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Working Paper No. 1508
November 2015

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# AN ANALYSIS OF THE COST OF DISABILITY ACROSS EUROPE USING THE STANDARD OF LIVING APPROACH

[DRAFT VERSION, OCTOBER 2015]

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## ABSTRACT

This article presents for the first time a comparative study of the cost of disability for 26 European countries. Using the European Union Statistics on Income and Living Conditions 2008 and two alternative methodologies, one based on how difficult it is for households to make ends meet and the other related to the access of households to a set of services and assets, we present estimates of the extra costs of disability for households. The comparative nature of the present analysis demonstrates these national estimates of cost disability from a broader perspective. Also discussed are the possible explanatory reasons for the pattern of costs across countries found in this analysis.

**KEYWORDS:** disability, cost, standard of living, income, welfare

**JEL CLASSIFICATION:** I10, I30

## 1. INTRODUCTION[1]

Disability can be understood as a functional limitation that results not only from a medical condition of the body or the whole person but also from the relation of a person with the environment, which involves dysfunction at one or more of three levels: impairments, activity limitations and participation restrictions.[2] The resulting loss of autonomy, physical or mental, prevents the performance of some of the activities of daily living.

Disability is far from a marginal phenomenon in developed countries.[3] According to Eurostat, 30.8% of European Union (EU) citizens suffered from a long-standing illness or health problem in 2008, rising to 31.2% in 2009, whereas 8.1% reported experiencing severe limitations in their daily activities.[4] Both in the Organization for Economic Co-operation and Development (OECD) and in the EU, there is strong concern about the issue and a mandate to promote and attain the full economic and social participation of people with disabilities.[5] As a reflection of this concern, in the OECD and in the EU there is a variety of disability benefit systems, regulations and coverage. Some of these policies address the reintegration of disabled people into the labour market, while others aim to compensate individuals with disabilities.[6] Public social spending in this area reached a sizable 2% of GDP in the EU27 in 2008, ranging from 0.7% in Cyprus to 4.4% in Denmark.

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[1] A previous version of the paper was published as Working Paper No. 645 of the Fundación de las Cajas de Ahorros (FUNCAS).

[2] We understand disability within the so-called "bio-psycho-social model", according to which disability is the result of the interaction of the functional status of a person with his/her environment, taking into account the social aspects of disability and not seeing disability only as a 'medical' or 'biological' dysfunction. This is the approach adopted by the International Classification of Functioning, Disability and Health, endorsed by the 54th World Health Assembly on May 22, 2001(resolution WHA 54.21). For a discussion of the definition and the measuring of disability, see OECD (2010).

[3] For a more global picture, with different insights into the situations of disabled people in developing countries, see WHO (2011).

[4] In particular, this information comes from the following questions of the European Union Statistics on Income and Living Conditions: "*People having a long-standing illness or health problem, by sex, age and activity status (%)*" (hlth_silc_04; last update 25-07-2011) and "*Self-perceived limitations in daily activities (activity limitation for at least the past six months) by sex, age and activity status* (%)" (hlth_silc_06; last update 14-12-2011).

[5] The OECD has a research field on disability, starting with a first report in 2003, opening a specific project of which one of the last outcomes is the report published in 2010, reviewing the policies of 13 countries. The European Commission has also published a European Disability Strategy 2010-2020 (European Commission, 2010). Nevertheless, in both cases the aim is restricted to the labour market outcomes of people with disability, particularly eliminating barriers to their labour market integration and fostering higher participation rates among workers with disability.

[6] For a review, see OECD (2003).

The aim of this paper is to offer an estimate of the extra costs of severe disability using a large sample of European countries. As far as we know, this is the first attempt to offer such an estimation using homogeneous data and the same methodology for all EU member countries (with the exceptions of Finland, France and Malta) plus Norway and Iceland. In addition, we try to outline several plausible explanations for the differences in estimated costs across countries.

Our approach to the cost of disability draws from the work of Amartya Sen (2004), who makes a distinction between two types of handicaps that tend to be associated with disability. On one hand, a disabled person may find it harder to get a job or to keep it, and he or she may receive a lower wage. Disability can even affect the acquisition or accumulation of human capital.[7] On the other hand, because persons with disabilities have special needs, they face more difficulties than non-disabled people do in achieving well-being from their resources or may need more income for the same activity. Sen calls the first one an “earning handicap” and the second one a “conversion handicap”. The latter handicap is recognised in social protection systems in many countries, which provide benefits, be they direct expenditure or tax expenditures, to offset the higher consumer costs associated with disability.

The starting point of our work is Sen’s (1985, 1987) concept of distributive justice, based on equalising people's basic capabilities. For this author, the ultimate reference in redistributive policy is the *standard of living*, not the utility or the mere possession of goods. The issue is to establish an objective minimum standard that represents a good approximation to the real income level, considering that the standard of living is primarily an issue concerning lifestyle, rather than the means for its development. For Sen, the standard of living is a matter of *functionings* and *capabilities*. As is well known, Sen’s point of departure is the modern theory of the consumer (Lancaster, 1966), according to which goods are not relevant in themselves, but because they incorporate features and properties that make them desirable. What matters is the use that each person can get from these characteristics, which depends on his or her *capability* to perform the *functions* to take advantage of the characteristics of each good. Therefore, given a set of goods, each individual, according to her/his capabilities, can convert its characteristics into different combinations of *functionings*, from which

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[7] This is illustrated, for example, by the work of She and Livermore (2009) for the United States.

she/he obtains a certain level of welfare. The standard of living approach aims to determine the extra cost of disability by comparing households with disabled and non-disabled members with the same level of welfare and allowing the difference in income to determine the extra cost of disability.

Researchers have devoted some attention to the study of the costs of disabilities, though almost all the literature focuses on Anglo-Saxon countries. This body of research is also based on very different methodologies (discussed in the third section) and it relies exclusively on national studies, so the comparability of the different results found in the literature is far from ideal. Apart from the surveys of Indecon (2004), Tibble (2005) and Stapleton, Protik and Stone (2008), one should highlight the works of Martin and White (1988), Matthews and Truscott (1990), Berthoud, Lakey and McKay (1993), Jones and O'Donnell (1995), Zaidi and Burchardt (2005), Kuklys (2005) and Wood and Grant (2010) for the United Kingdom, Indecon (2004) and Cullinan, Gannon and Lyons (2011) for Ireland, Saunders (2007) for Australia, She and Livermore (2007) and Mitra, Findley and Sambamoorthi (2009) for the United States, Wilkinson-Meyers *et al*. (2010) for New Zealand and Braña and Antón (2011) for Spain. In addition, Braithwaite and Mont (2009) estimate the cost of disability for two non-developed countries, Bosnia and Herzegovina and Vietnam.

Although a significant share of the mentioned studies are based on the standard of living approach, the overall results of this literature, discussed in more detail in the methodological section (Section 3), are extremely difficult to summarise. This is because the authors rely on different definitions of disability and use different variables and econometric specifications to estimate the extra cost of disability, making their outcomes difficult to compare. The starting point of this paper is that cross-country studies using a common methodology can contribute to test the appropriateness of the standard of living approach, answering the question whether the results for different countries are roughly similar, or the differences obtained are consistent with economic theory and the idiosyncratic features of these countries.

The current study estimates the extra cost of disability – understood as suffering a chronic health condition and a severe limitation in daily activities – for 26 European countries using two different strategies, one based on a subjective question about the household's ability to make ends meet and another related to the ownership of several assets.

