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Thank goodness for stickiness: Unravelling the evolution of income-related health inequalities before and after the Great Recession in Europe

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ABSTRACT

The Great Recession in Europe sparked concerns that the crisis would lead to increased income related health inequalities (IRHI). Did this come to pass, and what role, if any, did government transfers play in the evolution of these inequalities? Motivated by these questions, this paper seeks to (i) study the evolution of IRHI during the crisis, and (ii) decompose these evolutions to examine the separate roles of government versus market transfers. Using panel data for 7 EU countries from 2004 to 2013, we find no evidence that IRHI persistently rose after 2008, even in countries most affected by the crisis. Our decomposition reveals that, while the health of the poorest did indeed worsen during the crisis, IRHI were prevented from increasing by the relative stickiness of old age pension benefits compared to the market incomes of younger groups. Austerity measures weakened the IRHI reducing effect of government transfers.

Introduction

It is well known that those with higher incomes enjoy longer and healthier lives than those with lower incomes. Such inequalities are widespread and persistent; they exist across virtually all contexts, measures of health and socioeconomic status. A renewed focus on inequalities has culminated in calls from both the Center for Disease Control in the US and the European Commission to reduce disparities in health (CDC, 2013; European Commission, 2009a).

Part of this renewed focus on health inequalities may be attributable to the Great Recession. In the wake of this crisis, EU policy makers expressed concerns that socioeconomic disparities in health would be exacerbated, i.e. that the health and socioeconomic status of the most vulnerable members of society might be disproportionally hit (European Commission, 2009a).[1] Despite these

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[1] In 2009, for instance, the European Commission warned that *"the current economic crisis can (. . .) increase health inequalities through a deterioration of social determinants of health, especially for those with lower qualifications and savings, and who are already vulnerable"* (European Commission, 2009b, 14).

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concerns, and the justified alarm about the potential for deepened disparities, comprehensive cross-country evidence on changes in the distribution of health by income before, during and after the crisis is lacking.[2]

Additionally, evidence is also lacking on the relative importance of (changes in) different income sources for (changes in) income-related health inequalities (IRHI).[3] We distinguish between the two most important sources of income: market incomes (like wages), and government transfers (like old-age and unemployment benefits) and separate their influence on IRHI. Changes in these different income sources have plausibly differing IRHI consequences. Firstly, because their distribution across age and health groups differs, and secondly, because they tend to vary in opposite directions in times of recession and growth. For instance, Jenkins et al. (2012) show that between 2007 and 2009, households in the countries most affected by the crisis increasingly relied on income from social benefits and government transfers, claiming that "*protection of household incomes against the collapse of economic activity during the Great Recession (GR) was largely provided by the government*" (p14).

The distinction between market and government transfers is also important because of its implications for policy; governments are able to manipulate transfer payments more directly than, for example, wages. The crisis induced heterogeneous labor market effects across nearly all European countries and governments responded with a variety of austerity measures, primarily relating to unemployment and pension benefits. If there is a distinct role of transfer income for IRHI changes, then it is important to shed light on some of the —possibly unintended —IRHI consequences that policies governing these transfers may have had.

The aim of this paper is to address these gaps in the literature. Our contributions are fourfold. First and foremost, we present a novel decomposition method that seeks to identify the very different roles played by government transfers and market earnings for the evolution of IRHI. Secondly, we use comparable longitudinal data to document trends in IRHI in 7 European countries between 2004 and 2013 – both before and after the financial crisis. Third, by means of the decomposition, we unravel the most important drivers of IRHI trends pre- and post-crisis. Lastly, we provide descriptive evidence on the role that the austerity measures enacted in Greece have had on IRHI.

We add to the literature using concentration index-type measures to compare health inequalities by income across countries (Van Doorslaer et al., 1997; Van Doorslaer and Koolman, 2004). These and other European comparative studies report substantial pro-rich inequalities in health in Europe. Descriptive decomposition methods have been used to explain how such inequalities evolve over time within countries – the phenomenon of interest here. Allanson et al. (2010) develop and apply the most general such decomposition by separating changes in IRHI into those due to changes in the ranking variable, and those due to changes in the health variable. However, this approach does not allow for a more detailed investigation of the drivers of IRHI such as the separate roles of government and market transfers, or health and income variation across age, gender and place.

By imposing further structure a finer dissection of the changes in IRHI is possible. For instance, in a study of IRHI evolution in Europe in the 1990s, Van Ourti et al. (2009) employ an extended decomposition to investigate under what conditions income growth can lead to a reduction of IRHI. Baeten et al. (2013) make a further distinction between IRHI changes stemming from income and non-income factors in China in the 1990s and 2000s. A similar approach is taken by Coveney et al. (2016), who study IRHI changes in Spain between 2004 and 2012. They find that IRHI was primarily driven by the income position of the relatively unhealthy elderly groups, who tended to move down (up) the income ladder in "good" (bad) economic times.

While the findings of Coveney et al. (2016) hint at the distinct roles played by government transfers versus income from labour, the methods used did not explicitly separate their roles for IRHI evolution. Motivated by this, we derive a new decomposition method that explicitly incorporates this distinction. Further, studying a range of European countries with differing levels of exposure to the crisis as well as a range of different transfer policies provides further insights into the determinants of trends in IRHI.

We also address a limitation faced by many previous decomposition studies where an ordinal SAH measure - often the only measure of overall health available in cross-country panel datasets with sufficiently good income information - must be transformed into a ratio-scale measure. The usual approach is to use an interval regression to generate a deterministic ratio-scale health measure, and to use the estimated partial associations between the covariates - including income - and the underlying latent health variable to split IRHI changes stemming from income and non-income factors. However, the deterministic health measure will naturally miss some variation in the underlying ordinal SAH health variable, and changes in the income distribution codetermine the predicted change in IRHI. Instead we propose a two-step procedure where we first predict a ratio-scale measure that is conditional on the underlying SAH category but not income, and next use it to decompose IRHI. This overcomes both limitations and explicitly accounts for the health changes (and how they differ by income) that are not captured by the regression model used in our decomposition method.

