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Measuring Income-Related Inequalities in Health in Multi-Country Analysis

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ABSTRACT

Health inequalities remain a cause of concern for policymakers across the world. However, the measurement and monitoring of health inequalities over time and across countries remain a research challenge. The concentration index is one of the most popular measurement tools, however, it presents several drawbacks, especially for bounded variables, which are discussed in this study. Results from the European Community Household Panel dataset and the Statistics of Income and Living Conditions for Europe suggest that there is evidence of persistent socioeconomic inequalities in health in Europe. Further, results show the need of reporting both absolute and relative inequalities for appropriately monitoring and comparing trends in health inequalities across countries.

Keywords: Concentration Index, Inequalities In Health, Self-Assessed Health, Health Limitations, Europe.

Midiendo las desigualdades en salud relacionadas con la renta entre países

RESUMEN

Las desigualdades en salud siguen siendo prioritarias en la agenda política de los países. Sin embargo, la medida y la monitorización de dichas desigualdades en el tiempo y entre países continúan siendo un desafío para los investigadores. El Índice de Concentración es una de las herramientas más utilizadas; sin embargo, éste presenta limitaciones, especialmente para variables limitadas, que son comentadas en este estudio. Los resultados obtenidos a partir del Panel de Hogares de la Unión Europea y las Estadísticas de Renta y Condiciones de Vida Europea demuestran que existen desigualdades socioeconómicas en salud en Europa persistentes en el tiempo. Además, de los resultados se desprende la necesidad de mostrar las desigualdades tanto absolutas como relativas, para realizar el seguimiento adecuado de las mismas y asimismo, favorecer la comparación de las desigualdades en salud entre países.

Palabras claves: Índice de Concentración, desigualdades en salud, salud autopercibida, limitaciones en salud, Europa.

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1. INTRODUCTION

Health inequalities remain a health and public policy concern in all countries (Thouez, 2006); in particular, health inequalities by socioeconomic status are of interest as they are considered a performance measure within and across health care systems. As reported by the World Health Organisation (WHO) in the World Health Report 2000 (World Health Organisation, 2000), improving the health attainment of the population and reducing the health gap across socioeconomic groups are the main goals in any health care system, together with improving responsiveness to population needs and fairness of financing. At the European level, socioeconomic inequalities in health and health care use are particularly important given not only the challenges posed by the European Union enlargement but also by an aging population and the current financial crisis.

At the European level, the Member States of the European Union took a major initiative by making the fight against poverty and social exclusion as one of the central elements in the modernisation of the European social model in the European Councils in Lisbon and in Nice (2000). The Lisbon strategy acknowledges the importance of poverty reduction and elimination of social exclusion as mechanisms necessary for the European Union to become the most competitive and knowledge-based economy. A set of common objectives to be pursued by the Member States were established: to facilitate participation in employment and access by all to resources, rights, goods and services; to prevent the risks of exclusion; to help the most vulnerable, and to mobilize all relevant bodies.

At international level, the World Health Organisation Commission on Social Determinants (WHO Health Commission, 2008) was created, recognising the poor health of the poor, the social gradient in health within countries and the existence of health inequities between countries. These were linked to the results of a combination of poor social policies and programmes, unfair economic arrangements and bad politics. It is concluded by the Commission that action on the social determinants of health must involve the whole of government, civil society and local communities, business and international agencies. Three broad sets of recommendations to close the gap in health inequities have been provided by the Commission: improving daily living conditions, this is, housing, early child development, health care and social protection; tackling the unequal distribution of resources; and finally, measuring and understanding the problem.

Although there is an overall concern for health inequalities, there is also a substantial amount of evidence on the level of health inequalities across countries. Recent work has shown that significant inequalities favouring the better-off exist in EU member countries and that socioeconomic factors such as education, income and activity status have a substantial effect on the health of indi-

viduals (WHO Health Commission, 2008; Mackenbach, 2006; Hernández-Quevedo *et al.,* 2006; Hernández-Quevedo *et al.,* 2008; Hernández-Quevedo *et al.,* 2010). Robust epidemiological and economics methodological tools are available to measure inequalities in health across countries, but there are also numerous methodological issues that the comparative study of health inequalities presents.

Methods based on concentration curves and concentration indices have been extensively used for measuring inequalities and inequities in the literature (Wagstaff and vand Doorslaer, 2000). The health concentration curve (CC) and concentration index (CI) provide measures of relative income-related health inequality (Wagstaff *et al.,* 1989). As reported by Wagstaff, Paci and van Doorslaer (1991), the main advantages associated to the concentration index are that: they capture the socioeconomic dimension of health inequalities, they use information from the whole income distribution rather than just the extremes, they give the possibility of visual representation through the concentration curve, and finally, they allow checks of dominance relationships.

Some evidence on health inequalities

Several cross-country studies for European countries have provided evidence of inequalities in health outcomes related to socioeconomic variables, with a focus on whether disparities in health outcomes differ systematically according to socioeconomic variables, such as education or income. In particular, empirical contributions on health inequalities focus on whether the gap in health outcomes differs systematically according to socioeconomic status. On the contrary, and as argued by van Doorslaer and van Ourti (2011), the measurement and assessment of absolute inequalities in health has received relatively little attention, with a limited number of contributions (e.g., Le Grand, 1978; Wagstaff and van Doorslaer, 2004).

