Analysing equity in the use of long-term care in Europe

Research note 9/2014

Ricardo Rodrigues, Stefania Ilinca, Andrea Schmidt
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Abstract

There are significant differences across social protection systems in Europe in the scope, breadth and depth of coverage of the risk to need long-term care in old-age. Together with other factors, such as education, household structure or societal values regarding care for frail older people, these differences can have a significant impact on the use of long-term care. Using SHARE data, this Research Note compares differences between European countries in the use of long-term care across income groups, for older people living at home. It analyses not only inequalities in the use of long-term care, but also differences in use that persist after differences in need have been taken into consideration, i.e. horizontal inequity. For this purpose, concentration indices, concentration curves and horizontal inequity indices are estimated for home care services and informal care. The countries analysed here are Austria, Germany, Sweden, the Netherlands, Spain, Italy, France, Denmark, Greece, Belgium and Czech Republic. The findings suggest that differences in use of home care services across income groups mostly reflect differences in need between those same groups. For informal care, the differences in use persist even after accounting for needs, and less affluent individuals are much more likely to use informal care. Some possible causes for these differences and policy implications are considered.

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Introduction

A significant body of literature has established the existence of inequity in the use of healthcare in Europe among groups with different socio-economic conditions (van Doorslaer et al. 2004; Bago d'Uva et al. 2009; European Commission 2013). In comparison there has been a dearth of research on the issue of inequity in the use of long-term care services for older people. This gap in evidence is all the more salient because of the growing relevance of long-term care in the context of ageing societies (European Commission 2014) and the extreme diversity of arrangements and public resources allocated to long-term care systems. Public expenditure on long-term care in Europe ranges from less than 0.5% of GDP for Latvia, to 3.5% of GDP for Sweden and the Netherlands (Colombo et al. 2011; Rodrigues et al. 2012). The differences are explained not so much by the share of dependent older people in the population, but rather by differences in the scope, breadth and depth of coverage of long-term care systems (Rodrigues & Nies 2013). Unlike most healthcare systems in Europe, where access is free at the point of use, eligibility to long-term care services in many European countries is means-tested or/and asset-tested (Colombo et al. 2011). There is also a higher degree of substitution between long-term care services and care provided by informal carers (e.g. relatives or friends) (Bonsang 2009). In many countries, the latter are indeed the preferred source of care for many people (European Commission 2007). Perhaps unsurprisingly, informal care accounts for a significant share of care provided to frail older people (Colombo et al. 2011).

Against this backdrop, this Research Note aims to analyse whether there is evidence of horizontal inequity in the use of long-term care services provided at home in Europe. Horizontal inequity rests on the normative assumption that individuals with similar long-term care needs should receive the same level of services (or treatment) regardless of their income or socio-economic condition. Horizontal inequity thus refers to differences in use of long-term care across income groups that persist after differences in need have been taken into consideration. The countries analysed here are Austria, Germany, Sweden, the Netherlands, Spain, Italy, France, Denmark, Greece, Belgium and Czech Republic[1].

This Research Note starts by discussing characteristics of long-term care systems in the aforementioned countries that could affect the equitable use of long-term care. Section two reviews existing evidence of socio-economic inequality and inequity in long-term care. Section three provides a succinct description of the data and methods used for the empirical analysis and section four presents the main results. This Research Note concludes with some policy implications and further discussion in section five.

1. Equity-salient characteristics of long-term care systems

It has long been assumed that people of lower income have on average poorer health and experience greater limitations in carrying out activities indispensible to their daily living. Needs are therefore not uniformly distributed in the population, but rather skewed towards lower income groups (OECD & WHO 2003). Use of long-term care should therefore be concentrated among the poorer groups of the population, reflecting what could be termed as legitimate reasons for unequal use of services, i.e. those based on needs. Conversely, the negative association between need and income

[1] This Research Note uses data from SHARE wave 1 and 2 release 2.6.0, as of November 29 2013 (DOI: 10.6103/SHARE.w1.260 and 10.6103/SHARE.w2.260). The SHARE data collection has been primarily funded by the European Commission through the 5th Framework Programme (project QLK6-CT-2001-00360 in the thematic programme Quality of Life), through the 6th Framework Programme (projects SHARE-I3, RII-CT-2006-062193, COMPARE, CIT5- CT-2005-028857, and SHARELIFE, CIT4-CT-2006-028812) and through the 7th Framework Programme (SHARE-PREP, N° 211909, SHARE-LEAP, N° 227822 and SHARE M4, N° 261982). Additional funding from the U.S. National Institute on Aging (U01 AG09740-13S2, P01 AG005842, P01 AG08291, P30 AG12815, R21 AG025169, Y1-AG-4553-01, IAG BSR06-11 and OGHA 04-064) and the German Ministry of Education and Research as well as from various national sources is gratefully acknowledged (see www.share-project.org for a full list of funding institutions).

and the high costs associated with long-term care could mean that those more likely to need care are also those less able to afford it. Depending on the existence of a public safety net or on the scope, breadth and depth of coverage of public long-term care systems, affordability could therefore act as a barrier to the use of long-term care services.

Inequality and inequity in access to care: What is the distinction?

While the concepts of inequality ad inequity are sometimes used interchangeably, it is important to distinguish between the two, as they stand for two crucially different concepts in health economics and the analysis of access to health care.

Inequality is a purely dimensional concept, referring to the condition of being *different* or *unequal*, i.e. it pertains to dissimilarities in health or in the distribution of health resources between different population groups (Kawachi et al., 2002). Conversely, health equality would describe a total absence of variation and disparities between individuals and population groups in their health achievement and care utilization.

Inequity, on the other hand, is a more complex concept, comprising a moral dimension. In order for an inequality to be identified as *inequitable* a normative judgment of what is to be deemed fair is necessary. In other words, inequity refers to those inequalities that are unjust, unnecessary and avoidable (Kawachi et al., 2002; Dahlgren & Whitehead, 1991).

Inequities are inequalities that can be deemed unfair, unnecessary and avoidable.

Inequalities in health care can be determined by myriad factors, among which genetic variations and care needs, personal preferences and health behaviors, geographical location, gender, ethnic group and socio-economic status (Dahlgren & Whitehead, 1991). A decision on which determinants will cause unfair inequalities, i.e. inequities in health and health care, necessarily implies a normative judgment that is not always clear cut. To give but one example, while consensus can be easily reached that ethnicity should not affect an individual's access to care it is less clear how health behaviors and individual preferences should factor into care allocation decisions.

The specialized literature distinguishes between two separate equity goals in health care: **horizontal equity** - embodying the principle of equal treatment of individuals with equal health needs - and **vertical equity** - the unequal but equitable treatment of individuals with different care needs (Sutton, 2002). Empirically, the measurement of and the distinction between the two concepts is hugely complicated by the notorious difficulty in defining and measuring care needs. As a result, efforts to quantify and compare health care inequity in the last decades have focused on horizontal inequity analyses.

1.1. Differences in breadth and depth of coverage

Taking the middle of 2000s[2] as a reference point for the analysis, the 11 countries analysed show important differences with respect to the coverage of long-term care risks provided by social protection systems (Table 1). Sweden, Denmark, the Netherlands, Austria and Germany had universal long-term care systems, i.e. where access to benefits is based on need and not on income. Spain, Greece and the Czech Republic had mostly means-tested systems, although some components such as nursing care in Spain - provided through the healthcare system - were not means-tested. Italy had in effect a dual system, where means-tested services coexisted with a universal cash benefit. France had a universal long-term care system, but the amount of benefits had a relative step adjustment for income. Finally, in Belgium, some components of long-term care are universal (e.g. nursing care delivered through the healthcare system), but others, like home help (which is the responsibility of regional authorities), require income-based contributions or are means-tested (cash benefits).

There are also sizeable cross-country differences as to the share of people receiving publicly funded long-term care (either in-kind or cash) and public expenditure as a share of GDP (Table 1). These differences are evident even among countries with apparently similar approaches to long-term care. In terms of population coverage – measured as the share of people aged 65 and older with moderate and severe activity limitations that use long-term care – the Netherlands, Denmark and Austria have the highest share of frail older people receiving publicly funded long-term care. Spain, Germany and the Czech Republic have sizeable shares of their frail population that were not eligible or did not receive publicly funded care[3] (reliable data for Greece are not available).

Similar differences are found in public expenditure on long-term care as share of GDP – which includes both home and institutional care – with Sweden, the Netherlands and Denmark as the highest spending countries, while Spain spent the least (Table 1). Figures for private expenditure on long-term care (reflecting out-of-pocket payments and private insurance) are notoriously imprecise or nonexistent, with private expenditure as share of GDP often reflecting more the (in)ability of the statistical offices to gather and process information rather than real differences between countries. Furthermore, the majority of private expenditure in long-term care is allocated to institutional care. Nonetheless, private expenditure is relatively high in Germany, France, Italy and Spain and low in comparison in Sweden and Denmark.

[2] This reference point is justified by availability of data for empirical analysis – see section 3. In the meantime, at least the Czech Republic and Spain have introduced significant reforms to their long-term care system (Colombo et al, 2011, Rodrigues et al, 2012), which have somewhat changed the nature and characteristics of the systems in comparison with the information provided here. Both countries introduced universal benefits for long-term care.

[3] Including those receiving the cash option of the German Long-term Care Insurance.

Table 1: Coverage of long-term care risks

Country	Share (%) of frail old people with publicly funded long-term care [(a)]	Public expenditure on long-term care (% of GDP) [(a)]	Private expenditure on long-term care (% of GDP) [(a)]	Co-payments and importance of privately paid home care services
Austria	46.8	1.3	0.2	Income-related; Privately paid services (e.g. 24 hours care) have some importance
Germany	17.8	0.9	0.4	Long-term care insurance only partially covers costs; Privately paid services have some importance
Sweden	48.4	3.6	0.2	Limited co-payments; Privately paid services (e.g. home help) have some importance
Netherlands	69.1	3.5	NA	Privately paid services (with cash benefits) have limited importance
Spain	12.3	0.3	0.2	Market prices (limited availability of home care); Privately paid services are predominant
Italy	21.7	1.7	0.64[(b)]	Market prices (limited availability of home care); Privately paid services (including migrant carers) are predominant
France	23.1	1.0	0.32	Income-related; Sizeable private insurance; Privately paid services have some importance
Denmark	49.9	2.7	0.2	Limited co-payments; Privately paid services are marginal
Greece	NA	NA	NA	Free at the point of use (limited availability of home care); Privately paid services (including migrant carers) have some importance
Belgium	29.2	1.7	0.2	Income-related with discounts for severe needs
Czech Republic	25.9	0.3	NA	Market prices (limited availability of home care); Privately paid services are predominant

Source: (Colombo et al. 2011; Rodrigues & Schmidt 2010; Rodrigues et al. 2012; Tediosi & Gabriele 2010; Huber et al. 2009).

Notes: (a) Including institutional care.

(b) For home care only.

1.2. Other potential illegitimate sources of inequality

The cross-country differences regarding coverage of long-term care risks have the potential to influence the use of long-term care by impacting the financial burden that falls on households. There are, however, other factors that could also act as barriers to the use of long-term care and these might not be equally distributed in the population.

Long-term care is an area of public policy for which regional or local governments have sizeable responsibilities in the majority of countries analysed here. Not only are eligibility criteria often determined at the local level, but availability of services may also be conditioned by local budgets. In countries with social insurance-based systems (the Netherlands and Germany), eligibility criteria and benefit amounts are applicable to the whole population regardless of geography. The same applies to the Austrian long-term care allowance or the Italian cash benefit *Indennità di Accompagnamento*. Even in these cases, however, development of care services is still the responsibility of local governments and they may therefore still determine availability of care services. Geographic differences may also arise due to market forces as private providers may seek more affluent regions where demand or willingness to pay for care services may be perceived as higher. Geographic differences in available services may also reflect differences between rural and urban areas.

