HEDG Working Paper 05/12

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Cristina Hernández Quevedo
Andrew M Jones
Ángel López Nicolás
Nigel Rice

October 2005

ISSN 1751-1976

york.ac.uk/res/herc/hedgwp

Socioeconomic inequalities in health: a comparative longitudinal analysis using the European Community Household Panel

Cristina Hernández Quevedo[1], Andrew M Jones[1], Ángel López Nicolás[2] and Nigel Rice[3]

October 2005

Abstract

We measure socioeconomic inequalities in health across European Union Member States between 1994 and 2001. The analysis is based on the European Community Household Panel Users' Database (ECHP-UDB) and uses two binary indicators of health limitations for the full 8 waves of available data. Short-run and long-run concentration indices together with mobility and health achievement indices are derived for indicators of severe health limitation and any health limitation. Results demonstrate the existence of "pro-rich" inequality in health across Member States in both the short-term and the long-term, with health limitations concentrated among those with lower incomes. For all countries, the long-run indices show that income-related inequalities in health are widening over time, in the sense that the longer the period over which health and income are measured, the greater is the measure of income-related health inequality. The ranking of countries by long-run inequalities differs from that by overall health achievement; an equity-efficiency trade-off has to be faced in evaluating their performance and comparing countries with diverse health and social welfare systems.

Keywords: health inequality, social mobility, panel data

The *European Community Household Panel Users' Database*, version of December 2003, was supplied by Eurostat. This paper derives from the project "The dynamics of income, health and inequality over the lifecycle" (known as ECuity III Project), which is funded in part by the European Commission's Quality of Life and Management of Living Resources programme (contract QLK6-CT-2002-02297). Financial support from the Ministerio de Educación under project SEJ2005-08783-C04-02 is gratefully acknowledged by Ángel López Nicolás. We are grateful to participants at the iHEA meeting (Barcelona, 2005), HEDG Seminars (University of York) and ECuity III Workshop (Bonn, 2005), for their comments and, in particular, to Xander Koolman and Eddy van Doorslaer for their suggestions.

[1] Department of Economics and Related Studies, University of York, United Kingdom
[2] Departament d'Economia I Empresa and CRES, Universitat Pompeu Fabra & Departamento de Economía, Universidad Politécnica de Cartagena, Spain
[3] Centre for Health Economics, University of York, United Kingdom

1. Introduction

Persistent differences in health by socioeconomic status (SES) are one of the key policy issues facing many European countries (Jones and van Doorslaer, 2004). There is increasing concern that equity in health and health care in Europe may suffer as a result of the expansion of the European Union and the ageing of its populations. This is reflected, for instance, in the recent commitment at EU level of Member States to set up national action plans to combat poverty and social exclusion. While this challenge is not unique to European countries, what is unique in the European setting is that the process of economic and monetary unification places pressure on countries to harmonize their social policies. At the special European summit in Lisbon in March 2000, for the first time, social policy was explicitly introduced as a distinct focus of attention for European cooperation. It was agreed that common objectives for eradication of poverty and social exclusion would be adopted, that national policies would be designed to meet these, and that progress would be monitored. One tangible outcome of this process was a book on indicators of social inclusion in the EU edited by Atkinson *et al* (2002) which set out a number of recommendations for the development of quantitative indicators to be used for monitoring trends in the multidimensional concepts of poverty and social exclusion. These indicators include a simple measure of income-related health inequality that compares health in the first and fifth income quintiles.

This paper uses the *European Community Household Panel Users' Database* (ECHP-UDB) to measure income-related inequalities in health across European Union Member States. The ECHP-UDB is a standardised annual longitudinal survey, which provides 8 waves (1994-2001) of comparable micro-data about living conditions in the pre-enlargement European Union Member States (EU-15). The focus of our analysis is on two binary measures of health limitations, constructed from the answers to the question: "Are you hampered in your daily activities by any physical or mental health problem, illness or disability?". The first measure concentrates on the reporting of any limitations and the second on severe limitations.

The aim is to investigate the degree of socioeconomic inequality in health within and between the Member States of the European Union. We do this by exploiting the

longitudinal nature of the ECHP-UDB. We are interested in whether and to what extent poorer members of society face greater health problems than richer members of the society, and how this varies across time and countries included in the ECHP-UDB. To this end, income plays a central role in our analysis as it is used to construct a ranking of individuals by socioeconomic status[1]. The panel nature of the dataset allows us to compute both short-run and long-run indices of inequality based on the familiar concentration index of health inequality.

Our analysis demonstrates that income-related inequalities in health limitations exist among all Member States included in our analysis, both in the short-term and long-term. These socioeconomic inequalities favour the rich over the poor in each society. There is an important difference between long-term and short-term measures of inequality, even over the relatively short span of 8 years covered by the ECHP-UDB, in the sense that the longer the period over which health and income are measured the greater is the degree of income-related health inequality. This highlights the importance of adopting a longitudinal perspective when measuring and interpreting socioeconomic inequalities in health. The ranking of countries by long-run inequalities differs from that by overall health achievement: an equity-efficiency trade-off has to be faced in evaluating their performance and comparing countries with diverse health and social welfare systems.

2. Methods for the measurement of inequality and mobility

2.1 Cross-sectional measures

In health economics, methods based on concentration curves and indices have been used for measuring inequalities and inequities in health (Wagstaff and van Doorslaer, 2000). Although developed in the context of comparing inequalities across EU Member States, these methods have also had an impact on the methods proposed and used in health policy

[1] Of course income is associated with other indicators of socioeconomic status, such as wealth, occupational social group and education. To this extent the measures used here will capture these other dimensions of socioeconomic status. An attraction of using income is that it is a continuous measure and provides a finer ranking of individuals than can be obtained from broad categorical measures such as occupational socioeconomic group or highest educational qualifications.

statements by other international organisations, for example the OECD's Health System Performance Framework (Hurst and Jee-Hughes, 2001), the World Bank's Poverty Reduction Strategy (Claeson *et al*, 2001) and the WHO's World Health Report (Murray and Frenk, 2001).

The health concentration curve (CC) and concentration index (CI) provide measures of relative income-related health inequality (Wagstaff, Van Doorslaer and Paci, 1989). Wagstaff, Paci and van Doorslaer (1991) review and compare the properties of concentration curves and indices with alternative measures of health inequality. They argue that the main advantages are that: they capture the socioeconomic dimension of health inequalities; they use information from the whole of the distribution rather than just the extremes; that they give the possibility of visual representation, through the concentration curve, and allow checks of dominance relationships.

The concentration index (CI) is derived from the concentration curve (CC). This is illustrated in Figure 1 for a measure of illness. The sample of interest is ranked by socioeconomic status. So, if income is used as the relevant ranking variable, the horizontal axis begins with the poorest individual in society and progresses through the income distribution up to the very richest individual in society. 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 population shares of illness are proportional to income, such that the poorest 20% of individuals experience 20% of the illness in the population, and so on. In reality, it is unlikely that perfect equality exists in the distribution of illness. "Pro-poor" inequality is illustrated by the concave curve in the figure - the concentration curve. In the example shown, the poorest 20% of income earners experience more than 20% of illnesses. The fact that the concentration curve lies above the line of perfect equality indicates that there is pro-poor inequality in illness. The size of inequality can be summarised by the health concentration index (CI), which is given by twice the area between the concentration curve and the 45-degree line[2].

[2] In general the value of the concentration index will lie between -1 and 1. But Wagstaff (2005) shows that for binary variables these bounds shrink to μ-1 and 1-μ, where μ is the mean of the variable.

[Insert Figure 1 around here]

Socioeconomic inequality in health is cited widely as a concern for health policy makers, however it may not be the whole story. Recent work at the World Health Organisation, through their Evidence for Health Policy programme, has argued that policy makers should also be concerned about other sources of inequality, and that measurement should focus on total health inequality (e.g., Gakidou *et al.*, 2000). This can be analysed using health Lorenz curves and inequality can be measured using the Gini coefficient of health inequality (Le Grand, 1989; Wagstaff, Paci and van Doorslaer, 1991). The attraction of this approach is that there is a direct relationship between the concentration index and the Gini coefficient for health: the concentration index is proportional to the Gini coefficient, where the factor of proportionality is given by the ratio between the correlation coefficient for health and income rank and the correlation coefficient between health and health rank (Kakwani, 1980; van Doorslaer and Jones, 2003). This means that it is easy to move between these particular measures of socioeconomic and pure health inequality.

The income inequality literature makes a distinction between partial orderings, based on Lorenz or concentration curves, and complete orderings, based on index numbers such as the Gini and concentration indices. A partial ordering means that some combinations of distributions can be ranked unambiguously, but not all. The ambiguity arises if the Lorenz or concentration curves for two distributions cross each other. In order to obtain a complete ordering of distributions, Gini coefficients and concentration indices embed particular normative judgments about the weight given to individuals at different points in the income distribution and, hence, they embody a particular degree of inequality aversion. Sensitivity of the results to inequality aversion can be assessed by using extended concentration indices (Wagstaff, 2002). These add an extra parameter that can range from inequality neutrality (no concern for inequality) to extreme inequality aversion (Rawlsian lexi-min).