Evidence from cross-country analysis focusing on European countries shows that those with the lowest level of income, education or social status are those suffering worse levels of health, more chronic illnesses and more limitations in daily activity. This is not only the case for the EU15 (Hernández-Quevedo *et al.,* 2006; Kunst *et al.,* 2005; Dalstra *et al.,* 2006; Mackenbach *et al.,* 2005) but also for Central and Eastern European countries (Bobak, 2000; Helasoja, 2006). In particular, Hernández-Quevedo *et al.,* (2006) found income-related inequalities in health limitations in daily activities for all the countries considered with health limitations concentrated in the poorest individuals. Higher income-related inequalities were found for an indicator of severe health limitations against an indicator of any limitations in daily activity. A cross-country analysis by Hernández-Quevedo *et al.,* (2010) shows new evidence on socioeconomic inequalities in 20 of the 27 EU countries. The authors find significant income-

related inequalities in health limitations in the three years considered (2005 - 2007), with health limitations disproportionably concentrated among the worse-off. Besides, several countries show a particular trend on income-related inequalities in health: a clear increase on income-related inequalities in health limitations across time for Latvia, Luxembourg, Lithuania, Estonia, Belgium and Austria; a clear decreasing trend for socioeconomic inequalities in health limitations for Italy and Sweden; and for those countries without a clear pattern, an increase in overall inequalities everywhere is found, with the exception of Spain and Slovenia.

Despite data constraints, some studies have provided dynamic cross-country analysis of health inequalities in Europe, showing that health is a dynamic phenomenon (Contoyannis *et al.,* 2004a; Contoyannis *et al.,* 2004b); the persistence of health inequalities across time has been associated to socioeconomic factors, such as education, income and activity status (Contoyannis *et al.,* 2004a; Contoyannis *et al.,* 2004b; Olsen and Dahl, 2007; Smith, 2004; Hernández-Quevedo *et al.,* 2008; Jones and Wildman, 2008). These results highlight the importance of the dynamic approach when measuring health inequalities, with longitudinal data capturing the potential income mobility of individuals across time and its relationship with changes in health over time. A previous study based on the European Household Panel Data Survey (ECHP), an homogenised longitudinal dataset covering 1994 - 2001 for the EU15, finds evidence that those downwardly income-mobile individuals are more likely to suffer any health limitations in their daily activity due to their health status than upwardly income-mobile individuals (Hernández-Quevedo *et al.,* 2006), with long-run income inequalities in health limitations being higher than short-run inequalities in the countries included in the analysis and for the covered period (1994 - 2001).

Previous cross-country studies lack detailed discussion on the limitations of using the standard Concentration Index to measure health inequalities and what this implies for cross-country comparison of health inequalities over time. Whether alternative measurements may be used and what they imply in practice for policymakers require further discussion, which is intended in this study. This article aims to discuss the limitations associated to the standard Concentration Index for measuring socioeconomic inequalities in health across European countries as well as comparing the resulting trends on health inequalities with those obtained through a corrected version of the Concentration Index suggested by Erreygers (2009). For that purpose, two European longitudinal datasets are considered: the European Community Household Panel Survey users database (ECHP-UDB) and the Statistics of Income and Living Conditions (EU-SILC), provided by Eurostat. Some recommendations for researchers and policymakers are also drawn from the results.

2. METHODS

There are few measures used extensively to quantify inequalities in health within the corresponding economic literature. The main measures identified in the literature are: the range, the Lorenz curve and Gini coefficient, the slope and relative indices of inequality and the concentration index, among a few others not discussed here (Wagstaff *et al.,* 1991). The purpose of this section is to identify different measurement methods that could be useful in implementing cross-sectional comparisons of inequalities in health.

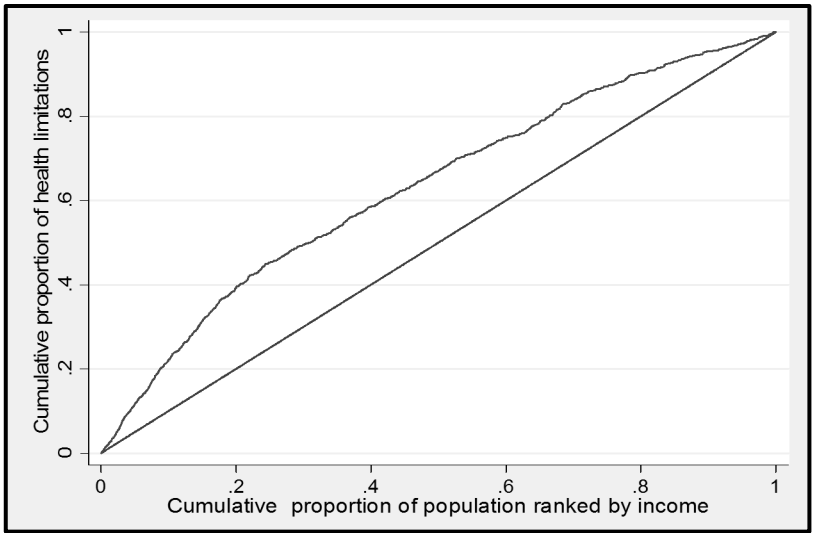
The range compares the experiences of the top and bottom socioeconomic groups. However, this measure has several limitations, including the fact that intermediate categories are not considered, as well as it does not take into account the size of the groups, which does not facilitate cross-country analysis. The Lorenz curve and Gini coefficients allow us to measure inequalities in health variables, irrespective of the socioeconomic dimension of these inequalities. It plots the cumulative proportion of the population, with individuals ranked by their level of health, from the sickest to the healthiest individual, against the cumulative proportion of health. The Gini captures the area between the 45-degree line, which represents perfect equality, and the Lorenz Curve is its visual representation.

