Income Inequality and Self-Rated Health Status: Evidence from the European Community Household Panel Survey*

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Abstract

We examine the effect of increasing income inequality on individual self-rated health status in a pooled sample of 11 member states of the European Union using longitudinal data from the European Community Household Panel (ECHP) survey. We use our sample to calculate our own income inequality indices measured at two standard levels of geography (NUTS 0 and NUTS 1). We find consistent evidence that income inequality is negatively related to self-rated health status in the European Union for both men and women. Interestingly, we find evidence of a slightly stronger negative correlation for women than for men at all level of household incomes. Our results also support the hypothesis that increasing income inequality is more detrimental to the health of men respondents living in low-income households. Our main findings are robust to various model specifications.

Keywords: Self-rated health; Income inequality; European Union; Panel data.

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1 Introduction

Numerous studies have reported the existence of an association between the level of income inequality in a population and aggregate health outcomes: average health among people living in high-inequality areas appears to be lower than their counterparts living in low-inequality areas. The relationship has been reported using aggregate (macro-level) data both across countries (Rodgers, 1979; Wilkinson, 1992) and across regions within countries (Kawachi and Kennedy, 1997; Lynch et al., 1998). This observation has lead researchers to argue that increasing income dispersion directly translates into poor health, thereby suggesting potential welfare gains from more progressive income redistribution policies. Another version of this argument is Wilkinson's (1996) controversial 'income inequality hypothesis' (IIH) which suggests that the primary determinant of differences in health outcomes among developed countries is the extent of differences in the disparity between the incomes of the rich and the poor within countries.[1]

Recent studies have cast doubts on the robustness of this 'ecological' association to model specifications and data sources both across countries (Judge et al., 1998; Gravelle et al., 2002) and across U.S. States (Mellor and Milyo, 2001). Rodgers (1979) and more recently Gravelle (1998) and Gravelle et al. (2002) also cautioned that this apparent causal relationship may just be the by-product of a statistical artefact if individual health is a non-linear function of income.[2] In order to examine rigorously the effect of income inequality on health, one needs to turn to individual level data and to control for relevant confounders, in particular individual income. The majority of studies which have taken this approach have almost exclusively focused on different geographical units within the United States.

Kennedy et al. (1998) and Mellor and Milyo (2002) found that state-level income

[1] An equally contentious issue is the characterization of the actual pathway by which greater income inequality translates into poor health. Many authors have hypothesized that inequality is a cause of some psycho-social stress detrimental to everyone's health in the society. We will not address this issue in this paper. See Deaton (2001) for a comprehensive review.

[2] Rodgers (1979) and Gravelle et al. (2002) showed that if a positive concave relationship between individual income and individual health exists, keeping average income constant, any increase in the dispersion of income must translate into poorer average population health.

inequality significantly affects self-reported health status even after controlling for individual incomes and other demographic variables. However, Mellor and Milyo (2002) also report that this association is no longer significant after controlling for regional fixed effects. In fact, this finding that state-level inequality is detrimental to self-rated health is not robust to alternative health outcomes or different levels of aggregation. For instance, Daly et al. (1998) found very weak evidence that state-level income inequality translates into increased mortality. Furthermore, unlike Kawachi et al. (1997) and Lynch et al. (1998), they report that this association is not robust to different measures of income inequality.

Considering a lower level of geography, Mellor and Milyo (2002) and Blakely et al. (2002) do not find any significant association between metropolitan-area-level income inequality and self-rated health. Interestingly, some studies have found evidence of a statistically significant association between county-level income inequality and self reported health status (Soobadeer and LeClere, 1999; Fiscella and Frank, 2000). However, the relationship is no longer significant when the health outcome is measured by mortality (Fiscella and Franks, 1997). Overall, these studies present weak support to the assertion that greater income inequality is detrimental to individual health in the United States.

Few comparable micro-level studies have examined the robustness of this association outside the United States. Results from these studies generally corroborate U.S. findings. For instance, Shibuya et al. (2002) found no significant evidence supporting that income inequality measured at the *prefectures* level has a detrimental effect on self-rated health status in Japan. Likewise, Gerdtham and Johannesson (2004) found no significant effect of community level income inequality on mortality in Sweden.[3] Weich et al. (2001, 2002), however, found significant association between the Gini coefficient of inequality in Britain's regions and mental disorders and self-reported health status.

[3] Among the non-U.S. studies we could also mention the contribution of Osler et al. (2002). These authors did not find conclusive evidence supporting a robust relationship between income inequality measured at the *parish* level and various causes of mortality in a Danish study conducted in Copenhagen. However, this study only focuses on areas within Copenhagen and is therefore difficult to compare to within country studies.

But they also found that the results were highly sensitive to the choice of inequality measure (the association disappears with Generalized Entropy indices of inequality).

The objective of this paper is to investigate this issue on a larger entity outside the United Sates by using comparable individual-level data gathered in 11 European Union countries, the European Community Household Panel (ECHP) survey data. Providing additional evidence from the European Union is of particular interest as its economic development is comparable to the United States while generally fostering more progressive social and health policies. At the same time, the European Union can be viewed as a fairly heterogeneous federation of independent States with pronounced regional identities. As a result, one should expect to observe non-negligible cross-regional variations in income and income inequality within E.U. regions.

Following Mellor and Milyo (2002) and Weich et al. (2002), we examine two versions of the IIH. The *strong* IIH assumes that income inequality is detrimental to all individuals in the society while the *weak* IIH states that income inequality is detrimental to the least well-off in society. Following Gerdtham and Johannesson (2004), we also explicitly test the absolute and the relative income hypotheses. The absolute income hypothesis posits that, *ceteris paribus*, higher individual income has protective a effect on individual health. By contrast, according to the relative income hypothesis, an individual's health is not so much affected by his absolute level of income than by his level of income *relative* to the average income in his reference community.

Our empirical strategy follows and extends the framework of Mellor and Milyo (2002) to take advantage of the longitudinal nature of the ECHP data. The use of panel data allows us to control for the potential confounding effects of unobservable individual (fixed) effects in the relationship between health income and income inequality. To assess the robustness of our results, we consider two standardized levels of geography, NUTS 0 and NUTS 1. The NUTS classification is the European Union's official regional classification system. NUTS 0 is the country level and NUTS 1 is the first level of aggregation below the country level.[4] We test the sensitivity of our results to different

[4]NUTS stands for 'Nomenclature des Unités Territoriales Statistiques'. The number of NUTS 1

measures of inequality.

The robustness of existing ecological cross-country studies has been undermined by the poor quality of their income distribution data which often lacked comparability across countries and across time (Judge, 1998; Macinko *et al*, 2003). In this paper, we overcome these limitations by using comparable longitudinal data gathered simultaneously and with a common questionnaire and methodology in different countries. Nevertheless, there is a well-founded concern that measures of self-reported health, even when collected from surveys sharing common wording of the health question, could never be interpreted in a comparable fashion (Sadana et al., 2000). An additional contribution of this paper is to offer a simple solution to correct for potential bias arising from the lack of comparability of the self-rated variables in micro-level cross-country studies.

The separate effect on gender has been largely overlooked in the income inequality literature (Macintyre and Hunt, 1997). This is surprising given the fact that we know that life expectancy is shorter for males and that mortality in males has been found to be much more sensitive to deprivation than in females (McCarron et al., 1994; Raleigh and Kiri, 1997). Among available evidence, in a macro-level international study of 13 OECD countries, McIsaac and Wilkinson (1997) did not find that the magnitude of the correlation between income inequality and mortality was significantly different across gender. Similar results from a within U.S. states study are reported by Kaplan et al. (1996). On the contrary, in a recent study, Regidor et al. (2003) found some evidence that female mortality in Spain might be more sensitive to income inequality than men's on 1980 data. However, they fail to confirm this finding on more recent data. We are not aware of any study using self-reported health status to explore the IIH separately on men and women.

To preview our results, unlike Mellor and Milyo (2002), we find statistically significant evidence supporting the strong income inequality hypothesis regardless of gender, even after controlling for individual socio-economic characteristics, income, and 'wel-

regions by country varies from 16 in Germany, 11 in Italy and the United Kingdom to only 1 in Denmark, Ireland, Sweden, and Luxembourg.

fare state' regimes. Our results also support the idea that income inequality is more detrimental to the lower income earners. However, we do not find support for a rigid interpretation of the weak IIH which stipulates that income inequality is *only* detrimental to the poorest in society. Interestingly, women appear to be more affected than men. However, the magnitude of the estimated gender differences is not overwhelming. Consistent with earlier U.S. studies, we find that the estimated detrimental effect of income inequality is sensitive to the level of geography at which it is measured. We find strong evidence about the absolute income hypothesis, and also find some evidence supporting the relative income hypothesis, but only for men.