We do not aim to add to the literature that started with Ruhm (2000), linking health and economic conditions, aiming to identify a causal effect of the crisis or income on health. Rather, our decomposition illustrates and unravels the association between income and health, and thus

[2] Ásgeirsdóttir and Ragnarsdóttir (2013) study differences in IRHI for 26 European countries in 2007. However, this cross-sectional approach is uninformative about the evolution of IRHI before, during and after the crisis.

[3] We estimate IRHI using disposable household income corrected for household composition. Estimates of IRHI might differ when other indicators of socioeconomic status are used. We refer to Wagstaff and Watanabe (2003); Van Ourti (2003); Lindelow (2006) and Frick and Ziebarth (2013) for more details.

IRHI, before and after a recession. Our approach also differs from the cross-country comparisons of Mackenbach et al. (1997; 2008; 2018, among others), which document levels and trends in socio-economic inequalities in health (mostly education- and occupation-related) for a large cross section of European countries. Our approach of following cohorts over time has the additional advantage that one can distinguish between healthy/unhealthy individuals moving up or down the income ladder, and poorer individuals facing worse/better health prospects than richer individuals.[4] Tracing both of these movements is essential to understanding the evolution of IRHI, and to identify appropriate policy levers to mitigate the IRHI consequences of economic downturns. For example, public health insurance programs may protect the poor from health decline, while programs such as disability insurance protect the (relative) incomes of those in poorer health.

Our findings are as follows. First, we do not find any lasting IRHI increases since the start of the Great Recession, even in countries that were severely affected by the crisis. Documenting annual IRHI changes across 7 European countries between 2004 and 2013, we find that these inequalities tended to remain at their pre-crisis level in the years following the onset of the recession, even while economic conditions worsened. Before the crisis, a time of relatively steady economic growth in Europe, IRHI was on average relatively flat, though it rose significantly in some southern countries such as Greece and Italy.

Second, our decomposition of these changes reveals that the flat post-crisis trend in IRHI can largely be attributed to two factors working in opposite directions. First, in the post-crisis period poorer individuals began to report worsening health. This led to an upward pressure on IRHI. Secondly, and simultaneously, the relative income position of the elderly tended to improve, as their incomes were mainly based on much stickier government transfers (pensions) that were relatively unaffected by the crisis. As the elderly tend to be in relatively lower health this had a downward pressure on IRHI. The crucial dampening role played by pensions has ensured that no substantial rise in IRHI has occurred as a result of the Great Recession in many EU countries.

Third, we find that differences in household structures across countries have IRHI implications. Namely, the IRHI reducing effect of pensions is limited in countries where the young tend to stay at home longer, and thus share the pension incomes of their elderly relatives.

Fourth, we show that the austerity measures enacted in Greece in 2010 and 2011 – which included pension reforms - appears to have undermined the IRHI dampening effect of government transfers. This occurred due to the fact that the austerity measures reduced the redistributive effect of transfers, especially pensions.

[4] Kreiner et al. (2018), for instance, demonstrate that the income gradient of life expectancy in Denmark and the US is halved if account is taken of income mobility over time.

Decomposition of changes in income-related health inequality

Our decomposition builds on methods developed by Van Ourti et al. (2009), Allanson et al. (2010) and Baeten et al. (2013). In this section we describe the approach for a balanced cohort of n individuals that we observe at the start (period 1) and end (period T) of a given time interval.

Health inequality measurement

To measure health inequalities we use the corrected concentration index (CCI) (Erreygers, 2009) which satisfies the principle of income-related health transfers, the mirror condition – i.e. that SES-health distributions should be ranked similarly when health is expressed as attainment or shortfall – and is insensitive to equal health additions (absolute inequality) (Erreygers and Van Ourti, 2011). When health is bounded between 0 and 1, the index can be written as:

$$CCI\left(h_t y_t\right) = \frac{8}{n^2}\sum_{i=1}^{n} z_{it} h_{it} \tag{1}$$

where h_t and y_t are the health and income distribution in period $t = (1, \ldots, T)$, h_{it} describes the health level of individual i which we assume is measured on a ratio scale and nonnegative. z_{it} is a weight that depends linearly on the income rank of individual i in period t with individuals ranked from poor $(i = 1)$ to rich $(i = n)$, i.e. $z_i = (2i - n - 1)/n$. This income weight takes the value 0 for the individual with median income, and increases linearly with income rank.

Changes in IRHI

Our interest lies in monitoring changes in IRHI. Taking the change in the *CCI* between period 1 and the final period T, we obtain:

$$CCI\left(h_T y_T\right) - CCI\left(h_1 y_1\right) = \frac{8}{n^2}\left[\sum_{i=1}^{n} z_{iT} h_{iT} - \sum_{i=1}^{n} z_{i1} h_{i1}\right] \tag{2}$$

Eq. (2) masks that there are two underlying drivers of changes in IRHI, i.e. changes in income ranks and changes of health over time. Both changes can be isolated after rewriting Eq. (2) following the logic used in Allanson et al. (2010):

$$CCI\left(h_T y_T\right) - CCI\left(h_1 y_1\right) = \frac{8}{n^2}\sum_{i=1}^{n}\left[\left(z_{iT} - z_{i1}\right) h_{iT} + z_{i1}\left(h_{iT} - h_{i1}\right)\right] \tag{3}$$

Eq. (3) shows that the change of IRHI equals the sum of health-related income mobility (first term) and income-related health mobility (second term). Health-related income mobility focuses on changes in the income distribution and measures the extent to which those that move up or down the income ladder $(z_{iT} - z_{i1})$ end up with good health in the final period (h_{iT}). Since health is nonnegative, health-related income mobility will be positive (negative)

when individuals with better health climbed (descended) the income ladder. Instead, income-related health mobility focuses on the health dimension and reveals whether health gains or losses ($h_{iT} - h_{i1}$) are concentrated among initially richer or poorer subgroups (z_{i1}). Both aspects are essential to understanding the change of IRH[5] .