However, the range and the Gini coefficients do not account for the socioeconomic dimension of health inequalities. Together with the Concentration Curve and associated Concentration Index explained before, other measures of inequalities in health reflect this socioeconomic dimension. These are the slope index of inequality and the relative index of inequality. The slope index of inequality (SII) is defined as the slope of the regression line showing the relationship between the level of health in each socioeconomic group and the hierarchical ranking of each socioeconomic group on the social scale. Alternatively, the Relative Index of Inequality (RII) can be obtained by simply dividing the SII by the mean level of population health and hence, becoming insensitive to the average of the health variable (Regidor, 2004). Here we focus on a widely used measure of income-related inequalities in health, that is, the concentration index, discussing the limitations that have been highlighted in the literature (Erreygers, 2009).

The concentration index (CI) is derived from the concentration curve (CC). This is illustrated in Figure 1 for a measure of ill-health. The sample of interest is ranked by socioeconomic status. If income is used as the relevant ranking variable, the horizontal axis begins with the poorest individual and progresses through the income distribution up to the richest individual. This relative income rank is then plotted against the cumulative proportion of illness on the vertical axis. This assumes that a cardinal measure of illness is available, that can be compared and aggregated across individuals. The 45-degree line shows

the line of perfect equality, along which the population shares of illness are proportional to income, such that the poorest 20% of individuals experience 20% of the illness in the population. In the example shown, the poorest 20% of income earners experience more than 20% of illnesses. Therefore, the CC plots the cumulative percentage of health against the cumulative percentage of the population ranked from the poorest to the richest (if income is the socioeconomic variable of interest). The size of inequality can be summarised by the concentration index, which is given by twice the area between the concentration curve and the 45-degree line.

Figure 1
Example of concentration curve for an indicator of health limitations compared to the 45-degree line (diagonal) of perfect equality



Source: EU-SILC data for Cyprus, 2007

There are various ways of expressing the CI algebraically. Here we present the most common in the literature for its convenience:

$$CI = \frac{2}{\mu}\mathrm{cov}(h_i, R_i) \qquad (1)$$

This shows that the value of the concentration index is equal to the covariance between individual health (h_i) and the individual's relative rank (R_i), scaled by the mean of health in the population (μ). Then the whole expression is multiplied by 2, to ensure the concentration index ranges between -1 and +1. Equation (1) indicates that the CI is a measure of the degree of association be-

tween an individual's level of health and their relative position in the income distribution. It is important to highlight that a value of CI equal to 0 does not mean absence of inequality, but an absence of the systematic socioeconomic gradient in the distribution, this is, an absence of inequality associated to the socioeconomic characteristics.

The CI is considered an appropriate measure of socioeconomic-related inequalities in health when health is measured on a ratio scale with non-negative values. However, measurement of inequalities is usually based on self-reported data, and it is not possible to obtain a concentration index from categorical health data. In this study, we use a dichotomous variable, which has been considered as a partial solution to this issue (O'Donnell *et al.,* 2008).

The standard CI combines a number of desirable properties for the measurement of socio-economic inequality; however, it presents several drawbacks which have been discussed in the relevant literature. Firstly, for bounded variables, the CI may depend on the mean of the health variable, making comparison of populations with different mean health levels problematic (Erreygers, 2009). Secondly, when the health variable is binary, the limits of the CI are not necessarily -1 and +1 (Wagstaff, 2005). Thirdly, inequalities in health do not "mirror" those in ill-health, implying that the CI does not satisfy the "mirror property" (Clarke *et al.,* 2002; Erreygers *et al.,* 2012). Finally, it has been argued that if the health variable has a qualitative nature, then the index becomes arbitrary. Wagstaff (2005) and Erreygers (2009) propose different correction mechanisms to deal with the limitations listed above. While both suggested corrections satisfy the mirror condition (Erreygers and van Ourti, 2011), Erreygers corrected CI has been found insensitive to any feasible equal addition to the health variable (hence, measuring quasi-absolute inequalities, as explained in Erreygers and van Ourti (2011)). However, the corrected Concentration Index following Erreygers (2009) is not a measure of relative inequality and hence, it is not directly comparable with the standard Concentration Index, which is a measure of relative inequality (but does not satisfy the mirror property, as argued by Wagstaff (2011).

Taking into account the standard CI given by expression (1), the Erreygers Concentration Index can be calculated as follows:

$$E(h) = \frac{4\overline{h}}{h^{\max} - h^{\min}} * CI(h) \qquad (2)$$

where $\overline{h}$ is the mean of the health variable, $h^{\max}$ and $h^{\min}$ are the extremes of the health variable and CI(h), the standard concentration index. The Erreygers CI has been previously employed to provide cross-country comparisons of income related inequalities in health. Van de Poel *et al.,* (van de Poel *et al.,* 2007; Hernández-Quevedo *et al.,* 2010; Hernández-Quevedo & Jiménez-Rubio, 2009;

Costa-Font *et al.,* 2013) are some of the examples where the Erreygers CI is used.

3. DATA AND VARIABLES' DEFINITION

3.1. Datasets

Two longitudinal datasets covering Europe have been applied in this study to obtain estimates of socioeconomic inequalities in health: the European Community Household Panel Users' Database and the Statistics on Income and Living Conditions.