Gini and concentration indices are measures of relative inequality and do not address the equity-efficiency trade-off. This trade-off can be captured by generalized Lorenz or

concentration curves, which multiply the Lorenz or concentration curve by the average level of illness. These curves allow comparisons across countries and provide evidence on generalised dominance relationships. The vertical height of the curve, on the right-hand axis, shows the mean level of illness and the curvature reflects income-related inequalities in illness. When a curve for one country is everywhere above that of another country it has greater overall prevalence of illness and a higher degree of income-related inequalities in its distribution. The fact that the curve for one country dominates the other provides an unambiguous ranking. In practice the ranking of countries may not be clear-cut as the curves will often cross each other, resulting in only a partial ordering.

A complete ordering can be imposed by using the generalized concentration index, $\mu(1-CI)$, which gives a single index that captures the trade-off between the mean of the distribution (μ) and the level of inequality (CI). This index can be interpreted as a simple form of social welfare function. To add greater flexibility, and relax the assumption about the degree of risk aversion that is implied by the standard measure of the concentration index, this approach can be combined with different degrees of inequality aversion, through the extended concentration index. This gives what Wagstaff (2002) calls an index of health achievement, which summarises the equity-efficiency trade-off for different degrees of inequality aversion. Different values of inequality aversion (ν) allow for differences in the weight that is attached to poorer individuals when calculating the concentration index. Hence, the index of achievement is given by the following expression:

$$IA(\nu) = \mu(1-C(\nu)) = \frac{1}{n}\sum_{i=1}^{n} y_i \nu(1-R_i)^{(\nu-1)} \qquad (1)$$

where y_i is the measure of illness for individual i and R_i is their relative rank in the distribution of income. When ν equals 1 the index of achievement simplifies to the mean level of illness (μ), when ν equals 2 the formula is based on the standard concentration index and larger values of ν imply greater weight for equity concerns. In our empirical analysis we follow Wagstaff and use ν equal to 4 and 8 in the sensitivity analysis.

2.2 Measures for longitudinal data

Longitudinal data offer information about the dynamics of individuals' health and income and their impact on inequality over periods stretching longer than the typical one year cross-sectional survey. If health policy - and social policy in general - is concerned with lifetime histories (see e.g. the "fair innings" argument described by Williams and Cookson, 2000) then the longer-run perspective provided by panel data can yield useful extra information. Recently, by drawing on the literature on income inequality, Jones and López Nicolás (2004) have explored the additional information that can be obtained by using panel data. Work on income mobility has focused on comparing the distribution of income using two perspectives: firstly, a cross-sectional or short-run perspective and secondly, a long-run perspective where income is aggregated over a series of periods. If an individual's income rank differs between the short-run and the long-run, there is evidence of income mobility. One way of measuring this phenomenon is through the index of income mobility proposed by Shorrocks (1978).

Jones and López Nicolás (2004) apply the principles used by Shorrocks (1978) to income-related health inequality. They show that income-related health inequality can be either greater or smaller in the long-run than the short-run and that, once again, these changes can be measured through an index of health-related income mobility which is based on the CI. It is useful to measure how much the longitudinal perspective, where N individuals are observed for T periods, alters the picture that would emerge from a series of cross-sections. Jones and López Nicolás (2004) define an index of *health-related income mobility* to measure the difference between long-run and short-run inequality:

$$M^T = 1 - \frac{CI^T}{\sum_t w_t CI^t} = \frac{2}{N\sum_t \bar{y}^t CI^t}\left(\sum_i \sum_t (y_{it} - \bar{y}_t)(R_i^t - R_i^T)\right) \qquad (2)$$

$$w_t = \frac{\bar{y}^t}{T\bar{y}^{=T}}$$

and

$$(i)\ \bar{y}^t = \frac{\sum_i y_{it}}{N} \qquad i = 1,\ldots,N; \quad t = 1,\ldots,T$$

$$(ii)\ \bar{y}^{=T} = \frac{\sum_t \sum_i y_{it}}{NT} = \frac{\sum_t \bar{y}^t}{T}$$

where:

y_{it}: a cardinal measure of illness for individual i (i=1,…,N) at time t (t=1,…,T).

$y_i^T=(1/T)\Sigma_t y_{it}$: the average for individual i after T periods.

R_i^t: relative rank of individual i in the distribution of N incomes in period t.

R_i^T: relative rank of individual i in the distribution of N average incomes after T periods.

This definition shows that the index of health-related income mobility is "one minus the ratio by which the CI for the joint distribution of longitudinal averages differs from the weighted average of the cross-sectional concentration indices, due to the systematic association between health and changes in the income rank of an individual" (Jones and López Nicolás, 2004). The larger the discrepancy between the short-run and long-run inequality measures the larger the value of M^T. No discrepancy implies M^T equals zero. The sign of the index is given by the covariance in the second term of expression (1). That is, a negative value for the index implies that long-run inequalities are greater than the average of sub-period inequalities and vice versa.

Jones and López Nicolás (2004) show that the long-term CI for mean health across T periods (denoted as CI^T) is the sum of two terms. The first term is a weighted sum of the short-term CI's (that is, the CI for each of the waves denoted as CI^t), while the second term reflects the covariance between levels of health and fluctuations in income rank over time. If the income ranking remains constant over time a standard decomposition result for concentration indices implies that the concentration index for the average over time is

equal to the (weighted) average of the concentration indices. However income ranks may change over time and it could be the case that, for example, downwardly income mobile individuals have poorer than average health. The effect of such relationships cannot be detected with cross-sectional data. If people switch ranks over the T periods, and these changes are systematically related to health, then the second term in the decomposition will be non-zero. If it is positive, then upwardly income mobile individuals – in the sense that their rank in the long-run distribution of income is greater than their rank when income is measured over a short period - enjoy a smaller than average level of illness. Of course, this means that downwardly mobile individuals would tend to have a greater than average level of illness. In these circumstances, long-run income-related health inequality would be greater than the average of the short-run measures.

3. The ECHP-UDB data

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 8 waves (1994 - 2001) of comparable micro-data about living conditions in the 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 and 130,000 adults were interviewed at each wave. 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, Luxembourg and the United Kingdom. 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[3] is included in the UDB, together with comparable versions of the British Household Panel Survey (BHPS), the German Socioeconomic Panel (GSOEP) and the Panel Survey for Luxembourg (PSELL)[4]. We use data for the following fourteen Member States of the EU, for the full number of available waves: Austria (waves 2 – 8), Belgium (1 – 8), Denmark (1 – 8), Finland (3 – 8), France (1 – 8), Germany (1 – 3), Greece (1 – 8), Ireland (1 – 8), Italy (1 – 8), Luxembourg (1 – 3), The Netherlands (1 – 8), Portugal (1 – 8), Spain (1 – 8) and United Kingdom (1 – 3).

Sample and variables

The purpose of this study is to construct a long-run measure of health inequalities, averaged over the full span of the panel data, and to compare this long-run measure with the standard short-run view. For this reason we need a full set of waves for each individual and we use a balanced sample of respondents, which implies that only individuals from the first wave who were interviewed in each subsequent wave are included in the analysis[5]. Table 1 shows the sample size for each country, for the whole sample and split by gender. For most countries, the sample size is between 20,000 and 50,000 observations. Exceptions are Spain and Italy with both having notably larger samples and Luxembourg and the UK with notably smaller samples.

[Insert Table 1 around here]

Health limitations

The ECHP-UDB dataset contains some limited information on health outcomes and health care utilisation. We use the information on health limitations, in particular responses

[3] Note however that the data for Sweden is not longitudinal, and has been derived from repeated cross-sections. We do not use data for Sweden.
[4] Data for Germany, Luxembourg and United Kingdom are taken from the original ECHP survey.
[5] Care should be taken when interpreting the results as the respondents in the balanced panel may not be representative of the full sample. Jones, Koolman and Rice (2005) have provided evidence of health-related non-response in the ECHP but they also find that estimates of the association between health and socioeconomic status are robust with or without adjustments for non-response.

provided to the question[6]: "Are you hampered in your daily activities by any physical or mental health problem, illness or disability?". Three possible answers are available for the respondent: "Yes, severely", "Yes, to some extent" and "No". In the ECHP-UDB, this information is provided for all countries and waves that we consider for our analysis[7]. We focus on two binary measures of health problems that have been derived from the responses to the health limitations question. From these responses, two dummy variables are constructed. The first, labelled HAMP1, represents an indicator of any limitations (severe or to some extent) versus no limitations; the second (HAMP2) represents an indicator of severe limitations versus no limitations or limited to some extent.

Descriptive Analysis

Figures 2 and 3 show the distribution of HAMP1 and HAMP2 respectively, for each country. For the variable HAMP1, the country with the highest percentage of individuals who report any limitation is Finland at 28.2%, followed by Portugal (25.6%) and the UK (25.2%). The country with the lowest percentage is Italy (12.6%), followed by Belgium (14.8%) and Ireland (16.2%). Similar results are found for the variable HAMP2. Portugal has the highest percentage of individuals who report being severely hampered (10.3%), followed by France (9.5%) and Finland (7.6%), while Ireland, Italy and Belgium have the lowest percentages at 3.4%, 4.3% and 4.6%, respectively.