Decomposition of IRHI changes

However, Eq. (3) is uninformative about the separate roles of different income sources for the change in IRHI, which is the primary aim of our analysis. To address this, in contrast to previous decompositions (Van Ourti et al., 2009; Allanson et al., 2010; Baeten et al., 2013), we break total income (y_{it}) down as the sum of market incomes (y_{it}^M) and government transfers (y_{it}^G), i.e. $y_{it} = y_{it}^M + y_{it}^G$.[6] Income weights can then be defined separately for each source. Weights associated with total income (z_{it}) and market income (z_{it}^M) are defined in the standard way described above, while the income weight associated with transfers is defined as the difference between an individual's total income rank and market income rank, $z_{it}^G = z_{it} - z_{it}^M$, such that it measures the number of steps on the income ladder that separate total from market income, and therefore does not depend on the rank of y_{it}^G. Substituting the change in total income weights ($z_{iT} - z_{i1}$) in Eq. (3) by the change of income-source specific income weights allows describing the role of income re-ranking (health-related income mobility) separately for each income source:

$$CCI(h_T|y_T) - CCI(h_1|y_1) = \frac{8}{n^2}\sum_{i=1}^{n}[(z_{iT}^M - z_{i1}^M)h_{iT} + (z_{iT}^G - z_{i1}^G)h_{iT} + z_{i1}(h_{iT} - h_{i1})] \quad (4)$$

The first term measures whether those ending up with good health in period T are more or less likely to move up or down the market income ladder compared to those ending up with worse health. The second term portrays the association between the de-/increase of the equalizing effect of government transfers, i.e. the change in the number of steps on the income ladder between market and total income, and final period health. The third term is identical to the second term in Eq. (2), i.e. it measures health-related total income mobility.[7]

While this extension of the Allanson et al. (2010) decomposition is informative about how the separate income sources influence IRHI evolution via re-ranking changes, it is silent about the distinct role played by factors such as age, gender, region or income that are associated with health. Since – to take one example – transfer and market incomes are distributed differently across various age groups, such a distinction is likely to be important in tracing out their distinct roles.

Following Van Ourti et al. (2009) and Baeten et al. (2013), we address this with a simple descriptive model that links health linearly and additively to its associated factors:[8]

$$h_{it} = \alpha + \theta(y_{it}) + \sum_{j=1}^{k} x_{jit}\beta_j + \varepsilon_{it} \quad (5)$$

where α is an intercept parameter; $\theta(y_{it})$ is a non-linear function of income; there are K non-income variables x_{jit} with $j = 1, \cdots, K$ (in our analysis, these are a set of age-sex and region dummies), β_j are the associated parameters reflecting partial associations, and ε_{it} captures the residual which has a zero mean. As the exact functional form for $\theta(.)$ pre-determines the sign and magnitude of some parts of our decomposition, we adopt a flexible functional form in the empirical application.

Combining Eqs. (4) and (5) shows that the change in IRHI can be expressed as the sum of 4 terms:[9]

$$CCI(h_T|y_T) - CCI(h_1|y_1) = \frac{8}{n^2}\sum_{i=1}^{n}\{\underbrace{(z_{iT}^M - z_{i1}^M)\sum_{j=1}^{k} x_{jiT}\beta_j}_{market-related\ \ income\ \ mobility} + \underbrace{(z_{iT}^G - z_{i1}^G)\sum_{j=1}^{k} x_{jiT}\beta_j}_{transfer-related\ \ income\ \ mobility} + \underbrace{z_{i1}\sum_{j=1}^{k}\beta_j(x_{jiT} - x_{ji1})}_{ageing\ \ and\ migration} + \underbrace{z_{iT}[\theta(y_{iT}) + \varepsilon_{iT}] + z_{i1}[\theta(y_{i1}) + \varepsilon_{i1}]}_{other}\} \quad (6)$$

The first 2 terms are similar to the income-source specific health-related income mobility terms in Eq. (4), except that income re-ranking is weighed by non-income related health in the last period.[10] Both *market-related* and *transfer-related* income mobility are more positive (neg-

[5] Brekke and Kverndokk (2014) have shown that income redistribution among two equally healthy individuals might increase the concentration index when health is, on average, positively correlated with income. This is because such income transfers increase the concentration of good (bad) health among the rich (poor), even though they do reduce income inequalities and leave the marginal health distribution unaffected. This effect is picked up by the health-related income mobility term.

[6] In line with the literature on the redistributive effect of government transfers (Plotnick, 1981; Lambert, 2001), we interpret market incomes as the incomes that would apply in the absence of government transfers.

[7] While conceptually feasible, we do not consider the income-source-specific contributions to income-related health mobility, i.e. $z_{i1}^M(h_{iT} - h_{i1}) + z_{i1}^G(h_{iT} - h_{i1})$, since these refer to the income positions in the first period, and therefore are not informative on the income dynamics between period 1 and 2. In contrast, health-related income mobility considers these dynamics, and hence informs on the evolution of the inequality reducing impact of government transfers, and its association with second period health levels.

[8] An additional assumption is that there is no structural change in the health equation across periods. In the empirical section we test and do not reject this hypothesis.

[9] Note that $\left(z_{iT}^M - z_{i1}^M\right)\left[\theta(y_{iT}) + \varepsilon_{iT}\right] + \left(z_{iT}^G - z_{i1}^G\right)\left[\theta(y_{iT}) + \varepsilon_{iT}\right] + z_{i1}\left[\theta(y_{iT}) + \varepsilon_{iT} - \theta(y_{i1}) - \varepsilon_{i1}\right] = z_{iT}\left[\theta(y_{iT}) + \varepsilon_{iT}\right] + z_{i1}\left[\theta(y_{i1}) + \varepsilon_{i1}\right]$.

[10] Non-income related health equals $E(h_{it}x_{1it}, \cdots, x_{Kit}) = \alpha + E\left[\theta(y_{it})\right] + \sum_{j=1}^{k} x_{jit}\beta_j + E[\varepsilon_{it}]$, but is simplified to $\sum_{j=1}^{k} x_{jit}\beta_j$ since

ative) when upwardly (transfer/market) income mobile individuals have better (worse) non-income related health in period T. Note that if the non-income variables consist of multiple variables that enter the health equation additively, then the mobility terms comprise a summation of different sub-terms. This holds, for example, if one uses a set of age-sex and region dummies as we do. This allows us to separate the aggregate mobility effect into the contribution per age-group and region category. Summing the total *transfer* and *market* mobility terms gives the *total* income mobility.

Between periods, individuals may change between age and region categories. This is captured by the *ageing and migration* term. It indicates how mobility in non-income related health, due to its association with initial income weights, has led to changes in IRHI. As ageing and within-country migration may have consequences for health, the degree to which they are associated with income ranks may affect IRHI. This term mainly acts as a control, allowing us to study changes in IRHI net of ageing and migration effects.