The article unfolds in four additional sections as follows. In section 2, we describe the database used to estimate the cost of disability, pointing out its strengths and shortcomings. The third section presents and discusses the methodology followed in an estimation of the cost of disability. In section 4, the results obtained in terms of the cost of disability in the 26 European countries are presented and discussed. Finally, section 5 summarises the main conclusions obtained in the paper and outlines further lines of research.

## 2. DATA

The database used in this research is the EU Statistics on Income and Living Conditions 2008 (hereafter EU-SILC 2008).[8] Our original aim was to study the cost of disability in the 27 member states of the EU plus Norway and Iceland, countries of the European Economic Area that are also included in the database. However, it was not possible to include Finland, France and Malta in the analysis. Finland was excluded because only the household head was interviewed about her/his disability condition, while the other two countries refused our request and did not authorise micro-data dissemination. Therefore, this study focuses on the cost of disability in 26 European countries.

The main advantage of this database is that it provides detailed information on household income and living conditions that is comparable across countries.[9] Sample sizes are disparate: they range from slightly over 3,300 households in Cyprus to roughly 20,000 in Italy. Nevertheless, the EU-SILC also has several shortcomings. First, some information is not available for all countries, so the comparative analysis necessarily has to be restricted to those variables that are present in all member states.[10] Second, and importantly, information in the database on disability is not as exhaustive and detailed as desirable. In particular, only two questions address this issue. The first asks the

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[8] Detailed information on the database, including methodological papers and national questionnaires, can be found at http://circa.europa.eu/Public/irc/dsis/eusilc/library.

[9] As is common in this type of survey, information on income refers to the previous year (2007).

[10] For instance, those countries that collect detailed information on some types of issues through other means (for instance, the gender pay gap) are not required to ask for the same information in the EU-SILC.

interviewee if he or she has a chronic illness or health problem, while the second inquires as to whether the household member has been limited in his or her daily activity during the previous six months. Although other studies in the literature, such as Zaidi and Burchardt (2005) – in some of their specifications – and Cullinan, Gannon and Lyons (2011), use similar questions to identify an individual with the disability, the limitations of the survey in this sense preclude us from having detailed information on the disability suffered by household members. That information would have contributed to better characterising the disability. Third, information on disability is not available for people 16 years old or under, an important limitation of this study that one should bear in mind. In order to assess this issue, we have replicated all the analyses comprising only those households without children. The results remain essentially the same.[11]

We define a person as being disabled if he or she simultaneously reports suffering from a chronic illness or condition and has been intensely limited during the past six months; this a somewhat strict definition.[12] The exigency of the chosen definition of disability can be seen clearly in the data shown in Table 1, where the percentage of the population considered to be disabled is much lower than the percentage of the population with a chronic condition or limitation in daily activities. Focusing on the average of the 26 countries, of the 30% of the population with a chronic condition and the 16.4% of the population with a condition that limits their activity, only 7.4% is considered to have a severe disability. A by-product of the definition of disability used in this study is the remarkably low dispersion (compared with other sources) of the percentage of the population considered to be suffering from a severe disability among the countries, which is roughly half of the dispersion of those with a chronic condition or with limitations in activity.

In order to check the plausibility of the results obtained in terms of prevalence of disability according to the proposed concept, we compare these results with those obtained using two alternative sources and definitions: the 2002 *European Labour Force Survey* (LFS) *ad-hoc* module on the employment of disabled persons and the

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[11] In fact, the correlation between the estimated costs across countries using the same methodology including and excluding children is above 95%.

[12] Unfortunately, the two questions are not linked in the survey, so it could be that a person with a chronic illness is, at the moment of the interview, suffering from a limitation in his or her daily activity for reasons unconnected to the chronic illness, a household accident, for example. In that case, our selection procedure would wrongly consider the person to be disabled.

2004 *European Health Interview Survey* (EHIS). For the 12 countries for which all the three data sources offer information, the EU-SILC shows the lowest variability among countries (the coefficient of variation is 0.237 in the EU-SILC compared with 0.471 in the LFS and 1.46 in the EHIS), which may suggest that the database we use better captures the disability condition.[13]

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[13] If part of the large disparities in disability rates observed is a product of the subjective component of the definition of disability, compared with a "true disability rate", a stricter definition of disability would allow us to arrive at an estimate of disability closer to such "true" rates. If that were so, then such a definition would also show a lower variability among countries as long as such a subjective component was somehow nationality specific.

Table 1. Population over 16 years old with a chronic condition, limitations in daily activities and disability condition in Europe (2008)

| | Chronic condition (%) | Limitations in daily activities (%) | | Disability (%) |
|---|---|---|---|---|
| | | Yes, limited | Yes, strongly limited | |
| Austria (AT) | 32.6 | 19.0 | 10.6 | 9.8 |
| Belgium (BE) | 24.4 | 15.9 | 6.6 | 5.7 |
| Bulgaria (BG) | 23.7 | 11.1 | 4.5 | 3.8 |
| Cyprus (CY) | 26.2 | 11.8 | 6.3 | 5.9 |
| Czech Republic (CK) | 27.2 | 16.4 | 5.4 | 5.3 |
| Germany (DE) | 36.2 | 22.4 | 10.4 | 9.7 |
| Denmark (DK) | 26.6 | 18.9 | 8.5 | 7.2 |
| Estonia (EE) | 37.8 | 20.7 | 9.5 | 9.4 |
| Spain (ES) | 30.6 | 17.6 | 5.4 | 4.9 |
| Greece (GR) | 22.1 | 11.5 | 8.1 | 7.9 |
| Hungary (HU) | 38.2 | 18.8 | 10.1 | 10.0 |
| Ireland (IE) | 24.0 | 14.3 | 5.4 | 4.9 |
| Iceland (IS) | 27.5 | 5.4 | 10.2 | 10.2 |
| Italy (IT) | 22.3 | 19.4 | 8.0 | 6.8 |
| Lithuania (LT) | 28.4 | 17.7 | 7.1 | 6.7 |
| Luxembourg (LU) | 24.2 | 13.6 | 7.0 | 4.7 |
| Latvia (LV) | 33.5 | 24.8 | 7.5 | 7.3 |
| Netherlands (NL) | 33.6 | 22.8 | 6.7 | 6.3 |
| Norway (NO) | 33.5 | 10.6 | 7.0 | 6.7 |
| Poland (PL) | 31.1 | 15.3 | 6.4 | 6.1 |
| Portugal (PT) | 33.8 | 18.4 | 11.9 | 11.2 |
| Romania (RO) | 19.2 | 12.3 | 6.7 | 6.2 |
| Sweden (SE) | 35.5 | 10.3 | 8.1 | 8.1 |
| Slovenia (SI) | 42.8 | 17.4 | 10.9 | 9.8 |
| Slovakia (SK) | 29.1 | 23.1 | 10.7 | 10.0 |
| United Kingdom (UK) | 32.5 | 11.0 | 8.4 | 8.4 |
| Unweighted mean | 29.8 | 16.4 | 7.9 | 7.4 |
| Standard deviation | 5.9 | 4.7 | 2.1 | 2.1 |

Source: Authors' analysis from EU-SILC 2008.