In the next section, data and methods used in this paper are outlined. Our empirical strategy and results are discussed in section 3, followed by some concluding remarks.

2 Data and Methods

2.1 The European Community Household Panel Survey

This study uses data drawn from the public use file of the European Community Household Panel survey (ECHP). The ECHP is a standardized multi-purpose annual longitudinal survey providing comparable micro-data about living conditions in the European Union Member States. The December 2003 release of the ECHP data used in this paper includes eight waves spanning the 1994–2001 time period. Over 60,000 households and 130,000 adults across the European Union were interviewed at each wave. The first wave covered all EU-15 Member States with the exception of Austria, Finland and Sweden. Austria joined in the second wave, Finland in the third, and Sweden in the fourth.[5] In the periods covering the first three waves, the ECHP ran parallel to existing similar panel surveys in Germany, Luxembourg and the United Kingdom.[6] From the fourth wave onwards, the ECHP samples were replaced by data harmonized *ex post* from these three existing surveys. Note that the ECHP data were 'cloned' backwards

[5] Note however that data for Sweden are not longitudinal, but derived from repeated cross-sections.

[6] The German Socio-Economic Panel (SOEP), the Luxembourg Socio-Economic Panel (PSELL), and the British Household Panel Survey (BHPS).

so that two versions of German, Luxembourgish, and British data are available in the first waves of the ECHP database.

The topics covered in the survey include income, employment, housing, health, and education. An harmonized (E.U.-wide) questionnaire was designed at Eurostat, and the survey was implemented in each Members States by 'National Data Collection Units'.[7] The public-use database is derived from the data collected in each of the Member States and is created, maintained and centrally distributed by Eurostat.[8] The attractive feature of the ECHP data for the purpose of this study is that it provides individual-level data on income and demographics including individual health which are comparable across countries and over time.

In principle, the design of the ECHP should allow us to cover all EU-15 Member States. However, because of exceptions to the general ECHP design rules and missing information, we had to restrict our analysis to a subset of countries. We only worked with data for Austria, Belgium Denmark, Finland, France, Greece, Italy, Ireland, Portugal, Spain and the United Kingdom. The German SOEP cloned dataset was dropped because of non-comparability of the subjective health status variable (it was derived *ex post* from an 11-point scale question that could not be satisfyingly harmonized with the original 5-point ECHP scale). Both the German and UK original ECHP samples, as well as data for the Netherlands, were excluded because information on NUTS 1 region of residence was not available. The Luxembourg PSELL cloned dataset does not contain information on self-reported health status. Finally, Sweden does not share the longitudinal design and was therefore dropped from our analysis. Additionally, after closer scrutiny and preliminary data checks, we dropped all data from wave 6 of the UK BHPS clone because of substantial inconsistency in the responses to the subjective health status variable compared to other waves.[9] We also dropped all data from wave

[7]National statistical institutes for most countries, or other private and public organizations.

[8]See EUROSTAT (2003) or Lehmann & Wirtz (2003) for more information on the database, and Peracchi (2002) for an independent critical review.

[9]In wave 6, the wording of the self-reported health question in the underlying BHPS was not consistent with the other waves (Taylor, 2003).

1 because regional income inequality estimates tended to be inconsistent with the rest of the series for several countries.[10]

For comparability with earlier studies, we follow Fiscella and Franks (1997) and Mellor and Milyo (2002) and limit our sample to individuals aged 25 to 74. The resulting sample contains a total number of 517,006 observations including 266,917 observations for females.[11] As in Mellor and Milyo (2002), our econometric analysis is based on unweighted data.[12] Unweighted descriptive statistics of all variables used in our analysis are presented separately for men and women in Tables 1 and 2.

2.2 Regional Measures of Income Level and Income Inequality

The ECHP data identify the region of residence of respondents down to the NUTS 1 level. NUTS 0 is the country level and NUTS 1 is the first level of aggregation within countries. We are therefore able to consider the health-inequality relationship at these two levels of geography. The size of the regions defined by the NUTS 1 classification varies considerably across the European Union. However, since the NUTS is determined on the basis of population thresholds, it is reasonable to expect that these regions delimit relatively homogeneous territorial units.[13] Furthermore, the NUTS classification was precisely created to facilitate the collection, compiling and dissemination of comparable regional statistics in the European Union. This makes our analysis easily reproducible.

Concerns over the quality of existing international data on income distribution is one of the most severe drawback suffered by a majority of (ecological) cross-national studies. Many studies relied on heterogeneous sources of income distribution data

[10]More detailed data checks are available from the authors upon request.

[11]Of course the actual number of respondents is much lower since each respondent could be present in up to 7 waves.

[12]However, sample weights were used to estimate regional level statistics (see *supra*).

[13]The territorial units included at the NUTS 1 level are determined by a minimum population threshold of 3 million and a maximum of 7 million. As a consequence, NUTS 0 and NUTS 1 levels coincide in smaller countries such as Luxembourg, Ireland or Denmark.

often collected at different point in time and/or failed to use an adequate measure of disposable income.[14] The ECHP survey allows us to circumvent these limitations since we are able to estimate our own regional income inequality measures using adequately defined individual-level income data.

The ECHP contains a measure of 'total net household income' expressed in national currency units. To make the household income data comparable across countries and over time, (i) all these data were expressed in 1995 prices using national consumer price indices, and (ii) cross-national differences in currency and price levels were normalized using the OECD purchasing power parity standards provided in the ECHP database.[15] In addition, in order to take economies of scale in household consumption and differences in needs between adults and children into account, we converted all household incomes into a 'single-adult equivalent income' by applying the conventional modified-OECD equivalence scale (Atkinson et al. , 2002, p.99).

We estimated four different inequality measures: the Gini coefficient, the ratio of the 90th and 10th percentiles, the ratio of the 50th and 10th percentiles, and the ratio of the 90th and 50th percentiles. All these widely-used measures of inequality are 'relative' in the sense that they are insensitive to changes in scale (equi-proportionate increases in everyone's income). The Gini and the percentile ratios are known to be relatively insensitive to extreme incomes. The first two measures assess the overall spread of incomes in the distribution, whereas we used the 50-to-10 and 90-to-50 ratios, sensitive only to the bottom-half and the top-half of the distribution, for checking the robustness of our results.

These measures were computed for all NUTS 0 and NUTS 1 regions and for all survey years for which we have sample data in the ECHP. The income variable used to estimate the indices was the 'single-adult equivalent income' and data for all individuals in the region were used regardless of age. To prevent estimates from being driven by

[14] See Judge (1998) and Macinko *et al.* (2003) for a comprehensive and critical review of these earlier cross-national studies.

[15] We did not find *regional* (NUTS 1) price indices so we were not able to correct for within-country price differentials.

a limited number of outlying observations, the top and bottom one percent of income observations were discarded in all regions. All sample observations were weighted using the cross-section sample weights provided in the database. We estimated the two NUTS level mean regional incomes similarly. The number of households per region used for estimation at the NUTS 1 level ranges from 209 (East Anglia (UK) in wave 8) to 4055 (Finland in wave 3).[16]

2.3 Health Indicators

The ECHP collects information on self-reported health status for all respondents older than 16. This subjective measure of non-fatal health is commonly used in the literature. It is measured on a standard 5-point scale labeled ‘very good’, ‘good’, ‘fair’, ‘poor’ and ‘very poor’. In this paper, we use this variable to derive two possible proxy measures of individual health. We first define a dummy indicator of poor health equal to one for the bottom two modes of this self-reported health status variable making our study comparable to Fiscella and Franks (1997, 2000), Soobadeer and LeClere (1999), Mellor and Milyo (2002) and Weich et al. (2002). This measure has become increasingly popular in the health literature comforted by the consistent finding of a significant association between this proxy measure of poor health and mortality.[17]

Table 3 presents for each country under study the distribution of the five point scale responses used to construct our individual measure of poor health. It reveals important cross-country differences in self-reported health for all modalities. For instance, a mere 2% of Portuguese and 11% of French report being in “very good” health compared to 45% of Danes and almost 50% of Greeks. Table 4 presents the resulting distribution of our proxy measure of poor health by gender. It reveals that, with the exception of the Republic of Ireland, women are more likely to report being in poor health in all countries under study. More striking than gender differences, it confirms

[16]Detailed information on the sample sizes by regions and waves are available upon request to the authors.