The final *other* term captures the change in IRHI that is unrelated to the non-income factors. Since we included age, gender and region in Eq. (5), this corresponds to the change in IRHI that remains after accounting for these variables.

It is possible to make a further distinction between income-predicted health gains, $\theta(y_{it})$, and health residuals, ε_{it}. Given that transfer and market incomes may contribute differently to IRHI via the non-linear function linking health and income, we believe that this distinction between $\theta(y_{it})$ and ε_{it} is *a priori* interesting. This allows us to arrive at our final decomposition:[11]

$$
\begin{aligned}
CCI(h_T \mid y_T) - CCI(h_1 \mid y_1) = \frac{8}{n^2}\sum_{i=1}^{n}\{ & \underbrace{(z_{iT}^{M} - z_{i1}^{M})\sum_{j=1}^{k} x_{jiT}\beta_j}_{market-related\ income\ mobility} \\
+ & \underbrace{(z_{iT}^{G} - z_{i1}^{G})\sum_{j=1}^{k} x_{jiT}\beta_j}_{transfer-related\ income\ mobility} \quad \underbrace{+ z_{i1}\sum_{j=1}^{k}\beta_j(x_{jiT} - x_{ji1})}_{ageing\ and\ migration} \\
& + \underbrace{z_{iT}^{M}\theta(y_{iT}^{M}) - z_{i1}^{M}\theta(y_{i1}^{M})}_{market-related\ inequality\ \Delta} + \underbrace{[z_{iT}\theta(y_{iT}) - z_{iT}^{M}\theta(y_{iT}^{M})] + [z_{i1}\theta(y_{i1}) - z_{i1}^{M}\theta(y_{i1}^{M})]}_{transfer-related\ inequality\ \Delta} \\
& + \underbrace{\varepsilon_{iT}(z_{iT} - z_{i1})}_{error\ rank\ change} + \underbrace{z_{i1}(\varepsilon_{iT} - \varepsilon_{i1})}_{error\ residual\ change} \Bigg\}
\end{aligned}
\tag{7}
$$

The first 3 terms are identical to those in Eq. (6) and the sum of the last 4 terms corresponds to the *other* term. *Market-related inequality change* measures the consequences for IRHI of the change in the distribution of market incomes. $\theta(y_{iT}^{M})$ denotes the predicted health level in the last period that corresponds to y_{iT}^{M}.[12] The product $z_{iT}^{M}\theta(y_{iT}^{M})$ therefore measures market-related inequality in the income-predicted health levels. This is simply the CCI for market income related health in the second period. The second product in the expression is identical, but refers to the first period. The difference between these two corrected concentration indices therefore captures how changes in the distribution of market incomes between the two periods were associated with changes in IRHI, both by their association with health through the $\theta(.)$ function, and via the re-ranking of individuals on the market income scale. For a monotonically increasing $\theta(.)$ function, *market-related inequality change* will indicate rising (falling) IRHI when the rich (poor) predominantly experience income improvements (deteriorations).

The next expression is the *transfer-related inequality change*. The term $\left[z_{iT}\theta(y_{iT}) - z_{iT}^{M}\theta(y_{iT}^{M})\right]$ captures the degree to which transfer incomes change the association between income weight and income-predicted health in the last period. In other words, this term captures the degree to which the addition of transfers to second-period market incomes results in a more (or less) equal distribution of income predicted health by income rank.[13] The second term measures this effect in the first period. Both terms thus reflect whether transfer incomes result in a more or less equal distribution of income-related health, or the extent of the redistributive effect of transfer incomes in the separate periods. Their difference indicates how this effect has changed over time, and its consequence for the evolution of IRHI. Summing *market-related inequality change* and *transfer-related inequality change* gives the change in the CCI for total income-related health between periods 1 and T.

The residuals in our simple descriptive health model (Eq. 5) capture health that is neither accounted for by the income function nor by the set of age-sex and region dummies. If the association between this residual and the income ranks changes between the two periods, this has implications for IRHI which are captured by the last two terms in Eq. 7. The first, *error rank change,* describes how the change in income ranks between the two periods is associated with residual health in the last period. The second error term, *error residual change*, describes whether the initially poor versus rich experience the largest changes in their residual health levels. Indirectly, the sum of the last two terms ($z_{iT}\varepsilon_{iT} - z_{i1}\varepsilon_{i1}$) allows us to trace the consequences of unexplained health changes for IRHI.

Empirical analysis

Data

We use the European Union *Survey on Income and Living conditions* (EU-SILC), a European-wide survey designed primarily to collect labour and income related data. It is well suited to our analysis for several reasons. First, it provides a detailed breakdown of the sources of disposable household income, which is crucial to measuring the sep-

CCI is an absolute inequality index, $E[\varepsilon_{it}] = 0$ and $\alpha + E\left[\theta(y_{it})\right]$ is constant.

[11] We have confirmed that the 4 terms in equation (6) are virtually invariant with respect to in- or exclusion of the income term $\theta(y_{it})$ in equation (5). The results are available from the authors upon request.

[12] Strictly speaking these are not health levels, but the same reasoning as in footnote 11 applies.

[13] For instance, note that if government transfers do not exist (i.e. $y_{iT}^{M} = y_{iT}$) this term will equal zero.

arate effects of government transfers and market income on IRHI trends. Secondly, individuals are asked to rate their self-assessed health (SAH), which is used to construct our health measure.

Our selection of countries is based on data availability and quality in the EU-SILC. We require that countries have adequate income and health data for the whole 2004–2013 period. Table A1 in the appendix provides an overview on the available information for the 29 EU-SILC countries and the selection criteria used for inclusion. This leaves us with the following 7 countries: Austria, Belgium, France, Greece, Italy, Portugal, and Spain.[14] We define a subset of these as crisis countries – those countries most severely affected by the crisis. Specifically, we apply this label to the countries in our sample that have been noted by the OECD as having suffered worse-than-average GDP declines as well as public spending cuts as a result of the crisis (OECD, 2012); Greece, Italy, Portugal, and Spain. Our own data also confirms that employment and household income trends after 2008 faired much worse in the latter four countries than the remaining countries in our sample (see figures B1 and B2).