European Community Household Panel Users' Database (ECHP-UDB)

The European Community Household Panel Users' Database (ECHP-UDB) is a standardised annual longitudinal survey, designed and coordinated by the European Commission's Statistical Office (EUROSTAT). It provides up to 8 waves (1994 - 2001) of comparable micro-data about living conditions in the pre-enlargement European Union Member States (EU-15). The survey is based on a standardised questionnaire that involves annual interviewing of individuals aged 16 and older from a representative panel of households (Peracchi, 2002). National Data Collection Units implemented the survey in each of the member countries. Approximately, 60,000 households, with 130,000 adults, were interviewed. The survey covers a wide range of topics including demographics, income, social transfers, individual health, housing, education and employment. The information provided in the ECHP-UDB can be compared across countries and over time, making it an attractive dataset for the purpose of our study.

The first wave included all EU-15 Member States with the exception of Austria and Finland. Austria joined in 1995 and Finland, in 1996. For the first three waves, the ECHP ran parallel to existing national panel surveys in Germany (GSOEP), Luxembourg (PSELL) and the United Kingdom (BHPS). From the fourth wave onwards, the ECHP samples were replaced by data harmonized ex-post from these three surveys. Hence, there were two versions of the ECHP database for Germany, Luxembourg and the United Kingdom. Although Sweden did not take part in the ECHP, the Living Conditions Survey is included in the UDB. We use a balanced sample of respondents, which has been constructed by including only those individuals from the first wave who were interviewed in each subsequent wave.

We consider data for the 14 countries included in the ECHP: Austria, Belgium, Denmark, Germany, Greece, Finland, France, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain and United Kingdom. Sample sizes for the different countries vary substantially from one country to other, ranging from 76,312 individuals for Italy, to only 5,337 for Luxembourg.

Statistics on Income and Living Conditions (EU-SILC)

The EU-SILC (Statistics on Income and Living Conditions) is an instrument aiming at collecting timely and comparable cross-sectional and longitudinal multidimensional micro-data on income, poverty, social exclusion and living conditions, becoming a key tool for policymakers interested in monitoring Lisbon strategy. The instrument is anchored in the European Statistical System (ESS). It replaced the European Community Household Panel from 2005 onwards.

The EU-SILC was launched in 2004 in 13 Member States (Belgium, Denmark, Estonia, Greece, Spain, France, Ireland, Italy, Luxembourg, Austria, Portugal, Finland and Sweden) and in Norway and Iceland. This first release of cross-sectional data mainly refers to the income reference year 2003 with a fieldwork carried out in 2004. The EU-SILC reached its full scale extension to include 25 Member States plus Norway and Iceland in 2005. Bulgaria, Romania, Turkey and Switzerland launched SILC in 2006.

The instrument aims to provide two types of data: cross-sectional data pertaining to a given time or a certain time period with variables on income, poverty, social exclusion and other living conditions (including three health items), and longitudinal data, pertaining to individual-level changes over time, observed periodically over a four year period.

In this study, we use the longitudinal section of the EU-SILC covering the years 2005, 2006 and 2007, which is nationally representative data for the three years considered. All individuals aged 16 or over in any of these waves are included in our analysis. The sample we use is therefore an "unbalanced panel" and includes all individuals whether they are only in one wave, in two waves or in all three waves considered.

We include 20 countries in our analysis: Austria, Belgium, Cyprus, Czech Republic, Estonia, Spain, Finland, France, Hungary, Italy, Lithuania, Luxembourg, Latvia, the Netherlands, Poland, Portugal, Sweden, Slovenia, Slovakia Republic and United Kingdom. The longitudinal data contained in the EU-SILC Users' database do not include information for Bulgaria, Denmark, Germany, Greece, Ireland, Malta and Romania; these countries are therefore not included in our analysis. The sample sizes for the different countries vary substantially from one country to other. The extreme cases are Italy, with 88,529 respondents, and Sweden, with only 10,800 respondents.

3.2. Variables

Health variables

To calculate income-related inequalities in health status using the ECHP dataset, we have considered a binary indicator of self-assessed health (SAH). The

original SAH question asked respondents: "How is your health in general?", with 5 possible answers: "very good", "good", "fair", "poor" and "very poor". Although responses may be collapsed differently, we have focused on a binary indicator of very good or good self-reported health status, following previous studies on health inequalities.

Similarly, the EU-SILC includes several variables regarding health outcomes. For the purpose of this study, we use a health outcome variable which indicates whether the individual suffers any limitation in daily activities due to health problems for at least the last six months, with three possible answers: "yes, strongly", "yes, limited", "no, not limited". For this analysis, we create a binary indicator of suffering any type of limitation in daily activities (equalling 1 if individuals report being strongly limited or limited - categories 1 and 2 in the original variable). This variable is considered a quasi-objective indicator, which should capture the level of health of individuals more accurately than the self-reported health variable (e.g., Hernández-Quevedo *et al.,* 2008).

Socioeconomic variables

To calculate income-related inequalities in self-percieved health, we have considered equivalised household income as our socioeconomic indicator for the analysis using the ECHP dataset. The income variable is the logarithm of equivalised real income, adjusted using the Purchasing Power Parities (PPPs) and the Consumer Price Index (CPI). It is equivalised by the OECD modified scale to adjust for household size and composition. For the EU-SILC analysis, we use equivalised household disposable income, which is a derived variable already included in the EU-SILC database. In our regression analysis we include the logarithm of this variable (*ln_inc*).