## 3. METHODOLOGY

The extra cost that disability imposes on households has been studied from different perspectives, which are associated with different research strategies.[14] The subjective-direct approach, the most straightforward procedure, consists of asking disabled

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[14] For a survey on the different strategies, see, for instance, Indecon (2004), Wilkinson-Meyers *et al.* (2010) and WHO (2011).

individuals (or experts) what are the costs of having a disability. The main limitation of this method is that respondents can hardly make an accurate estimation of how much they would spend on common goods everyone purchases if they were not disabled (Zaidi and Burchardt, 2005). Some studies using this approach include Martin and White (1988) and Wood and Grant (2010) for the UK, Wilkinson-Meyers *et al.* (2010) for New Zealand and the report of Indecon (2004) for Ireland, which offers a set of estimates for specific types of disability according to several assumptions and another one based on a detailed survey of disabled individuals (whose response rate was less than 20% and whose size was less than 300).

The second possible strategy (the comparative approach) relies on the study of the consumption patterns of both the disabled and the non-disabled population, identifying those items disabled people spend more on in order to control for income. This approach has usually been applied to evaluate the extra costs faced by disabled people associated with certain items, as Matthews and Truscott (1990) and Jones and O'Donnell (1995) do for the British case and Mitra, Findley and Sambamoorthi (2009) do for medical expenses in the United States. Although this method overcomes several of the limitations of the subjective-direct approach, it presents a serious shortcoming: the estimated cost of disability is constrained by the incomes of disabled individuals; in other words, they only report how much they actually spend, so it is not possible to measure the potential cost of disability.

The third and last approach is the so-called standard of living approach. This method is based on comparing the income levels of households with and without disabled members with the same level of welfare. The extra income required by households with disabled members to achieve that level of welfare represents the extra cost of disability. This method has received good reviews because of the robustness of the results obtained (Indecon, 2004, Tibble, 2005).

Furthermore, some authors (Wilkinson-Meyers *et al.*, 2010) have recently proposed using a mixed methodology to take advantage of the strengths of these other methods. This would involve looking at the specific needs of disabled individuals with the advice of a panel of experts, corroborating the estimation of the costs with a focus group of disabled individuals and, finally, validating the model using broad surveys.

The findings of the most relevant works on this topic are summarised in Table 2. As mentioned in the introduction of this article, most of this literature focuses on Anglo-Saxon countries (mainly the United Kingdom) and, because of the different strategies, disability definitions and variables and econometric specifications used to estimate the cost of disability, estimates vary widely across works and countries.

Table 2. Summary of the main works that estimate the extra costs of disability (I)

| Work | Country | Period | Method | Main results |
|---|---|---|---|---|
| Martin and White (1988) | United Kingdom | 1985 | Subjective-direct approach | From €15 to €43 per week for each point on the severity score, from 0 to 10, depending on the degree of disability |
| Matthews and Truscott (1990) | United Kingdom | 1985 | Comparative approach | €16 per week on fuel, services, tobacco and durables but €18 per week less on transport and clothing |
| Berthoud, Lakey and McKay (1993) | United Kingdom | 1985 | Standard of living approach | Between €14 and €112 for each point on the severity score, from 0 to 10, depending on the degree of disability (between 4% and 31% of household income) |
| Jones and O'Donnell (1995) | United Kingdom | 1986–1987 | Comparative approach | Households with disabled people need to spend 45% more on transport and 64% more on fuel |
| Kuklys (2005) | United Kingdom | 1996–1999 | Standard of living approach | 12–70% of household income depending on the econometric specification |
| Zaidi and Burchardt (2005) | United Kingdom | 1996–1997 and 1999–2000 | Standard of living approach | Between €10 and €26 per week (1.1% and 7.7% of household income) depending on the type of household for each point on the severity score, from 0 to 22 (1996–1997) and between 16% and 50% of household income depending on household characteristics (1999–2000). |
| Wood and Grant (2010) | United Kingdom | 2010 | Subjective-direct approach | €932–1,749 per month |
| Indecon (2004) | Ireland | 1999–2000 and 2003 | Standard of living approach (1999–2000) and subjective-direct approach based on a survey of people with specific disabilities (2003) | Standard of living approach: €157 per week (23.3% of household income) for a household with a median income<br>Subjective-direct approach: spinal injury, €269 per week; Down's syndrome, €143 per week; vision impairment, €89; schizophrenia, €46. |
| Cullinan, Gannon and Lyons (2011) | Ireland | 1995–2001 | Standard of living approach | Moderate disability: €122 per week (20.3% of household income)<br>Severe disability: €202 per week (37.3% of household income) |
| Cullinan, Gannon and O'Shea (2011) | Ireland | 2001 | Standard of living approach | The analysis only includes households whose members are 65 years old and over.<br>Moderate disability: €118 per week<br>Severe disability: €203 per week |
| She and Livermore (2007) | United States | 1996–1999 | Standard of living approach | Having a disabled member increases the poverty line for one-person households by between €9,340 (78%) and €24,508 (284%). |
| Mitra, Findley and Sambamoorthi (2009) | United States | 1996–2004 | Comparative approach | Having a disability is associated with a 168% higher health expenditure and a 65% higher out-of-pocket health expenditure |

Table 2. Summary of the main works that estimate the extra costs of disability (II)

| Work | Country | Period | Method | Main results |
|---|---|---|---|---|
| Saunders (2007) | Australia | 1998–1999 | Standard of living approach | 29% of household income (40–49% in the case of severe disability) |
| Wilkinson-Meyers *et al.* (2010) | New Zealand | 2005–2007 | Subjective-direct approach based on consulting experts and the disability community | For people with low to moderate disability, €26 per week (including the opportunity cost of time performing light housework) and €155 per week (excluding the opportunity cost of time) |
| Braithwaite and Mont (2009) | Vietnam and Bosnia | 2004 | Standard of living approach | Vietnam: 9% of household income<br>Bosnia: 14% of household income |
| Braña and Antón (2011) | Spain | 2007 | Standard of living approach | Moderate disability: 39.9–52.8% of household income<br>Severe disability: 71.7–76% of household income |

Note: Monetary figures are expressed in Euros in 2010 prices.

Source: Authors' elaboration based on the works quoted in the table and inflation and exchange rates data from Eurostat, the Bureau of Labor Statistics and the Reserve Bank of New Zealand.

In this article, we follow the third methodology, the standard of living approach, (from now on *subjective-indirect*), which has been the most popular one in an otherwise sparse but growing literature (Zaidi and Burchardt, 2005, Indecon, 2004, She and Livermore, 2007, Saunders, 2007, Braithwaite and Mont, 2009, Cullinan, Gannon and Lyons, 2011). This method consists of estimating the effect of income and disability on welfare in order to determine how much income is needed to compensate for the existence of members with disabilities in the household, given a level of welfare. In practice, the method can be operationalised by estimating a model such as:

$$W_i = \alpha Y_i + \beta D_i + \gamma X_i + \varepsilon_i \qquad [1]$$

where $Y_i$ is the income of household *i*, $W_i$ is a variable that denotes the welfare level or standard of living of household *i*, $D_i$ is a dummy variable indicating whether or not there are disabled members in the household and $X_i$ is a vector that includes an intercept and a set of variables capturing the socio-demographic characteristics of households (head sex, head age (using several dummies), head marital status, head migrant status, head pensioner condition, household size, number of children of 0–4, 5–10 and 10–13 years old and housing tenure status).[15] We have not included other more complex variables associated with the circumstances of people with disabilities, such as whether the disabled person is the household head or lives with relatives, because, first, they were very highly correlated with other variables related to household structure and the presence of disabled people in the household and, second, because we postpone the analysis of such peculiarities to the section devoted to the discussion of the results.