Use of long-term care might also be influenced by the living arrangements of frail older people, their household size and composition. Spouses, as well as children, are an important source of informal care (Rodrigues et al. 2013). Household composition may also impact the use of home care services given the scope for substitution between informal care and home care services (Motel-Klingebiel et al. 2005). Living together with the spouse or having children living nearby may change the relative cost of long-term care services and frail older people may replace them with informal care – something much less likely to happen in healthcare (Bonsang 2009).

Living arrangements may also impact the use of long-term care through the eligibility criteria for publicly funded long-term care, in the case of systems that are not 'carer-blind'. For example, in the Netherlands, the care that co-residing relatives or household members are deemed to provide on a daily basis, termed 'customary care', is part of the assessment criteria to calculate eligibility to publicly funded long-term care. In Germany, the amount of the long-term care insurance benefit is reduced if users take it as a cash payment often used to compensate informal carers.

Given the above-mentioned substitutability between formal home care services and informal care, cash-for-care benefits may also influence the use of different types of long-term care. In particular, cash-for-care benefits may reduce the relative cost of informal care vis-à-vis home care services if there are no restrictions as to their use to compensate informal carers. This substitution effect is likely to be greater for those co-residing with a spouse or other relatives, for frail older people with high care needs, or those for which affordability of formal home care services is an issue. Austria, Germany and Italy provide unregulated cash-for-care benefits and have furthermore a sizeable grey market of care based on migrant carers (Rodrigues et al. 2012). France and the Netherlands have cash-for-care benefits but impose stringent regulations as to their use to compensate informal carers and, at least in the case of France, the cash-for-care benefit cannot be use to compensate spouses. Spain and the Czech Republic have some cash-for-care benefits operating alongside home care services; while in Sweden and Denmark cash-for-care benefits are negligible. These characteristics are summarised in Table 2.

Table 2: Summary of characteristics of long-term care systems

Country	Type of system	Cash-for-care benefits	Scope for regional differences
Austria	Universal long-term care allowance.	Unregulated universal cash benefits	Federal long-term care allowance; Home care services determined by regional governments
Germany	Universal long-term care insurance	Unregulated universal cash benefits; Amounts lower for cash option used to pay informal care	Federal benefit; Home care services determined by regional governments
Sweden	Universal benefits	Marginal use of cash benefits	Home care services determined by regional governments
Netherlands	Universal long-term care insurance	Regulated universal cash benefits; Amounts depend on available informal care	Country-wide long-term care insurance benefit; Home care services determined by regional governments
Spain	Means-tested benefits	Limited unregulated cash benefits	Home care services determined by regional governments
Italy	Universal cash benefit and means-tested in-kind benefits	Unregulated cash benefits	Country-wide cash benefit; Home care services determined by regional governments
France	Universal benefit whose amount is income-related	Regulated universal cash benefit; Amounts depend on available informal care	Country-wide cash benefit; Home care services determined by regional governments
Denmark	Universal benefits	Marginal use of cash benefits	Home care services determined by regional governments
Greece	Means-tested benefits	Limited unregulated cash benefits	Home care services determined by regional governments
Belgium	Universal benefits with priority to lower income	Unregulated (means-tested and universal – Flanders only) cash benefits	Home care services determined by regional governments; Social insurance in Flanders only
Czech Republic	Means-tested benefits	Limited unregulated (means-tested) cash benefits	Home care services determined by regional governments;

Source: (Colombo et al. 2011; Rodrigues et al. 2012; Rodrigues & Nies 2013).

As with healthcare, education may also influence the use of long-term care. Education may be associated with different preferences for long-term care, e.g. if higher educated individuals may prefer more professional services as opposed to informal care or more costly (and better quality) services. Education may also be a proxy for socio-economic status and better educated individuals may be more willing and able to pay for care out-of-pocket, e.g. to overcome waiting lists. Higher educated individuals may also be able to better navigate social protection systems, or make more credible claims to benefits and thus have a higher take-up rate of home care services.

All the above mentioned factors may be considered to be illegitimate sources of inequality in the use of long-term care and thus translate into horizontal inequity. For example, frail older people with similar care needs may receive different types of care because they differ as to their living arrangements. Finally, there is also an element of individual heterogeneity related to preferences, genetic frailty, individual values (e.g. regarding the role of the family or the state in care for frail older people) that might also influence use of long-term care.

2. Brief review of evidence of socio-economic gradients in the use of long-term care

2.1. Socio-economic gradients in use of long-term care services

As mentioned earlier, there is limited research on potential differences in the use of long-term care due to socio-economic condition. In one of the few studies available, Sarasa and Billingsley (2008) find lower odds of using home care services among lower income individuals for the cluster of countries comprising Spain, Italy and Greece, but no statistical evidence of inequity for the two other clusters of countries considered – Sweden and Denmark, and Austria and Germany, respectively. They link the pro-rich bias found in Southern European countries to difficulties in reconciling paid employment and unpaid help, and to the existence of stronger family values among low-income groups. Correspondingly, Motel-Klingebiel and colleagues (2005) show in a European cross-country analysis that the existence of family norms associates with less use of formal home care services, even though they find that the bias in the use of these services (in favour of those with better education and better-paid jobs) is explained by household and socio-demographic characteristics and health status of the care recipient.

For Europe as a whole, evidence of the existence of a gradient by socio-economic status in the use of long-term care services is mixed. In home care, Bonsang (2009) finds that income plays a significant role in the decision to use paid domestic help, and that both higher education and income have a positive impact on the number of hours of this type of help (conditional on having any). Other pan-European studies find no significant differences across groups from distinct social and economic strata in the use of home care services (Broese van Groenou et al. 2006; Suanet et al. 2012), albeit some single country studies do report pro-rich differences (See Larsson & Silverstein 2004 on Sweden; Klie & Blinkert 2002 on Germany; Da Roit 2007 on Italy; García-Gómez et al. 2014 on Spain). Although not the focus of the present analysis, in residential care, a systematic literature review of determinants found inconclusive evidence on the role of education as a predictor of nursing home placement (Luppa et al. 2010). However, for this type of care, it is likely that institutional factors and co-payment rules play an even greater role than in home care. For example, quality standards of nursing homes are subject to huge differences across countries, e.g. regarding room size (Huber et al. 2009), which in turn affects the preferences of people of higher socio-economic status to move to a nursing home. Similarly, high income-related co-payments might deter groups of higher socio-economic status to use residential care services.

2.2. Socio-economic gradients in the use of informal care

Among families from poorer social and economic strata, several factors contribute to a stronger tendency to use informally provided care from relatives instead of turning to formal care services, compared to middle or upper class families. Importantly, social norms regarding intergenerational help tend to be stronger among the poor, and family members usually live in closer proximity. Also, they have a desire to avoid out-of-pocket payments (Theobald 2012). From the perspective of those providing care, opportunity costs to leave employment are lower in less well-paid jobs (Sarasa & Bilingsley 2008), which makes informal carers more readily available in low-income groups.

A number of European cross-country studies show that there is a pro-poor bias in the use of informal care. Groups of lower socio-economic status, and in particular of lower education, were found to be more likely to use informal care, even after accounting for differences in health status between socio-economic groups and other characteristics of the care recipient (Bonsang 2009; Broese van Groenou et al. 2006; Larsson & Silverstein 2004). In addition, there is evidence that lower educated children are more likely to provide informal care to their frail older parents (Broese van Groenou & van Tilburg 2003; Sarasa & Bilingsley 2008; Haberkern & Szydlik 2010), even though for

Nordic countries evidence on socio-economic differences in informal care use is mixed (Sarasa & Bilingsley 2008; Haberkern & Szydlik 2010; Larsson & Silverstein 2004)[4].

In a qualitative study in Italy, Da Roit (2007) shows that perceptions about care to older parents differ substantially between middle and lower class women. In poorer households, the use of care provided by family members is not an explicit choice but rather an unquestioned response to dependency within the family. This corroborates findings from Germany about complex patterns of class-related economic and cultural factors that influence care arrangements (Theobald 2012). These can ultimately result in a higher drop-out from the labour market and a higher poverty risk of carers (Colombo et al. 2011; Rodrigues et al. 2013). All cross-country studies, however, stress the existence of large country differences, given that the availability of services also matters substantially for the mix of informal and formal care (Motel-Klingebiel et al. 2005) as do societal factors (Suanet et al. 2012) and legal rules on care provision (Haberkern & Szydlik 2010).

3. Data and Methods

3.1 Data

The data used for the current analysis are taken from the second wave of the Survey of Health, Ageing and Retirement in Europe (SHARE) and were collected between 2006 and 2007 (Börsch-Supan et al. 2013; Börsch-Supan et al. 2008). The sample includes nearly 19.000 individuals from 11 countries (Table 3) for whom valid information was available on use of home care services and informal care, income level and a number of other variables of interest. The sample includes only community-dwelling individuals aged 60 or older, at the time of the interview. The countries included are: Austria, Germany, Sweden, the Netherlands, Spain, Italy, France, Denmark, Greece, Belgium and the Czech Republic.

Table 3: Descriptive statistics for the prevalence and intensity of formal and informal care services

Country	Obs.	Recipients of formal care		Recipients of informal care		Average weekly no. of care hours	
		No.	%	No.	%	Formal	Informal
Austria	888	72	8.19	202	22.75	19.33	1.82
Germany	1704	88	5.25	429	25.18	13.45	2.83
Sweden	1972	118	6.12	409	20.74	5.98	2.32
Netherlands	1675	186	11.40	332	19.82	4.77	1.33
Spain	1552	128	8.31	325	20.94	14.49	2.07
Italy	2092	117	5.62	397	18.98	13.69	1.36
France	1771	392	22.87	323	18.24	5.80	0.91
Denmark	1598	200	12.90	370	23.15	3.56	1.39
Greece	1962	72	3.74	483	24.62	28.05	2.07
Belgium	1992	360	18.36	492	24.70	5.33	1.89
Czech Republic	1730	89	5.25	612	35.38	5.42	6.4
Total	**18936**	**1822**	**9.81**	**4374**	**23.1**	**8.13**	**2.22**

Note: Unweighted results.

This Research Note analyses the use of two forms of care: home care services and informal care, both referring to the last 12 months before the survey. Home care services include professional or paid nursing or personal care, home help, meals-on-

[4] These studies did not consider intensity of informal care provision. Inconclusive evidence could be linked to the fact that informal care is more of a complement to formal care in the Nordic countries instead of a full-time occupation (see, for instance, Rodrigues et al., 2012), thus creating strong interdependencies between both types of care.

wheels, as well as home care and paid home help received from private providers and paid out-of-pocket or through private insurance[5]. Informal care refers to personal care (e.g. dressing, bathing or showering, eating, getting in or out of bed, using the toilet), practical household help (e.g. with home repairs, gardening, transportation, shopping, household chores) and help with paperwork provided by relatives, friends or neighbours from outside the household, as well as to personal care provided by co-residing individuals. The probability to use home care services and informal care is expressed as a dichotomous variable (yes/no received care) for each type of care, while intensity in the use of each is expressed as the total number of hours received. In the case of home care services, the total number of hours received results from summing over all categories of care services described above, whenever the responded has benefited from any such services during the previous year.

The main income measure used throughout the analysis is total household gross income in Euro, a comprehensive income measure, which is computed as the sum of all monetary income[6] received by any of the registered household members during the reference year. In order to maintain comparability between countries, our income indicator is adjusted for purchasing power parity and equivalised using the square root scale, i.e. divided by the square root of the number of household members (OECD 2011). When wealth, rather than income is used, it includes all household real assets, net of any debt on them, and all net financial assets[7](Christelis 2011).