3.3. Descriptive analysis

According to results shown in Table 1 corresponding to ECHP-UDB, Denmark and Ireland show the highest rates of individuals perceiving very good or good health in 1994 (83% and 80%, respectively), while Portugal and Italy show the lowest (53% and 60%, respectively). If we consider the trends over time for those countries with 8 waves available in the ECHP-UDB, the proportion of individuals reporting good or very good health decreases over time for most countries, while for others such as Spain and Italy, there is no particular trend, and hence, individuals perceiving very good or good health remain stable over the eight years considered. However, it is possible to see that for Portugal, there is a substantial decrease in the prevalence of reporting very good or good health, compared to the rest of the countries.

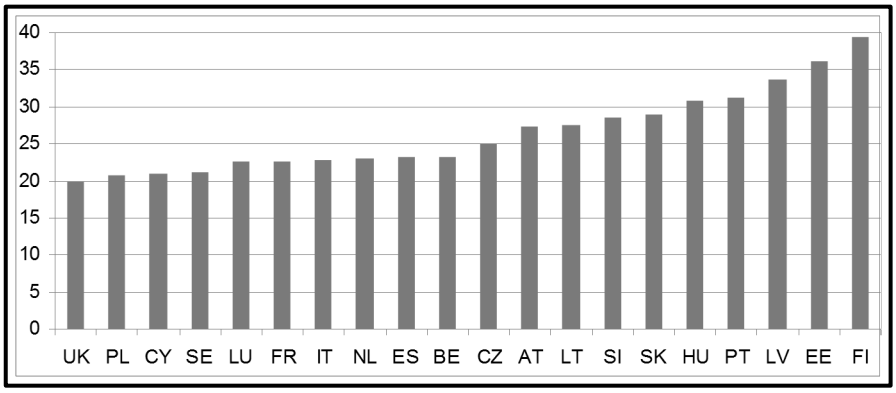
Table 1
Prevalence of very good or good health and sample size, ECHP-UDB 1994 - 2001

	1994	1995	1996	1997	1998	1999	2000	2001	NxT
D	0.678	0.669	0.663						24108
L	0.668	0.669	0.670						5337
UK	0.749	0.718	0.706						16146
DK	0.830	0.802	0.775	0.782	0.758	0.758	0.733	0.720	20288
NL	0.761	0.742	0.736	0.723	0.717	0.695	0.680	0.683	37248
BE	0.781	0.778	0.775	0.756	0.755	0.734	0.731	0.730	24064
FR	0.656	0.618	0.600	0.587	0.565	0.576	0.561	0.547	57808
Irl	0.800	0.802	0.809	0.809	0.809	0.813	0.804	0.796	21984
IT	0.598	0.613	0.602	0.604	0.577	0.573	0.559	0.562	76312
EL	0.730	0.723	0.747	0.712	0.728	0.725	0.732	0.733	51072
ES	0.638	0.655	0.661	0.652	0.648	0.654	0.655	0.629	60392
PT	0.525	0.481	0.456	0.431	0.414	0.415	0.387	0.378	58784
AT		0.729	0.729	0.735	0.711	0.710	0.722	0.724	28007
FI			0.636	0.644	0.633	0.624	0.615	0.598	23358

Note: AT (Austria), BE (Belgium), D (Germany), DK (Denmark), EL (Greece), ES (Spain), FI (Finland), FR (France), Irl (Ireland), IT (Italy), L (Luxembourg), NL (The Netherlands), PT (Portugal), UK (United Kingdom).

Source: Own elaboration.

Figure 2
Percentage of individuals reporting any health limitations in their daily activity, EU-SILC 2005 - 2007



Note: AT (Austria), BE (Belgium), CY (Cyprus), CZ (Czech Republic), EE (Estonia), ES (Spain), FI (Finland), FR (France), HU (Hungary), IT (Italy), LT (Lithuania), LU (Luxembourg), LV (Latvia), NL (The Netherlands), PL (Poland), PT (Portugal), SE (Sweden), SI (Slovenia), SK (Slovak Republic), UK (United Kingdom).

Source: Own elaboration.

In terms of the percentage of individuals reporting suffering any health limitation in their daily activity, EU-SILC data for 2005 - 2007 shows that the highest corresponds to Finland (39%), Estonia (36%), and Latvia (34%), while

the lowest ones correspond to the UK (20%), Poland, Cyprus, and Sweden (all three with 21%), in average (see Figure 2).

4. RESULTS

The standard CI for each country is computed using the convenient regression formula (Newey and West, 1994; O'Donnell *et al.,* 2008), in which a fractional rank variable is created. In particular, we estimate the linear regression:

$$2\sigma_R^2\left(\frac{h_i}{\mu}\right) = \alpha + \beta R_i + \varepsilon_i \qquad (3)$$

Where σ_R^2 is the variance of the fractional rank. The OLS estimate of β corresponds to the estimated standard concentration index (see O'Donnell *et al.,* 2008). We correct for cross-cluster correlation as a form of serial correlation is always likely to be present owing to the rank nature of the regressor (Kakwani *et al.,* 1997). To correct the standard errors, we use the Newey-West (1994) variance-covariance matrix, which corrects for autocorrelation, as well as heteroscedasticty. In Stata, the command *newey* produces OLS regression coefficients with Newey-West standard errors. Once the standard CI is obtained, we calculate Erreygers Concentration Index by applying equation (2).