In equation [1], the relationship between welfare, income and disability is linear, which implies that the cost of disability in terms of income is given by a fixed monetary amount represented by $-\beta/\alpha$. In such a specification, disability has a fixed effect on the level of welfare given by $\beta < 0$, while the effect of income on welfare is represented by $\alpha > 0$. Therefore, the amount of income that neutralises the negative effect of disability on household welfare is given by (minus) the ratio of both coefficients.[16]

Obviously, such a relationship can be modelled in alternative ways, including income in logs, squared or even interactions between both variables. A specification including income logs, for instance, assumes not only decreasing returns to income in terms of welfare but also that the cost of disability is a constant proportion of income. Although we tried several alternative specifications during the process of this research, we finally opted for a specification where income was modelled in logs, which proved to be the one that best fitted the data in most cases according to the several statistical criteria described below.

One of the main issues of concern in the standard of living approach is how to determine households' levels of welfare disregarding income data. Following the spirit of Zaidi and Burchardt (2005), we proceed in two ways. First, we consider responses given by household heads to the question regarding the ability of the households to make ends meet with their current incomes. The possibilities for answering this question were "with great difficulty", "with difficulty", "with some difficulty", "fairly easily", "easily" and "very easily". In order to fit the model, we use an ordered *logit*, which assumes the existence of an underlying and unobservable variable (welfare), which is

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[15] The set of variables included in the analysis is similar to the ones used by other works in the literature such as Indecon (2004), Zaidi and Burchardt (2005) and Cullinan, Gannon and Lyons (2011). We do not control for regional variables using dummies because we want to obtain an average estimate of the cost of disability by country, not by a base or reference region.

[16] See Zaidi and Burchardt (2005) or Cullinan, Gannon and Lyons (2011) for a more detailed description of the methodology.

codified into intervals that determine categories that are fully observed by the researcher. As is well known, this type of model is estimated using maximum likelihood methods. The phrasing of the question used to construct the welfare indicator is similar to the questions used in comparable studies for other countries.[17]

Second, we construct an indicator that aims to capture welfare using information on the assets of households. One possibility is to simply count the number of household assets and amenities and fit a negative binomial regression model. However, this method shows problems of convergence for some countries, thus hindering the comparability of the analysis.[18]Another option is grouping the assets and considering a certain number of them to determine a given level of welfare. For example, four items can be interpreted in terms of a low level of welfare and 15 items as a larger level. This strategy, used by Zaidi and Burchardt (2005), Braithwaite and Mont (2009) and Cullinan, Gannon and Lyons (2011), gives rise to problems of convergence similar to those found in the negative binomial regression. We therefore used a third and quite pragmatic approach: we carried out a principal component analysis (PCA) of 15 different items/assets or dimensions of the households in the sample. All these items were found to be positively correlated with household income.

The first principal component obtained by this procedure is a continous variable which accounts for as much of the variability of the data as possible and can be considered to be a good way of estimating household welfare (Filmer and Pritchett, 2001), is taken as the dependent variable of equation [1], which is thus estimated using OLS with robust standard errors. One of the main advantages of this method is that, as long as the first component aims to capture as much as variance as possible, it proves to

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[17] This question is similar to the one included in the European Community Household Panel used by Cullinan, Gannon and Lyons (2011). Zaidi and Burchardt (2005) also use a similar question taken from the British Household Panel Survey, along with another one asking whether the interviewed household can save. She and Livermore (2007) and Saunders (2007) test several questions in the same spirit (food insecurity or ability to pay bills, meet expenses, pay rent or mortgage and get medical care, among others).

[18] As is well known, these types of models are estimated by maximum likelihood, involving the maximisation of complex log-likelihood functions. In practice, this process is a search of the maximum by trial and error. In some countries, the proposed specifications did not converge (and we ruled out that this problem was associated with multicollinearity problems). Thus, given that our article has a comparative purpose, we decided not to use these models. Other more simple alternatives, such as the Poisson model, were ruled out because of the strong assumptions they entailed. In any case, it is also worth mentioning that in the work of Braña and Antón (2011) for Spain similar results are obtained when using the PCA component as dependent variables as using a binomial negative regression where the number of items was the outcome of interest. Moreover, in this research, the welfare index –and the final results- obtained by PCA is fairly robust to different ranges of goods and household characteristics.

be quite robust to the inclusion of one or another item. We also estimated a well-being index using a multiple correspondence analysis (MCA), finding that the correlation at the household level between both indexes (the one obtained using the PCA and the other by the MCA) was over 99%. For comparability purposes with the first approach, we also estimated the model including income in logs. The following items, those on which there is available information in the SILC, were selected to carry out the analysis:

- Capacity to afford to pay for a one-week annual holiday away from home.
- Capacity to afford a meal with meat, chicken, fish or vegetarian equivalent every second day.
- Capacity to meet unexpected financial expenses.
- To have a telephone.
- To have a colour television set.
- To have a computer.
- To have a washing machine.
- To have a car.
- Not to have any natural light problems at home.
- Not to have any noise problems at home.
- Not to have any pollution or environmental problems.
- No crime or violence in the area.
- Not to have a leaking roof, damp walls, floors or foundation or rot in window frames and floor.
- To be able to keep home adequately warm.
- Not to be in a crowded household (defined as two or more people per room).

The use of two different methodologies – a choice also made by Zaidi and Burchardt (2005) – aims to assess how robust the findings are to the approach chosen to measure household welfare. In the first case, the question is more subjective (since the household self-reports its ability to make ends meet), while the second one can be considered to be a more objective approach, since it only relies on a household's assets and services.

We have finally used an econometric specification that includes in income in logs because of two reasons. First, it makes interpretation and comparison with most of papers in the literature easier, since this article has comparative purposes and such model has been the most used by far in previous research. Second, it seems to be the model that best fits the data in many cases, both using measures as the Akaike and Bayesian Information Criteria in the case of multinomial *logit* and $R^2$ in OLS regressions.

# 4. RESULTS

## 4.1. ESTIMATES OF THE EXTRA COST OF DISABILITY

Before presenting the results of the empirical analysis, it is advisable to look at the main descriptive statistics, namely the proportion of households with people with any chronic condition, the proportion of households with people with intense limitations in their daily activities and, finally, the percentage of households with disabled members (according to the definitions presented earlier) (Table 3).

The data show a larger dispersion in the numbers of households with people with disabilities compared with the already large differences found in terms of the people with disabilities reproduced in Table 1. In a relatively small number of countries (the Scandinavian countries plus the Netherlands, Iceland and Slovenia), the percentage of the population with disabilities (as defined in this paper) is roughly equivalent to the percentage of households with people with disabilities. The rest have a much larger percentage of households with members with disabilities compared with the population with disabilities. This fact reflects the existence of a lower emancipation rate among people with disabilities in these latter set countries.