The EU-SILC is a rotating panel. A new random sample (referred to as a rotation group) is drawn every year, followed for 4 years and then dropped. Therefore, at any point, each country has 4 concurrent panel samples. There are 7 rotation groups in our study period, i.e. 2004–2007, . . ., 2010–2013. We use balanced data from all 7 rotation groups to estimate our model for health (Eq. 5).[15],[16] Table 1 provides numbers of individuals (each observed for 4 years) per rotation group and country. Due to changes in data collection methods, the income data for France from 2009 onwards are not comparable to earlier waves. We therefore ignore the 2007–2010 period for France.[17]

Table shows for each rotation group the period spanned and the number of individuals observed for the whole 4 year period for each country.

Income measurement

The EU-SILC provides, per person and household, a detailed breakdown of the components of annual household income. We separate total income into what we term *market* income and *transfer* income. An individual's market income is defined as the equivalized value of disposable household income before all social transfers, and transfer income as the equivalized value of the sum of all household social transfers.[18] The income reference period is the previous calendar year. Table 2 lists the EU-SILC components that make up household market and transfer income.

Public pensions form the largest share of transfer income, and employee income (income from work) for market incomes.[19] When using the term "pensions" we are referring to what EU-SILC terms "old age" benefits. These include the collection of all social payments to the elderly that are designed to provide a replacement income when a person retires or has reached a certain age.[20]

Health measurement

Individuals are asked: "*How is your health in general? Is it: (1) very good, (2) good, (3) fair, (4) bad, (5) very bad?*". We cannot directly use this variable since the *CCI* requires a ratio-scaled health measure (Erreygers and Van Ourti, 2011). In order to transform the ordinal SAH measure in EU-SILC to a ratio-scaled measure, we perform an interval regression with the threshold values imposed from external data.[21] Covariates included are age/sex dummies, region dummies, a set of education dummies, and an indicator for the presence of a chronic illness. This set of predictor variables is parsimonious, yet is strongly associated with health.

We use the interval regression predicted health in our decomposition analysis, but *conditional on the SAH category reported* by the respondent. This implies that the reported SAH category determines the thresholds within which the predicted ratio-scaled health measure will lie, while the covariates determine the exact value of the measure within these thresholds.[22] Conditioning on both

[14] Our selection criteria is that a country is represented in all 7 rotation groups. Furthermore, although many of the Nordic countries – Finland, Iceland and Sweden – are present in all rotation groups, their use of register-based data collection methods leads to many missing values of the SAH variable raising concerns of attrition bias. Sample sizes in some of these countries are too low for reliable analysis. For instance, there are only 13 women above the age of 75 in the 2004 sample in Iceland.

[15] We symmetrically drop the top and bottom 1% of total incomes to remove potential outliers.

[16] Our restriction to balanced panels excludes the possibility of attrition bias. However, trends of IRHI computed when using all data, not just a balanced panel – are extremely similar to those we find here, suggesting attrition bias is not driving our results.

[17] The data collection method for certain components of income in France, namely "*interest, dividends and profit from capital investments in unincorporated business*", went from being survey-based to register-based in 2009. The average value of this component increased by almost €3,000, and led to a dramatic rise in average incomes. It is not possible to distinguish between "real" increase in the component and inflation due to more accurate collection methods.

[18] Household equivalent income equals household income divided by the square root of the number of individuals living in the household in the current period.

[19] See Table A2.

[20] Old age benefits includes public pension payments, care allowances, disability cash benefits, lump sum payments at the time of retirement and other cash benefits. It does not include any payments from *private* pension plans, which enter the market income definition. Disability and other payments also appear as a separate category, as this captures these payments when they are afforded to individuals who have not retired. See the EU-SILC guidelines documentation for further details. Our data shows private pensions are not an important part of transfers for these countries. On average across all rotation groups and countries, payment from private plans are less than 1% of old age benefits. Per country, the average fraction of private payments to pension payments is never higher than 3%.

[21] For each country we imposed the identical thresholds from the empirical distribution function of the health utility index in the *Canadian National Population Health Survey* 1994-1995 (Van Doorslaer and Jones, 2003).

[22] This precludes, for instance, a situation where individuals with identical covariates but different levels of SAH are assigned identical health. More formally, the prediction conditional on the SAH category equals $E\left(h^* z_i, a_{j-1} \leq h^* \leq a_j\right)$ where h_i^* represents the latent health variable, z_i is a vector with covariates and a_j with $j = 1, \ldots, 5$ are the SAH thresholds imposed from external data. Consider equation (8) in Van Doorslaer and Jones (2003) for more details.

Table 1
Individuals per rotation group and country in EU-SILC dataset.

Rotation group	1	2	3	4	5	6	7
Period	2004-2007	2005-2008	2006-2009	2007-2010	2008-2011	2009-2012	2010-2013
Observations							
Austria	2,287	1,919	1,901	1,893	1,881	2,199	2,161
Belgium	1,102	1,713	1,749	1,828	1,624	1,746	1,875
Greece	2,152	2,021	2,418	2,148	2,655	2,368	2,182
Spain	3,805	4,438	4,631	5,143	5,188	4,841	4,245
France	1,417	2,281	2,324	2,321	2,358	2,266	2,284
Italy	7,947	7,531	7,219	7,286	6,293	5,378	4,715
Portugal	1,568	1,425	1,470	1,672	1,748	2,089	2,125

Table 2
Income components of transfer and market incomes.

Transfer income	Market income
• Unemployment benefits	• Gross employee cash or near cash income
• Old-age benefits	• Company car
• Survivor benefits	• Gross cash benefits or losses from self-employment
• Sickness benefits	• Pensions received from individual private plans
• Disability benefits	• Income from rental of a property or land
• Education-related allowances	• Regular inter-household cash transfers received
• Family/children related allowances	• Returns from unincorporated business
• Social exclusion not elsewhere classified	• Income received by people aged under 16
• Housing allowances	
	Minus
	• Regular taxes on wealth
	• Regular inter-household cash transfer paid
	• Tax on income and social insurance contributions

Table shows the makeup for our definitions of *Transfer* and *Market* incomes as used in the EU-SILC survey.

the SAH category, as well as the individual covariates, leads to a more informative prediction of the unobserved health measure compared to only conditioning on covariates (Van Doorslaer and Jones, 2003). In addition, excluding income from the covariates avoids a mechanical relationship between the predicted health measure and income, which would predetermine the evolution of IRHI. The interval regression is performed per country, pooling all rotation groups. The regression results for each country are shown in the appendix, in table A3.[23]

Implementation of decomposition

The decomposition is performed separately for each country but, importantly, does not use the estimates of the interval regression. Instead, we estimate our simple explanatory OLS model for health (Eq. 5) by pooling all rotation groups for country *c*, and using the interval regression-predicted health variable described above as the dependent variable and as covariates only age-gender, region and income, not education or chronic conditions (see table A4). This regression provides the non-income and income coefficients, and residuals used in the decomposition (Eq. 7) for country *c*.

