3.7	3.9	5.1	6.9	10.0	13.2
Spain	3.4	3.4	4.1	5.5	9.2	13.0	16.9
Sweden	3.3	5.0	5.4	7.1	9.0	12.7	17.0
UK	4.5	3.8	3.8	4.7	5.2	14.8	28.2

Long-term care utilisation

The European Commission provides user profiles for long-term care services as well. However, the data for long-term-care are defined differently from health care user profiles. The data provides an estimate on the average consumption per recipient and the number of recipients. The age profiles are provided in five-year cohorts except the first and last cohorts: 0-14, 15-19, 20-24,…, 85-89, above 90 years. Most of the target groups in the present study are defined in ten-year cohorts. Also, the health and long-term care user profiles for children is for children aged 0-17 years, while persons 18-24 years constitute the next age group. Thus, some of the European Commission long-term care user profiles are overlapping with different target groups. As with the estimated health care user profiles, we calculate an average user profile to fit our target groups.

The value of long-term care insurance for a person in target group j in country k is estimated as follows:

$$\frac{u_{Ljk}}{n_{jk}} = \frac{1}{n_{jk}} \frac{p_{Ljk} r_{Ljk}}{\sum_j p_{Ljk} r_{Ljk}} u_{Lk}, \quad \text{(A.4)}$$

where u_{Ljk} / n_{jk} is the public expenditure on long-term care per person in target group j in country k, p_{Ljk} is the estimated value of long-term care per recipient in target group j in country k, and r_{Ljk} is the number of recipients of long-term care in target group j in country k. Total expenditure on long-term care in country k is denoted u_{Lk}. Iceland is not part of the European Commission data on long-term care. Applying the same procedure as with health care, we construct a user profile for long-term care in Iceland.

Table A.7: Public spending on long-term care per person by age and country, in percent of GDP per capita, 2009

Country	0-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75+ years
Austria	0.3	0.4	0.4	0.4	0.5	1.5	9.0
Belgium	0.2	0.2	0.2	0.2	0.6	2.1	16.9
Czech Republic	0.1	0.1	0.1	0.1	0.2	0.5	1.9
Denmark	0.1	0.6	0.8	1.1	1.6	3.4	20.6
Estonia	0.0	0.0	0.0	0.1	0.2	0.6	1.9
Finland	0.2	0.4	0.6	0.8	1.0	2.6	17.0
France	0.6	1.1	1.0	1.1	1.3	1.6	8.7
Germany	0.2	0.2	0.2	0.2	0.4	1.2	7.0
Greece	0.0	0.1	0.1	0.1	0.1	0.3	1.4
Hungary	0.0	0.1	0.1	0.2	0.2	0.5	1.8
Ireland	0.2	0.3	0.3	0.3	0.4	1.2	6.8
Iceland	0.1	0.2	0.5	0.6	1.0	3.0	20.5
Italy	0.2	0.5	0.6	0.6	0.6	1.1	4.4
Luxembourg	0.0	0.0	0.0	0.0	0.0	0.1	0.4
Netherlands	1.0	1.7	1.5	1.5	1.2	5.8	29.1
Norway	0.5	0.5	0.5	0.5	0.4	2.9	23.3
Poland	0.1	0.0	0.1	0.3	0.5	1.2	2.5
Portugal	0.0	0.0	0.0	0.0	0.1	0.2	0.9
Slovakia	0.0	0.0	0.0	0.0	0.0	0.1	0.2
Slovenia	0.3	0.2	0.2	0.4	0.7	1.7	5.8
Spain	0.1	0.1	0.1	0.2	0.3	2.6	4.6
Sweden	0.0	0.0	0.9	1.6	1.5	4.1	31.1
UK	0.2	0.2	0.3	0.3	0.4	1.3	6.9

8. Appendix B: Sensitivity analysis

Table B.1: SNA scale estimation results, including different public services in the scale, 2006