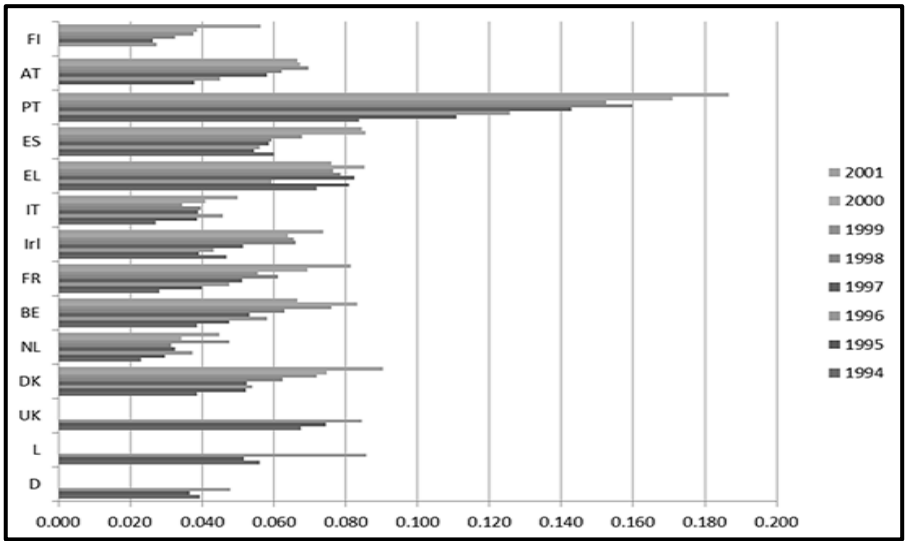
According to the ECHP-UDB data, there is evidence of income-related health inequalities for all the countries analysed in the period 1994 - 2001 (see Table 1A and Figure 3). Very good and good health categories are disproportionately concentrated among the richest individuals in that period. There is a clear increasing trend for several countries, including United Kingdom, Denmark, France, Ireland, Spain, Portugal and Finland. For the remaining countries, Germany, Luxembourg, the Netherlands, Belgium, Italy, Greece and Austria, there is no clear trend, remaining persistent over time. From the results above, it can be seen that Portugal presents much larger inequalities than the rest of the European countries considered in the 8-year period covered by the ECHP-UDB.

However, if previous results are compared with the trends provided by the Erreygers CI (Table 2A and Figure 4), it is possible to see that trends remain similar, excepting for the case of Ireland and Austria. In the Irish case, according to the Erreygers CIs, the trend over time is not clear, although inequalities persist over the period. For the case of Austria, Erreygers CI shows a clear increasing trend of health inequalities over time.

Further, income-related inequalities in health limitations have been measured for the 20 countries considered within the EU-SILC dataset, for the three waves included in our analysis, in order to see the trend on inequalities in health limitations across time and hence, exploiting the longitudinal format of the data.

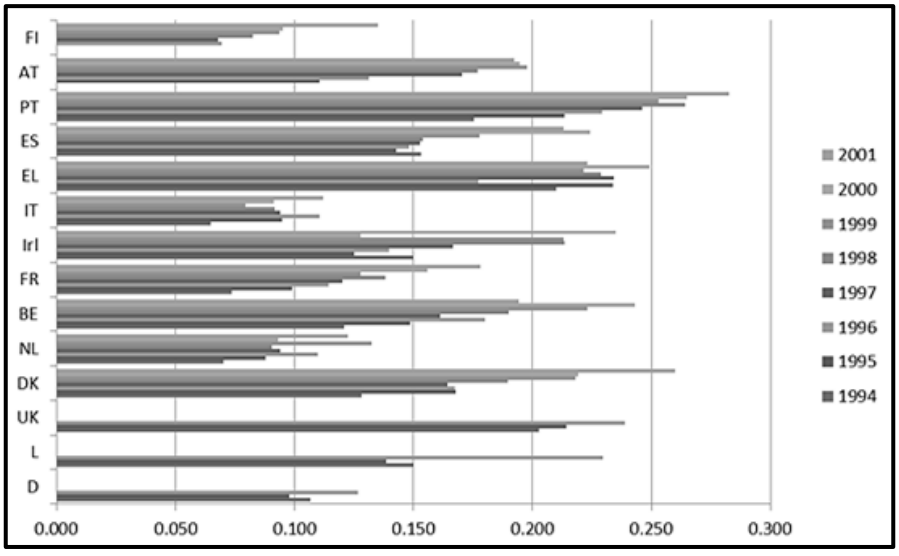
The Concentration Indices calculated here are short-term CIs for each of the waves.

Figure 3
Standard CIs for very good or good self-assessed health, ECHP 1994 - 2001



Source: Own elaboration.

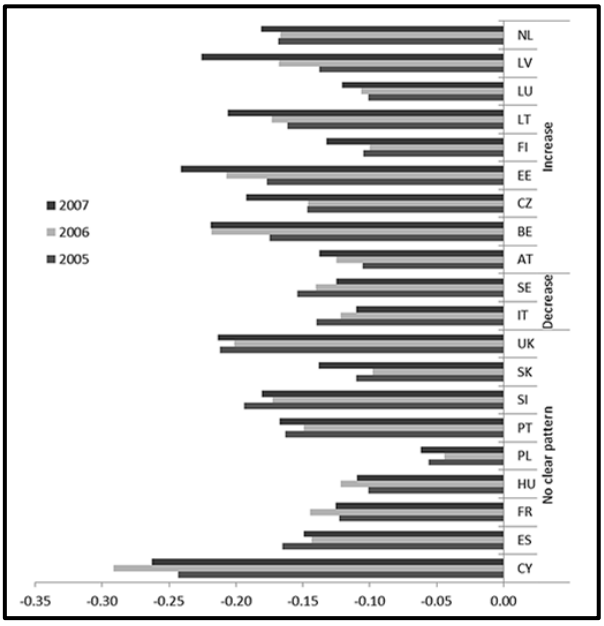
Figure 4
Erreygers CIs for very good or good self-assessed health, ECHP 1994 - 2001



Source: Own elaboration.