As care utilization is likely to be driven to a large extent by the care needs of an individual, health status and frailty are accounted for throughout the analysis and they are proxied by: (1) an indicator for less than good self-reported health; (2) indicators for moderate and severe disability (limitations in activities of daily living); (3) the number of diagnosed chronic conditions; (4) the use of aids for restricted mobility; (5) indicator for the presence of long term illness, diagnosed by a physician; (6) indicator for cognitive impairment, i.e. diagnosed Alzheimer's disease, dementia, organic brain syndrome, senility or any other serious memory impairment; and (7) an indicator for poor mental health, i.e. 3 or higher on the Euro-D scale.

A number of variables recognised in the literature as determinants of health and long-term care utilization were also considered, although not directly related with an individual's health status or his care needs (Marmot & Wilkinson 2005). These can be broadly classified into three categories: (i) level of education – including indicators for having completed secondary or tertiary education, (ii) regional and local characteristics – including dummies for the region of residence[8] and indicators of the level of urbanism; and (iii) a set of household characteristics. The latter includes variables like marital status, household size and whether the respondent lives alone, the number of children and the number of daughters of the respondent. Given the characteristics of our target population, which is overwhelmingly inactive on the labour market we do not specifically account for employment status.

3.2 Methods

3.2.1 Concentration curves and concentration indices

Within the long tradition of measuring socio-economic inequalities in health, the concentration curve and the associated concentration indices have become established

[5] The SHARE questionnaire (in English and all national languages) is available at: http://www.share-project.org/data-access-documentation/questionnaires/questionnaire-wave-2.html

[6] This includes income from employment and self-employment, unemployment benefits, any income from pensions, insurance payments received, interests and/or dividends from bank accounts, bonds, stocks or mutual funds and income from rent.

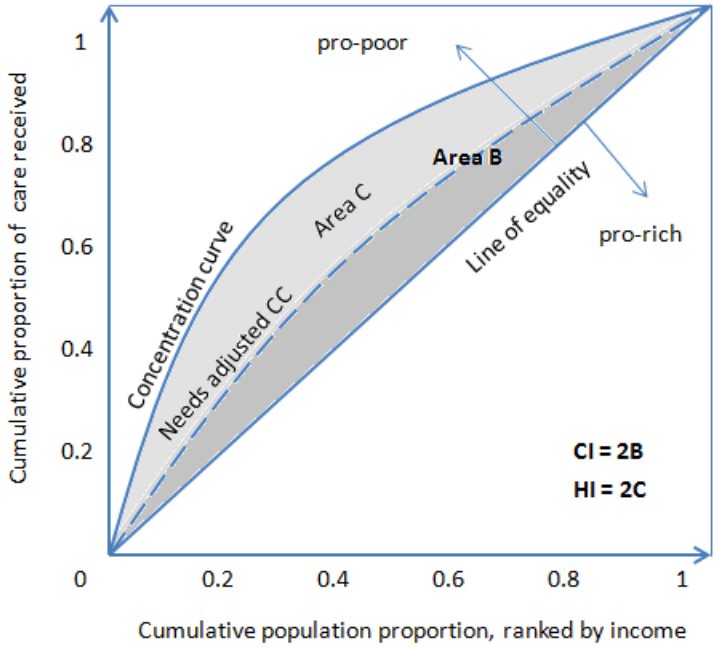
[7] This includes: the value of the main residence and all other real estate (minus any mortgages on them), the value of cars, of the business share owned (if any), the value of any bank accounts, stocks and bonds, mutual funds, retirement accounts and life insurance.

[8] We use NUTS level 1 regions, always using the region that include the capital city as the reference category. For countries where NUTS 1 regions were not defined (i.e. Sweden, Denmark and the Czech Republic) we used NUTS 2 regions. No regional information was available for Germany.

as the most appropriate measures (Wagstaff et al. 1991), able to synthetically capture the distribution of the healthcare use variables considered with respect to that of the socio-economic status, in the entire population (rather than comparing its extremes).

The concentration curve (Figure 1) is obtained by plotting the cumulative proportion of the long-term care use variable against the cumulative population proportion, ranked by socio-economic status - in this case, income - from the most to the least disadvantaged. If each individual were to receive an equal share of total provided care, irrespective of his income level, the concentration curve would overlap the 45-degree line, marking a perfectly equal distribution of care in the population. If, however, systematically higher values for long-term care use are registered among poorer (richer) people, the concentration curve will lie above (below) the line of equality describing a situation of pro-poor (pro-rich) inequality (i.e. a higher concentration of the long-term care use variable among lower (higher) income groups).

Figure 1: Plot of concentration curves and concentration indices for income related inequalities in health



The larger Area B becomes (the sum of the light and dark shaded areas in Figure 1), the more the observed distribution of care diverges from equality, whereas a smaller area would reflect more contained differences with respect to the equality line and thus lower inequality levels. In other words, measuring the size of area B provides an intuitive and synthetic measure of the extent of socio-economic inequality in the distribution of the long-term care use variable. This measure is known as the Concentration Index (CI), it equals twice the area between the concentration curve and the 45-degree line and is bounded between -1 and 1. When the two lines coincide the CI will equal zero. By convention, the CI takes negative values when pro-poor inequality is present and positive values when the long-term care use variable is disproportionately concentrated in the upper income quintiles.

As a synthetic measure of inequality, the CI is well-adapted for comparisons between countries and over time. Initially developed for continuous variables (e.g. number of hours of home care services used), it is possible to calculate a correct form of the concentration index for binary or bounded variable (Erreygers 2009). It is this corrected concentration index that it is used for the probability to use home care services and informal care (see Annex 1 for more details).

It is also worth noting here that pro-poor and pro-rich inequality in different parts of the income distribution can offset each other when the concentration curve crosses the line of equality. In other words, a low value of the CI could result on one hand from low inequality levels and on the other, from high inequality levels of contrary sign along the income distribution. To avoid such confusion, the values of the CI should be interpreted in conjunction with the plot for its associated concentration curve.

3.2.2 The decomposition of the concentration index

While the concentration index provides a reliable measure of total socio-economic inequality, it provides no information about the factors that might determine the degree of inequality observed, which are of particular relevance for policy-making. In order to identify and quantify the contribution of different determinants to socio-economic inequality in access to care, Wagstaff and colleagues developed a decomposition technique that is employed in this Research Note (Wagstaff et al. 2003).

It begins by specifying a linear regression model that relates access to long-term care with a set of variables which can be thought to determine demand for the different types of care. Drawing on this association, the CI previously calculated can be now expressed as the sum of the contributions of all considered factors (or combinations of factors) and an error component (i.e., a generalised concentration index for the error term). The sign and magnitude of the contribution of each factor will depend on how much long-term care use is influenced by it (its 'average elasticity' or the sensitivity of long-term care use to variations in this factor) and by how much this factor is itself unequally distributed with respect to income (its concentration index). As an example, if higher education is a strong predictor of use of home care services (i.e. has a higher 'average elasticity') and if it is unequally concentrated among richer individuals (i.e. has a high CI in absolute value with a positive sign), then higher education will have a sizeable and pro-rich contribution to the overall CI (see Annex 1 for more details).

For inherently non-linear models, as the ones presented in this analysis, the decomposition results are obtained from a linear approximation of the model based on a 'partial effect' representation (van Doorslaer et al. 2004).

3.2.3 The horizontal inequality index

The decomposition of income-related *inequalities* into contributions of various determinants affords the opportunity to extend the analysis into the measurement of *inequity*, by separating the relevant determinants into 'need' factors, which lead to justified or fair inequalities, and 'non-need' factors which associate with unfair inequalities in use of long-term care. The categorization implies a normative judgment and following the growing consensus in the literature, health status, age and gender are considered indicative of long-term care need and fall in the first category (O'Donnell et al. 2008; Bago d'Uva et al. 2009). Other personal, household or regional characteristics are considered not legitimate determinants of access to care and fall in the 'non-need' category.

The horizontal inequity (HI) index derives from the already stated principle that individuals with equal care needs should receive equal amounts of care, and requires the standardization of the long-term care use variable by the level of need of each individual. Horizontal inequity, then, is a measure of the difference between actual and need-predicted care utilization.

Estimates of horizontal inequity are derived through the indirect standardization method (Wagstaff & van Doorslaer 2000). After separating the determinants of long-term care use into a need and a non-need vector a logistic regression model is used to estimate how much care each individual would have received had he been treated in the same way as were, on average, other individuals with equal care needs. In order

to obtain a clean prediction of need-driven utilization, all non-need variables are set to their means, thus neutralizing their effect[9].

Graphically, in Figure 1, the dashed concentration curve is plotting need-predicted levels of utilization while the continuous concentration curve describes actual use, as observed in the population. The dark shaded area represents need-driven inequality, while the area between the two concentration curves (labelled C in the graph) corresponds to inequalities that cannot be explained by legitimate factors and can be deemed 'unfair'. In the same spirit as the CI, the HI index is computed as twice the area between the actual and need-predicted concentration curves (the lighted shaded area in the graph) and ranges between -1 and 1. A negative (positive) value of HI points to horizontal inequity favouring the poor (rich).

4. Results

4.1. Cross-country inequalities and inequities in the use of long-term care

For home care services, the overwhelming majority of the concentration indices (CI) for the probability to use these services are negative, which indicates that less affluent individuals are more likely to receive long-term care services (Table 4). Fairly marked differences are noticeable between countries, with Germany, Austria and Spain registering relatively lower inequality levels, while in Denmark and Sweden, pro-poor inequality is considerably greater. Italy is the only country in our sample where inequality favours the rich (positive CI), but the estimated CI value is not statistically significant.

Table 4: Inequality and inequity in probability to use home care services

Country	CI	Std. Error	HI	Std. Error
Austria	-0.005	0.024	0.032	0.018
Germany	**-0.037**	0.017	-0.019	0.015
Sweden	**-0.116**	0.019	-0.028	0.015
Netherlands	**-0.090**	0.027	-0.030	0.021
Spain	-0.030	0.022	0.008	0.018
Italy	0.034	0.019	0.031	0.017
France	-0.069	0.035	-0.020	0.029
Denmark	**-0.192**	0.022	**-0.039**	0.016
Greece	-0.009	0.010	-0.004	0.008
Belgium	**-0.053**	0.022	0.009	0.019
Czech Republic	**-0.052**	0.014	**-0.027**	0.013