[17]See McCallum et al. (1994), Idler and Kasl (1995), Idler and Benyamini (1997), Strauss and Thomas (1998) among others.

the extent of cross-country variations evidenced by the magnitude of the differences in the share of respondents reporting being in poor health across countries. For instance, the prevalence of poor health in men ranges between just below 3% in the Republic of Ireland to 18% in Portugal while ranging between just below 3% in the Republic of Ireland to more than 25% in Portugal for women.

Aside from genuine differences in health status across countries, or possible measurement errors, a plausible explanation for the differences presented in Tables 3 and 4 is the sensitivity of self-reported health responses to systematic reporting biases across-countries. This observation has lead some researchers to question the actual comparability of self-reported health variables collected in cross-national surveys such as the ECHP.[18] It is worthwhile to note that efforts to achieve cross-country comparability are usually mostly concentrated on producing comparable wording of questions while very little is done to ensure that collected data across-countries can be interpreted in a comparable fashion. In this respect, the ECHP data is comparable in the sense that comparable wording of questions eliminates bias due to differences in survey methodologies. Sadana et al. (2000) convincingly argue that reporting biases due to differences in norms and expectations across individuals belonging to some groups or subgroups (possibly countries or regions within countries) may be reponsible for the considerable variations in self reported health reported in Tables 3 and 4. These authors recommend that self-reported health status should be adjusted to account for potential cross-country reporting bias if one truly wants to compare self reported health as opposed to differences in norms or expectations.

To address the issue of comparability, we consider an alternative transformation of the 5-point scale self-reported health variable. The scores of individual ill-health are calculated in several steps. For each country, we first ran an ordered probit model of the 5-point health scale separately for men and women controlling for age, marital status, education levels and month of interview. We then use the coefficient estimates to predict the (conditional) probability that each respondent has of being in each of the

[18]See Sadana et al. (2000) for a review.

five possible categories. These probabilities are used to calculate, for each respondent, the cumulative probability of being in a better category than that actually reported (plus half the probability of being in the reported category). Finally a linearizing logit transform is applied to the cumulative probability. The cumulative probability reflects how badly the respondent fares compared to individuals from the same country and sharing the same gender, education etc. The score is therefore a *relative* indicator of health purged from systematic differences in self-reported health due to country of residence, age, gender, education, marital status, and month of interview.

As the score of individual health is a continuous variable and is free from systematic country differences, we no longer need to be concerned about the equivalence of cut-off points across countries nor do we need to arbitrarily decide which cut-off point best capture poor health. However, the measure is *relative* and it remains that an interpretation of the results in terms of cross-country differences in *absolute* health levels would still be at risk of potential responding bias arising from existing differences in norms and expectations across countries. We resolve this issue by exploiting the panel structure of our sample. In particular, we treat cross-country differences due to norms and expectations as an unobservable fixed effects which can be controlled for using standard linear panel data techniques.

3 Empirical Specifications and Results

To estimate the effect of income inequality on self-reported health, we consider two different models.

We first estimate a random effect probit model using the standard dichotomous measure of poor health as dependent variable. This approach is similar to Mellor and Milyo (2002) and implicitly assumes that self-reported health is not contaminated by cultural differences or norms across countries. However, we argued earlier that in the context of a multi-country study this assumption may not hold.[19] In particular, this

[19] In fact, even within country area studies such as the one by Mellor and Milyo (2002) could potentially be affected by reporting bias across States due to differences in norms and expectations.

approach may yield biased estimates if part of the observed cross-country variations in the 5 point scale responses across countries originates from these above mentioned non-health related factors. In order to address this issue, we turn to a fixed effects specification using our estimated score of individual ill-health as the dependent variable. The fixed effects specification comes with the additional benefit of eliminating the effect of unobserved time-constant covariates that are associated with health. This includes, in particular, fixed regional characteristics, such as differences in norms and expectations, or differences in the public provision of health care.

3.1 Random Effects Probit Model Results

We consider three specifications to test the sensitivity of our results to the choice of confounding factors. To test for the sensitivity of our results to the choice of geography, each specification is respectively estimated with the inclusion of the regional mean income and a regional measure of income inequality at both the NUTS 0 and the NUTS 1 levels.

Table 5 reports the estimated effects of income inequality on self-reported health when income inequality is measured by the Gini coefficient. The first three columns report the NUTS 0 level results while in columns 4 to 6, we report NUTS 1 level estimates. The last six columns report the results from the female sample. Our baseline specification explores the association between income inequality and self-reported health controlling for both the mean regional income and individual income.[20] Our second specification is augmented by the addition of controls for individual characteristics.[21] Following Mellor and Milyo (2002), we add to our last specification regional dummies to control for various determinants of health which cannot be directly measured in the ECHP but could have an important regional component. We choose to define regional dummies following the classification of welfare regimes of Esping-Anderson (1990) which

[20] We considered several specification household income to allow for the non-linear relationship between individual income and health including a spline function in income as in Mellor and Milyo (2002). As it did not affect our results, we opted for a more parsimonious quadratic function.

[21] These controls include a cubic in age, dummies for highest level of education achieved and marital status dummies.

we believe is appropriate to capture relevant regional variations in access to health care, health care practices and provisions or social norms between the countries included in our sample. To test the robustness of our results to the choice of inequality index, we repeated our analysis with three different measures of income spread including the 90th to 10th, the 50th to 10th, and the 90th to 50th percentiles income ratios. The results are reported in Tables 6 to 8.

Contrary to prior expectations, our most striking result is the finding of a highly significant detrimental effect of income inequality on self-reported health. This result is robust to model specifications, the choice of inequality index, the level of geography and across gender. Regardless of gender, we find that the magnitude of the estimated detrimental effect of income inequality on individual health is somewhat attenuated once income inequality is measured at a lower level of geography. This results is broadly in line with the observation from U.S. studies that the detrimental effect of income inequality tends to disappear when it is measured at a lower level of aggregation than U.S. States. In contrast, though the estimated effect is attenuated it remains nonetheless highly significant. It would have been useful to test the robustness of our results to a lower level of aggregation such as NUTS 2 level. However, respondent's residence information at this level of geography is not available in the ECHP.

The significant coefficient estimates of the quadratic function of household income support the hypothesis of a concave positive non-linear relationship between household income and individual health and are consistent with the absolute income hypothesis. Higher income leads to better health outcomes. This finding is robust to model specification, level of geography and gender. On the contrary, we do not find robust evidence in support of the relative income hypothesis evidenced by the sensitivity of the estimated relationship between the regional mean income and self-reported health to model specifications and the choice of geography. For instance, at the NUTS 0 level, the positive and significant coefficient on regional mean income is consistent with the relative income hypothesis: higher mean regional income implies a higher 'reference' income and therefore a lower health outcome for a given (absolute) income level. However, we only do find support for the relative income hypothesis at the NUTS 1 level once we control for both individual characteristics and regional fixed effects. Note that our specification implies that individuals belonging to the same NUTS region constitute a reference group.[22] This is similar to the approach of Mellor and Milyo (2002) and Gerdtham and Johannesson (2004).

Following, Mellor and Milyo (2002) and Gerdtham and Johannesson (2004), we also explore whether income inequality is more detrimental to the least well-off in society by interacting income inequality with five income quintiles dummy variables. Results for this weak version of the income inequality hypothesis are presented in Tables 9 to 12. We find that all interaction terms are statistically significant at standard levels and that the estimated effect generally decreases in magnitude with income quintiles. Our results are generally robust to model specifications at all levels of geography and across gender. Thus, we find robust evidence that income inequality is detrimental to everyone's health but that it affects more strongly the health of the poorest people. This is in line with the results of Weich et al. (2002) for the United Kingdom. We interpret these results as broadly supportive of the weak IIH.

In general, the magnitude our estimates reveals that European females are more adversely affected by income inequality than European men. This result is surprising considering than mortality in women has been found to be less sensitive to deprivation than in men and that self-reported health is considered a good predictor of mortality.

Puzzlingly, we find that the addition of confounding factors contributes to increase the estimated detrimental effect of income inequality at both levels of geography. This finding is counterintuitive and at odds with the findings of previous micro-level studies. One source of bias discussed earlier is that this result may be driven by the lack of genuine cross-country comparability in the self-reported health variable. We address this issue empirically by re-estimating a linear fixed effects model of individual health scores.

[22] Again, in the absence of clear theoretical foundations, it is difficult to assess which community level is the most relevant to test the validity of the relative income hypothesis.For instance, Deaton (2003) argues that reference groups do not have to be necessarily limited to geography. Educational group is one possibility (Deaton and Paxson, 2001).

3.2 Fixed Effects Results

The estimated effects of income inequality on individual health scores are reported in Tables 13 to 16. We consider two model specifications. In our baseline model, we simply regress individual health score on regional mean income and a regional income inequality index. Our alternative specification adds a quadratic function of household income to control for the potential non-linear relationship between income and health. Note that we do not explicitly control for other confounders since the estimated scores have already been adjusted to individual characteristics and country of residence.