According to the results following EU-SILC data analysis, all the estimated CIs are statistically significant at a 5% significance level (see Figure 5 and Table 3A). Besides, all CI's for health limitations are negative and different from 0. This means that not only is there evidence of income-related inequalities in health limitations in the three waves, but that health limitations are disproportionately concentrated among the worse-off in the three-year period considered. This result is consistent with previous studies at EU-15 level, which found significant income-related inequalities in health limitations across the EU-15 Member States concentrated in the poorest individuals of each society (Hernández-Quevedo *et al.,* 2006). For the latest data available, namely 2007, we can see that the highest levels of income-related inequalities in health limitations exist in Cyprus, Estonia, and Latvia while the lowest correspond to Poland, Hungary and Italy.

Figure 5
Standard CIs for health limitations, EU-SILC 2005-2007



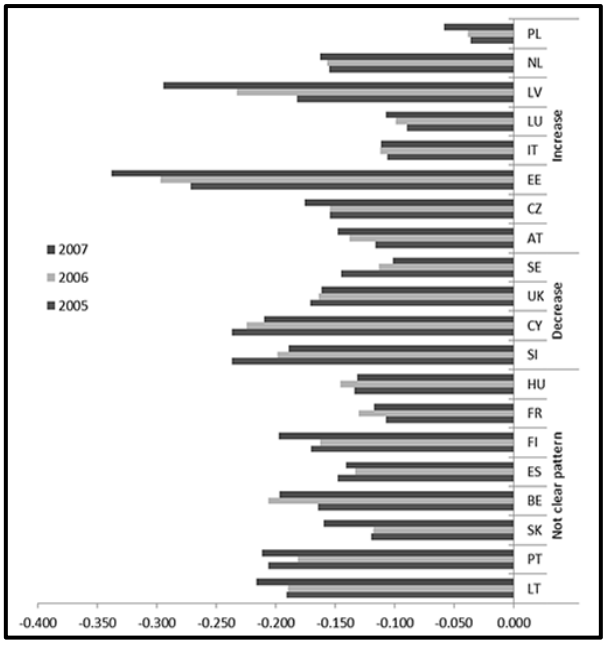
Source: Own elaboration.

Moreover, for several countries a clear trend on socioeconomic inequalities in health limitations through time is shown by the results. For Latvia, Luxembourg, Lithuania, Estonia, Belgium and Austria, there is a clear increase on income-related inequalities in health limitations across time, while for Italy and Sweden there is a clear decreasing trend for socioeconomic inequalities in

health limitations from 2005 to 2007. If we compare income-related inequalities in health limitations between 2005 and 2007 for those countries without a clear pattern, we can see that overall inequalities increased everywhere with the exception of Spain and Slovenia.

However, if previous results are compared with the trends provided by the Erreygers CI (see Figure 6 and Table 4A), it is possible to see that similar trends in inequalities in health limitations remain for some of the countries, but for others, the direction of the trend changes substantially. This is the case for Italy, which shows an increasing trend according to Erreygers CI, while the standard CI would imply a decreasing trend in the period considered. For some of the countries not following a particular trend according to the standard CI, they present an increasing or decreasing trend following the Erreygers CI estimates. This is the case for Poland, which now presents an increasing trend according to Erreygers CI, and for Cyprus, United Kingdom and Slovenia, which show a decreasing trend according to Erreygers CI. Further, two countries which follow an increasing pattern according to the standard CI, Lithuania and Finland, do not show a clear trend according to Erreygers CI, although inequalities in health limitations remain persistent over time.

Figure 6
Erreygers CIs for health limitations, EU-SILC 2005-2007



Source: Own elaboration.

5. CONCLUSIONS

Health inequalities across socioeconomic groups are a health and public policy concern in all countries. There exist robust methodological tools from the epidemiological and economics disciplines to measure inequalities in health and there is a substantial amount of evidence on the level of inequalities in health across countries. However, there are numerous methodological issues that the study of health inequalities introduces, since the choice of the measure may influence results.

While numerous measurement tools have been developed for measuring health inequalities, the concentration index is one of the more wide-used measures that capture socioeconomic inequalities in health. However, it presents several limitations for cross-country comparisons of health inequalities for bounded variables. In particular, comparison of populations with different mean health levels might be problematic as well as not satisfying the mirror property (Erreygers, 2009), among others. In this study, we compare the trends obtained through the standard CI with those obtained by using the Erreygers CI, which is one of the suggested corrections in the literature that satisfies the mirror property and it is not mean-dependent. However, and as discussed in this study, the standard Concentration Index and the Erreygers CI measure different things (while one measures relative inequalities, the correction shows "quasi-absolute" inequalities), which should be taken into account by policymakers in order to interpret the obtained results.

For the purpose of this analysis, two longitudinal datasets at European level are used: the European Community Household Panel Survey users database and the Statistics of Income and Living Conditions, both provided by Eurostat. Health inequalities estimates show that health inequalities persist over time and affect those worse-off, despite policy actions to tackle them at European level (Dahlgren and Whitehead, 2006). When trends on health inequalities over time are compared across concentration indices, important differences are shown depending on the index considered (standard CI vs Erreygers CI).