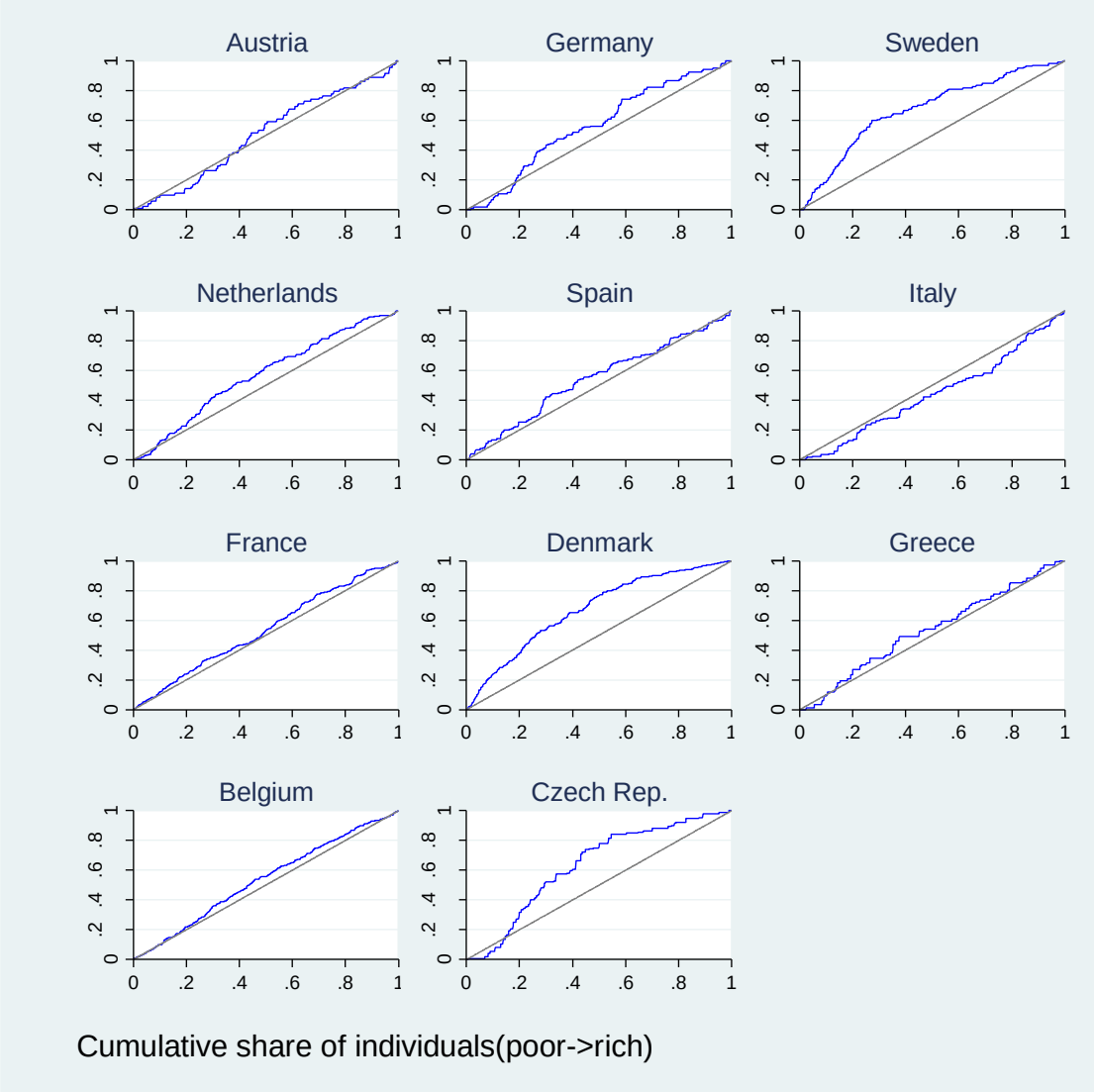
Notes: Statistically significant values indicated in bold (P < 0.05). Weighted results.

The concentration curves for the probability to use home care services (Figure 2) supplement the information provided by the CI and provide better insight into the cross-country distribution of home care use. In Austria, Germany, and to a lesser extent in the Czech Republic and Greece, the concentration curves lie below the 45 degree line, describing a pro-rich distribution of home care, for the lowest income quintile. This is, however, off-set by stronger, pro-poor distribution of the probability to use home care services in upper income quintiles. Exceptionally, in the case of Italy, the concentration curve remains below the 45 degree line along the whole

[9] The non-linearity of the model used is accounted for by using an approximation of need-standardized care obtained from differencing actual and need-predicted care utilization and adding the mean of the prediction (thus ensuring that actual and need-standardised care utilization have the same mean).

income distribution, indicating that better-off individuals have disproportionately more access to home care. For France, Greece and Belgium the concentration curves for home care services are very close to perfect equality, while in Sweden and Denmark the distribution of home care services is clearly pro-poor.

Figure 2: Concentration curves for probability to use home care services



Note: Weighted results.

The pro-poor inequality in the use of home care services seems to reflect, to a very large extent, the unequal distribution of need. After accounting for the disproportionate concentration of care needs among the worse-off (HI indices in Table 4), differences in access to care services by income are much attenuated. This is reflected in the lower values of the HI indices, which are significantly different from zero only for Denmark and the Czech Republic. In these countries, poorer individuals use significantly more than their need-predicted share of home care (negative HI). All in all, we find very little evidence of horizontal inequity in home care services utilization in European countries.

All CI for the probability to use informal care are markedly negative and all but one (the Netherlands) are statistically significant (Table 5). Compared to home care services, informal care in Europe is distributed even more unequally in favour of the poor, even though between-country variation remains substantial. The lowest inequality levels are observed in Belgium and Italy, while three time higher values are registered for Sweden and the Czech Republic.

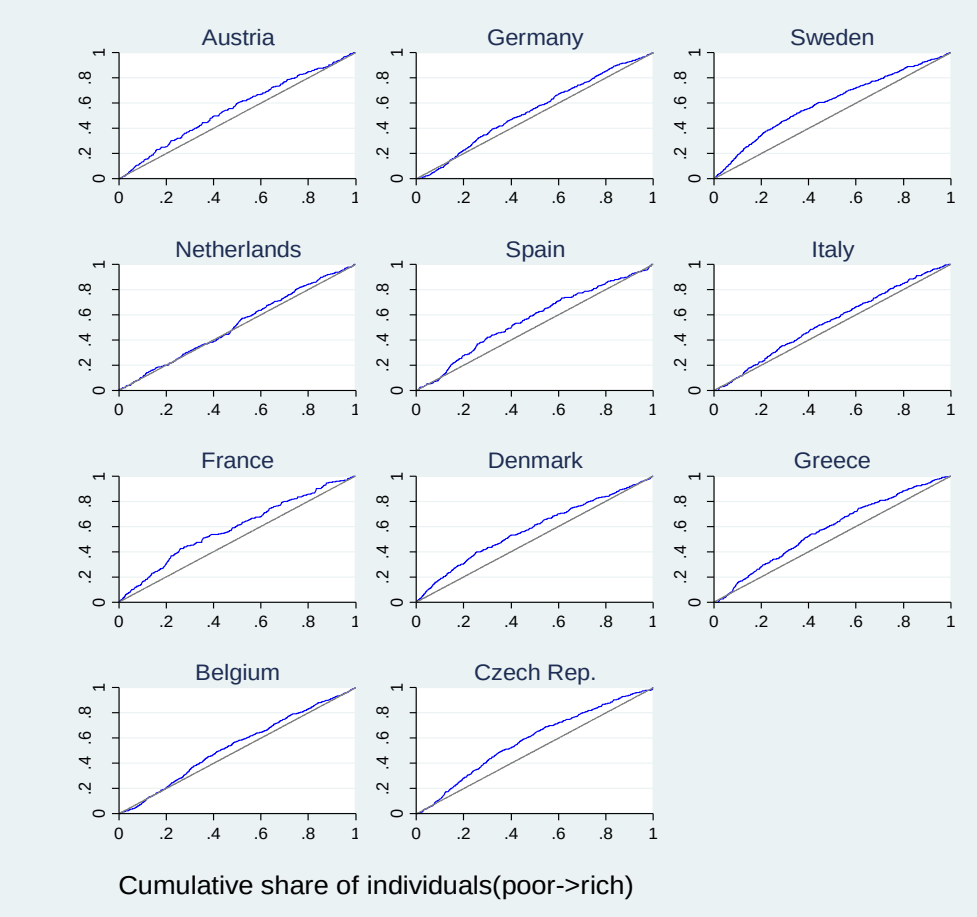
Table 5: Inequality and inequity in probability to use informal care

Country	CI	Std. Error	HI	Std. Error
Austria	**-0.107**	0.035	**-0.105**	0.031
Germany	**-0.094**	0.030	**-0.088**	0.027
Sweden	**-0.200**	0.026	**-0.098**	0.025
Netherlands	-0.036	0.029	-0.036	0.028
Spain	**-0.102**	0.028	-0.021	0.024
Italy	**-0.079**	0.027	-0.024	0.023
France	**-0.132**	0.032	**-0.060**	0.026
Denmark	**-0.153**	0.026	**-0.085**	0.025
Greece	**-0.149**	0.024	**-0.076**	0.021
Belgium	**-0.068**	0.023	**-0.047**	0.021
Czech Republic	**-0.220**	0.036	-0.146	0.033

Note: Statistically significant values indicated in bold (P < 0.05). Weighted results.

Virtually all concentration curves for the probability to use informal care lie above the equality line across the entire income distribution, indicating systematic pro-poor inequality (Figure 3). Three exceptions are noteworthy: the Netherlands, for which the actual distribution of informal care follows fairly closely a situation of perfect equality – i.e., the concentration curve mostly overlaps the 45 degree line, and, Germany and Belgium, where the concentration curves crosses the equality line in the first income quartile.

Figure 3: Concentration curves for probability to use informal care



Note: Weighted results.

After controlling for unequal distribution of need, there is strong evidence of horizontal inequity in the probability to use informal care, systematically favouring poorer individuals (Table 5). While for the Netherlands, Spain and Italy the HI indices are not statistically different from zero, for the rest of the sample the HI indices have very high values, ranging from -0.05 in Belgium to -0.15 in the Czech Republic.

The analysis of income-related inequality, as presented above, was replicated for the intensity of use of long-term care, i.e. the conditional number of care hours received. CI and HI indices were also calculated for both home care services and informal care intensity (for detailed results please refer to Annex 2). However, the indices were not statistically significant for either type of long-term care and results are not shown here. These results are more likely to reflect the very small sample sizes for users of long-term care in the dataset than the true distribution in the population. For the rest of this Research Note the analysis focuses only on the probability to use long-term care and not on care intensity.

4.2. The effect of wealth on inequality and inequity

The analysis on inequality and inequity in the probability to use long-term care has thus far focused exclusively on household income as a ranking variable. Arguably, wealth can be considered a better proxy for the socio-economic status of older people, as it better reflects the distribution of welfare. This effect is likely to be particularly relevant for the population group considered here (older individuals aged 60 and above), who may have accumulated sizeable assets during their lifespan (e.g. own housing) and thus have a positive 'net worth' situation compared to other age groups (Colombo et al. 2011). To analyse the effect of wealth on inequality and inequity in long-term care utilization, CI and HI indices presented in section 4.1 were recalculated using wealth or a combination of wealth and income (an aggregate measure summing total household income with 40% of household net worth, i.e. income + 0.4 wealth) as the ranking variable (Table 6). (Annex 3 shows the concentration curves by country and care type.)

Table 6: Effect of wealth on CI and HI indices for probability to use home care services

Country	Income		Income & Wealth		Wealth	
	CI	HI	CI	HI	CI	HI
Austria	-0.005	0.032	-0.029	0.025	**-0.095**	-0.016
Germany	**-0.037**	-0.019	**-0.051**	-0.019	**-0.073**	-0.019
Sweden	**-0.116**	-0.028	**-0.127**	**-0.034**	**-0.130**	**-0.041**
Netherlands	**-0.090**	-0.030	**-0.115**	-0.023	**-0.161**	-0.025
Spain	-0.030	0.008	-0.029	0.011	-0.040	0.001
Italy	0.034	0.031	0.035	**0.046**	0.003	**0.038**
France	-0.069	-0.020	**-0.104**	-0.041	**-0.159**	**-0.064**
Denmark	**-0.192**	**-0.039**	**-0.215**	**-0.053**	**-0.216**	**-0.069**
Greece	-0.009	-0.004	-0.016	-0.010	**-0.031**	**-0.025**
Belgium	**-0.053**	0.009	**-0.085**	0.006	**-0.118**	-0.012
Czech Republic	**-0.052**	**-0.027**	**-0.058**	**-0.028**	**-0.054**	-0.024

Note: Statistically significant values indicated in bold ($P < 0.05$). Weighted results.