We then take 3 rotation groups (2004–2007, 2007–2010, 2010–2013), and calculate and decompose the change in the *CCI* from the first year (the base year) for country *c*.[24] We only present the decomposition with respect to the last year of the rotation group because intermediate decompositions are similar in sign and relative magnitude within rotation groups.[25] In order to allow for statistical inference on IRHI levels, IRHI changes and the decomposition terms, we bootstrap the entire procedure 1500 times, including the interval regression.

Results and discussion

This section first examines the general trends in IRHI in the 7 countries under study between 2004 and 2013. We then separately study the role of the *mobility, health inequality*, *ageing and migration*, and the *error change* terms in IRHI changes before and after the financial crisis in 2008. Finally, the role of the austerity measures enacted in Greece on IRHI is explored.

IRHI trends across 7 European countries

Fig. 1 shows how IRHI, as measured by the *CCI* and calculated using predicted health, has evolved between 2004

[23] The average value of this health variable is shown per country and rotation group in figure A1.

[24] We also estimated the OLS (and the underlying interval regression) models separately for each of the three rotation groups as the partial associations between the covariates and the dependent variables might have changed due to the Great Recession. The resulting decomposition estimates, available upon request from the authors, confirm that the assumption of no structural change imposed in the main results is reasonable.

[25] An exception is Greece in the 2010-2013 decomposition, which we explore in more detail below. The full decomposition results per comparison and per rotation group are available upon request.

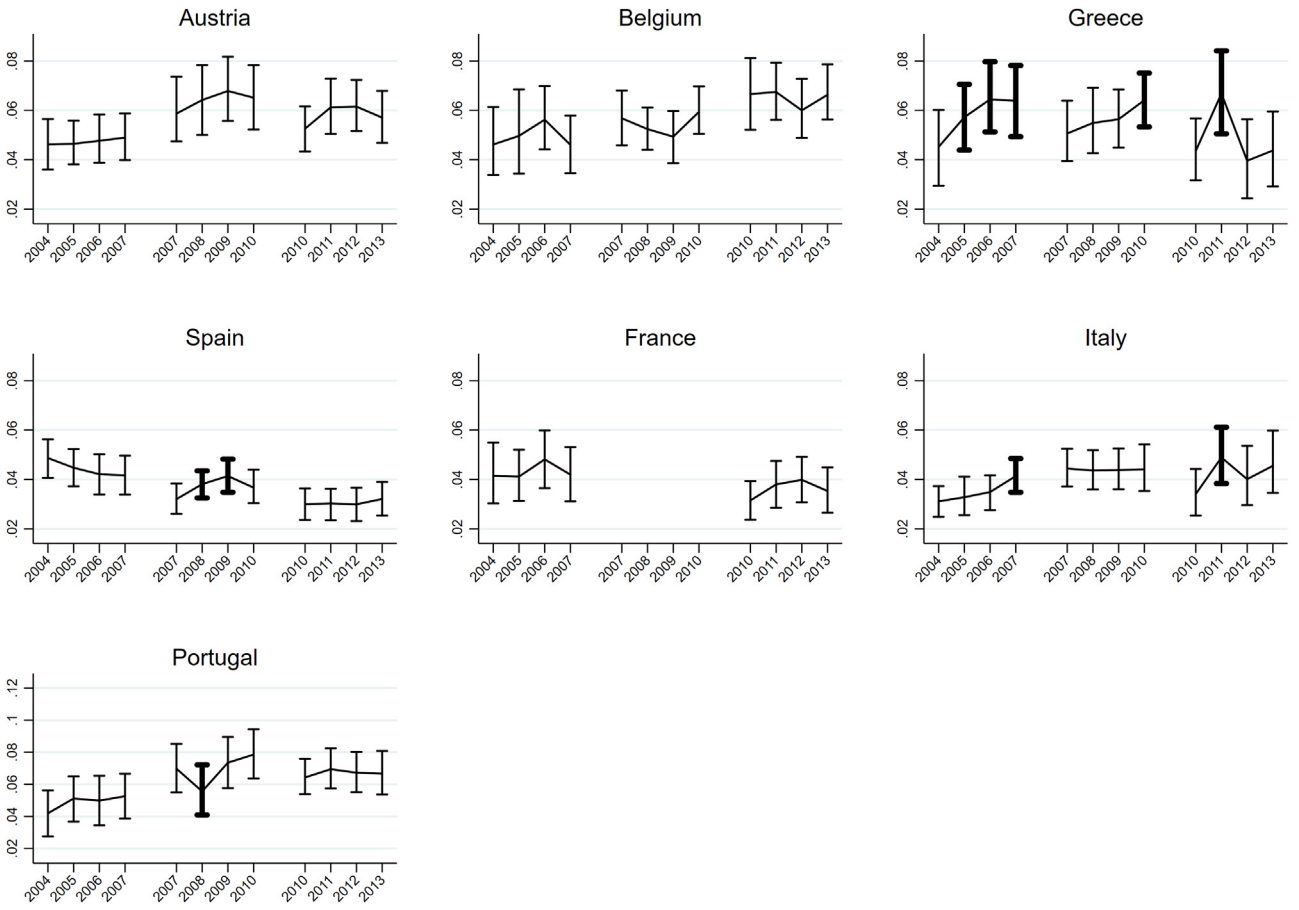

Fig. 1. IRHI trends: CCI in each year.
Figure shows, for each country, CCI per year, per rotation group, with 95 % confidence interval. Note the different scale of Portugal. Bold bars indicate years in which difference in CCI compared to base year is statistically significant ($p < 0.05$). Y-axis: value of the CCI. See Eq. (1) for the relevant formula. No comparable data for France for 2007–2010 (c.f. footnote 18).

and 2013 for the 7 countries under study.[26] The separate lines represent the three rotation groups used to span the period. While the confidence intervals in Fig. 1 are informative about the sampling variability of the yearly point estimates of IRHI, our interest lies in examining the *changes* of IRHI between different periods. It is therefore useful to know if the changes in IRHI with respect to the base year are statistically significant, which is indicated by the bold bars.[27]

We note both geographical and time patterns in the IRHI trends. IRHI evolution in the non-crisis countries (Austria, Belgium, France) was remarkably flat in all three rotations groups, in stark comparison to the more volatile trends in the crisis countries (Greece, Italy, Portugal, Spain). However, for no country did IRHI significantly change when comparing 2013 to 2010.