[Insert Figure 2 around here]

[Insert Figure 3 around here]

Table 2 shows the percentage of individuals who report either any or severe limitations across income quintiles. Minimum and maximum percentages are highlighted. These range from 6.3% of respondents who report some health limitations in the fifth income quintile in Italy to 26% in the first income quintile in the UK. The range for severe health

[6] The question is coded PH003A in the ECHP-UDB.

[7] Although the question was asked similarly in all the countries where the data was available, the French case is an exception as the question was reworded for the full panel (1994 – 2001) from "… hampered by any chronic, physical or mental health problem, illness or disability?" to "Gêné par une maladie chronique, un handicap?".

limitations goes from 1.4% in the fifth quintile for Ireland to 15.4% in the second income quintile in Portugal.

Country-specific results show a clear association between income and health. In general, there exists a gradient across income quintiles in the reporting of both severe and any health limitations, such that a higher proportion of respondents in lower income quintiles report limitations compared to respondents from higher quintiles. Further, there is variation across countries in the observed income gradients. For example, for Portugal the gradient ranges from 15.4% of respondents reporting severe limitations in the second quintile to 5.5% in the fifth quintile. For Italy, the range is 5.2% in the first quintile to 2.7% in the fifth quintile. Similarly there is variation across income quintiles in the proportion of respondents reporting health limitations to some extent. For Luxembourg, the proportion ranges from 20.7% in the lowest quintile to 11.5% in the highest. This is in contrast to Italy where the corresponding figures are much lower at 9.2% and 6.3%, respectively.

[Insert Table 2 around here]

4. Inequality and mobility

4.1 Concentration curves

We begin by focusing on income-related inequalities, Figures 4 and 5 show the concentration curves for all countries for HAMP1 and HAMP2. The health and income variables are the within-individual averages across the 8 waves. To achieve comparability across countries, our measure of income rank is based on equivalised real household income. This represents household income adjusted using country-specific Purchasing Power Parities (PPP), the Consumer Price Index (CPI) and the modified-OECD equivalence scale, to control for household size and composition. Total household income includes all net monetary income received by household members during the reference year. All analyses are weighted using the personal weights provided in the ECHP-UDB.

For HAMP1, all concentration curves are above the 45-degree line, giving evidence of pro-rich inequalities in health for all countries. For some countries the concentration curves are closer to the 45-degree line than for others, implying less income-related inequality in health limitations. The concentration curves for HAMP2 in each country are further from the 45-degree line than the ones for HAMP1, which implies that inequalities in severe limitations are higher than for any limitation.

[Insert Figure 4 around here]

[Insert Figure 5 around here]

Figure 6 shows the concentration curves for HAMP1 for all of the countries that have 8 waves of data available. The curve for Ireland lies above those for the Netherlands, Belgium, Italy and Portugal, this provides an unambiguous ranking in terms of relative inequality, as the concentration curves do not intersect. Although Ireland shows higher pro-rich inequalities in health compared to Denmark, France, Greece and Spain across most of the income distribution, concentration curves for these countries overlap at the bottom of the distribution (Denmark, France) or at the top (Spain, Greece).

[Insert Figure 6 around here]

Figure 7 shows all the concentration curves for HAMP2 for the countries that have 8 waves of data available. Like HAMP1, Ireland has the highest pro-poor inequalities in HAMP2, when it is compared to the Netherlands, Belgium, France and Italy. However, the ranking is ambiguous for individuals at the bottom of the distribution for Denmark and Greece, and the top of the distribution in the case of Spain, Portugal and Greece.

[Insert Figure 7 around here]

Figures 8 and 9 show the long-run generalised concentration curves for both HAMP1 and HAMP2. These augment the concentration curves by taking account of the average prevalence of illness in each country and embody the equity-efficiency trade-off. Figure 8 shows the curves for the 9 European countries that have the full 8 waves of data available.

It is clear that, across the whole income distribution, the curve for Portugal lies above Spain, Belgium and Italy, which means that Portugal performs worse than these countries in terms of both the mean and income-related inequalities in HAMP1. The curve for Portugal is above those for all other countries except at the bottom tail of the income distribution; this prevents an unambiguous ranking. Comparison of the curves for Spain and Belgium illustrates the notion of an equity-efficiency trade-off. The average level of illness is greater in Spain compared to Belgium so that the generalised concentration curve for Spain lies above Belgium on the right-hand axis. On the pure efficiency criterion of minimising the prevalence of illness the distribution of illness in Belgium would be preferred to that of Spain. However the two curves cross, at a point corresponding to roughly the bottom 40% of the income distribution, as illness is more concentrated among those on low incomes in Belgium. A policy-maker that is averse to income-related inequality and is willing to trade-off a reduction in overall population health to reduce inequalities, may therefore rate the Spanish performance above the Belgian. A similar comparison applies to Greece and Ireland, with the curves crossing at around the bottom 60% of the income distribution. In this case the ranking would switch from favouring the distribution in Ireland to that of Greece at a lower level of aversion to inequality.

[Insert Figure 8 around here]

Figure 9 shows the long-run generalised concentration curves for HAMP2. The curve for Portugal lies above Spain, Belgium, Italy, Ireland and France for the whole income distribution. However, an unambiguous ranking cannot be provided for the Netherlands, Greece and Denmark, as their curves overlap at the bottom of the income distribution.

[Insert Figure 9 around here]

4.2 Concentration, mobility and health achievement indices

Concentration indices

To calculate the short-run and long-run concentration indices, together with the mobility and health achievement indices, we use the maximum number of waves available for each country as contained in the ECHP-UDB. Table 3 presents the short-run CIs together with

the long-run CI^T and the mobility index (M^T) for HAMP1 and HAMP2 for each country and for all available waves of the ECHP-UDB. The short-term CI's are negative for all waves and all countries. This implies pro-poor inequality in illness in all periods – in general, poorer people have more than an equal share of illness compared to richer people.

Further, for Luxembourg, France, the UK and Austria the CI for HAMP1 increases over consecutive waves, indicating that inequalities widen over time within this sample of individuals. Few countries display CI's that are lower in absolute value at the end of the panel compared to the beginning. Some countries appear to have a relatively stable degree of inequality - for example, while the figures for the UK are increasing over the three available waves, the increases are modest. For other countries the increases are more dramatic. For example, in Luxembourg, the degree of measured inequality more than doubles over the three waves. For Finland, Austria and Ireland the CI for HAMP1 in the last wave of observation is one and half times the value of the CI in the first wave. We also observe variation in measured inequality across countries, so while Germany exhibits relatively low values for the CI, Greece and Ireland exhibit relatively large values. The CI's for HAMP2 are in general increasing over time, with all but Germany and Italy exhibiting a larger (in absolute value) CI at the end of the panel compared to the beginning.

[Insert Table 3 around here]

Figure 10 shows the long-run CI and M^T (in absolute values) for HAMP1 for each country. Recall that the long-run CI's inform us about the degree of income-related health inequality when both income and health are averaged over the whole period for which individuals are observed. Long-term concentration indices are negative for all the countries; hence, there are long-term income-related inequalities in health, with health limitations more concentrated among those with lower incomes.

[Insert Figure 10 around here]

The length of the period over which individuals are observed is important. If there is mobility over time then its effect accumulates over time, so long-run CI's and the corresponding mobility measures must be compared over equal periods of time for

different countries. Among the countries for which a full 8 year period is available, the estimates reveal that Ireland has the highest level of long-term "pro-poor" inequality in illness (-0.299), followed by Greece (-0.224) and Denmark (-0.198), while the Netherlands (-0.114) has the lowest level. For HAMP2 (Figure 11) the results are similar, with Ireland (-0.409) followed by Denmark (-0.378) and Belgium (-0.304) again exhibiting the highest levels of pro-poor inequality in illness. For each country, the long-term CI is greater for severe limitations than it is for any limitations, indicating that inequalities become more pronounced when considering more severe health problems.

[Insert Figure 11 around here]

Mobility indices

In all countries the mobility indices are negative. This shows that there is greater long-run income-related inequality in both HAMP1 and HAMP2, than would be inferred by the average of short-run indices. In other words, downwardly income-mobile individuals are more likely to suffer health limitations and upwardly mobile individuals are less likely to in all countries analysed. If the absolute size of the overall mobility index is compared across countries with the same number of waves available, it can be seen that Ireland (-0.240), followed by Italy (-0.202) and Greece (-0.126), have the highest mobility indices in absolute terms for HAMP1, while the minimum level corresponds to Spain (-0.100), followed by Denmark (-0.104) and France (-0.110). For HAMP2, Ireland (-0.209), followed by Portugal (-0.174) and Greece (-0.129), have the highest mobility indices, while Spain (-0.080), followed by Italy (-0.092) and France (-0.101), have the lowest.

To allow for differences in the number of waves available for each country, we report the average M^T per year. In Figure 12, we can see that Austria (-0.005) has the lowest level of average M^T per year for HAMP1, followed by Finland (-0.010) and Spain (-0.012), while the highest levels in absolute terms are in Luxembourg (-0.042), Ireland (-0.030) and Italy (-0.025). Figure 13 shows the results for our indicator of severe limitation. In this case, Germany (-0.0007) has the lowest level of average M^T per year, while Luxembourg has the highest (-0.056), followed by the United Kingdom (-0.034) and Ireland (-0.026). These results show that the strength of the relationship between downward income mobility and

health limitations varies across countries. This suggests a research agenda to explore how this may be associated with differing policies and institutional arrangements.