In the case of the probability to use home care services, adding a correction for household wealth to the ranking variable leads to an increase in the measured level of pro-poor inequality: most concentration indices have more pronounced negative values and more become statistically significant. The effect is even more evident when

individuals are ranked according to wealth alone. The most marked differences are observed for Germany, Netherlands, France and Belgium, where the values of the CI double with respect to the original income ranking. Interestingly, in the countries where income-related inequality in access to care was evaluated as high the re-ranking on wealth leads to only marginal changes in CI values: this is the case of Sweden and Denmark.

The consistent increases in the absolute values of inequality indices also lead to more pronounced levels of horizontal inequity. More HI indices are significantly different from zero when ranking by wealth and there is evidence of pro-poor inequity in the use of home care services in Sweden, France, Denmark and Greece. The use of wealth as a ranking variable (considered alone or in conjunction with income) makes the pro-rich inequity in the use of home care services in Italy more pronounced. While the HI index was positive with income, albeit not statistically significant, it is reinforced and significantly different from zero when considering wealth.

The effect of the correction for wealth in the ranking variables is less systematic when it comes to the probability to use informal care. In the Netherlands, Italy, France, Greece, Belgium Austria and Germany inequality increases steadily when moving from the income to the wealth ranking, albeit the changes remain small in absolute value (Table 7). In Spain and Denmark, using wealth as a ranking variable produces virtually no change in the CI for the probability to use informal care. Finally, inequality in informal care utilization reduces slightly when using wealth instead of income for Sweden and the Czech Republic, albeit CI values remain negative – i.e. the distribution remains pro-poor.

The effect of re-ranking by wealth on the level of horizontal inequity in informal care utilization appears equally unsystematic and dissimilar to the dynamics revealed by the analysis of inequity in home care services. Using only wealth as the ranking variable, the negative indices are lower for France, Greece and Belgium. Whereas for Austria, Sweden and Denmark there is still pro-poor inequity in the use of informal care when considering wealth, but much less so than for income.

Table 7: Effect of wealth on CI and HI indices for probability to use informal care

Country	Income		Income & Wealth		Wealth	
	CI	HI	CI	HI	CI	HI
Austria	**-0.107**	**-0.105**	**-0.119**	**-0.096**	**-0.133**	**-0.069**
Germany	**-0.094**	**-0.088**	**-0.089**	**-0.062**	**-0.114**	-0.041
Sweden	**-0.200**	**-0.098**	**-0.202**	**-0.091**	**-0.164**	**-0.062**
Netherlands	-0.036	-0.036	-0.057	-0.040	**-0.103**	-0.055
Spain	**-0.102**	-0.021	**-0.095**	-0.010	**-0.102**	-0.016
Italy	**-0.079**	-0.024	**-0.107**	-0.034	**-0.130**	-0.039
France	**-0.132**	**-0.060**	**-0.137**	**-0.057**	**-0.168**	**-0.083**
Denmark	**-0.153**	**-0.085**	**-0.152**	**-0.069**	**-0.142**	**-0.052**
Greece	**-0.149**	**-0.076**	**-0.165**	**-0.081**	**-0.184**	**-0.099**
Belgium	**-0.068**	**-0.047**	**-0.095**	-0.034	**-0.157**	**-0.063**
Czech Republic	**-0.220**	-0.146	**-0.216**	**-0.132**	**-0.147**	-0.064

Note: Statistically significant values indicated in bold ($P < 0.05$). Weighted results.

4.3. Decomposing inequality in use of long-term care

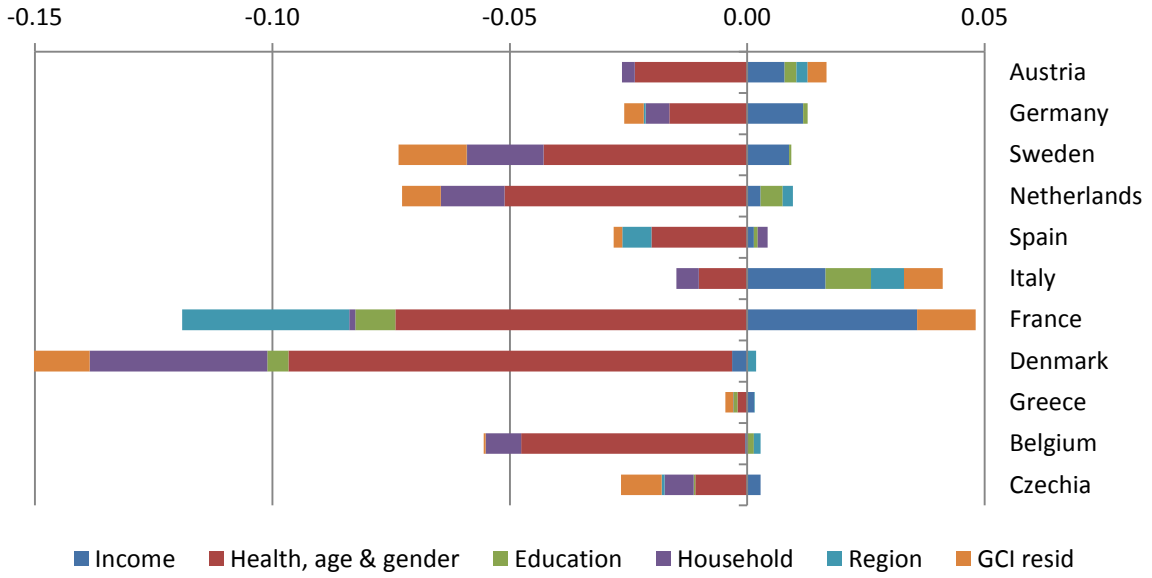
The decomposition analysis distinguishes five main sources of income related inequality in access to long-term care services: (i) income; (ii) need factors – subsuming health status, age group and gender; (iii) education achievement; (iv) household characteristics and (v) region characteristics. Four of these vectors

aggregate the contributions of several variables and might hide positive and negative contributions of similar magnitudes which cancel each other out in the summation (see Annex 4 for detailed contributions of each factor). Following the specialised literature, a logarithmically transformed income variable is used.

In order to facilitate the interpretation, Figure 4 and Figure 5 below, display graphically the results of the factor decomposition. The sum of the bar sizes on either side of zero reflects the degree of inequality in each country; i.e. a perfectly equal distribution of care irrespective of income would result in perfectly balanced bars to the left and right of the origin, whereas for a perfectly equitable distribution the sum of the bars would equal the legitimate needs bar.

With the sole exception of Italy, in all analysed countries, the largest contribution to inequality in the probability to use home care services can be ascribed to need factors (Figure 4). This suggests that European long-term care systems tend to be pro-poor mainly because care needs are disproportionately concentrated in the lower part of the income distribution. This is especially true in Sweden, the Netherlands, Denmark and Belgium, where more than half of the measured level of inequality is explained by legitimate differences in health, age and gender.

Figure 4: Decomposition of inequality in probability to use home care services



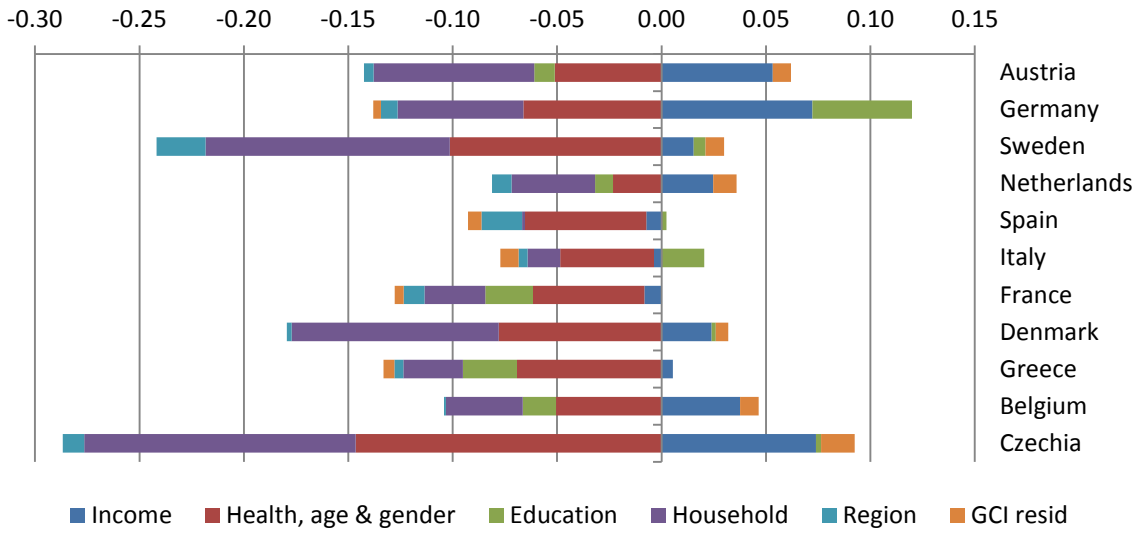
Note: Weighted results.

Conversely, income contributes positive values to overall inequality and concentrates in the better-off population groups. The effect is most noteworthy in France, Italy and Germany where differences in household income are more significantly pro-rich, while Denmark is the only European country where the better-off have less access to home care services. Italy, however, stands out of the group as the only country in the sample where income inequality completely off-sets the contribution of legitimate need factors.

Among non-need factors, household characteristics are the most significant driver of inequality and generally contribute to pro-poor inequality. The highest contribution of household characteristics to the CI is observed in Denmark and accounted for by the higher likelihood of living alone for individuals in lower income quintiles. The effect of education is marginal in most countries analysed and tends to contribute to pro-rich inequality (except for Denmark, France and the Czech Republic). Similarly, regional characteristics have a very limited impact on home care inequality, with the exception of France, where the disproportionately higher affluence in the capital region accounts for the significantly pro-poor contribution.

It is immediately apparent from Figure 5, that need factors remain an important source of inequality also in the decomposition of the CI for the probability to use informal care. Nonetheless, the relative magnitude of their contribution is significantly reduced: whereas need factors account for the bulk of pro-poor inequality in access to home care services, in the case of informal care household characteristics prove equally important. This should not be surprising, as household characteristics likely act as a proxy for availability of informal helpers in the immediate family circles. In fact, the negative contributions to the total concentration index are mainly the result of a higher probability to live alone[10] and have more children and daughters in the lower income quartiles, all characteristics that associate positively with the probability of receiving informal care. Austria, Sweden and the Czech Republic stand out for the large contribution of household characteristics to overall inequality, whereas in Spain and Italy we observe much lower levels.

Figure 5: Decomposition of inequality in probability of informal care use



Note: Weighted results.

The contribution of income is generally positive, with highly varying magnitudes between European countries. The high values registered in Austria, Germany and the Czech Republic are contrasted by much lower contributions in Spain, Italy and France. Interestingly, the latter are also the countries where the distribution of income adds to pro-poor inequality.

Education achievement also makes an important contribution to inequalities in access to informal care. Most pronounced in Germany and Italy, where its contribution is pro-rich, but also considerable in Greece, France and Belgium, this time registering negative values.

5. Concluding remarks

The distribution of home care services across European countries seems to reflect differences in need between individuals with dissimilar income. The exception to this is Italy, where there seems to be some signs of pro-rich inequity in the use of home care services. This does not mean that the effect of income on the probability to use home care services is neutral, as the results from the decomposition analysis showed.

[10] This result might seem counterintuitive, given that spouses are such an important source of informal care. It is explained by the generally low prevalence of co-residential care with respect to extra-residential care, both in our sample and in the population. As these two types of care are not distinguished in the present analysis, this result is driven by the fact that most of the provided care comes from relatives and friends from outside the household, to individuals who often live alone.