Table 3. Main descriptive statistics of the database

| | Observations (no. of households) | % of households with people with chronic illnesses or conditions | % of households with people with intense limitations | % of households with disabled people |
|---|---|---|---|---|
| Austria (AT) | 6,078 | 49.4 | 17.9 | 16.6 |
| Belgium (BE) | 6,793 | 38.2 | 11.7 | 10.2 |
| Bulgaria (BG) | 4,772 | 46.0 | 10.8 | 9.2 |
| Cyprus (CY) | 4,045 | 45.8 | 13.3 | 12.3 |
| Czech Republic (CK) | 12,361 | 40.4 | 9.3 | 9.1 |
| Germany (DE) | 13,672 | 49.3 | 14.9 | 13.8 |
| Denmark (DK) | 6,036 | 26.6 | 8.4 | 7.1 |
| Estonia (EE) | 5,443 | 54.4 | 16.3 | 16.1 |
| Spain (ES) | 14,719 | 50.6 | 11.3 | 10.3 |
| Greece (GR) | 7,276 | 37.4 | 15.7 | 15.5 |
| Hungary (HU) | 9,798 | 59.2 | 19.0 | 18.9 |
| Ireland (IE) | 5,766 | 43.4 | 11.3 | 10.5 |
| Iceland (IS) | 3,231 | 27.1 | 10.1 | 10.1 |
| Italy (IT) | 23,237 | 36.4 | 14.7 | 12.6 |
| Lithuania (LT) | 5,242 | 44.6 | 13.4 | 12.6 |
| Luxembourg (LU) | 4,091 | 38.4 | 13.2 | 8.9 |
| Latvia (LV) | 5,647 | 54.8 | 15.4 | 14.8 |
| Netherlands (NL) | 10,866 | 33.0 | 6.5 | 6.1 |
| Norway (NO) | 5,829 | 33.3 | 6.9 | 6.5 |
| Poland (PL) | 16,489 | 52.5 | 13.7 | 13.2 |
| Portugal (PT) | 4,938 | 55.4 | 22.8 | 21.4 |
| Romania (RO) | 8,562 | 35.2 | 14.5 | 13.5 |
| Sweden (SE) | 7,942 | 35.2 | 8.0 | 8.0 |
| Slovenia (SI) | 11,352 | 41.0 | 10.4 | 9.3 |
| Slovakia (SK) | 7,106 | 51.7 | 22.9 | 21.2 |
| United Kingdom (UK) | 9,419 | 49.8 | 14.8 | 14.8 |

Source: Authors' analysis from EU-SILC 2008.

The estimated costs of disability (with their corresponding 95% confidence intervals) in the 26 countries included in this study are displayed in Figures 1 and 2. The graph bars depict the estimates of the term $-\beta/\alpha$, where $\beta$ is the coefficient on the dummy for disability condition and $\alpha$ is the coefficient associated with income (in logs). The error bars, denoting 95% confidence intervals, are computed from the standard error of the mentioned term. The detailed econometric results – which comprise 52 econometric analyses (two models and 26 countries) – are not reproduced in the text for brevity, but the complete regressions, including the coefficients for the control variables, are available from the authors upon request.

Several conclusions can be drawn about the estimated cost of disability (extra income needed to reach the same standard of living in two otherwise equivalent households but for the existence of members with disabilities) reproduced in both figures, the first using the question on the resources to make ends meet and the second using the assets approach. First, it should be mentioned that, overall, the magnitude of the costs is reasonably similar in both models, between 21% and 99% of household income in the first approach and between 20% and 132% according to the second one.[19] Nevertheless, there are important differences for particular countries, such as the Netherlands, Denmark, Romania or Spain. Second, overall, the subjective model produces a lower cost of disability (only in 8 out of 27 cases the cost is higher, and only five of them the differences are over 10%). This is an interesting result in itself that can be interpreted in terms of the existence of a process of the downward adaptation of the expectations of households with disabled people that allows for them to make ends meet with lower increases in household income (to compensate for the higher needs of disabled people) (Chubon, 1994), reaching nevertheless similar levels of well-being. In the next section, we develop this argument in detail. Third, the results obtained are roughly in line with the estimates of the few countries with data on the issue. Finally, although it is difficult to extrapolate a clear pattern from the results, several facts can be highlighted. For example, in both estimations Scandinavian countries, headed by Norway, lead the ranking of the costs of disability, while at the bottom, in general, we find Eastern European countries and Luxembourg. The next section discusses several explanations for these patterns.

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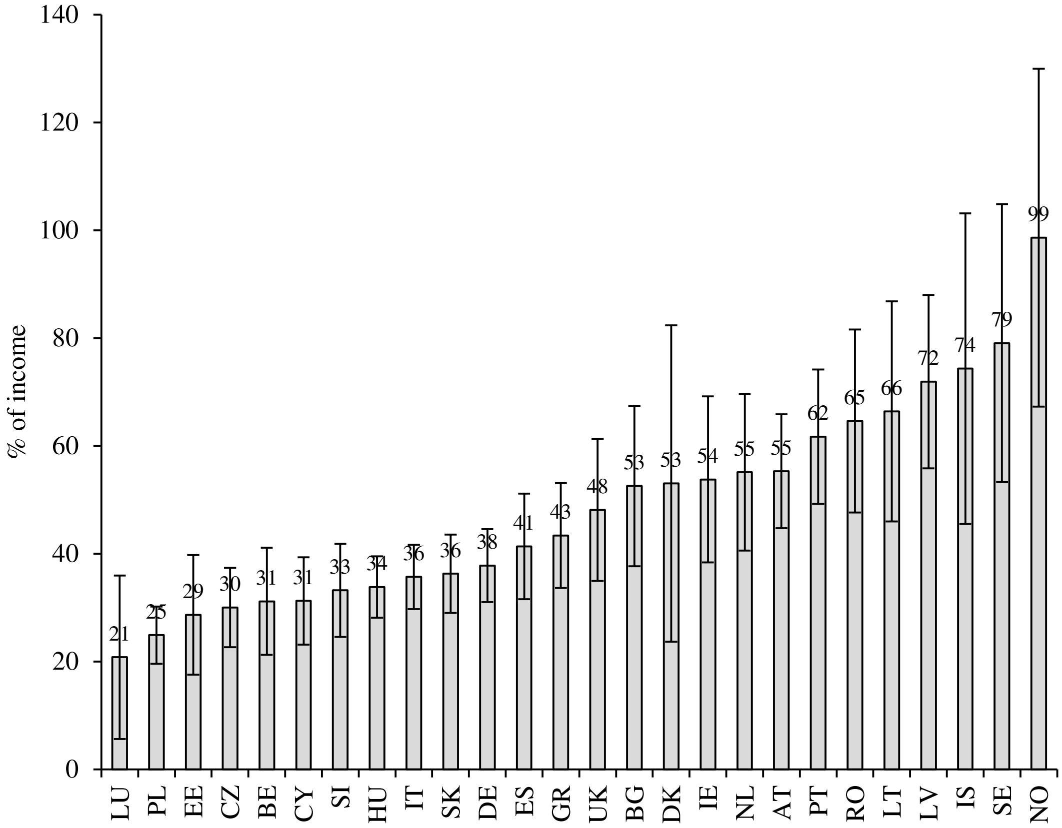
[19] The corresponding amounts of these costs in Euros PPS for a household with a median income are included in Figure 5.