[Insert Figure 12 around here]

[Insert Figure 13 around here]

Index of health achievement

The index of health achievement (IA) combines the measure of income-related inequalities with the mean level of illness (Wagstaff, 2002). We calculate the index using the standard concentration index and we allow for differences in the level of inequality aversion. Results for each country are included in Table 4. Our health indicators are measures of health limitations (ill-health), implying that high values of the achievement index indicates poorer performance (Wagstaff, 2002).

[Insert Table 4 around here]

We have already shown evidence of long-term income-related inequalities in health for all of the 14 European countries. This inequality increases the value of the index of achievement relative to the mean. We focus on those countries with 8 waves of data available. As with the generalised concentration curves, equity-efficiency trade-offs are revealed: some countries perform poorly in terms of income-related inequality but do better than others in terms of average health. This is the case for Ireland, which has higher long-run income-related inequalities in HAMP1 compared to Portugal, but a lower overall prevalence of health limitations in Ireland contributes to a higher index of achievement for Portugal, which is an indicator of poorer performance. Using the standard formula for the concentration index (where the risk aversion parameter ν equals 2), the poorest levels of achievement are found in Portugal (0.305) and France (0.267), while the best is Italy (0.148). In the case of HAMP2, the best and worst values are again Portugal (0.124) and Italy (0.053).

For HAMP1 and HAMP2, pro-rich inequalities in health increase with values of v greater than 2. However, there are exceptions. For both indicators of health limitations, Italy does not follow this pattern, with C(8) being greater than C(2) in absolute terms. This is because the concentration curves for Italy deviate from the 45° more at the top end of the income distribution than at the bottom (see Figures 4 and 5), so that measured income-related health inequality goes down as more weight is given to the bottom end of the distribution.

[Insert Table 5 around here]

Table 5 summarises the ranking of countries in terms of the index of achievement for different levels of inequality aversion (v=1,2,4,8). For HAMP1, Italy has the best performance whatever the level of inequality aversion and is always accompanied by Belgium and Spain in the top three places. Finland and Portugal are consistently the worse performers, whatever the level of inequality aversion. Most countries are fairly stable in their ranking. Denmark, France and Ireland show worsening performance as more weight is given to equity concerns, while the reverse is true for the Netherlands. For HAMP2, Ireland performs best in terms of the mean alone but Italy ranks highest as soon as inequality aversion is introduced. Portugal performs worst, followed by France, for all but the highest level of inequality aversion, where the ordering is reversed. Finland and Greece are also among the worst four performers for all levels of inequality aversion.

5. Conclusions

The measurement of socio-economic inequalities in health has an important role in the context of informing the social and health policy agenda of European Union countries. This study uses two indicators of health limitations to measure income-related inequalities using longitudinal data from the ECHP-UDB. We apply the approach of Jones and López Nicolás (2004), which allows us to distinguish between short-run and long-run socioeconomic inequalities for our health variables of interest. The difference between these two measures is summarised using the mobility index (M^T). The long-run picture is

augmented by presenting indicators that capture the equity-efficiency trade-off: generalised concentration curves and an index of health achievement (Wagstaff, 2002).

Our analysis demonstrates that income-related inequalities in health limitations exist among all Member States included in our analysis, both in the short-term and long-term. These socioeconomic inequalities favour the rich over the poor in each society. There is an important difference between long-term and short-term measures of inequality, even over the relatively short span of 8 years covered by the ECHP-UDB, in the sense that the longer the period over which health and income are measured the greater is the degree of income-related health inequality. This highlights the importance of adopting a longitudinal perspective when measuring and interpreting socioeconomic inequalities in health. The ranking of countries by long-run inequalities differs from that by overall health achievement; an equity-efficiency trade-off has to be faced in evaluating their performance.

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Table 1: Sample size for each country considered in the analysis

Wave	D	DK	NL	B	L	F	UK	Irl	I	EL	E	P	A	Fin
1	8,036	2,536	4,656	3,008	1,779	7,226	5,382	2,748	9,539	6,384	7,549	7,348	-	-
2	8,036	2,536	4,656	3,008	1,779	7,226	5,382	2,748	9,539	6,384	7,549	7,348	4,001	-
3	8,036	2,536	4,656	3,008	1,779	7,226	5,382	2,748	9,539	6,384	7,549	7,348	4,001	3,893
4	-	2,536	4,656	3,008	-	7,226	-	2,748	9,539	6,384	7,549	7,348	4,001	3,893
5	-	2,536	4,656	3,008	-	7,226	-	2,748	9,539	6,384	7,549	7,348	4,001	3,893
6	-	2,536	4,656	3,008	-	7,226	-	2,748	9,539	6,384	7,549	7,348	4,001	3,893
7	-	2,536	4,656	3,008	-	7,226	-	2,748	9,539	6,384	7,549	7,348	4,001	3,893
8	-	2,536	4,656	3,008	-	7,226	-	2,748	9,539	6,384	7,549	7,348	4,001	3,893
Men	11,640	9,776	16,928	10,808	2,571	26,936	7,119	10,512	36,840	23,224	27,712	26,960	13,370	11,484
Women	12,468	10,512	20,320	13,256	2,766	30,872	9,027	11,472	39,472	27,848	32,680	31,824	14,637	11,874
Total	24,108	20,288	37,248	24,064	5,337	57,808	16,146	21,984	76,312	51,072	60,392	58,784	28,007	23,358

Table 2: Percentage of health limitations by income quintiles

Country	Limitations to some extent Income quintiles					Severe limitations Income quintiles				
	1	2	3	4	5	1	2	3	4	5
Germany	17.72	17.15	15.67	14.33	14.90	9.63	7.34	5.72	5.53	4.72
Denmark	20.38	17.54	16.64	13.81	11.23	10.75	7.12	3.43	2.67	2.08
Netherlands	18.61	17.36	15.53	14.86	13.66	10.25	9.08	6.73	5.55	5.09
Belgium	14.46	10.70	8.94	8.79	8.71	9.53	5.57	3.17	2.18	2.55
Luxembourg	20.65	18.36	18.91	12.91	11.53	7.14	5.16	4.58	4.16	2.34
France	16.69	15.01	12.98	10.18	10.18	14.11	11.90	10.52	5.65	5.65
UK	25.76	21.77	17.10	13.66	14.54	9.76	10.48	7.06	4.22	2.13
Ireland	17.24	20.35	13.09	10.62	7.98	6.82	6.26	3.26	1.85	1.44
Italy	9.18	9.94	9.09	7.91	6.26	5.22	5.22	4.98	3.97	2.72
Greece	14.39	11.81	9.73	9.50	6.43	12.26	9.44	7.55	6.51	3.49
Spain	14.71	15.51	13.44	10.49	7.01	7.23	7.36	7.08	5.38	2.59
Portugal	19.35	18.53	15.93	14.25	11.14	14.30	15.36	11.34	8.43	5.50
Austria	18.30	14.44	12.23	11.40	11.25	8.18	5.33	4.97	3.90	3.32
Finland	22.21	22.09	19.87	20.46	18.63	10.09	9.78	6.80	6.38	5.61

Note: Both the highest and lowest percentages of responses by income quintiles across countries have been highlighted in this table

Table 3: Inequality and mobility indices across the EU Member States

	D	DK	NL	B	L	F	UK	Irl	I	EL	E	P	A	Fin
HAMP1														
1994	-.090	-.149	-.064	-.133	-.083	-.129	-.167	-.153	-.090	-.202	-.188	-.112	-	-
1995	-.076	-.187	-.112	-.160	-.138	-.139	-.173	-.193	-.106	-.218	-.182	-.163	-.116	-
1996	-.089	-.165	-.108	-.118	-.200	-.146	-.182	-.237	-.107	-.162	-.141	-.194	-.129	-.067
1997	-	-.183	-.103	-.167	-	-.146	-	-.250	-.098	-.206	-.131	-.188	-.136	-.093
1998	-	-.155	-.104	-.110	-	-.141	-	-.278	-.075	-.197	-.144	-.187	-.146	-.114
1999	-	-.189	-.125	-.163	-	-.159	-	-.273	-.087	-.220	-.178	-.172	-.160	-.108
2000	-	-.224	-.113	-.179	-	-.155	-	-.275	-.119	-.217	-.174	-.161	-.163	-.108
2001	-	-.175	-.092	-.152	-	-.168	-	-.269	-.117	-.167	-.178	-.182	-.181	-.114
CI^T	-.089	-.198	-.114	-.163	-.155	-.166	-.185	-.299	-.119	-.224	-.182	-.190	-.153	-.108
MI^T	-.040	-.104	-.120	-.116	-.126	-.110	-.062	-.240	-.202	-.126	-.100	-.122	-.038	-.061
HAMP2														
1994	-.163	-.295	-.146	-.232	-.111	-.180	-.297	-.293	-.153	-.232	-.208	-.163	-	-
1995	-.132	-.371	-.215	-.264	-.178	-.173	-.271	-.309	-.145	-.294	-.211	-.206	-.136	-
1996	-.153	-.325	-.169	-.265	-.241	-.195	-.306	-.268	-.124	-.210	-.150	-.231	-.047	-.144
1997	-	-.318	-.189	-.277	-	-.184	-	-.399	-.166	-.254	-.165	-.256	-.168	-.110
1998	-	-.338	-.128	-.293	-	-.217	-	-.467	-.145	-.248	-.159	-.240	-.188	-.174
1999	-	-.355	-.188	-.241	-	-.220	-	-.348	-.104	-.253	-.145	-.259	-.237	-.165
2000	-	-.433	-.202	-.292	-	-.206	-	-.384	-.131	-.300	-.250	-.274	-.266	-.189
2001	-	-.421	-.212	-.318	-	-.225	-	-.351	-.139	-.254	-.244	-.213	-.223	-.254
CI^T	-.149	-.378	-.202	-.304	-.216	-.223	-.321	-.424	-.152	-.291	-.209	-.274	-.187	-.195
MI^T	-.002	-.043	-.104	-.110	-.168	-.101	-.101	-.209	-.092	-.129	-.080	-.174	-.023	-.097