Income is associated with higher probability to use home care services, but this is off-set by the differences in needs. For informal care, the situation is somewhat different as there is strong evidence of pro-poor inequity in the use of this type of long-term care, i.e. after controlling for differences in needs across the income distribution. The analysis of the decomposition of the CI for informal care shows that differences in household size and composition are as important as needs in contributing to pro-poor horizontal inequity. These results seem to confirm earlier findings of the literature surveyed in section 2 that point to a socio-economic gradient (pro-poor) in the use of informal care.

Despite the differences between countries, the links with different policies regarding long-term care are not always linear, with countries with apparently dissimilar approaches achieving similar results in terms of equity. For example, the HI indices for the probability to use informal care for Austria and Sweden are equivalent and so are those of Germany and Denmark. However, the concentration curves for the probability to use home care services did show that the lower income quintile had a disproportionately lower probability of using these services, but mostly only in countries where unregulated cash benefits play an important role in publicly supported care (Italy, Germany and Austria). From the point of view of public policy, these results raise some concerns as they may hint at greater difficulties of using services by lower income frail older people despite the availability of universal cash benefits.

In countries with means-tested systems coupled with limited provision of home care services, such as Italy, Spain and the Czech Republic, there was no evidence of pro-poor inequity in the probability to use informal care. One possible reason for this might be that in the absence of services informal care is the only option not only for lower income individuals, but also for those in higher income groups. In the Netherlands, there was also no evidence of pro-poor inequity in informal care, but this result most likely reflects the effect of the 'customary care' principle in assessing eligibility for public benefits. Spain and the Czech Republic have changed their long-term care systems into universal systems since the date of the survey and it would have been interesting to analyse possible changes. However, since the SHARE waves subsequently collected do not have information on long-term care use it was not possible to carry out this analysis.

The effect of wealth on horizontal inequity in the use of long-term care was differentiated across countries and between types of care. Had the pro-poor inequity in the probability to use of home care services been attenuated when ranking by wealth, this could have indicated that better-off individuals could be tapping into their accumulated savings to pay for home care services. Instead, wealth ranking seems to make the inequity in the use of home care services even more pro-poor. One possible explanation for this lies in the fact that a sizeable share of wealth will be comprised of one's own house and the effect captured by the HI indices may be related to housing conditions. Tenants may not only be poorer, because they do not own their houses, but also live in poorer living conditions and therefore be prioritised in the allocation of home care services. For informal care, the effect of accounting for wealth is the opposite and it seems to mitigate the pro-poor inequity. One possible explanation is that the possibility of bequest reinforces informal care provision in higher income households.

From the policy viewpoint, it is important to discuss whether differences in household composition that seem to shape a significant part of the dissimilarities in use of informal care by income should be treated as a legitimate source of inequality in use of long-term care. Similarly, the fact that probability to use informal care is higher among lower income frail older people even after controlling for need deserves some reflection. One question this raises is whether the burden of informal care is falling disproportionately among lower income individuals and whether this could have further equity repercussions in terms of employment and health of those carers.

As mentioned earlier, CI and HI indices for intensity of home care services and informal care resulted in statistically non-significant findings, which likely reflect the small sample sizes of actual users of formal and informal care. Examples from the

literature on inequity in healthcare use (van Doorslaer et al. 2004) and on patterns of informal care provision (Bolin et al. 2008) point to the possible differences between probability to use and intensity of care. It is therefore not possible to extrapolate the findings reported here to the intensity of long-term care and this is an area that deserves further research.

Another important caveat is the absence of information on frail users of institutional care. As they might not represent a random section of the population, their absence from the sample may bias some results. This is likely to be the case if, for instance, poorer individuals are somewhat more likely to transfer to institutional care.

SHARE data include questions on individual values regarding the role of the family in caring for frail older people. However, the analysis did not include this information due to the high number of missing values. It was therefore not possible to investigate whether the mitigated pro-poor inequity in the probability to use informal care when accounting for wealth could reflect stronger preferences for informal care among wealthier households. Similarly, it was not possible to test whether the lack of pro-poor inequity in the probability to use informal care in Spain, Italy and the Czech Republic could also reflect strong preferences for informal care that overcome income differences.

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Annex 1 - Additional notes on Methodology

The concentration curve (CC) plots the cumulative proportion of the health variables (y-axis in Figure 1) against the fractional rank of the population, ranked by socio-economic standard, i.e. income (x-axis). The associated concentration index (CI) can be written as:

$$CI = 1 - \frac{2}{n\mu}\sum_{i=1}^{n} h_i(1 - r_i) \quad (1)$$

Where, *n* represents the sample size, h_i is the health variable, μ is the average of the health variable and $r_i = {}^{i}/_{n}$ is the fractional rank in the income distribution for the *i*th person, *i* = 1 for the poorest and *i* = *n* for the richest individual.

Alternatively, the 'convenient regression' expression based on the covariance between h_i and the fractional rank, can be used for the estimation:

$$CI = \frac{2}{\mu} cov(h, r) \quad (2)$$

For bounded variables the value of the CI depends upon the mean of the variable, rendering the application of a scale correction necessary. This is the corrected concentration index (CCI) proposed by Erreygers (2009):

$$CCI = \frac{4*\mu}{h_{max} - h_{min}} * CI \quad (3)$$

The CI can be decomposed into the contributions of different explanatory factors by a regression analysis technique. Starting from an explanatory model, such as:

$$h_i = \alpha + \sum_k \beta_k x_{ki} + \varepsilon_i \quad (4)$$

Where x_k is a vector of variables which associate with the health variable and ε is the error term, the CI of the health variable can be rewritten as:

$$CI = \sum_k \left({}^{\beta_k \bar{x}_k}/_{\bar{h}}\right) CI_k + {}^{GC_\varepsilon}/_{\bar{h}} \quad (5)$$

Where $\bar{x}_k$ is the mean of x_k , CI_k is the concentration index for regressor x_k and GC_ε is the generalised concentration index of the error term.

In order to measure horizontal inequity, we start by equation (4) and separate the vector of regressors x_k into a vector of need factors (N_k) and a vector of non-need factors (Z_j), as follows:

$$h_i = \alpha + \sum_k \beta_k N_{ik} + \sum_j \delta_j Z_{ij} + \varepsilon_i \quad (5)$$

The need-predicted utilization is then defined as:

$$\hat{h}_i = \hat{\alpha} + \sum_k \hat{\beta}_k N_{ik} + \sum_j \hat{\delta}_j \bar{Z}_{ij} + \varepsilon_i \quad (6)$$

We note that the effect of non-need variables is neutralised by setting them equal to their means ($\bar{Z}_j$) for the purpose of the prediction. In the case of a non-linear regression model, however, the effect of non-need factors cannot be completely neutralised by setting then equal to any value. A good approximation can be obtained by subtracting the need-predicted care utilization from the level of actual utilization and adding the mean of the prediction (which effectively ensures that the two utilization variables have the same mean). Formally,

$$\hat{h}_i^{IS} = h_i - F(\hat{\alpha} + \sum_k \hat{\beta}_k N_{ik} + \sum_j \hat{\delta}_j \bar{Z}_{ij}) + \frac{1}{n}\sum_{n=1}^{n} F(\hat{\alpha} + \sum_k \hat{\beta}_k N_{ik} + \sum_j \hat{\delta}_j \bar{Z}_{ij}) + \varepsilon_i \quad (7)$$

Where $\hat{h}_i^{IS}$ is the indirectly standardised need-predicted utilization and F(.) will take the form of the specific non-linear model used (e.g. logit, probit, Poisson). We can now generate the concentration curve of the need-predicted utilization and define the horizontal inequity index as:

$$HI = 2 * \int [CC_{actual} - CC_{need-predicted}] \quad (8)$$

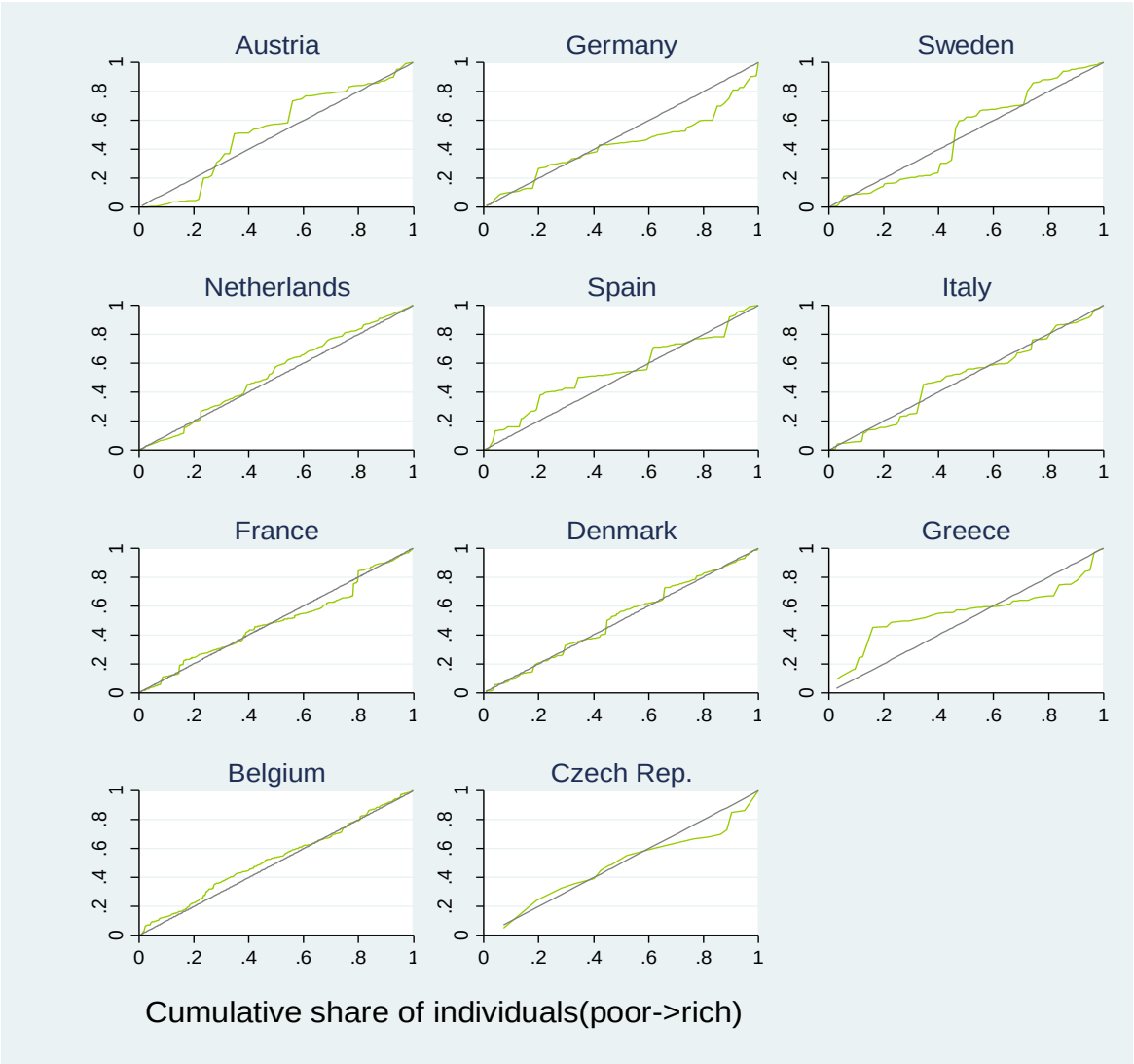
Annex 2 – Main results of the analysis of inequality and inequity in the intensity of care utilization