The reported results from both the Gini and the 90th to 10th models confirm our earlier finding of a significant detrimental effect of income inequality on health for both men and women at the two levels of geography. Also consistent with our first set of results, we find that the magnitude of this detrimental effect is reduced at the NUTS 1 level without affecting its statistical significance. Results from these two models are not completely robust when other measures of income inequality are considered. Both the 50th to 10th and 90th to 50th models offer much more mitigated evidence in support of the IIH. The 50th to 10th model fails to confirm any significant detrimental effect at the NUTS 0 level for both men and women while we find no evidence of a significant effect from 90th to 50th model at the NUTS 1 level for men.

Our regional mean income estimates are now robust to model specifications, measures of income inequality and the level of geography considered. Interestingly, we find significant support for the relative income hypothesis among men while our results suggest that increased regional mean income is protective to women health. This latest result is not statistically significant however.

We re-explore the weak income inequality hypothesis by allowing income inequality to vary with income levels. We do find some evidence suggesting that income inequality is more hazardous to the health of the least well-off men at the NUTS 1 level. As for the strong IIH, results from the 50th to 10th and 90th to 50th models are quite sensitive to the choice of geography and gender. In summary, once we control for potential cross-country responding bias, though we still find some evidence in support of the weak income inequality hypothesis for men our results are not as robust as those implied by our model of poor health.

The magnitudes of the estimated differences across gender are no longer very robust either. For instance, our Gini model suggests that income inequality is more detrimental to men at the NUTS 0 level and to women at the NUTS 1 level. While the 90th to 10th model suggests that women are consistently more affected by income inequality than men, this observation is no longer robust to the choice of geography for both the 50th to 10th and 90th to 50th models.

4 Conclusions

This is the first study which formally has explored, separately on men and women, the robustness of the income inequality hypothesis using individual multi-country data of Member States of the European Union. We have been careful in addressing the pitfalls suffered by earlier ecological cross-national studies. Furthermore, we offer a simple solution to a major concern that is specific to individual multi-country studies using the self-reported health variable as proxy measure of health. Namely that individual responses to self-reported health could be contaminated by systematic cross-country reporting biases due to differences in norms and expectations across countries. Whether we control for potential reporting bias, we generally find a strong and significant support in favour of the strong version of the income inequality hypothesis for both men and women in our pooled sample of 11 E.U. countries. This finding is at odds with comparable recent within-country studies in the United States (Mellor and Milyo 2002) and in Sweden (Gerdtham and Johannessen, 2004), but making our analysis more comparable would have required regional income and income inequality statistics at a lower level than NUTS 1.

We do find some evidence in support the relative income hypothesis for men. We also do confirm a well-established result in this literature, in support of the absolute income hypothesis that higher income is associated with better health. Interestingly, our results suggest that income inequality is generally slightly more detrimental to woman than to men when it is measured by standard income inequality indices including the Gini coefficient and the 90th to 10th percentile ratio.

Given the complexity surrounding the interpretation of self-reported health status across countries, one should carefully consider the results reported in this study. Additional studies are needed, preferably from other data sources, to completely convince ourselves that our results are not simply reflecting the lack of comparability of the self-reported health variable. Possible extensions of this paper could examine the sensitivity of its results to either objective measures of health or mortality. However, subjective health variables available in the ECHP data are too limited while a rigorous mortality study would require a much longer panel such as in Gerdtham and Johannesson (2004).

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Tables and Regression Results

Table 1: Summary statistics (males)

Variable	N	Mean	Min	Max
Indicator of poor health	250089	0.08	0.00	1.00
Health score	248269	0.04	-8.43	10.04
Mean income at NUTS 0	250089	11245.62	7512.33	15782.92
Gini coefficient at NUTS 0	250089	0.28	0.19	0.34
Ratio of 90th to 10th percentile at NUTS 0	250089	3.89	2.42	5.42
Ratio of 90th to 50th percentile at NUTS 0	250089	1.90	1.48	2.24
Ratio of 50th to 10th percentile at NUTS 0	250089	2.03	1.56	2.46
Mean income at NUTS 1	250089	11067.19	5554.96	18939.36
Gini coefficient at NUTS 1	250089	0.27	0.19	0.37
Ratio of 90th to 10th percentile at NUTS 1	250089	3.75	2.42	6.26
Ratio of 90th to 50th percentile at NUTS 1	250089	1.87	1.48	2.68
Ratio of 50th to 10th percentile at NUTS 1	250089	1.98	1.56	3.11
Conservative regime	250089	0.24	0.00	1.00
Social-Democratic regime	250089	0.11	0.00	1.00
Southern regime	250089	0.52	0.00	1.00
Household income (in single-adult equivalent units)	250089	12289.41	0.21	1.25e+06
Age of individual	250089	46.80	25.00	74.00
Upper secondary education level (ISCED 3)	250089	0.29	0.00	1.00
Less than upper secondary education level (ISCED 0-2)	250089	0.51	0.00	1.00
Separated	250089	0.01	0.00	1.00
Divorced	250089	0.03	0.00	1.00
Widowed	250089	0.02	0.00	1.00
Never married	250089	0.21	0.00	1.00

Table 2: Summary statistics (females)

Variable	N	Mean	Min	Max
Indicator of poor health	266917	0.10	0.00	1.00
Health score	265206	0.04	-9.84	10.66
Mean income at NUTS 0	266917	11268.89	7512.33	15782.92
Gini coefficient at NUTS 0	266917	0.28	0.19	0.34
Ratio of 90th to 10th percentile at NUTS 0	266917	3.89	2.42	5.42
Ratio of 90th to 50th percentile at NUTS 0	266917	1.90	1.48	2.24
Ratio of 50th to 10th percentile at NUTS 0	266917	2.03	1.56	2.46
Mean income at NUTS 1	266917	11098.17	5554.96	18939.36
Gini coefficient at NUTS 1	266917	0.27	0.19	0.37
Ratio of 90th to 10th percentile at NUTS 1	266917	3.75	2.42	6.26
Ratio of 90th to 50th percentile at NUTS 1	266917	1.87	1.48	2.68
Ratio of 50th to 10th percentile at NUTS 1	266917	1.98	1.56	3.11
Conservative regime	266917	0.24	0.00	1.00
Social-Democratic regime	266917	0.11	0.00	1.00
Southern regime	266917	0.51	0.00	1.00
Household income (in single-adult equivalent units)	266917	11833.50	0.02	1.25e+06
Age of individual	266917	47.32	25.00	74.00
Upper secondary education level (ISCED 3)	266917	0.26	0.00	1.00
Less than upper secondary education level (ISCED 0-2)	266917	0.56	0.00	1.00
Separated	266917	0.02	0.00	1.00
Divorced	266917	0.05	0.00	1.00
Widowed	266917	0.09	0.00	1.00
Never married	266917	0.14	0.00	1.00

Table 3: Distribution across self-reported health status (Percentage)

Country	Very good	Good	Fair	Poor	Very poor
Denmark	45.10	33.28	16.44	4.03	1.15
Belgium	20.74	52.78	21.65	4.01	0.82
France	11.05	47.96	33.43	3.76	3.81
UK (ECHP)	23.15	47.63	20.43	6.81	1.98
Ireland	43.79	37.70	15.73	2.23	0.55
Italy	14.30	46.68	30.04	7.59	1.38
Greece	49.67	27.13	15.57	5.79	1.84
Spain	15.26	51.35	22.53	9.27	1.58
Portugal	2.15	40.54	35.55	17.93	3.83
Austria	27.82	43.90	21.59	5.48	1.21
Finland	16.05	47.20	31.05	5.04	0.66

Notes:

Table 4: Distribution across (recoded) health status (Percentage)

	Men		Women	
Country	Good/Fair	Poor	Good/Fair	Poor
Denmark	95.98	4.02	93.69	6.31
Belgium	95.76	4.24	94.65	5.35
France	93.27	6.73	91.67	8.33
UK (ECHP)	92.20	7.80	90.36	9.64
Ireland	97.14	2.86	97.31	2.69
Italy	92.03	7.97	90.03	9.97
Greece	92.92	7.08	91.86	8.14
Spain	91.14	8.86	87.26	12.74
Portugal	82.17	17.83	74.61	25.39
Austria	93.48	6.52	93.15	6.85
Finland	94.27	5.73	94.32	5.68

Table 5: Random effects probit: probability of reporting poor health (gini model)