Table 4: Index of achievement across the EU Member States by levels of inequality aversion

	D	DK	NL	B	L	F	UK	Irl	I	EL	E	P	A	Fin
HAMP1														
IA(1)=μ	.235	.219	.239	.161	.218	.229	.235	.173	.132	.181	.169	.256	.182	.307
IA(2)	.256	.262	.267	.187	.252	.267	.278	.225	.148	.221	.200	.305	.210	.340
IA(4)	.277	.308	.298	.219	.279	.306	.318	.276	.152	.259	.215	.341	.243	.369
IA(8)	.294	.349	.326	.245	.304	.339	.337	.316	.146	.298	.217	.358	.278	.384
HAMP2														
IA(1)=μ	.072	.055	.076	.049	.048	.097	.060	.040	.046	.076	.056	.098	.051	.088
IA(2)	.083	.076	.091	.064	.058	.119	.080	.058	.053	.098	.068	.124	.060	.105
IA(4)	.094	.101	.108	.081	.068	.139	.095	.076	.055	.120	.073	.145	.070	.118
IA(8)	.104	.124	.122	.095	.081	.157	.101	.091	.051	.141	.072	.154	.079	.125

Table 5: Ranking of countries by the index of achievement by levels of inequality aversion

	best													worst
HAMP1														
IA(1)=μ	I	B	E	IRL	EL	A	L	DK	F	D=	UK=	NL	P	FIN
IA(2)	I	B	E	A	EL	IRL	L	D	DK	NL=	F=	UK	P	FIN
IA(4)	I	E	B	A	EL	IRL	D	L	NL	F	DK	UK	P	FIN
IA(8)	I	E	B	A	D	EL	L	IRL	NL	UK	F	DK	P	FIN
HAMP2														
IA(1)=μ	IRL	I	L	B	A	DK	E	UK	D	NL=	EL=	FIN	F	P
IA(2)	I	IRL	L	A	B	E	DK	UK	D	NL	EL	FIN	F	P
IA(4)	I	L	A	E	IRL	B	D	UK	DK	NL	FIN	EL	F	P
IA(8)	I	E	A	L	IRL	B	UK	D	NL	DK	FIN	EL	P	F

Note: "=" denotes pairs of countries that have the same achievement index.

Figure 1: Concentration curve for ill-health

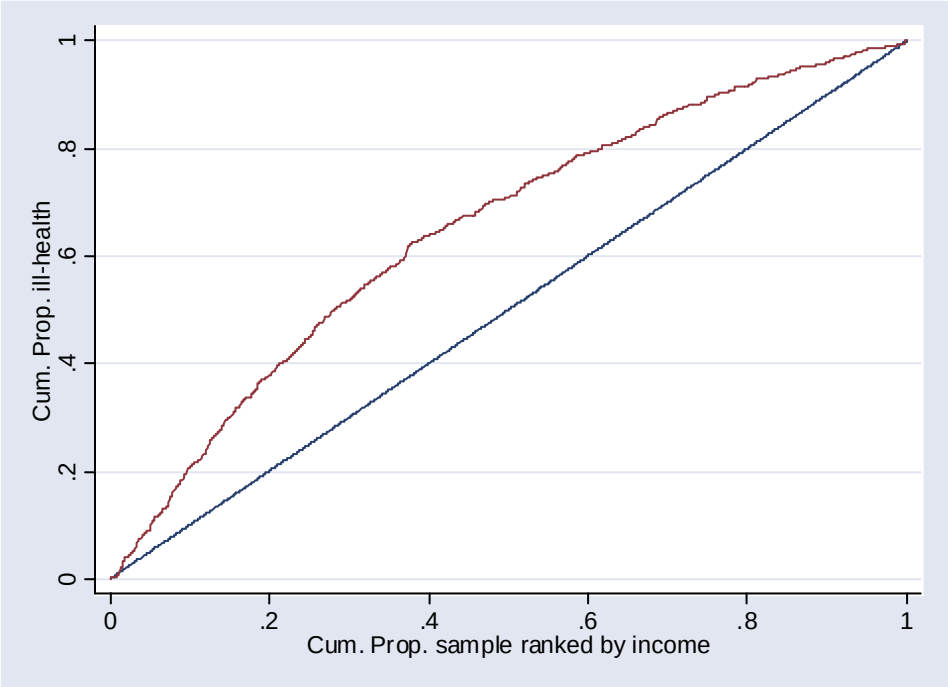


Figure 2: Percentage of individuals hampered (HAMP1), across the Member States

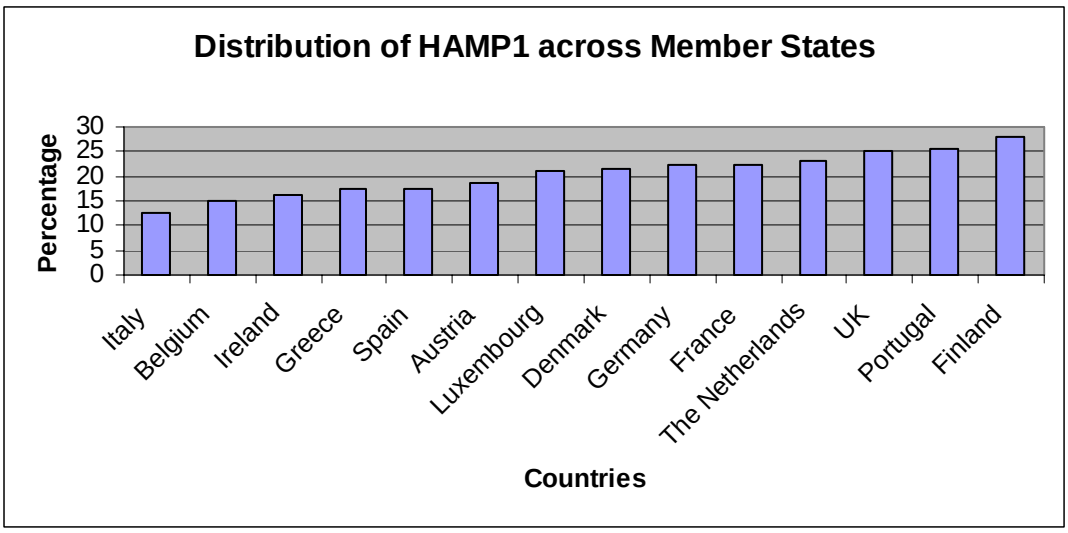


Figure 3: Percentage of individuals severely hampered (HAMP2) across the Member States

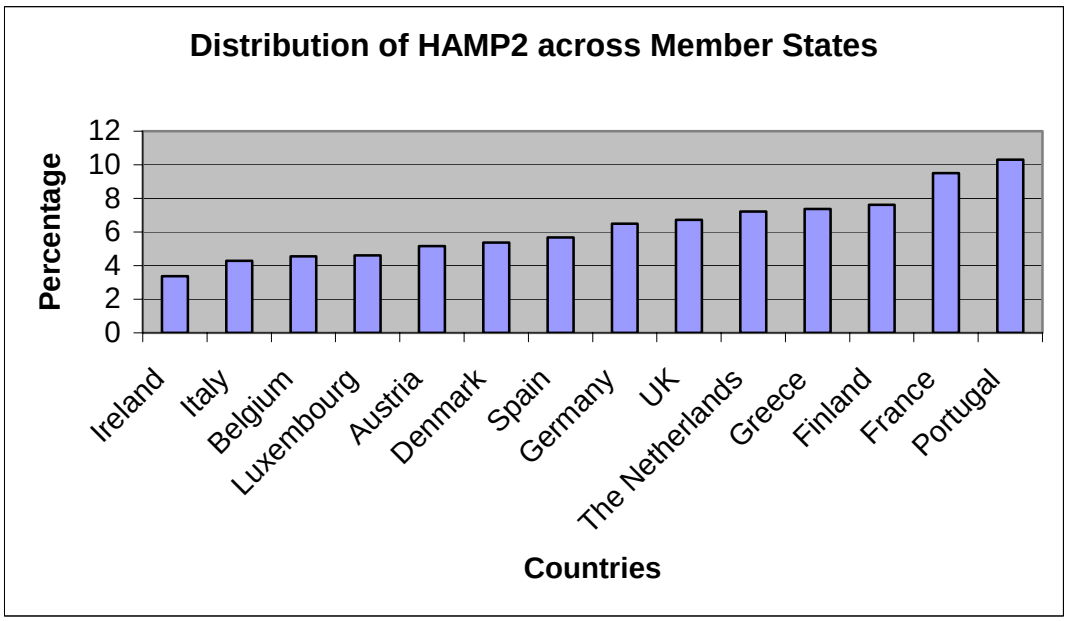


Figure 4: Concentration curves for HAMP1 (by country)