Table A1: Inequality and inequity in the intensity of long-term care use

Country	Home care		Informal care	
	CI	Std. error	CI	Std. error
Austria	-0.058	0.115	0.068	0.071
Germany	0.120	0.139	0.090	0.049
Sweden	-0.014	0.071	0.008	0.052
Netherlands	-0.055	0.045	0.068	0.072
Spain	-0.106	0.141	-0.180	0.156
Italy	0.002	0.104	0.051	0.083
France	0.022	0.088	-0.005	0.060
Denmark	-0.020	0.058	0.204	0.076
Greece	-0.156	0.194	-0.073	0.059
Belgium	-0.053	0.047	0.036	0.064
Czech Republic	0.014	0.125	0.065	0.092

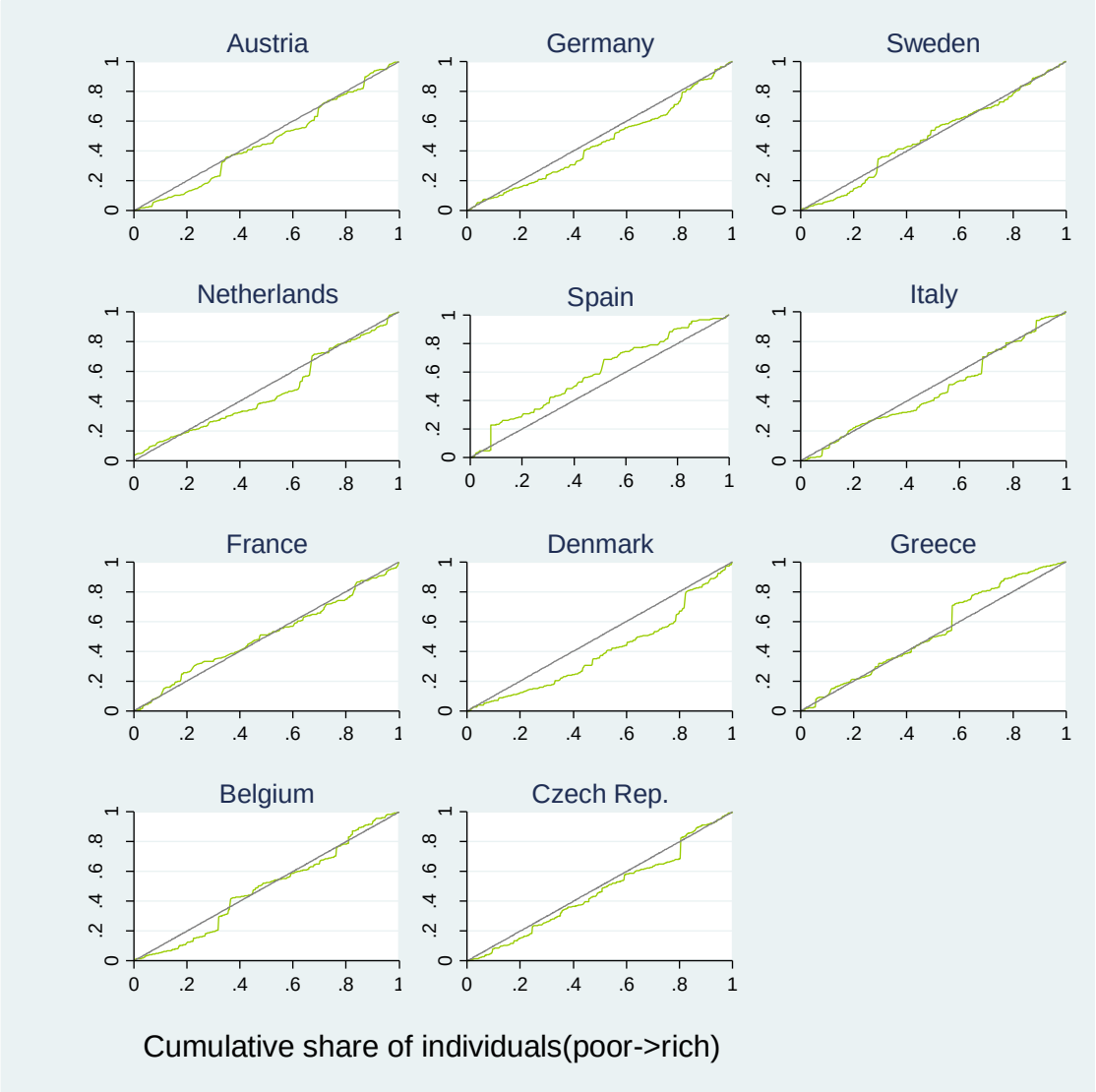
Notes: Statistically significant values indicated in bold ($P < 0.05$). Weighted results.

Figure A1: Concentration curves for the intensity of home care services use



Note: Weighted results.

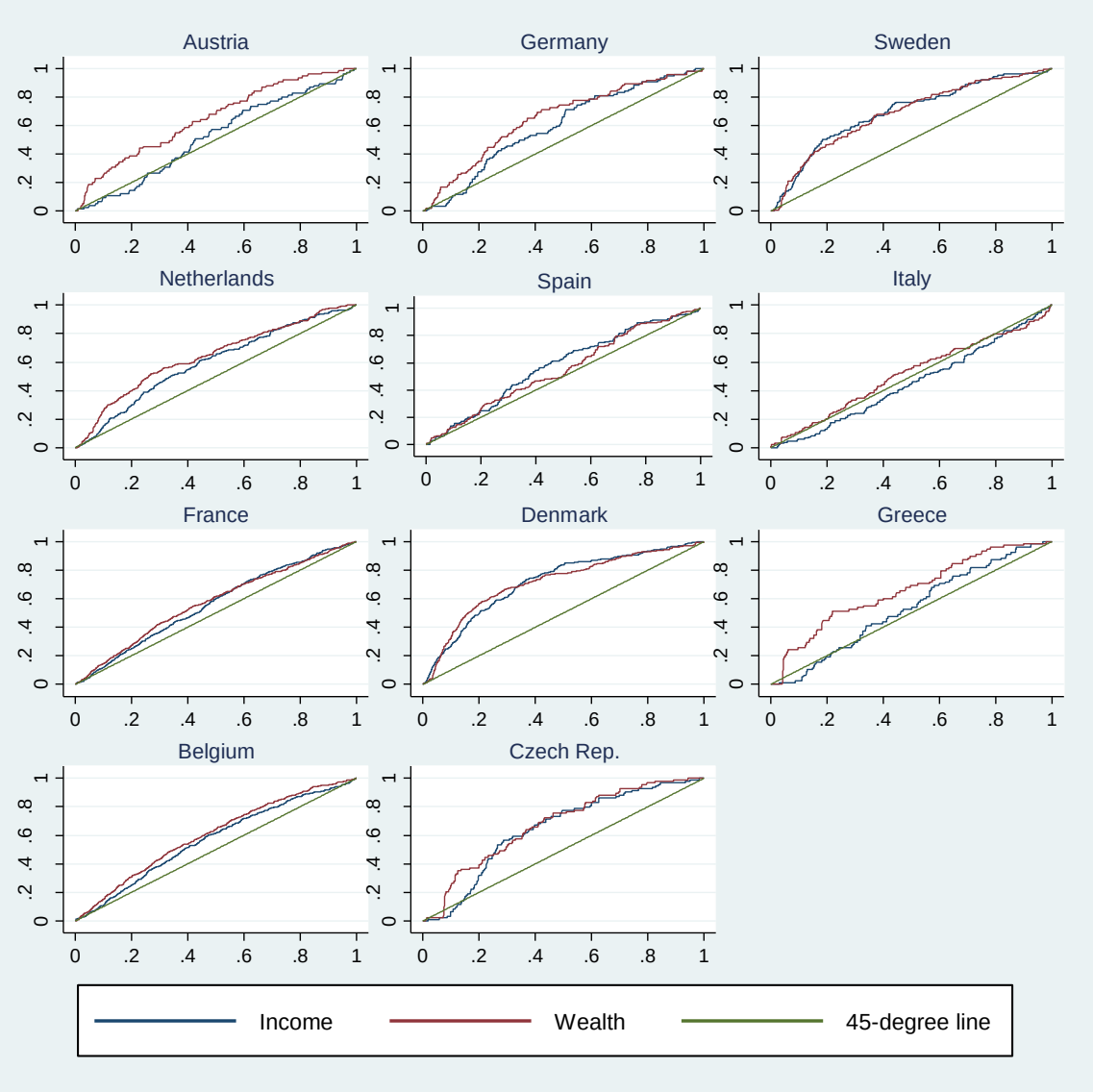
Figure A2: Concentration curves for the intensity of informal care services use



Note: Weighted results.

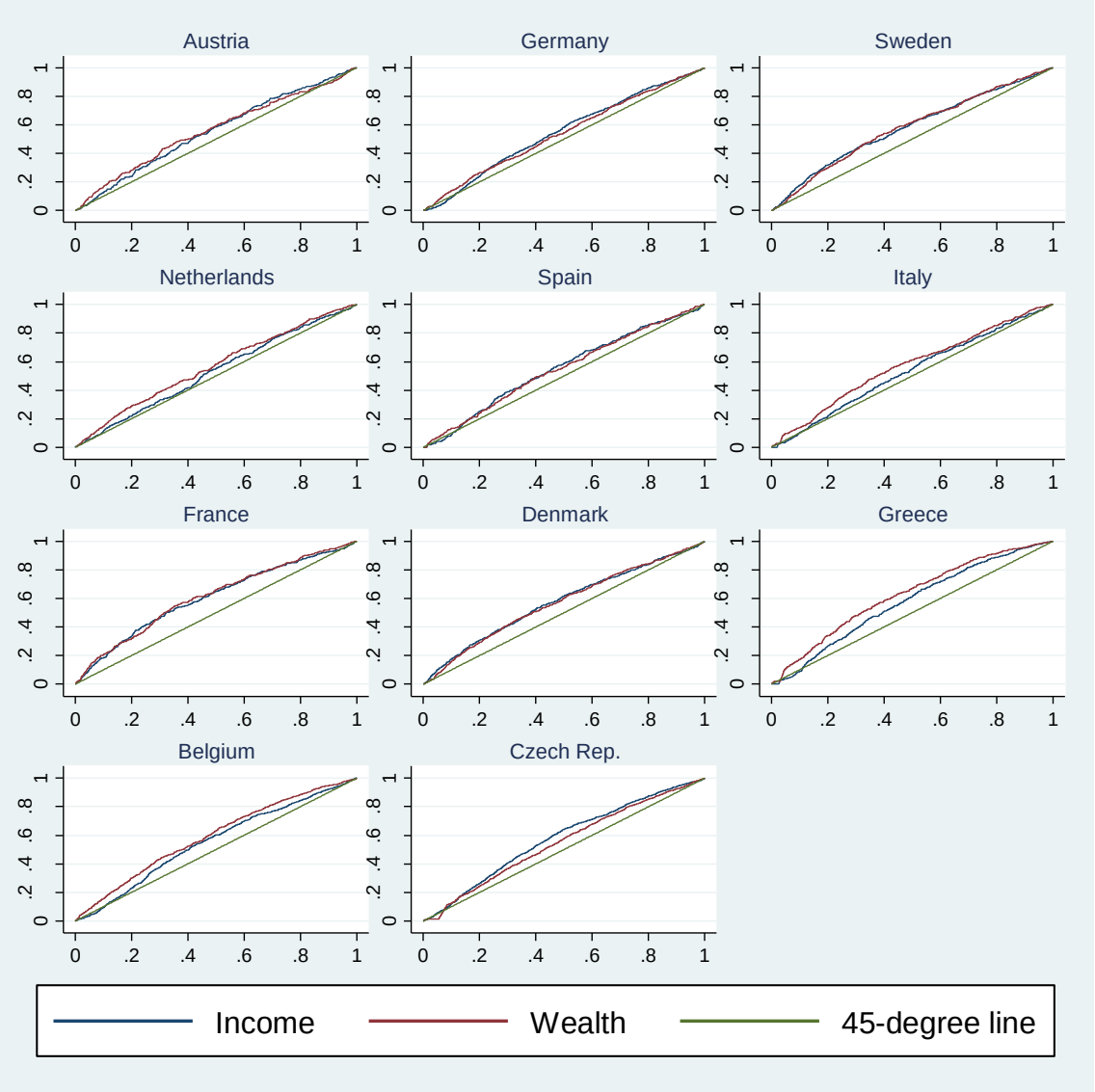
Annex 3 – Concentration curves for effect of wealth ranking on inequality in long-term care use

Figure A3: Concentration curves for probability to use home care services by income and wealth



Note: Weighted results.