According to the results and taking into account that health inequalities can be measured both in relative or absolute terms, it seems appropriate for researchers to show both types of indicators when monitoring trends in inequalities, as well as discussing the value judgements associated with each of the indices considered for the analysis. Further insight should be also provided on how the magnitude and direction of socioeconomic health inequalities vary with alternative measures to measure inequalities such as entropy indicators (Borrell and Talih, 2011), which should be explored further in the context of cross-country analysis.

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APPENDIX

Table 1A
Standard CIs for very good or good self-assessed health, ECHP 1994 - 2001

	1994	1995	1996	1997	1998	1999	2000	2001
D	0.039	0.037	0.048					
L	0.056	0.052	0.086					
UK	0.068	0.075	0.085					
DK	0.039	0.052	0.054	0.053	0.063	0.072	0.075	0.090
NL	0.023	0.030	0.037	0.033	0.032	0.048	0.034	0.045
BE	0.039	0.048	0.058	0.053	0.063	0.076	0.083	0.067
FR	0.028	0.040	0.048	0.051	0.061	0.056	0.069	0.081
Irl	0.047	0.039	0.043	0.051	0.066	0.066	0.064	0.074
IT	0.027	0.039	0.046	0.039	0.040	0.035	0.041	0.050
EL	0.072	0.081	0.059	0.082	0.079	0.076	0.085	0.076
ES	0.060	0.054	0.056	0.059	0.059	0.068	0.086	0.085
PT	0.084	0.111	0.126	0.143	0.160	0.153	0.171	0.187
AT		0.038	0.045	0.058	0.062	0.070	0.067	0.066
FI			0.027	0.026	0.033	0.038	0.039	0.056

Source: Own elaboration.

Table 2A
Erreygers CIs for very good or good self-assessed health, ECHP 1994 - 2001

	1994	1995	1996	1997	1998	1999	2000	2001
D	0.107	0.098	0.127					
L	0.150	0.139	0.230					
UK	0.203	0.214	0.239					
DK	0.128	0.168	0.167	0.165	0.190	0.218	0.219	0.260
NL	0.070	0.088	0.110	0.094	0.091	0.133	0.093	0.122
BE	0.121	0.148	0.180	0.161	0.190	0.223	0.243	0.194
FR	0.074	0.099	0.114	0.120	0.138	0.128	0.156	0.178
Irl	0.150	0.125	0.140	0.166	0.214	0.213	0.128	0.235
IT	0.065	0.095	0.111	0.094	0.092	0.079	0.091	0.112
EL	0.210	0.234	0.177	0.234	0.229	0.222	0.249	0.223
ES	0.153	0.143	0.148	0.153	0.154	0.178	0.224	0.213
PT	0.176	0.214	0.229	0.246	0.264	0.253	0.265	0.283
AT		0.111	0.131	0.171	0.177	0.198	0.195	0.193
FI			0.069	0.068	0.082	0.094	0.095	0.135

Source: Own elaboration.

Table 3A
Standard CIs for health limitations, EU-SILC 2005 - 2007

	2005	2006	2007
BE	-0.17	-0.22	-0.22
CZ	-0.15	-0.15	-0.19
EE	-0.18	-0.21	-0.24
ES	-0.16	-0.14	-0.15
FR	-0.12	-0.14	-0.13
IT	-0.14	-0.12	-0.11
CY	-0.24	-0.29	-0.26
LV	-0.14	-0.17	-0.23
LT	-0.16	-0.17	-0.21
LU	-0.10	-0.11	-0.12
HU	-0.10	-0.12	-0.11
NL	-0.17	-0.17	-0.18
AT	-0.11	-0.12	-0.14
PL	-0.06	-0.04	-0.06
PT	-0.16	-0.15	-0.17
SI	-0.19	-0.17	-0.18
SK	-0.11	-0.10	-0.14
FI	-0.10	-0.10	-0.13
SE	-0.15	-0.14	-0.13
UK	-0.21	-0.20	-0.21

Source: Own elaboration.

Table 4A
Erreygers CIs for health limitations, EU-SILC 2005-2007

	pooled	2005	2006	2007
BE	-0.193	-0.165	-0.206	-0.197
CZ	-0.162	-0.155	-0.154	-0.176
EE	-0.306	-0.272	-0.297	-0.338
ES	-0.140	-0.148	-0.133	-0.141
FR	-0.119	-0.107	-0.130	-0.117
IT	-0.110	-0.106	-0.112	-0.111
CY	-0.222	-0.237	-0.224	-0.210
LV	-0.238	-0.182	-0.233	-0.294
LT	-0.200	-0.191	-0.189	-0.216
LU	-0.098	-0.090	-0.099	-0.107
HU	-0.138	-0.134	-0.146	-0.132
NL	-0.158	-0.155	-0.157	-0.162
AT	-0.136	-0.116	-0.138	-0.148
PL	-0.045	-0.036	-0.039	-0.058
PT	-0.199	-0.206	-0.182	-0.212
SI	-0.207	-0.237	-0.199	-0.189

Table 4A (continue)
Erreygers CIs for health limitations, EU-SILC 2005-2007

	pooled	2005	2006	2007
SK	-0.133	-0.120	-0.118	-0.160
FI	-0.177	-0.170	-0.163	-0.197
SE	-0.118	-0.145	-0.113	-0.102
UK	-0.166	-0.171	-0.164	-0.162

Source: Own elaboration.