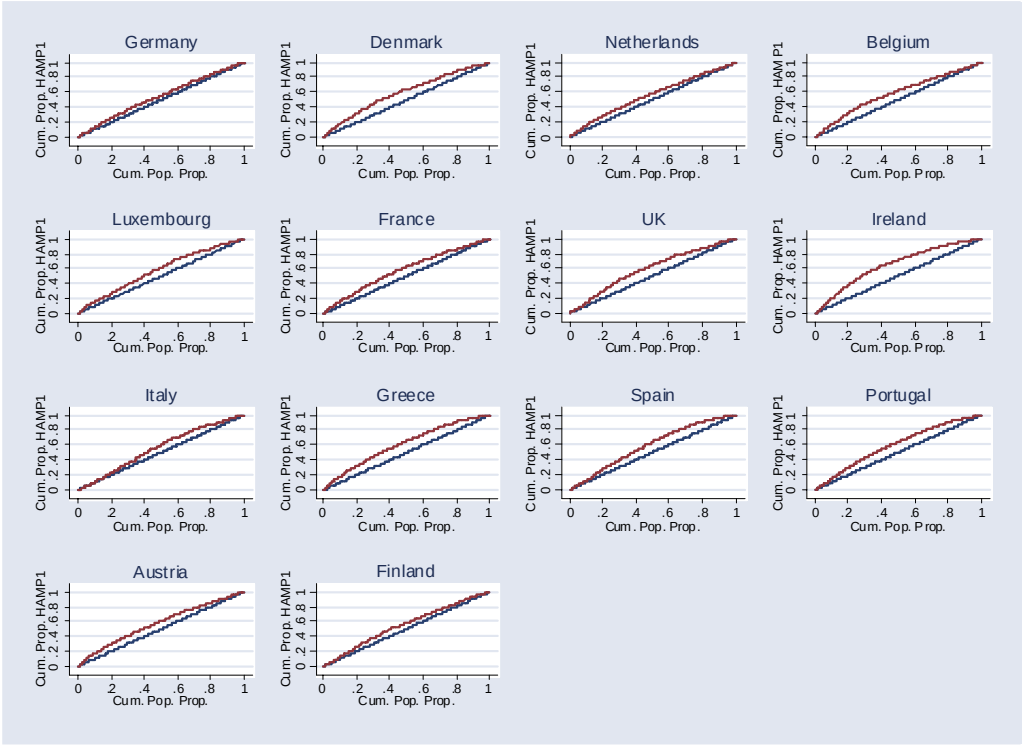


Figure 5: Concentration curves for HAMP2 (by country)