	Men						Women					
Explanatory variable		NUTS 0			NUTS 1			NUTS 0			NUTS 1	
Mean income	0.195***	0.357***	0.828***	-0.124**	0.031	0.149**	0.155**	0.189***	0.928***	-0.165***	-0.085*	0.205***
	(2.625)	(4.775)	(7.971)	(2.237)	(0.591)	(2.246)	(2.272)	(2.930)	(10.205)	(3.407)	(1.814)	(3.525)
Gini coefficient	5.955***	6.069***	10.669***	3.642***	3.989***	4.561***	7.358***	7.374***	12.915***	4.520***	5.003***	5.522***
	(13.152)	(12.771)	(14.714)	(10.504)	(11.327)	(10.825)	(17.336)	(17.506)	(20.292)	(14.254)	(15.972)	(15.004)
Household income	-0.392***	-0.287***	-0.286***	-0.382***	-0.281***	-0.281***	-0.333***	-0.206***	-0.204***	-0.328***	-0.200***	-0.198***
	(26.544)	(19.632)	(19.523)	(25.478)	(19.093)	(19.030)	(24.550)	(16.073)	(15.909)	(23.765)	(15.277)	(15.108)
Household income squared	0.003***	0.002***	0.002***	0.003***	0.002***	0.002***	0.003***	0.002***	0.002***	0.003***	0.002***	0.002***
	(17.251)	(12.353)	(12.420)	(16.641)	(11.967)	(12.021)	(18.104)	(11.599)	(11.621)	(17.831)	(11.161)	(11.122)
Control for individual char.	no	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes
Control for regime-type effects	no	no	yes	no	no	yes	no	no	yes	no	no	yes

Notes: Coefficient on mean regional income and household income multiplied by 10,000. Coefficient on squared household income multiplied by 100,000,000. Stars indicate significance at 10%, 5% and 1% levels. Absolute z-values in parentheses.

Table 6: Random effects probit: probability of reporting poor health (p9to1 model)

	Men						Women					
Explanatory variable	NUTS 0			NUTS 1			NUTS 0			NUTS 1		
Mean income	0.123	0.232***	0.388***	-0.230***	-0.060	0.039	0.023	0.052	0.403***	-0.323***	-0.215***	0.061
	(1.616)	(3.022)	(3.940)	(4.258)	(1.154)	(0.595)	(0.336)	(0.777)	(4.670)	(6.895)	(4.675)	(1.063)
Ratio of 90th to 10th percentile	0.263***	0.244***	0.299***	0.125***	0.145***	0.142***	0.308***	0.297***	0.359***	0.141***	0.171***	0.161***
	(11.275)	(10.110)	(9.284)	(7.901)	(9.173)	(8.165)	(14.357)	(13.928)	(12.853)	(10.002)	(12.223)	(10.637)
Household income	-0.390***	-0.286***	-0.285***	-0.383***	-0.281***	-0.281***	-0.333***	-0.205***	-0.204***	-0.332***	-0.200***	-0.200***
	(26.227)	(19.535)	(19.462)	(25.058)	(19.132)	(19.073)	(24.717)	(15.953)	(15.799)	(24.245)	(15.279)	(15.223)
Household income squared	0.003***	0.002***	0.002***	0.003***	0.002***	0.002***	0.003***	0.002***	0.002***	0.003***	0.002***	0.002***
	(17.135)	(12.327)	(12.378)	(16.595)	(12.026)	(12.064)	(18.125)	(11.554)	(11.537)	(18.017)	(11.206)	(11.203)
Control for individual char.	no	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes
Control for regime-type effects	no	no	yes	no	no	yes	no	no	yes	no	no	yes

Notes: Coefficient on mean regional income and household income multiplied by 10,000. Coefficient on squared household income multiplied by 100,000,000. Stars indicate significance at 10%, 5% and 1% levels. Absolute z-values in parentheses.

Table 7: Random effects probit: probability of reporting poor health (p5to1 model)

	Men						Women					
Explanatory variable	NUTS 0			NUTS 1			NUTS 0			NUTS 1		
Mean income	-0.358***	-0.244***	-0.136	-0.396***	-0.224***	-0.121**	-0.602***	-0.540***	-0.259***	-0.537***	-0.438***	-0.148***
	(5.592)	(3.810)	(1.618)	(8.176)	(4.742)	(1.981)	(10.368)	(9.590)	(3.489)	(12.767)	(10.446)	(2.744)
Ratio of 50th to 10th percentile	0.288***	0.195***	-0.057	0.181***	0.236***	0.191***	0.238***	0.199***	-0.139*	0.136***	0.211***	0.134***
	(4.330)	(2.894)	(0.641)	(4.183)	(5.462)	(4.135)	(3.934)	(3.325)	(1.808)	(3.579)	(5.518)	(3.296)
Household income	-0.392***	-0.288***	-0.289***	-0.385***	-0.282***	-0.282***	-0.338***	-0.207***	-0.207***	-0.336***	-0.203***	-0.203***
	(25.580)	(19.761)	(19.807)	(24.581)	(19.214)	(19.153)	(25.365)	(16.018)	(16.017)	(24.719)	(15.424)	(15.435)
Household income squared	0.003***	0.002***	0.002***	0.003***	0.002***	0.002***	0.003***	0.002***	0.002***	0.003***	0.002***	0.002***
	(17.030)	(12.499)	(12.562)	(16.538)	(12.132)	(12.150)	(18.406)	(11.632)	(11.650)	(18.231)	(11.325)	(11.336)
Control for individual char.	no	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes
Control for regime-type effects	no	no	yes	no	no	yes	no	no	yes	no	no	yes

Notes: Coefficient on mean regional income and household income multiplied by 10,000. Coefficient on squared household income multiplied by 100,000,000. Stars indicate significance at 10%, 5% and 1% levels. Absolute z-values in parentheses.

Table 8: Random effects probit: probability of reporting poor health (p9to5 model)

	Men						Women					
Explanatory variable		NUTS 0			NUTS 1			NUTS 0			NUTS 1	
Mean income	0.313***	0.414***	0.792***	-0.187***	-0.043	0.086	0.306***	0.283***	0.917***	-0.208***	-0.138***	0.179***
	(4.250)	(5.649)	(7.791)	(3.497)	(0.824)	(1.311)	(4.610)	(4.491)	(10.397)	(4.463)	(3.050)	(3.116)
Ratio of 90th to 50th percentile	1.318***	1.244***	1.593***	0.565***	0.588***	0.593***	1.640***	1.553***	2.015***	0.762***	0.820***	0.840***
	(15.499)	(14.264)	(14.829)	(9.479)	(9.788)	(9.013)	(21.111)	(20.224)	(21.587)	(14.267)	(15.481)	(14.695)
Household income	-0.393***	-0.287***	-0.286***	-0.383***	-0.281***	-0.282***	-0.331***	-0.205***	-0.203***	-0.330***	-0.199***	-0.198***
	(26.463)	(19.662)	(19.604)	(25.250)	(19.198)	(19.130)	(24.316)	(16.008)	(15.862)	(24.073)	(15.219)	(15.129)
Household income squared	0.003***	0.002***	0.002***	0.003***	0.002***	0.002***	0.003***	0.002***	0.002***	0.003***	0.002***	0.002***
	(17.267)	(12.352)	(12.434)	(16.657)	(12.077)	(12.110)	(18.021)	(11.573)	(11.591)	(17.946)	(11.167)	(11.152)
Control for individual char.	no	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes
Control for regime-type effects	no	no	yes	no	no	yes	no	no	yes	no	no	yes

Notes: Coefficient on mean regional income and household income multiplied by 10,000. Coefficient on squared household income multiplied by 100,000,000. Stars indicate significance at 10%, 5% and 1% levels. Absolute z-values in parentheses.