Variable	ECEC	Education	Health care	Long-term care	Education and health care	All 4 services
Constant	0.50	0.50	0.46	0.50	0.46	0.46
0-3 years	0.40	0.30	0.33	0.30	0.32	0.41
3 years to education age	0.58	0.30	0.33	0.30	0.33	0.59
Education age (below 14 years)	0.30	0.66	0.34	0.30	0.68	0.68
Education age (above 13 years)	0.50	0.93	0.53	0.50	0.93	0.93
Above education age - 54 years	0.50	0.50	0.54	0.50	0.54	0.54
55-64 years	0.50	0.50	0.59	0.51	0.59	0.60
65-74 years	0.50	0.50	0.66	0.52	0.66	0.68
75 years and above	0.50	0.50	0.74	0.62	0.74	0.85
R2-adjusted	1.000	1.000	0.999	1.000	0.999	0.999

Table B.2: At-risk-of-poverty for extended income measure (SNA scale) by household type and country. Percent, 2009

	Household type									
Age of adults	**18-64**		**18-64**		**65-74**		**75+**		**18+**	
Number of adults	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**3+**	**3+**
Children	**No**	**No**	**Yes**	**Yes**	**No**	**No**	**No**	**No**	**No**	**Yes**
Austria	14.5	5.0	8.6	3.0	15.2	2.2	1.9	0.0	1.2	4.2
Belgium	13.5	7.6	12.1	7.7	6.0	4.3	2.1	0.6	6.3	8.6
Czech Republic	9.1	2.4	19.7	4.8	3.2	0.0	5.6	0.0	1.5	3.9
Denmark	13.7	3.0	3.9	2.1	8.4	1.1	1.6	0.0	2.4	4.4
Estonia	29.2	11.1	12.3	6.3	26.7	0.5	52.4	0.0	7.3	6.6
Finland	24.6	5.4	7.6	4.3	17.0	1.1	0.5	0.0	4.8	4.0
France	11.5	4.6	11.3	5.0	7.2	1.3	3.6	0.8	6.5	6.9
Germany	22.3	6.5	16.8	4.8	13.4	3.3	5.2	0.4	2.4	3.5
Greece	17.7	16.5	19.4	15.4	16.9	2.9	28.4	8.4	11.5	16.9
Hungary	13.5	7.3	4.2	4.2	4.1	1.3	4.2	0.7	4.2	6.6
Iceland	16.0	4.7	16.4	4.7	1.4	0.0	1.0	0.0	2.0	1.1
Ireland	19.6	8.1	5.6	5.7	5.8	3.2	5.8	5.6	3.4	2.0
Italy	17.1	8.8	23.4	8.7	19.8	4.3	18.7	4.9	7.2	13.9
Luxembourg	15.6	5.3	7.3	5.9	3.1	1.1	2.5	0.0	6.3	7.9
Netherlands	6.4	2.0	5.0	1.7	2.2	0.2	0.2	0.0	1.0	2.4
Norway	17.2	2.4	9.5	2.5	4.2	0.4	0.0	0.0	2.3	1.2
Poland	25.4	9.8	15.6	11.3	20.9	0.9	20.7	3.5	9.4	13.0
Portugal	21.2	14.5	7.2	6.8	21.3	2.8	27.0	3.8	7.5	13.6
Slovakia	13.0	5.2	25.5	8.7	2.6	0.0	11.3	1.6	3.1	11.7
Slovenia	31.0	6.7	7.4	3.0	35.5	4.8	40.1	7.6	3.2	3.5
Spain	19.8	12.5	24.4	15.7	10.6	5.6	11.8	5.6	9.8	19.6
Sweden	18.9	5.8	17.9	3.5	9.7	1.6	0.0	0.0	3.4	5.6
UK	26.1	11.5	8.2	6.4	16.1	9.2	3.4	0.0	7.4	9.3

Table B.3: C_1-coefficient for the distribution of income by income definition and country