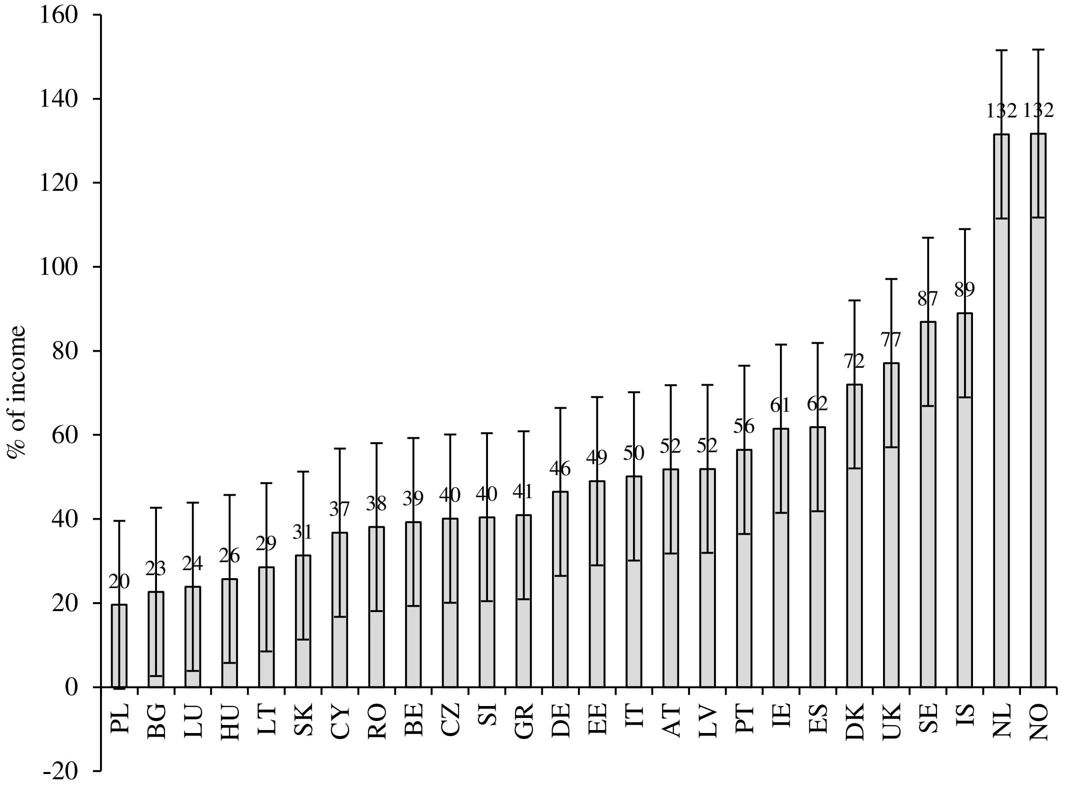
Figure 1. The estimated cost of disability across the EU (welfare based on reported ability to make ends meet)



Note: Interval confidences calculated at the 95% confidence level using the delta method. Acronyms follow the list of acronyms of the EU, presented in Tables 1 and 3.

Source: Authors' analysis from EU-SILC 2008.

Figure 2. The estimated cost of disability across the EU (welfare based on the PCA of households' assets)



Note: Interval confidences calculated at the 95% confidence level using the delta method. Acronyms follow the list of acronyms of the EU, presented in Tables 1 and 3.

Source: Authors' analysis from EU-SILC 2008.

In order to check the robustness of our findings, we repeat the analysis changing the definition of disability, making it less demanding, and re-performing the calculations using both strategies (the question about how people make ends meet and the welfare indicator based on households' items). The alternative definition of disability includes those individuals who report suffering a chronic illness and being limited either to a certain degree or intensively. This broader concept obviously increases the percentage of households with disabled individuals. The results obtained using this alternative definition are available upon request and are very similar to the ones reported earlier.

In order to assess the robustness of the results, we compute the correlation between the results obtained in the four different following models: model I, which is based on intense limitations in daily activities and the question about ability to make ends meet; model II, based on intense limitations in daily activities and households' assets; model III, based on mild or intense limitations in daily activities and the question about ability to make ends meet, and model IV, based on mild or intense limitations in daily activities and households' assets. In this respect, the correlation (displayed in Table 4) between the results obtained using these methods is around 0.5 in the case of intense limitations in daily activities (model I vs. model II) and more than 0.6 when individuals with intense or mild limitations in daily activities are considered to be disabled (model III vs. model IV). Second, there is barely any difference when we compare the results according to the definition of disability used. In other words, the correlation between the models based on the question on the ability to make ends meet (model I vs. model III) and those based on households' assets (model II vs. model IV) is remarkably high, around 0.9. Nevertheless, it is worth mentioning that the differences according to the way in which welfare is measured are larger than those reported by Zaidi and Burchardt (2005) for the UK, who obtained similar findings both for the subjective question on ability to make ends meet and for the approach based on households' items.

Table 4. Parametric and non-parametric correlation among outcomes of the different models

Pearson's correlation coefficient (parametric)

| | Model I | Model II | Model III | Model IV |
|---|---|---|---|---|
| Model I | 1.000 | | | |
| Model II | 0.647 | 1.000 | | |
| Model III | 0.876 | 0.605 | 1.000 | |
| Model IV | 0.565 | 0.913 | 0.647 | 1.000 |

Spearman's rank correlation coefficient (non-parametric)

| | Model I | Model II | Model III | Model IV |
|---|---|---|---|---|
| Model I | 1.000 | | | |
| Model II | 0.606 | 1.000 | | |
| Model III | 0.844 | 0.522 | 1.000 | |
| Model IV | 0.537 | 0.951 | 0.638 | 1.000 |

Notes:

- Model I is based on intense limitations in daily activities and the question about ability to make ends meet; model II is based on intense limitations in daily activities and households' assets; model III is based on mild or intense limitations in daily activities and the question about ability to make ends meet; model IV is based on mild or intense limitations in daily activities and households' assets.
- All correlation coefficients are significantly different from zero at the 1% level.

Source: Authors' analysis from EU-SILC 2008.

## 4.2. DISCUSSION

The results presented in the previous subsection suggest the existence of important variations in the extra cost of disability across the 26 European countries included in this study. There are alternative explanations for these differences.

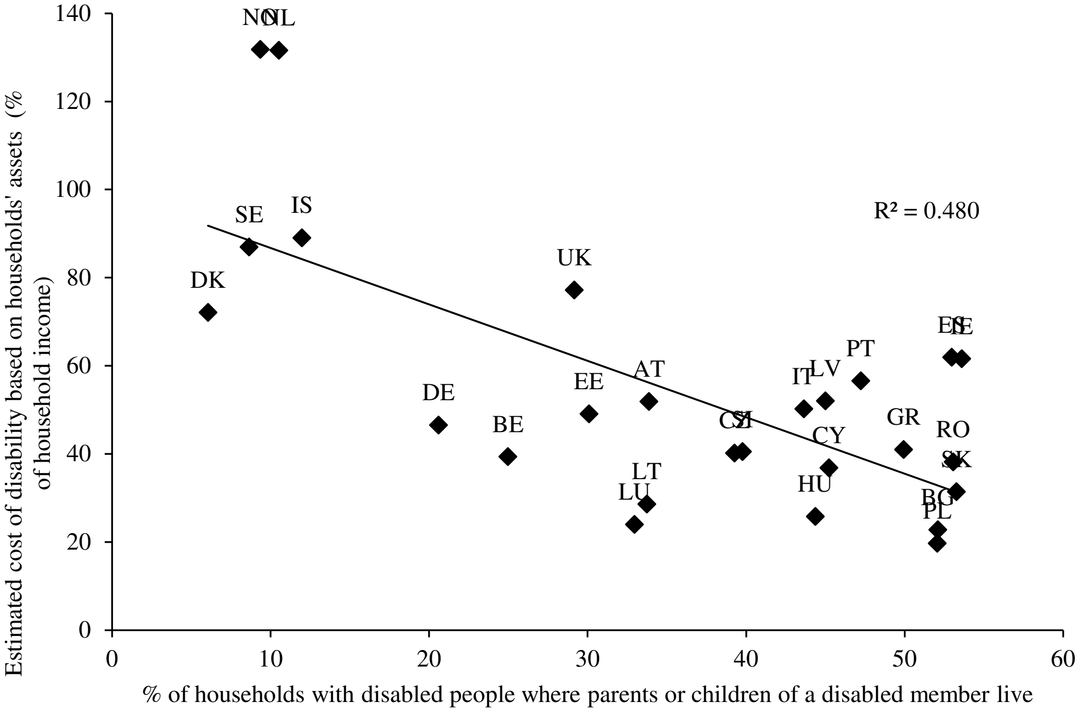
The first possible explanation is that part of the estimated differences might be related to measurement problems because of the subjective nature of the disability data used in the analysis. As can be inferred from Table 1, some countries, notably Hungary, Estonia, Portugal, Slovakia, Austria and Germany, declare much higher strong disability rates, around 10% or higher, than countries such as Denmark, the Netherlands and Slovenia, with strong disability rates around 5%. It could be argued that some of these differences are related to the disparate concept of disability applied by the respondent when filling in the survey questionnaire (and not to their "true" degree of disability). In this respect, Jürges's (2007) cross-national differences in self-reported health tend to be higher than the differences in true health (measured by diagnosed conditions), while the degree of dissonance between the two is different among countries, with Danish and Swedish having a tendency to overrate their health statuses compared with Germans, for example, who have a tendency to underrate it. If that were the case, those countries with high "statistical" (i.e. self-reported) disability rates would show a lower cost of disability, because part of the population considered to be disabled is not really so, showing therefore zero or a very low extra cost and thereby bringing down the estimated average cost of disability. We tested whether there is a negative correlation between the strong disability rate and the cost of disability and, although such a relation holds for specific countries such as Germany (high disability rate and low disability cost) or Denmark (the opposite), it does not hold for all countries. Thus, we conclude that although measurement error might be one of the factors behind the observed differences, is not the sole factor.