Table 9: Random effects probit: probability of reporting poor health (gini model)

	Men						Women					
Explanatory variable	NUTS 0			NUTS 1			NUTS 0			NUTS 1		
Mean income	0.047	0.219***	0.780***	-0.210***	-0.046	0.166**	0.028	0.100	0.896***	-0.230***	-0.130***	0.207**
	(0.628)	(2.913)	(7.548)	(3.824)	(0.850)	(2.513)	(0.404)	(1.536)	(9.855)	(4.711)	(2.771)	(3.584)
Gini coefficient times lowest fifth	7.308***	7.147***	11.620***	4.787***	4.943***	5.435***	8.140***	7.925***	13.454***	5.142***	5.412***	5.962**
	(15.894)	(14.869)	(15.963)	(13.555)	(13.656)	(12.701)	(19.026)	(18.602)	(21.080)	(15.854)	(16.981)	(16.068
Gini coefficient times second fifth	6.887***	6.743***	11.206***	4.411***	4.578***	5.040***	7.891***	7.739***	13.250***	4.969***	5.283***	5.787**
	(15.069)	(14.089)	(15.405)	(12.556)	(12.722)	(11.794)	(18.556)	(18.256)	(20.788)	(15.450)	(16.668)	(15.637
Gini coefficient times third fifth	6.286***	6.224***	10.675***	3.833***	4.079***	4.517***	7.611***	7.559***	13.049***	4.734***	5.158***	5.612**
	(13.811)	(13.047)	(14.683)	(10.962)	(11.368)	(10.562)	(17.915)	(17.872)	(20.478)	(14.782)	(16.301)	(15.151
Gini coefficient times fourth fifth	5.856***	5.952***	10.390***	3.434***	3.819***	4.221***	7.151***	7.213***	12.680***	4.325***	4.843***	5.245**
	(12.889)	(12.478)	(14.276)	(9.829)	(10.648)	(9.850)	(16.827)	(17.051)	(19.883)	(13.488)	(15.282)	(14.116
Gini coefficient times highest fifth	5.097***	5.275***	9.675***	2.723***	3.155***	3.491***	6.689***	6.858***	12.273***	3.939***	4.535***	4.841**
	(11.155)	(10.973)	(13.251)	(7.698)	(8.681)	(8.058)	(15.631)	(16.072)	(19.188)	(12.146)	(14.126)	(12.877
Household income	-0.136***	-0.074***	-0.065***	-0.151***	-0.084***	-0.067***	-0.150***	-0.083***	-0.067***	-0.180***	-0.101***	-0.073**
	(6.282)	(3.560)	(3.203)	(7.117)	(4.001)	(3.265)	(8.069)	(4.425)	(3.681)	(8.576)	(5.549)	(3.886)
Household income squared	0.001***	0.001**	0.001**	0.001***	0.001***	0.001**	0.001***	0.001***	0.001***	0.002***	0.001***	0.001**
	(4.482)	(2.275)	(2.003)	(5.085)	(2.634)	(2.067)	(6.957)	(4.403)	(3.873)	(8.122)	(5.062)	(4.046)
Control for individual char.	no	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes
Control for regime-type effects	no	no	yes	no	no	yes	no	no	yes	no	no	yes

Notes: Coefficient on mean regional income and household income multiplied by 10,000. Coefficient on squared household income multiplied by 100,000,000. Stars indicate significance at 10%, 5% and 1% levels. Absolute z-values in parentheses.

Table 10: Random effects probit: probability of reporting poor health (p9to1 model)

	Men						Women					
Explanatory variable	NUTS 0			NUTS 1			NUTS 0			NUTS 1		
Mean income	-0.017	0.106	0.343***	-0.327***	-0.145***	0.039	-0.090	-0.029	0.370***	-0.388***	-0.260***	0.05
	(0.224)	(1.370)	(3.490)	(6.078)	(2.764)	(0.605)	(1.289)	(0.439)	(4.284)	(8.185)	(5.632)	(0.96
90/10 perc. ratio times lowest fifth	0.348***	0.316***	0.359***	0.182***	0.192***	0.186***	0.360***	0.333***	0.392***	0.169***	0.189***	0.183*
	(14.572)	(12.772)	(11.053)	(11.178)	(11.719)	(10.467)	(16.491)	(15.306)	(13.933)	(11.568)	(13.199)	(11.84
90/10 perc. ratio times second fifth	0.318***	0.287***	0.330***	0.158***	0.169***	0.161***	0.344***	0.320***	0.379***	0.159***	0.183***	0.173*
	(13.454)	(11.713)	(10.174)	(9.724)	(10.356)	(9.027)	(15.867)	(14.842)	(13.484)	(10.989)	(12.758)	(11.18
90/10 perc. ratio times third fifth	0.277***	0.252***	0.293***	0.119***	0.136***	0.125***	0.324***	0.308***	0.365***	0.145***	0.175***	0.162*
	(11.759)	(10.297)	(9.049)	(7.355)	(8.297)	(6.994)	(15.021)	(14.315)	(13.006)	(10.033)	(12.229)	(10.44
90/10 perc. ratio times fourth fifth	0.246***	0.232***	0.273***	0.093***	0.119***	0.105***	0.292***	0.284***	0.340***	0.119***	0.154***	0.137*
	(10.474)	(9.493)	(8.392)	(5.674)	(7.198)	(5.824)	(13.541)	(13.193)	(12.074)	(8.096)	(10.636)	(8.717
90/10 perc. ratio times highest fifth	0.193***	0.184***	0.223***	0.046***	0.075***	0.057***	0.260***	0.259***	0.312***	0.096***	0.135***	0.111*
	(8.049)	(7.404)	(6.774)	(2.649)	(4.293)	(2.974)	(11.852)	(11.816)	(10.963)	(6.240)	(8.879)	(6.751
Household income	-0.141***	-0.079***	-0.072***	-0.171***	-0.103***	-0.085***	-0.156***	-0.086***	-0.074***	-0.208***	-0.115***	-0.089*
	(6.723)	(3.822)	(3.530)	(8.275)	(4.903)	(4.131)	(8.380)	(4.707)	(4.027)	(10.565)	(6.477)	(4.86
Household income squared	0.001***	0.001**	0.001**	0.001***	0.001***	0.001***	0.002***	0.001***	0.001***	0.002***	0.001***	0.001*
	(4.733)	(2.458)	(2.243)	(5.950)	(3.340)	(2.736)	(7.334)	(4.579)	(4.153)	(9.433)	(5.649)	(4.67
Control for individual char.	no	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes
Control for regime-type effects	no	no	yes	no	no	yes	no	no	yes	no	no	yes

Notes: Coefficient on mean regional income and household income multiplied by 10,000. Coefficient on squared household income multiplied by 100,000,000. Stars indicate significance at 10%, 5% and 1% levels. Absolute z-values in parentheses.

Table 11: Random effects probit: probability of reporting poor health (p5to1 model)

Explanatory variable	Men NUTS 0			Men NUTS 1			Women NUTS 0			Women NUTS 1		
Mean income	-0.521***	-0.379***	-0.189**	-0.504***	-0.315***	-0.117*	-0.727***	-0.625***	-0.303***	-0.608***	-0.486***	-0.152*
	(8.054)	(5.825)	(2.247)	(10.369)	(6.567)	(1.916)	(12.332)	(10.950)	(4.089)	(14.193)	(11.444)	(2.82
50/10 perc. ratio times lowest fifth	0.458***	0.346***	0.041	0.284***	0.323***	0.266***	0.352***	0.275***	-0.085	0.192***	0.249***	0.175*
	(6.806)	(5.059)	(0.458)	(6.514)	(7.367)	(5.717)	(5.783)	(4.547)	(1.105)	(4.973)	(6.428)	(4.28
50/10 perc. ratio times second fifth	0.402***	0.292***	-0.017	0.236***	0.278***	0.214***	0.318***	0.250***	-0.115	0.168***	0.232***	0.150*
	(5.999)	(4.291)	(0.187)	(5.395)	(6.322)	(4.579)	(5.241)	(4.150)	(1.486)	(4.361)	(5.990)	(3.64
50/10 perc. ratio times third fifth	0.320***	0.221***	-0.091	0.157***	0.209***	0.140***	0.280***	0.227***	-0.141*	0.140***	0.217***	0.126*
	(4.789)	(3.259)	(1.017)	(3.600)	(4.754)	(2.987)	(4.644)	(3.785)	(1.830)	(3.621)	(5.602)	(3.06
50/10 perc. ratio times fourth fifth	0.265***	0.187***	-0.128	0.110**	0.180***	0.105**	0.218***	0.181***	-0.192**	0.086**	0.176***	0.076
	(3.970)	(2.763)	(1.438)	(2.508)	(4.085)	(2.218)	(3.609)	(3.023)	(2.484)	(2.210)	(4.519)	(1.83
50/10 perc. ratio times highest fifth	0.169**	0.101	-0.221**	0.024	0.100**	0.013	0.162***	0.140**	-0.240***	0.048	0.146***	0.03
	(2.507)	(1.482)	(2.450)	(0.529)	(2.191)	(0.273)	(2.662)	(2.319)	(3.085)	(1.190)	(3.663)	(0.71
Household income	-0.146***	-0.086***	-0.075***	-0.169***	-0.103***	-0.081***	-0.161***	-0.093***	-0.077***	-0.206***	-0.117***	-0.084*
	(6.795)	(4.001)	(3.517)	(7.903)	(4.734)	(3.787)	(8.062)	(4.998)	(4.017)	(9.865)	(6.401)	(4.42
Household income squared	0.001***	0.001***	0.001**	0.001***	0.001***	0.001**	0.002***	0.001***	0.001***	0.002***	0.001***	0.001*
	(4.917)	(2.731)	(2.338)	(5.813)	(3.318)	(2.551)	(7.349)	(4.750)	(4.156)	(9.081)	(5.635)	(4.42
Control for individual char.	no	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes
Control for regime-type effects	no	no	yes	no	no	yes	no	no	yes	no	no	yes

Notes: Coefficient on mean regional income and household income multiplied by 10,000. Coefficient on squared household income multiplied by 100,000,000. Stars indicate significance at 10%, 5% and 1% levels. Absolute z-values in parentheses.