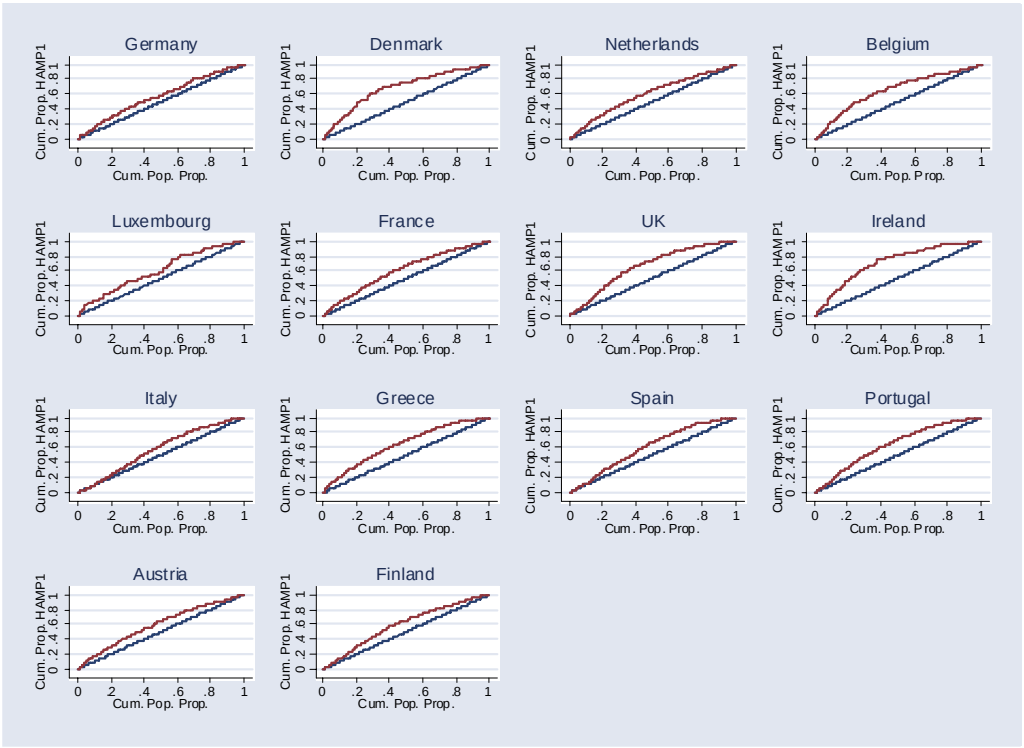


Figure 6: **Concentration curves for HAMP1**

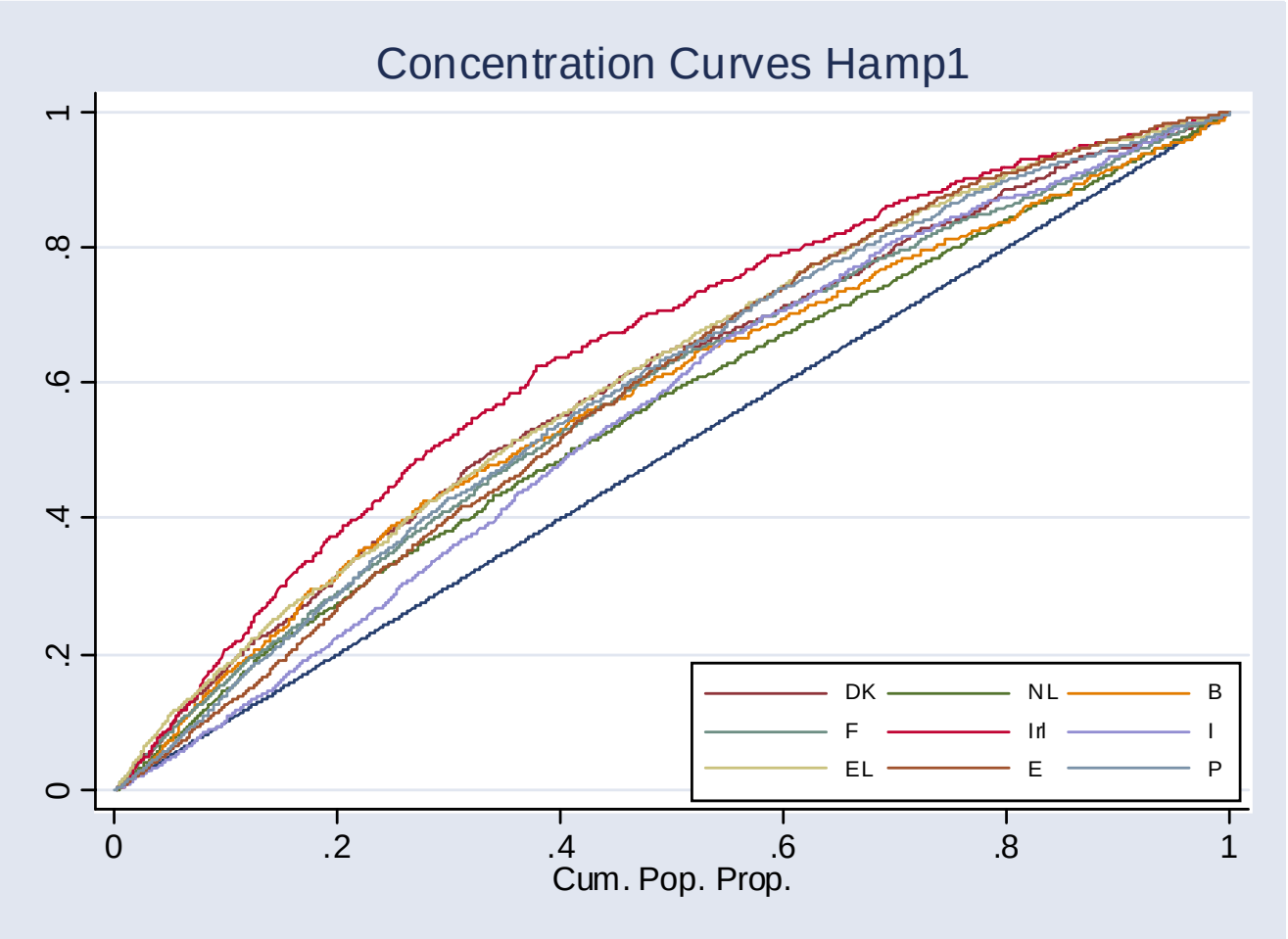


Figure 7: Concentration curves for HAMP2

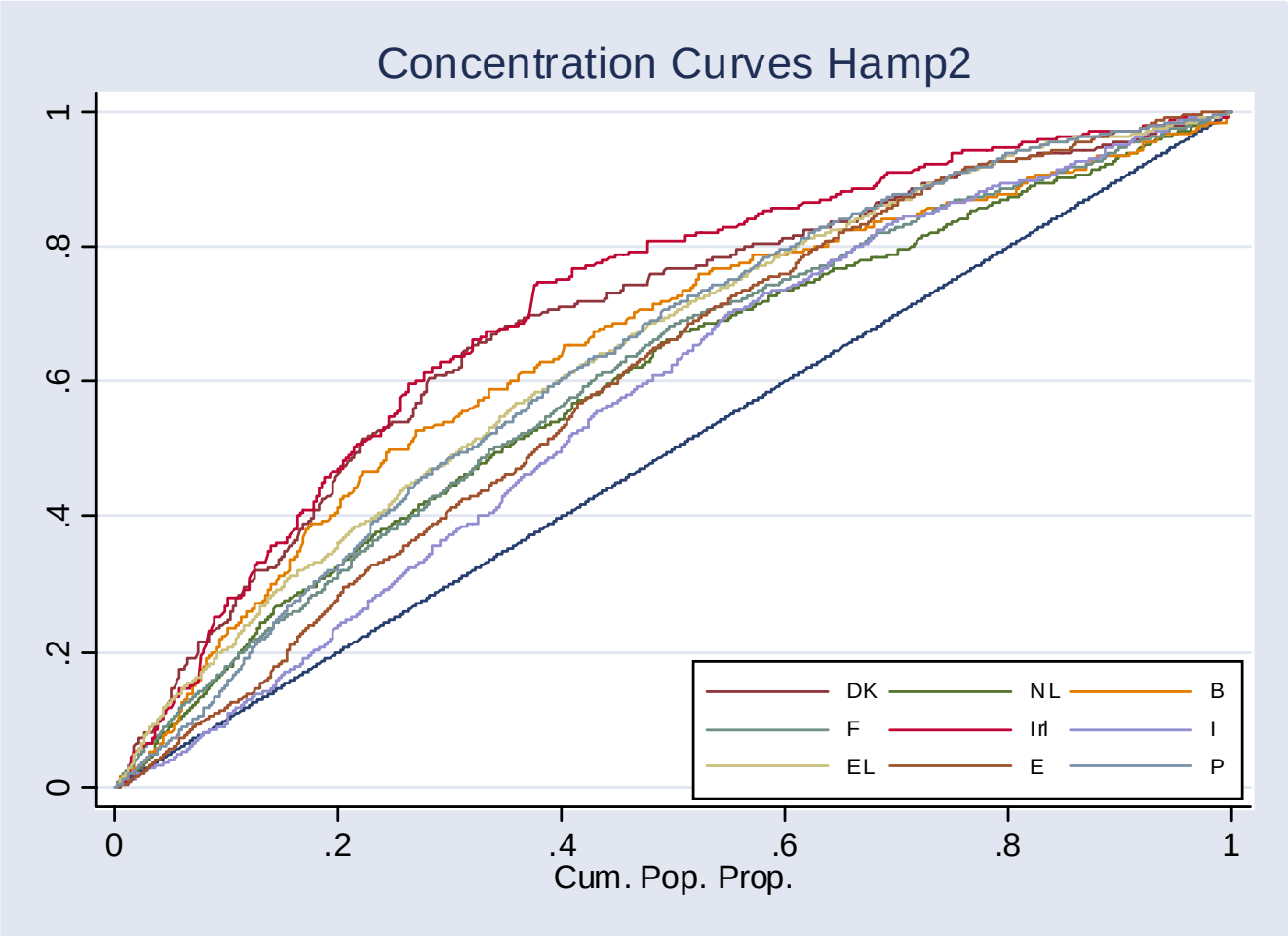


Figure 8: Generalised concentration curves for HAMP1

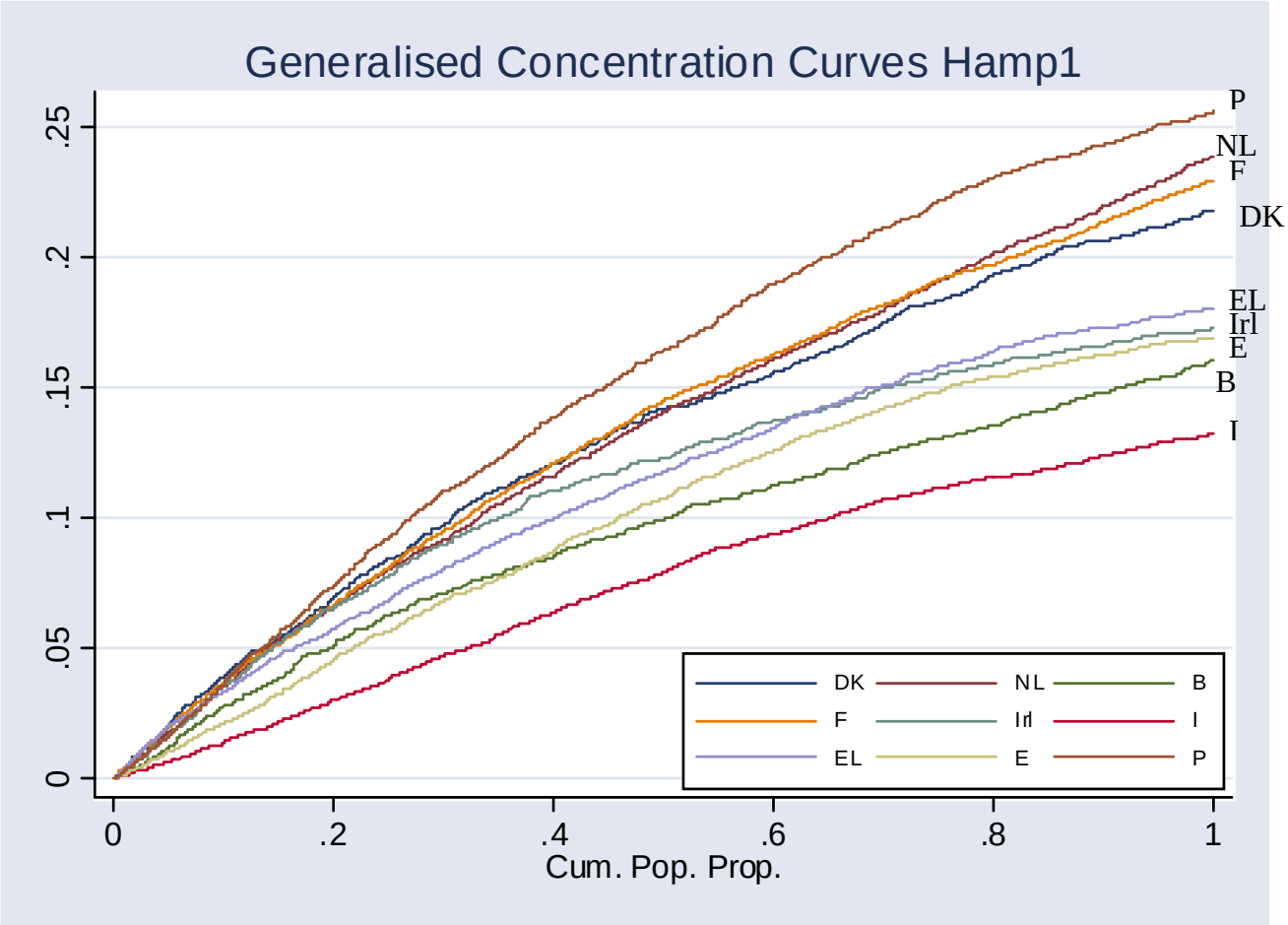


Figure 9: **Generalised concentration curves for HAMP2**

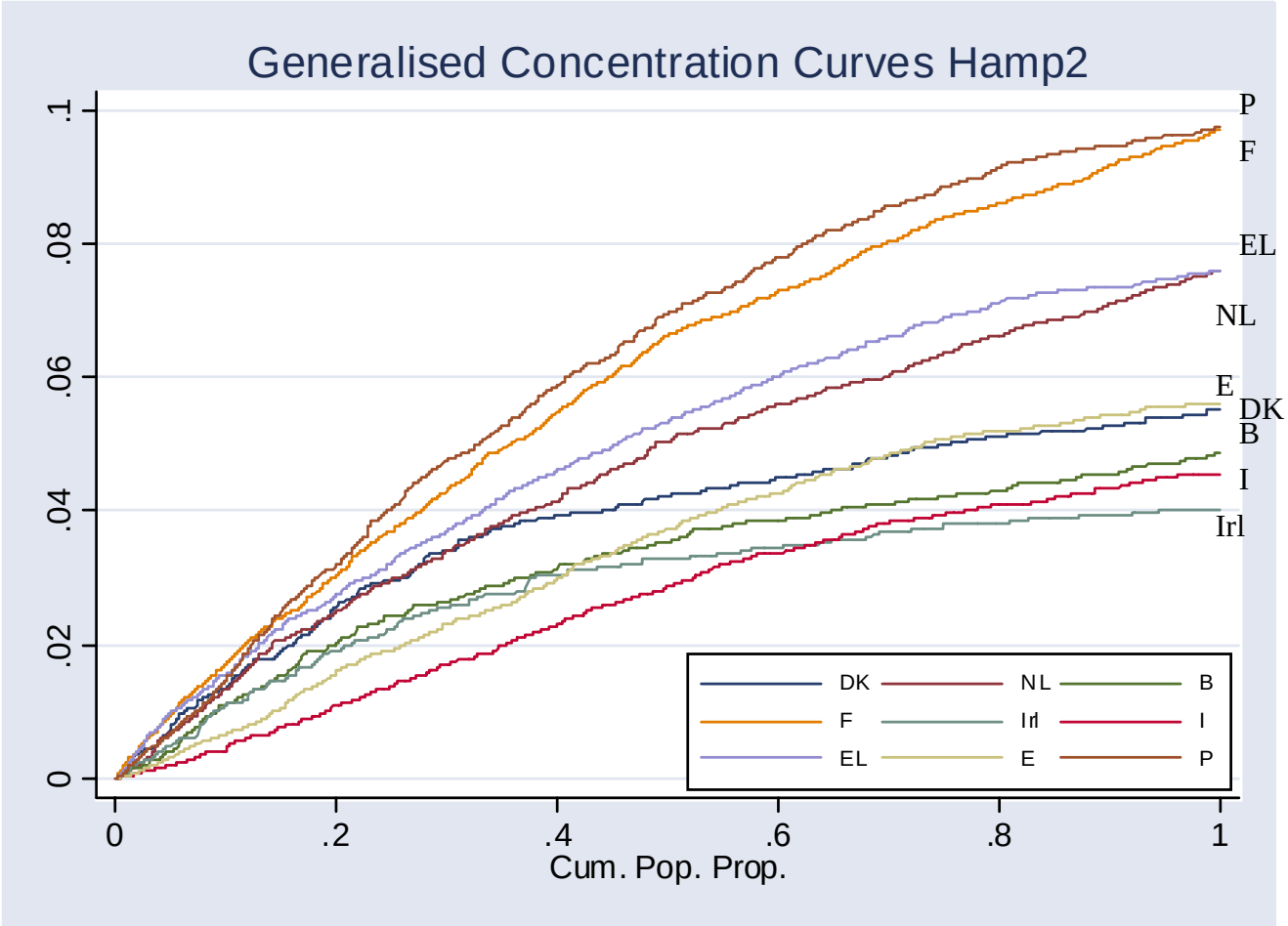
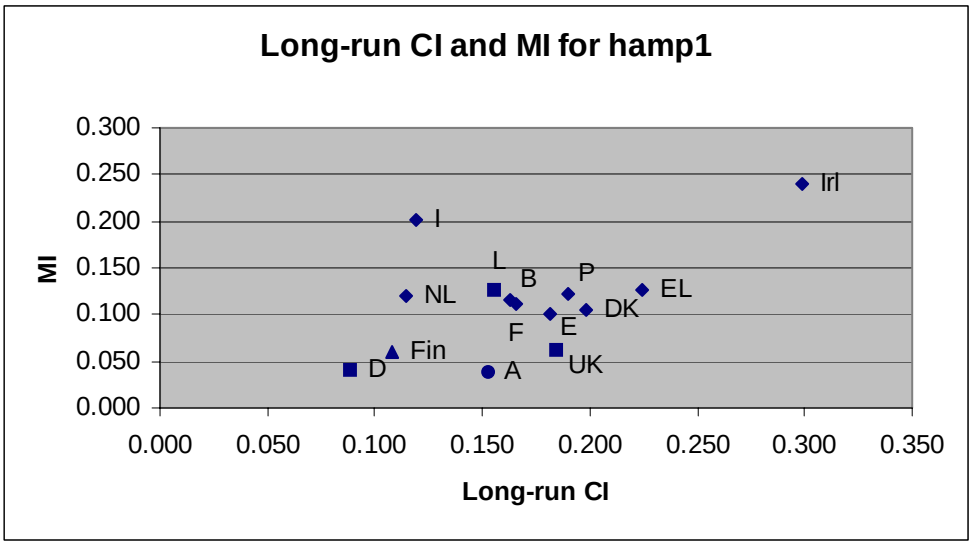
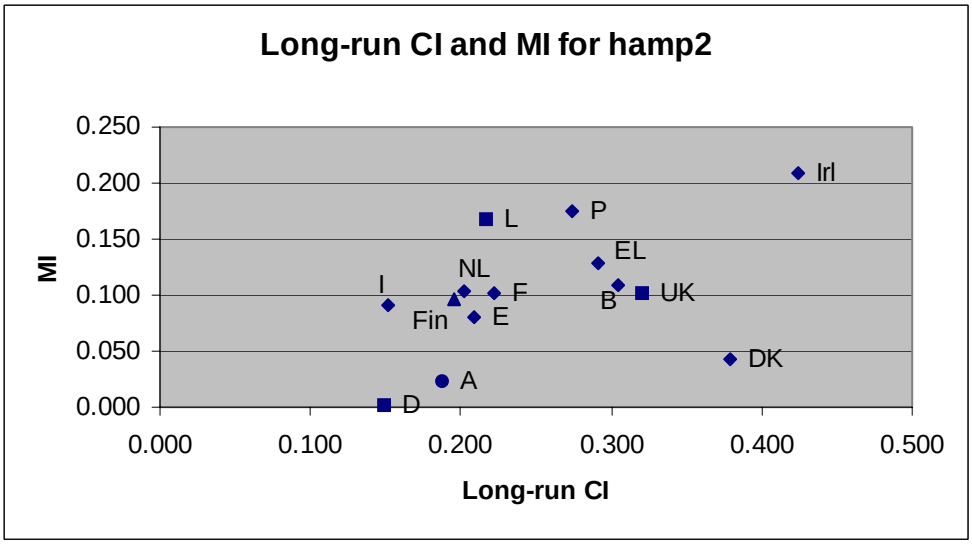


Figure 10: Long-run inequality and mobility index for any limitation (HAMP1)