We distinguish between 3 different periods in our analysis based on the economic growth of the different countries (see appendix B). Following Jenkins et al. (2012), we consider the 2004–2007 period to be the *pre-crisis period*; a time of relatively normal growth for the 7 countries. We term the rotation group spanning 2007–2010 the *crisis period*. Finally, the *post-crisis* rotation period (2010–2013) is when consequences of the Great Recession are most obvious in crisis countries, while large effects for household income, inequality and employment are absent for the non-crisis countries.

We do not find particular differences in post-crisis IRHI trends between the crisis and non-crisis countries. Despite temporary jumps in Italy and Greece, there is no country where IRHI levels in 2013 significantly exceed those of 2010. The decomposition in the next section is motivated by this finding: why – despite initial concerns – did IRHI not significantly rise after the Great Recession, not even in the countries most heavily affected by the crisis? We will focus on the pre-crisis (2004–2010) and post-crisis (2010–2013) periods, as these periods encapsulate clear phases of economic growth or decline for most countries, while the crisis

[26] Our focus is on absolute income related health inequalities. However, figure A2 in the appendix shows that relative income-related health inequalities have evolved similarly over the same period.

[27] We do not check the statistical significance of changes across rotation groups since we only observe the same set of individuals over a period of 4 years.

period (2007–2010) often includes mixed periods of both (see appendix B).

Decomposition results

Figs. 2–4 depict the estimated *income mobility*, *inequality change,* and *error change* terms, respectively. The *ageing and migration* term proves to be rather unimportant for explaining IRHI evolution (figure A5). Panels A and B in Fig. 2 show the results for, respectively, the *pre-crisis* and *post-crisis* rotation groups for all countries. The leftmost cluster of bars in panel A shows (in order from left to right) the contribution that *market-related mobility* (black), *transfer-related mobility* (grey) and *total income mobility* (white, and the sum of the previous two terms) had on IRHI changes in Austria between 2004 and 2007. The remaining clusters/panels have a similar interpretation for the different countries and rotation groups. In Fig. 3 each cluster of bars shows, per country, the effect that *market-related inequality change, transfer-related inequality change* and *total inequality change* (sum of the previous two terms) had on IRHI change in that rotation group. Similarly, Fig. 4 shows the *rank change, residual change,* and the *total error* change (sum of the previous two terms).[28]

Both the *mobility* and *error* terms are much larger in magnitude than the inequality terms, and are thus the more important determinants of IRHI change. We explore each set of terms below.

Mobility terms

Fig. 2 reveals that, across countries and periods, *market mobility* tends to be positive and sizable. In comparison – though usually negative – the size and sign of *transfer mobility* is more varied, and therefore it is often this term which leads to differences in the *total mobility* term across country-period comparisons.

Recall that the mobility terms can be further split into per-age/sex groups and per-region contributions (see Eq. 7). Doing so gives an indication of which age/sex group's income movements are influencing the direction of the separate mobility terms, and therefore gives insight into the patterns in Fig. 2. While we do not refer to these more detailed results explicitly in the main text, they underlie much of the following discussion, and can be found in the appendix for each country, mobility term and for both the pre- and post-crisis period.[29]

The reason for the IRHI increasing effect of *market mobility* is that improvements in market incomes mostly help the youngest, and therefore healthiest, groups to climb the income ladder, thereby increasing health disparities by market income. Given the variation in *transfer mobility*, we distinguish between the following patterns.

First, one can distinguish between two types of periods and countries: (i) those in which transfer mobility fully compensates for the increase in IRHI caused by *market mobility*, such as in Austria, Spain and Portugal (pre- and post-crisis), and Italy (post-crisis), and (ii) periods and countries in which transfer mobility is close to zero, such as in Belgium and France (pre- and post-crisis), and Italy (pre-crisis).

Second, *transfer mobility* is positive in Greece pre-crisis. Further decomposition of this terms reveals that this can be attributed to household structure. Rather than pensions solely being enjoyed by the old, younger people in Greece also benefited from the large increase in pension incomes between 2004 and 2007. This is due to young individuals continuing to live at their parent's home, and therefore benefiting from their parent's (or grandparent's) influx in pension income upon the retirement of the elderly members of the household.[30] This increase in transfer income for the young and the just-retired, and to the exclusion of the very-elderly, led to increasing income disparities between the healthy and the unhealthy, and therefore increased IRHI.[31]

Lastly, there is a consistent pattern for the crisis countries post-crisis, whereby *transfer mobility* is large and negative in the final rotation group. In Portugal, for instance, this term "over-compensated" for *market mobility*, and led to decreases in IRHI between 2010 and 2013. This is due to the "stickiness" of pensions relative to income from work – while the crisis led to a significant fall in the incomes of the young, the incomes of elderly (and, on average, unhealthier) pensioners were less affected. This generated a drop in IRHI.

Market and transfer inequality change

The smaller association between income and health relative to the association between age and health (table A4) implies that the *inequality change* terms are small compared to the *mobility* and *error change* terms (Fig. 3). The total *inequality change* terms are very small and not statistically significant. The market and transfer *inequality change* terms tend to be larger than the *total* term, but of opposite sign, still quantitatively unimportant and often statistically insignificant. The positive market terms are the result of wage growth for the employed and a gradual increase of the number of retirees in our panels. By contrast, the transfer-related *inequality change* terms are negative since the redistributive effect of transfers was negative in each year, i.e. market income-related health inequalities ($z_{it}^{M}\theta\left(y_{it}^{M}\right)$) were always larger than total income-related health inequalities ($z_{it}\theta(y_{it})$). The most important government transfer, in term of its redistributive effects, are pensions.[32]

[28] Figures A3-A4 illustrate these terms for the rotation group 2007-2010.