The second possible explanation considered is related to one of the methodologies used, the so-called *subjective-indirect*. As explained in section 3, this methodology compares the difficulty that different households have in making ends meet with their current incomes, interpreting these differences in the ability of otherwise identical households but for the presence of one of more members with disabilities in terms of the cost of the disability. It can be argued that the ability to make ends meet is affected by the expectations of the households of what they are entitled to do (what they want to do). If that is so, then societies with a strong feeling of equal rights for disabled people and a strong culture of equality might breed higher expectations and demands in households with disabled members and correspondingly higher disability costs. This could explain the high cost of disability in countries with a strong social-democratic tradition of equal opportunities such as Denmark, Sweden and Norway. This argument seems sound, but in order to serve as a reasonable explanation of the observed differences in disability costs, such differences should only be present in the subjective-indirect method, and not in the second objective method, and that is not the case. Therefore, we must also reject this second explanation as a prime hypothesis for the observed differences in cost.

The last explanation considered is the different living arrangements of individuals with disabilities and patterns of caring for disabled people across Europe. In particular, there are very important differences among the characteristics of households with disabled individuals in the countries included in this study. It can be argued that when people with disabilities live with parents or children who care for them, an important share of the extra cost of disability will be covered by them through publicly financed informal care. In contrast, if people with disabilities live on their own in single households, they will be more dependent on services brought from outside the household and, hence, such costs will be more visible to our estimation method.

In order to test this hypothesis, we present several plots using cross-country data that support it. Such figures are based on model II (the approach based on model I yields similar but somewhat weaker correlations). First, as shown in Figure 3, there exists a negative correlation between the percentage of households with disabled individuals sharing residency with parents or descendants and the estimated cost of disability. Figure 4 complements the information in the previous graph by pointing out a positive correlation between the proportion of households with disabled individuals, where the disabled person lives alone, and the cost of disability. Both figures show that, on average, those countries with a higher estimated cost of disability are also countries where disabled individuals tend to live more on their own. This evidence could be explained by the fact that part of the cost of disability would be higher for people who live alone because they need extra monetary resources to face their disability condition in terms of mobility, household duties and so on that otherwise would be taken care of by other members of the household (outside of the market).

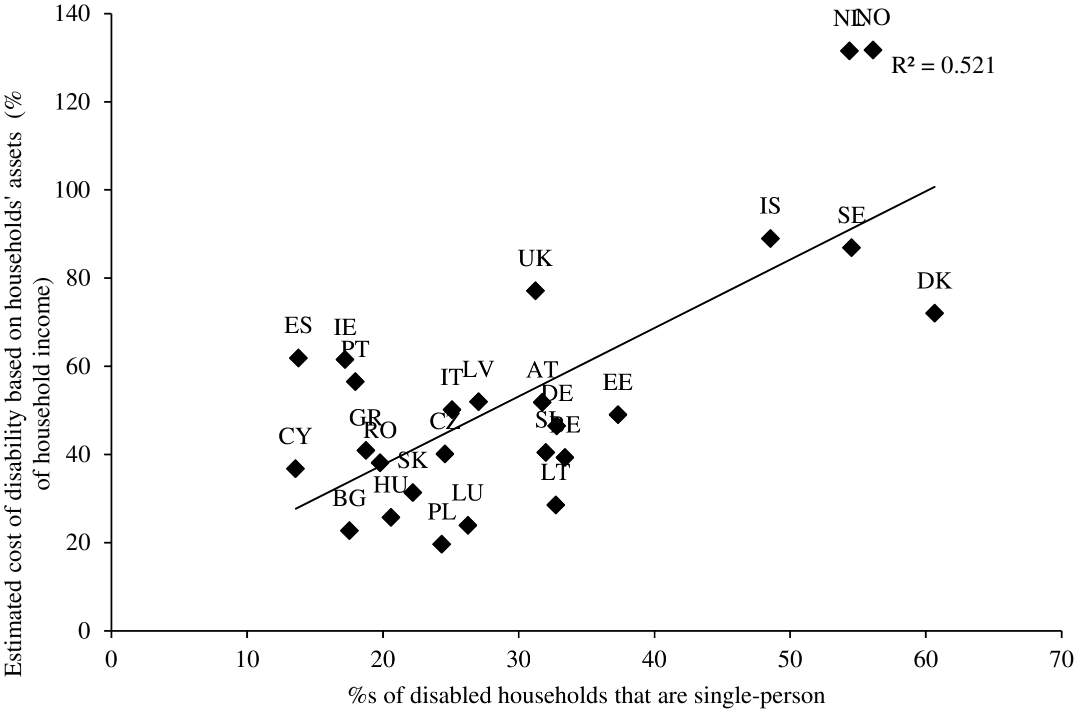
Figure 3. Percentage of households with disabled members where disabled people share residency with their parents or descendants and estimated disability cost



Note: Acronyms follow the list of acronyms of the EU, presented in Tables 1 and 3.

Source: Authors’ analysis from EU-SILC 2008.

Figure 4. Percentage of single-member households where the member has a disability and estimated disability cost



Note: Acronyms follow the list of acronyms of the EU, presented in Tables 1 and 3.

Source: Authors' analysis from EU-SILC 2008.