Figure A4: Concentration curves for probability to use informal care by income and wealth



Note: Weighted results.

Annex 4 – Decomposition analysis: contributions to inequality in long-term care use

Table A5: Contributions to inequality in the use of home care services

Contribution of	Austria	Germany	Sweden	Netherlands	Spain	Italy
CI	**-0,0053**	**-0,0373**	**-0,1160**	**-0,0904**	**-0,0308**	**0,0344**
Income	0,0079	0,0118	0,0087	0,0028	0,0013	0,0165
f60-69	-0,0003	-0,0009	-0,0055	-0,0119	-0,0036	-0,0003
f70-79	0,0024	0,0013	0,0024	0,0045	0,0021	0,0011
m60-69	-0,0060	-0,0025	-0,0062	-0,0121	-0,0034	-0,0017
m70-79	-0,0010	-0,0003	0,0001	0,0039	0,0004	-0,0006
m80+	-0,0007	-0,0002	0,0003	0,0001	-0,0002	-0,0001
Less than good SRH	-0,0023	-0,0050	-0,0032	-0,0047	-0,0026	-0,0002
Moderate limitations	-0,0017	-0,0012	-0,0010	-0,0024	-0,0018	-0,0001
Severe limitations	0,0001	-0,0009	-0,0034	-0,0006	-0,0063	-0,0002
Mobility aids	-0,0148	-0,0085	-0,0254	-0,0206	-0,0028	-0,0045
N. chronic conditions	-0,0009	0,0003	-0,0011	-0,0016	-0,0009	-0,0007
Long-term illness	0,0020	-0,0012	0,0005	-0,0003	-0,0001	-0,0006
Poor mental health	-0,0004	-0,0012	-0,0001	-0,0052	-0,0011	-0,0019
Cognitive impairment	0,0002	-0,0002	0,0005	0,0002	0,0004	-0,0001
Household size	-0,0025	-0,0007	0,0005	-0,0005	0,0007	-0,0006
N. children	0,0013	0,0011	-0,0003	0,0018	0,0021	0,0006
N. daughters	-0,0004	-0,0003	0,0002	-0,0012	-0,0010	-0,0011
Married	0,0035	0,0007	-0,0131	-0,0058	0,0001	0,0013
Live alone	-0,0045	-0,0057	-0,0033	-0,0076	-0,0001	-0,0049
Secondary education	0,0001	0,0020	0,0009	0,0015	0,0029	0,0073
Tertiary education	0,0025	-0,0011	-0,0004	0,0032	-0,0021	0,0022
Small urban area	0,0001	-0,0011	0,0002	0,0021	0,0014	0,0009
Big city	0,0023	0,0007	-0,0015	-0,0005	0,0013	0,0030
Region 2	-0,0003		0,0004	-0,0002	-0,0005	-0,0010
Region 3	0,0001		-0,0003	0,0011	-0,0005	-0,0016
Region 4			0,0002	-0,0005	-0,0010	0,0042
Region 5			0,0001		-0,0012	0,0013
Region 6			0,0001		-0,0050	
Region 7			0,0007		-0,0005	
Region 8			-0,0001			

Table A5 (continued): Contributions to inequality in the use of home care services

Contribution of	France	Denmark	Greece	Belgium	Czech Republic
CI	**-0,0696**	**-0,1923**	**-0,0094**	**-0,0537**	**-0,0529**
Income	0,0358	-0,0032	0,0015	-0,0004	0,0027
f60-69	-0,0095	-0,0121	-0,0001	-0,0035	-0,0011
f70-79	0,0129	0,0064	0,0001	0,0059	0,0021
m60-69	-0,0172	-0,0199	-0,0004	-0,0187	-0,0042
m70-79	-0,0017	0,0020	-0,0001	-0,0002	-0,0005
m80+	-0,0011	0,0005	-0,0001	0,0001	0,0001
Less than good SRH	-0,0158	-0,0102	-0,0004	-0,0065	-0,0004
Moderate limitations	-0,0036	-0,0046	-0,0001	-0,0043	-0,0002
Severe limitations	-0,0060	-0,0023	-0,0002	-0,0057	-0,0001
Mobility aids	-0,0199	-0,0456	-0,0002	-0,0054	-0,0014
N. chronic conditions	-0,0086	-0,0021	-0,0002	-0,0004	-0,0009
Long-term illness	-0,0016	-0,0028	-0,0001	-0,0023	0,0003
Poor mental health	-0,0015	-0,0020	-0,0002	-0,0023	-0,0039
Cognitive impairment	-0,0001	-0,0003	-0,0001	0,0001	-0,0004
Household size	-0,0036	0,0102	-0,0002	-0,0078	-0,0010
N. children	0,0040	-0,0001	-0,0001	-0,0002	0,0001
N. daughters	-0,0009	0,0001	0,0001	-0,0008	-0,0003
Married	0,0025	-0,0146	-0,0002	-0,0004	-0,0042
Live alone	-0,0032	-0,0328	0,0003	0,0017	-0,0006
Secondary education	0,0038	-0,0008	-0,0001	-0,0001	0,0001
Tertiary education	-0,0121	0,0037	-0,0008	0,0015	-0,0004
Small urban area	-0,0018	0,0001	-0,0001	0,0029	-0,0001
Big city	-0,0029	0,0020	0,0001	-0,0026	-0,0004
Region 2	-0,0194	-0,0005	0,0001	0,0014	-0,0001
Region 3	-0,0038	-0,0003	0,0001	-0,0003	-0,0001
Region 4	-0,0005	0,0060	-0,0001		0,0040
Region 5	0,0001	-0,0001			-0,0004
Region 6	-0,0065				-0,0028
Region 7					-0,0009
Region 8					0,0001

Table A6: Contributions to inequality in the use of informal care

Contribution of	Austria	Germany	Sweden	Netherlands	Spain	Italy
CI	**-0.1076**	**-0.0942**	**-0.2006**	**-0.0365**	**-0.1027**	**-0.0794**
Income	0.0532	0.0722	0.0154	0.0247	-0.0073	-0.0036
f60-69	-0.0010	-0.0054	-0.0031	0.0037	-0.0082	-0.0020
f70-79	0.0127	-0.0006	-0.0006	-0.0023	0.0037	0.0037
m60-69	-0.0195	-0.0085	-0.0159	0.0037	-0.0085	-0.0063
m70-79	-0.0024	-0.0029	-0.0006	-0.0014	0.0010	-0.0016
m80+	-0.0019	-0.0001	0.0007	-0.0001	0.0005	-0.0001
Less than good SRH	0.0012	-0.0047	-0.0010	-0.0023	-0.0001	-0.0133
Moderate limitations	-0.0028	-0.0040	-0.0132	-0.0034	-0.0045	0.0003
Severe limitations	-0.0007	-0.0028	-0.0142	-0.0035	-0.0173	-0.0029
Mobility aids	-0.0114	-0.0295	-0.0303	-0.0185	-0.0100	-0.0081
N. chronic conditions	-0.0037	-0.0057	-0.0174	-0.0001	-0.0024	-0.0028
Long-term illness	-0.0054	0.0018	0.0008	0.0006	-0.0026	-0.0048
Poor mental health	-0.0156	-0.0045	-0.0062	0.0002	-0.0034	-0.0056
Cognitive impairment	-0.0003	0.0009	-0.0012	-0.0001	-0.0061	-0.0010
Household size	-0.0097	-0.0021	0.0114	0.0011	0.0001	-0.0011
N. children	-0.0065	0.0028	-0.0071	0.0088	0.0085	0.0050
N. daughters	-0.0104	-0.0120	-0.0064	-0.0126	-0.0065	-0.0018
Married	-0.0482	-0.0200	-0.0035	-0.0252	-0.0032	-0.0163
Live alone	-0.0019	-0.0288	-0.1114	-0.0121	-0.0003	-0.0015
Secondary education	-0.0003	-0.0826	-0.0046	0.0008	-0.0022	0.0145
Tertiary education	-0.0096	0.1303	0.0103	-0.0094	0.0045	0.0059
Small urban area	0.0084	-0.0052	0.0136	0.0016	0.0002	0.0091
Big city	-0.0186	0.0044	-0.0270	-0.0024	-0.0072	-0.0090
Region 2	0.0021		-0.0002	-0.0023	0.0025	0.0006
Region 3	0.0033		-0.0008	-0.0016	0.0003	-0.0014
Region 4			0.0006	-0.0045	-0.0061	-0.0065
Region 5			0.0001		0.0051	0.0028
Region 6			0.0006		-0.0121	
Region 7			-0.0103		-0.0022	
Region 8			-0.0002			

Table A6 (continued): Contributions to inequality in the use of informal care

Contribution of	France	Denmark	Greece	Belgium	Czech Republic
CI	**-0.1328**	**-0.1531**	**-0.1490**	**-0.0685**	**-0.2204**
Income	-0.0082	0.0239	0.0054	0.0376	0.0740
f60-69	-0.0045	-0.0016	-0.0024	-0.0024	-0.0090
f70-79	0.0016	0.0060	0.0093	0.0056	0.0107
m60-69	-0.0142	-0.0132	-0.0207	-0.0100	-0.0506
m70-79	-0.0007	0.0002	-0.0018	-0.0004	-0.0031
m80+	-0.0006	-0.0011	0.0012	-0.0001	0.0024
Less than good SRH	-0.0065	-0.0060	-0.0137	-0.0068	-0.0188
Moderate limitations	-0.0032	-0.0096	-0.0045	-0.0044	-0.0195
Severe limitations	-0.0069	-0.0078	-0.0050	-0.0099	-0.0095
Mobility aids	-0.0143	-0.0223	-0.0115	-0.0082	-0.0179
N. chronic conditions	-0.0011	-0.0089	-0.0091	-0.0030	-0.0016
Long-term illness	-0.0009	-0.0041	-0.0109	-0.0039	0.0003
Poor mental health	-0.0001	-0.0088	-0.0001	-0.0050	-0.0280
Cognitive impairment	-0.0014	-0.0002	0.0002	-0.0016	-0.0015
Household size	0.0083	0.0246	0.0021	-0.0084	0.0053
N. children	0.0044	-0.0001	0.0070	0.0040	-0.0001
N. daughters	-0.0042	-0.0083	-0.0104	-0.0106	-0.0240
Married	-0.0144	-0.0150	-0.0042	-0.0096	-0.0429
Live alone	-0.0232	-0.1004	-0.0230	-0.0123	0.0683
Secondary education	-0.0042	-0.0007	-0.0130	0.0002	-0.0002
Tertiary education	-0.0187	0.0028	-0.0128	-0.0162	0.0026
Small urban area	0.0002	0.0023	-0.0043	-0.0001	0.0001
Big city	-0.0033	-0.0029	-0.0036	-0.0024	-0.0079
Region 2	-0.0062	-0.0032	0.0007	0.0015	0.0006
Region 3	-0.0026	-0.0012	0.0020	0.0001	-0.0019
Region 4	0.0001		0.0009		0.0087
Region 5	-0.0001				-0.0015
Region 6	0.0020				-0.0064
Region 7					-0.0018
Region 8					0.0001