Country	Cash income (EU)		Extended income (EU)		Extended income (NA)		Extended income (SNA)	
	2006	2009	2006	2009	2006	2009	2006	2009
Austria	0.366	0.360	0.300	0.297	0.302	0.295	0.302	0.296
Belgium	0.373	0.372	0.305	0.302	0.305	0.301	0.305	0.301
Czech Republic	0.349	0.346	0.278	0.275	0.289	0.285	0.289	0.285
Denmark	0.347	0.368	0.282	0.298	0.270	0.291	0.272	0.292
Estonia	0.446	0.431	0.378	0.363	0.385	0.365	0.385	0.364
Finland	0.358	0.353	0.302	0.299	0.298	0.293	0.300	0.294
France	-	0.398	-	0.327	-	0.326	-	0.327
Germany	0.414	0.398	0.347	0.333	0.353	0.335	0.353	0.336
Greece	0.465	0.450	0.386	0.379	0.392	0.385	0.392	0.385
Hungary	0.358	0.340	0.288	0.278	0.287	0.278	0.287	0.278
Iceland	0.375	0.356	0.303	0.293	0.300	0.290	0.301	0.291
Ireland	0.423	0.444	0.338	0.343	0.347	0.352	0.347	0.352
Italy	0.446	0.437	0.360	0.353	0.367	0.361	0.367	0.362
Luxembourg	0.376	0.384	0.308	0.301	0.303	0.300	0.304	0.301
Netherlands	0.375	0.357	0.294	0.284	0.295	0.281	0.296	0.282
Norway	0.348	0.332	0.282	0.269	0.276	0.263	0.278	0.265
Poland	0.437	0.426	0.361	0.355	0.365	0.361	0.366	0.362
Portugal	0.478	0.448	0.384	0.357	0.389	0.364	0.390	0.364
Slovakia	0.351	0.373	0.272	0.296	0.290	0.310	0.290	0.310
Slovenia	0.328	0.344	0.278	0.292	0.274	0.286	0.274	0.286
Spain	0.439	0.472	0.354	0.376	0.363	0.383	0.364	0.383
Sweden	0.341	0.351	0.266	0.282	0.261	0.274	0.262	0.276
UK	0.446	0.445	0.367	0.362	0.376	0.365	0.377	0.366

Note: France is treated as missing in 2006 due to a break in time series.

Table B.4: C_3-coefficient for the distribution of income by income definition and country

Country	Cash income (EU)		Extended income (EU)		Extended income (NA)		Extended income (SNA)	
	2006	2009	2006	2009	2006	2009	2006	2009
Austria	0.213	0.212	0.167	0.168	0.174	0.173	0.174	0.174
Belgium	0.211	0.209	0.165	0.163	0.172	0.168	0.172	0.169
Czech Republic	0.207	0.204	0.160	0.158	0.172	0.169	0.172	0.169
Denmark	0.194	0.197	0.147	0.148	0.148	0.152	0.149	0.153
Estonia	0.271	0.255	0.221	0.208	0.233	0.215	0.233	0.215
Finland	0.213	0.205	0.169	0.163	0.175	0.168	0.176	0.169
France	-	0.246	-	0.197	-	0.201	-	0.201
Germany	0.245	0.238	0.198	0.190	0.209	0.200	0.210	0.201
Greece	0.283	0.269	0.232	0.223	0.240	0.231	0.240	0.232
Hungary	0.207	0.193	0.159	0.152	0.165	0.158	0.165	0.158
Iceland	0.234	0.210	0.181	0.164	0.186	0.170	0.187	0.170
Ireland	0.259	0.273	0.200	0.204	0.214	0.219	0.214	0.219
Italy	0.262	0.251	0.207	0.199	0.216	0.210	0.217	0.210
Luxembourg	0.224	0.225	0.175	0.169	0.178	0.175	0.179	0.175
Netherlands	0.225	0.205	0.170	0.155	0.176	0.159	0.177	0.160
Norway	0.183	0.184	0.138	0.138	0.142	0.142	0.144	0.144
Poland	0.264	0.255	0.214	0.208	0.223	0.218	0.223	0.219
Portugal	0.309	0.278	0.244	0.218	0.251	0.227	0.252	0.227
Slovakia	0.199	0.209	0.151	0.162	0.166	0.176	0.166	0.176
Slovenia	0.180	0.190	0.148	0.157	0.150	0.158	0.150	0.158
Spain	0.252	0.267	0.200	0.209	0.210	0.217	0.210	0.217
Sweden	0.185	0.189	0.132	0.140	0.137	0.142	0.138	0.144
UK	0.271	0.272	0.216	0.212	0.229	0.221	0.230	0.221

Note: France is treated as missing in 2006 due to a break in time series.

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