Table 12: Random effects probit: probability of reporting poor health (p9to5 model)

	Men						Women					
Explanatory variable		NUTS 0			NUTS 1			NUTS 0			NUTS 1	
Mean income	0.161**	0.273***	0.769***	-0.284***	-0.129**	0.105	0.175***	0.192***	0.898***	-0.281***	-0.188***	0.183*
	(2.184)	(3.703)	(7.588)	(5.342)	(2.467)	(1.592)	(2.635)	(3.015)	(10.187)	(5.969)	(4.112)	(3.195
90/50 perc. ratio times lowest fifth	1.541***	1.421***	1.782***	0.727***	0.720***	0.727***	1.780***	1.646***	2.127***	0.851***	0.875***	0.909*
	(17.946)	(16.093)	(16.433)	(12.041)	(11.718)	(10.881)	(22.748)	(21.246)	(22.652)	(15.667)	(16.342)	(15.78
90/50 perc. ratio times second fifth	1.477***	1.360***	1.717***	0.670***	0.665***	0.666***	1.739***	1.617***	2.093***	0.824***	0.855***	0.880*
	(17.279)	(15.460)	(15.876)	(11.151)	(10.887)	(10.009)	(22.340)	(20.955)	(22.352)	(15.260)	(16.039)	(15.34
90/50 perc. ratio times third fifth	1.386***	1.281***	1.635***	0.586***	0.592***	0.589***	1.696***	1.588***	2.059***	0.788***	0.837***	0.853*
	(16.263)	(14.607)	(15.144)	(9.773)	(9.706)	(8.833)	(21.808)	(20.635)	(22.030)	(14.656)	(15.702)	(14.86
90/50 perc. ratio times fourth fifth	1.320***	1.241***	1.592***	0.529***	0.556***	0.545***	1.626***	1.536***	2.002***	0.728***	0.792***	0.798*
	(15.528)	(14.148)	(14.732)	(8.816)	(9.096)	(8.161)	(20.909)	(19.958)	(21.417)	(13.495)	(14.800)	(13.85
90/50 perc. ratio times highest fifth	1.207***	1.139***	1.482***	0.427***	0.461***	0.439***	1.552***	1.481***	1.938***	0.671***	0.747***	0.737*
	(14.151)	(12.941)	(13.695)	(7.054)	(7.469)	(6.503)	(19.910)	(19.153)	(20.691)	(12.328)	(13.826)	(12.66
Household income	-0.130***	-0.070***	-0.057***	-0.152***	-0.088***	-0.066***	-0.138***	-0.077***	-0.057***	-0.178***	-0.101***	-0.067*
	(5.959)	(3.364)	(2.786)	(7.134)	(4.126)	(3.159)	(7.559)	(4.080)	(3.185)	(8.405)	(5.511)	(3.606
Household income squared	0.001***	0.001**	0.000*	0.001***	0.001***	0.001**	0.001***	0.001***	0.001***	0.002***	0.001***	0.001*
	(4.269)	(2.145)	(1.703)	(5.160)	(2.779)	(2.021)	(6.455)	(4.176)	(3.476)	(8.013)	(5.045)	(3.848
Control for individual char.	no	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes
Control for regime-type effects	no	no	yes	no	no	yes	no	no	yes	no	no	yes

Notes: Coefficient on mean regional income and household income multiplied by 10,000. Coefficient on squared household income multiplied by 100,000,000. Stars indicate significance at 10%, 5% and 1% levels. Absolute z-values in parentheses.

Table 13: Fixed effects regression on health scores (gini model)

	Men				Women			
Explanatory variable	NUTS 0		NUTS 1		NUTS 0		NUTS 1	
Mean income	0.310***	0.322***	0.180***	0.191***	-0.021	-0.009	-0.043	-0.031
	(6.490)	(6.711)	(4.362)	(4.596)	(0.458)	(0.186)	(1.076)	(0.778)
Gini coefficient	2.179***	2.184***	0.864***	0.866***	1.733***	1.740***	0.944***	0.946***
	(6.601)	(6.617)	(3.765)	(3.774)	(5.330)	(5.350)	(4.200)	(4.210)
Household income		-0.012**		-0.011**		-0.014***		-0.015***
		(2.162)		(2.061)		(2.647)		(2.724)
Household income squared		0.000		0.000		0.000***		0.000***
		(0.219)		(0.160)		(3.638)		(3.678)

Notes: Coefficient on mean regional income and household income multiplied by 10,000. Coefficient on squared household income multiplied by 100,000,000. Stars indicate significance at 10%, 5% and 1% levels. Absolute *t*-values in parentheses.

Table 14: Fixed effects regression on health scores (p9to1 model)

	Men				Women			
Explanatory variable	NUTS 0		NUTS 1		NUTS 0		NUTS 1	
Mean income	0.212***	0.225***	0.161***	0.172***	-0.082*	-0.070	-0.052	-0.040
	(4.714)	(4.950)	(3.974)	(4.210)	(1.878)	(1.589)	(1.318)	(1.017)
Ratio of 90th to 10th percentile	0.049***	0.049***	0.026***	0.026***	0.055***	0.055***	0.040***	0.040***
	(3.102)	(3.110)	(2.882)	(2.878)	(3.589)	(3.602)	(4.485)	(4.488)
Household income		-0.011**		-0.011**		-0.014***		-0.015***
		(2.127)		(2.044)		(2.619)		(2.709)
Household income squared		0.000		0.000		0.000***		0.000***
		(0.203)		(0.154)		(3.626)		(3.673)

Notes: Coefficient on mean regional income and household income multiplied by 10,000. Coefficient on squared household income multiplied by 100,000,000. Stars indicate significance at 10%, 5% and 1% levels. Absolute t-values in parentheses.

Table 15: Fixed effects regression on health scores (p5to1 model)

	Men				Women			
Explanatory variable	NUTS 0		NUTS 1		NUTS 0		NUTS 1	
Mean income	0.167***	0.179***	0.147***	0.158***	-0.134***	-0.122***	-0.079**	-0.068*
	(3.908)	(4.158)	(3.706)	(3.950)	(3.221)	(2.911)	(2.052)	(1.738)
Ratio of 50th to 10th percentile	0.011	0.011	0.069***	0.069***	0.016	0.016	0.076***	0.076***
	(0.266)	(0.269)	(3.242)	(3.244)	(0.402)	(0.411)	(3.620)	(3.627)
Household income		-0.011**		-0.011**		-0.014***		-0.015***
		(2.114)		(2.051)		(2.604)		(2.715)
Household income squared		0.000		0.000		0.000***		0.000***
		(0.194)		(0.157)		(3.616)		(3.676)

Notes: Coefficient on mean regional income and household income multiplied by 10,000. Coefficient on squared household income multiplied by 100,000,000. Stars indicate significance at 10%, 5% and 1% levels. Absolute t-values in parentheses.

Table 16: Fixed effects regression on health scores (p9to5 model)

	Men				Women			
Explanatory variable	NUTS 0		NUTS 1		NUTS 0		NUTS 1	
Mean income	0.259***	0.272***	0.133***	0.144***	-0.047	-0.034	-0.070*	-0.058
	(5.549)	(5.775)	(3.258)	(3.496)	(1.031)	(0.754)	(1.751)	(1.451)
Ratio of 90th to 50th percentile	0.265***	0.266***	-0.001	-0.001	0.256***	0.257***	0.071**	0.071**
	(4.792)	(4.804)	(0.032)	(0.039)	(4.714)	(4.731)	(2.157)	(2.156)
Household income		-0.012**		-0.011**		-0.014***		-0.015***
		(2.143)		(2.049)		(2.628)		(2.702)
Household income squared		0.000		0.000		0.000***		0.000***
		(0.215)		(0.157)		(3.634)		(3.671)

Notes: Coefficient on mean regional income and household income multiplied by 10,000. Coefficient on squared household income multiplied by 100,000,000. Stars indicate significance at 10%, 5% and 1% levels. Absolute t-values in parentheses.