In other words, in countries where disabled individuals live alone and do not share a household with their relatives (the potential and actual caregivers for disabled individuals and children in many European countries) and therefore do not profit from informal care (non-market services provided by the family), the cost of disability is higher. Not by chance, those countries where households with disabled individuals seem to support the heaviest load are also countries that have established more generous disability social protection systems. As depicted in Figure 5, there is a positive correlation between the "generosity" of the disability protection programs of the different countries and the cost faced by a household with a handicapped person and the median income (the $R^2$ rises up to 0.64 if one removes Luxembourg, a clear outlier).[20]

One interpretation of such a relation is that social protection systems try to respond to different needs. An alternative interpretation might be that it is precisely the

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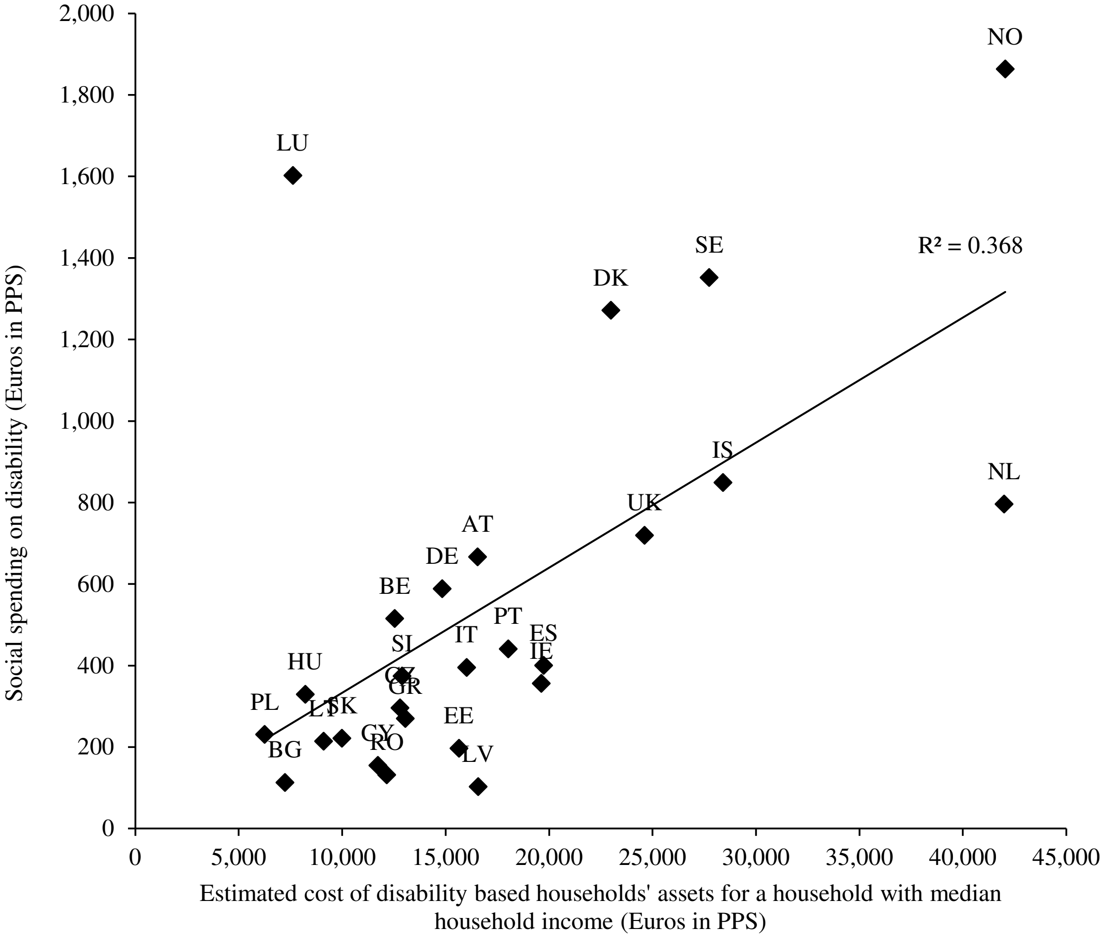
[20] According to the econometric log specification used in the article, the cost of disability as a proportion of disposable income is constant. The cost of disability in Euros in PPS has been calculated for a household with a median income, which can be considered to be representative. The correlation obtained when using the mean income is exactly the same.

existence of such generous systems what allows people with disabilities to live on their own and not to be forced to be dependent on family care. A more eclectic view simply assumes that both issues (the cost of disability and disability benefits) are likely to be jointly determined, partly because living arrangements and the Welfare State are embedded in institutional and social frameworks. In this respect, it is worth reflecting on the types of magnitudes we are dealing with. Throughout this article, we have referred to a purely monetary concept of welfare. It is plausible to assume that people with disabilities who are able to live on their own in places such as the Netherlands or the Nordic countries enjoy some non-pecuniary but valuable compensation through the higher autonomy and greater freedom of choice, as they are not forced to depend exclusively on their relatives' care. Some of these rewards could also be shared by their families, who would thus enjoy a greater degree of freedom when deciding whether to act as their caregivers or not.

A last remark to be made in this section refers to Luxembourg and its position at the bottom of the rankings. The low cost in the Grand Duchy can be interpreted as a result of an extremely high per capita income, closely related to the particularities of the country, which could result in the cost of disability being a lighter load for households.

Figure 5. Per capita social spending on disability and estimated disability cost



Note: Acronyms follow the list of acronyms of the EU, presented in Tables 1 and 3.

Source: Authors’ analysis from EU-SILC 2008.

## 5. CONCLUSION

The aim of this paper was to present for the first time, as far as we know, a comparative analysis of the cost of disability in Europe using the EU-SILC 2008. This study was based on the so-called standard of living approach, using two different methodologies (one based on self-reported ability to make ends meet and the other associated with access to several items, assets and services). Because of its comparative ambition, the work also served to test the usefulness and appropriateness of the standard of living method itself, which so far has provided results reasonably consistent with economic theory.

The first important finding of this study is that there is a significant diversity in the cost of disability across European countries. The overall pattern show Scandinavian countries at the top of the ranking and Eastern European states at the bottom. The second contribution of the article is related to the discussion of these disparate patterns. After rejecting different hypotheses that could help interpret the results, such as the different expectations of people with disabilities in different countries or problems related to the mismeasurement of disability rates, our analysis suggests that, to a large extent, the cost of disability is related to the living arrangements of people with disabilities. It is reasonable to assume that those persons with disabilities who live with their relatives will enjoy some services and goods for free, while disabled individuals living on their own do not profit to the same extent from the free care provided by the family. Then, people with disabilities will face higher costs and, consequently, the cost of disability will be (and will show in our estimates to be) higher in those countries with a higher degree of the emancipation of people with disabilities.

The results presented so far leave the authors (and probably the readers) with a bittersweet sensation. On one side, the application of a given methodology, until now only applied to a single country, to a common database and a large number of countries has shown interesting patterns in terms of the cost of disability, a novel result by itself that the authors have explained by resorting to different hypotheses. On the other side, the diversity of the cost estimated – depending on the country – could be due to the intrinsic limitations of the method used. Obviously, when estimates are produced for a single country there is no point of comparison to see whether the results are acceptable or not. The comparative analysis opens such a perspective.

This final reflection is that there is a long way to go in the study of the cost of disability in both developed and developing countries. Disability is a common phenomenon in Europe and it is likely to be a more and more important problem in the coming decades because of the ageing of the population pyramid. In this sense, several lines for further research can be suggested. First, the findings could be reinforced by the use of databases that, apart from income, contain more detailed and objective information on the health conditions of individuals (even if self-reported), information which was not available when writing this paper. Second, research on the extra costs of disabilities could profit from the joint use of alternative methods of estimation (without being restricted to the use of a single approach), combining quantitative and qualitative methods. Third, the EU-SILC database offers the possibility to study the impact of disability on living conditions from a longitudinal perspective. In this respect, it seems particularly relevant to explore the links between poverty and disability across Europe.

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