* Different symbols have been used to distinguish the number of waves available for each of the countries: 1 – 3 waves (square), 1-8 waves (diamond), 2 – 8 waves (circle) and 3 – 8 waves (triangle).

Figure 11: Long-run inequality and mobility index for severe limitations (HAMP2)



* Different symbols have been used to distinguish the number of waves available for each of the countries: 1 – 3 waves (square), 1-8 waves (diamond), 2 – 8 waves (circle) and 3 – 8 waves (triangle).

Figure 12: Average mobility index per year for any limitation (HAMP1)

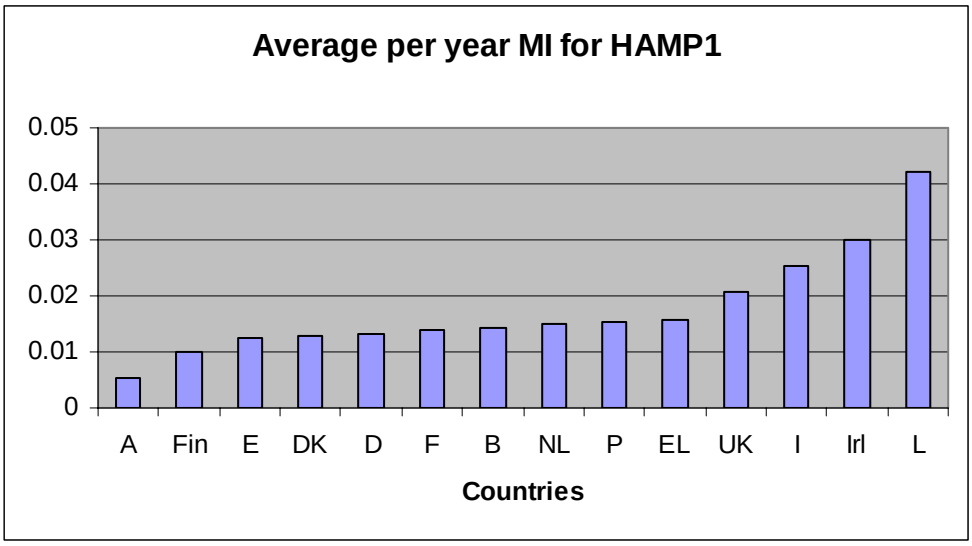


Figure 13: Average mobility index per year for severe limitations (HAMP2)