Table 17: Fixed effects regression on health scores (gini model)

	Men				Women			
Explanatory variable	NUTS 0		NUTS 1		NUTS 0		NUTS 1	
Mean income	0.344***	0.342***	0.208***	0.207***	-0.008	-0.005	-0.031	-0.028
	(7.135)	(7.093)	(4.998)	(4.960)	(0.168)	(0.116)	(0.753)	(0.697)
Gini coefficient times lowest fifth	2.305***	2.314***	0.984***	0.993***	1.786***	1.771***	0.998***	0.980***
	(6.971)	(6.994)	(4.270)	(4.302)	(5.481)	(5.433)	(4.426)	(4.342)
Gini coefficient times second fifth	2.177***	2.181***	0.855***	0.859***	1.706***	1.701***	0.918***	0.910***
	(6.579)	(6.589)	(3.707)	(3.723)	(5.234)	(5.217)	(4.064)	(4.029)
Gini coefficient times third fifth	2.118***	2.117***	0.800***	0.800***	1.751***	1.755***	0.963***	0.965***
	(6.399)	(6.395)	(3.464)	(3.463)	(5.371)	(5.381)	(4.261)	(4.268)
Gini coefficient times fourth fifth	2.076***	2.068***	0.761***	0.755***	1.692***	1.706***	0.903***	0.916***
	(6.268)	(6.244)	(3.291)	(3.265)	(5.185)	(5.227)	(3.990)	(4.045)
Gini coefficient times highest fifth	2.043***	2.024***	0.730***	0.714***	1.668***	1.704***	0.874***	0.910***
	(6.167)	(6.097)	(3.155)	(3.072)	(5.111)	(5.206)	(3.856)	(3.991)
Household income		0.006		0.005		-0.011		-0.011
		(0.880)		(0.765)		(1.559)		(1.599)
Household income squared		-0.000		-0.000		0.000***		0.000***
		(1.535)		(1.460)		(2.971)		(2.993)

Notes: Coefficient on mean regional income and household income multiplied by 10,000. Coefficient on squared household income multiplied by 100,000,000. Stars indicate significance at 10%, 5% and 1% levels. Absolute *t*-values in parentheses.

Table 18: Fixed effects regression on health scores (p9to1 model)

	Men				Women			
Explanatory variable	NUTS 0		NUTS 1		NUTS 0		NUTS 1	
Mean income	0.247***	0.245***	0.187***	0.186***	-0.068	-0.066	-0.039	-0.037
	(5.428)	(5.378)	(4.584)	(4.550)	(1.547)	(1.493)	(0.989)	(0.928)
90/10 perc. ratio times lowest fifth	0.059***	0.059***	0.035***	0.035***	0.059***	0.058***	0.043***	0.042***
	(3.719)	(3.759)	(3.813)	(3.849)	(3.825)	(3.755)	(4.861)	(4.709)
90/10 perc. ratio times second fifth	0.049***	0.049***	0.025***	0.026***	0.053***	0.053***	0.038***	0.037***
	(3.102)	(3.120)	(2.796)	(2.817)	(3.444)	(3.419)	(4.216)	(4.155)
90/10 perc. ratio times third fifth	0.044***	0.044***	0.022**	0.022**	0.056***	0.056***	0.041***	0.041***
	(2.819)	(2.816)	(2.368)	(2.367)	(3.643)	(3.654)	(4.553)	(4.563)
90/10 perc. ratio times fourth fifth	0.041***	0.041***	0.019**	0.019**	0.052***	0.053***	0.036***	0.037***
	(2.614)	(2.581)	(2.057)	(2.022)	(3.351)	(3.404)	(4.034)	(4.122)
90/10 perc. ratio times highest fifth	0.039**	0.038**	0.017*	0.016*	0.050***	0.052***	0.034***	0.037***
	(2.479)	(2.382)	(1.843)	(1.727)	(3.228)	(3.352)	(3.763)	(3.961)
Household income		0.006		0.004		-0.010		-0.010
		(0.955)		(0.606)		(1.427)		(1.539)
Household income squared		-0.000		-0.000		0.000***		0.000***
		(1.583)		(1.357)		(2.889)		(2.959)

Notes: Coefficient on mean regional income and household income multiplied by 10,000. Coefficient on squared household income multiplied by 100,000,000. Stars indicate significance at 10%, 5% and 1% levels. Absolute *t*-values in parentheses.

Table 19: Fixed effects regression on health scores (p5to1 model)

	Men				Women			
Explanatory variable	NUTS 0		NUTS 1		NUTS 0		NUTS 1	
Mean income	0.202***	0.201***	0.175***	0.175***	-0.120***	-0.118***	-0.067*	-0.065*
	(4.688)	(4.651)	(4.383)	(4.358)	(2.871)	(2.821)	(1.710)	(1.655)
50/10 perc. ratio times lowest fifth	0.031	0.033	0.088***	0.089***	0.023	0.020	0.084***	0.081***
	(0.784)	(0.822)	(4.058)	(4.091)	(0.597)	(0.524)	(3.949)	(3.799)
50/10 perc. ratio times second fifth	0.013	0.014	0.071***	0.071***	0.012	0.010	0.072***	0.071***
	(0.327)	(0.347)	(3.264)	(3.285)	(0.299)	(0.263)	(3.398)	(3.330)
50/10 perc. ratio times third fifth	0.005	0.006	0.063***	0.063***	0.018	0.018	0.079***	0.079***
	(0.134)	(0.138)	(2.922)	(2.925)	(0.474)	(0.471)	(3.713)	(3.711)
50/10 perc. ratio times fourth fifth	-0.001	-0.001	0.058***	0.057***	0.010	0.012	0.071***	0.072***
	(0.018)	(0.034)	(2.683)	(2.658)	(0.264)	(0.303)	(3.312)	(3.387)
50/10 perc. ratio times highest fifth	-0.004	-0.007	0.055**	0.053**	0.008	0.013	0.068***	0.073***
	(0.109)	(0.165)	(2.520)	(2.428)	(0.203)	(0.320)	(3.163)	(3.362)
Household income		0.006		0.004		-0.011		-0.012*
		(0.876)		(0.594)		(1.635)		(1.706)
Household income squared		-0.000		-0.000		0.000***		0.000***
		(1.530)		(1.346)		(3.021)		(3.065)

Notes: Coefficient on mean regional income and household income multiplied by 10,000. Coefficient on squared household income multiplied by 100,000,000. Stars indicate significance at 10%, 5% and 1% levels. Absolute *t*-values in parentheses.

Table 20: Fixed effects regression on health scores (p9to5 model)

	Men				Women			
Explanatory variable	NUTS 0		NUTS 1		NUTS 0		NUTS 1	
Mean income	0.294***	0.292***	0.163***	0.161***	-0.034	-0.031	-0.057	-0.055
	(6.229)	(6.191)	(3.931)	(3.896)	(0.735)	(0.684)	(1.427)	(1.372)
90/50 perc. ratio times lowest fifth	0.284***	0.285***	0.016	0.018	0.264***	0.262***	0.079**	0.076**
	(5.129)	(5.148)	(0.475)	(0.514)	(4.850)	(4.807)	(2.389)	(2.302)
90/50 perc. ratio times second fifth	0.265***	0.266***	-0.003	-0.002	0.252***	0.252***	0.067**	0.066**
	(4.788)	(4.795)	(0.083)	(0.065)	(4.632)	(4.619)	(2.031)	(1.995)
90/50 perc. ratio times third fifth	0.257***	0.256***	-0.011	-0.011	0.259***	0.260***	0.074**	0.074**
	(4.629)	(4.624)	(0.313)	(0.315)	(4.754)	(4.766)	(2.226)	(2.234)
90/50 perc. ratio times fourth fifth	0.251***	0.249***	-0.017	-0.018	0.251***	0.253***	0.065**	0.067**
	(4.518)	(4.496)	(0.492)	(0.518)	(4.597)	(4.639)	(1.967)	(2.027)
90/50 perc. ratio times highest fifth	0.246***	0.243***	-0.021	-0.024	0.247***	0.253***	0.062*	0.067**
	(4.431)	(4.372)	(0.619)	(0.690)	(4.536)	(4.630)	(1.854)	(2.009)
Household income		0.006		0.005		-0.011		-0.011*
		(0.860)		(0.812)		(1.620)		(1.669)
Household income squared		-0.000		-0.000		0.000***		0.000***
		(1.515)		(1.488)		(3.016)		(3.043)

Notes: Coefficient on mean regional income and household income multiplied by 10,000. Coefficient on squared household income multiplied by 100,000,000. Stars indicate significance at 10%, 5% and 1% levels. Absolute t-values in parentheses.