[29] See tables A5-A11. The results per region are supressed as they are small and not important for the decomposition, but available upon request from the authors.

[30] This trend has also received attention in the Greek press, with a 2019 article noting that more than half of Greeks between 25 and 35 still live with their parents – one of the highest rates in the EU (Greek City Times, 2019).

[31] While household structure plays a similar "protective" role for the younger in Italy pre-crisis, this is more strongly compensated by the effect among the very elderly.

[32] We confirm this by repeating our decomposition and redefining *transfer* income to only include income from "old age benefits" and "survivor

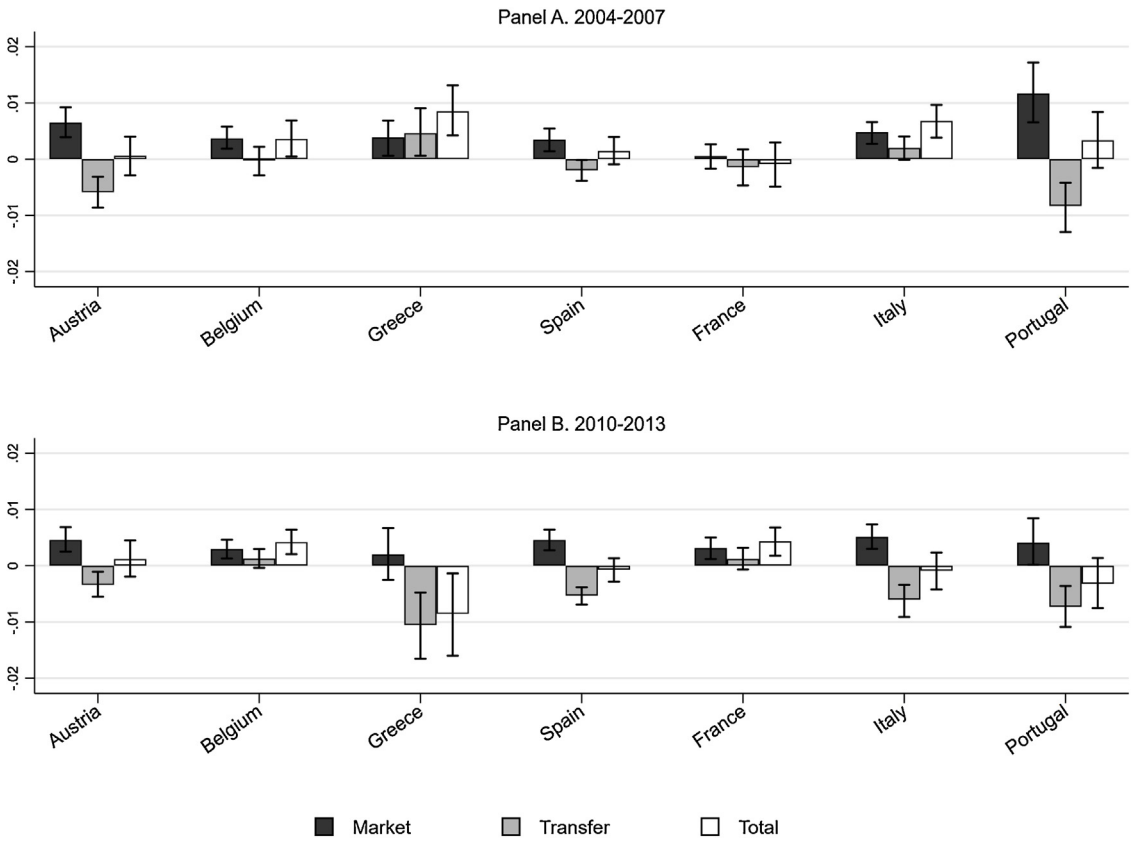

Fig. 2. Income mobility terms.
Figure shows decomposition results for income mobility terms (expressions 1 and 2 of Eq. (7), and their sum) for 2004–2007 and 2010–2013 rotation groups, per country.

The only exception to the general trends noted above are in Greece, which experienced a quantitatively important decrease in the market *inequality change* term post-crisis such that it contributes negatively to IRHI. We discuss the Greek experience in more detail in the last part of the results section.

Error terms

Recall that the *error rank change* term captures the IRHI consequences of the association between the changes in *total* income rank between the two periods, and the health residual in the second period. The *error residual change* term captures the IRHI consequences of the association between the changes in the health residual between the two periods, and the *total* income rank in the first period. To inform the following discussion of the *rank changes* term (*residual changes* term), we examine the average change in *total* income rank (health residual) for each decile of the health residual in the second period (each decile of the *total* income rank in the first period) for both the 2004–2007 and 2010–2013 comparisons. This information can be found in tables A12-A18 of the appendix.

The aggregate effect of the error terms makes up a large contribution to IRHI change in most periods and most crisis countries (compare the 'total' bars in Figs. 4 with). While these terms generally contribute similarly to IRHI change as the mobility terms, the confidence intervals are wider, partly because the residual has a higher variance than age-gender-region predicted health.

The consistently negative *rank change* term indicates that individuals with higher (lower) residual health, i.e. who are in better (worse) health than predicted by our health model in Eq. (5), systematically move down (up) the *total* income ranks. In other words, in addition to young, and thus healthy, individuals moving down the *total* income distribution (because they do not receive pension benefits – the transfer mobility term), otherwise healthy individuals also drop down the *total* income ladder. This could, for instance, mean that formerly healthy, employed individuals lost their jobs and associated income, while unhealthier individuals on e.g. disability benefits did not lose income and went up in the income ranks. A comparison of tables A12-A18 and A5-A11 reveals that the latter *total* income rank changes among the healthy, standardized for age, gender and region, were in general larger than the *total* income rank changes for those healthy because

benefits", and attributing the remaining transfer components to market income. The fact that the results remain extremely similar implies that pensions are the most important social transfers to understand the redistributive effect and its change over time. Results available upon request.

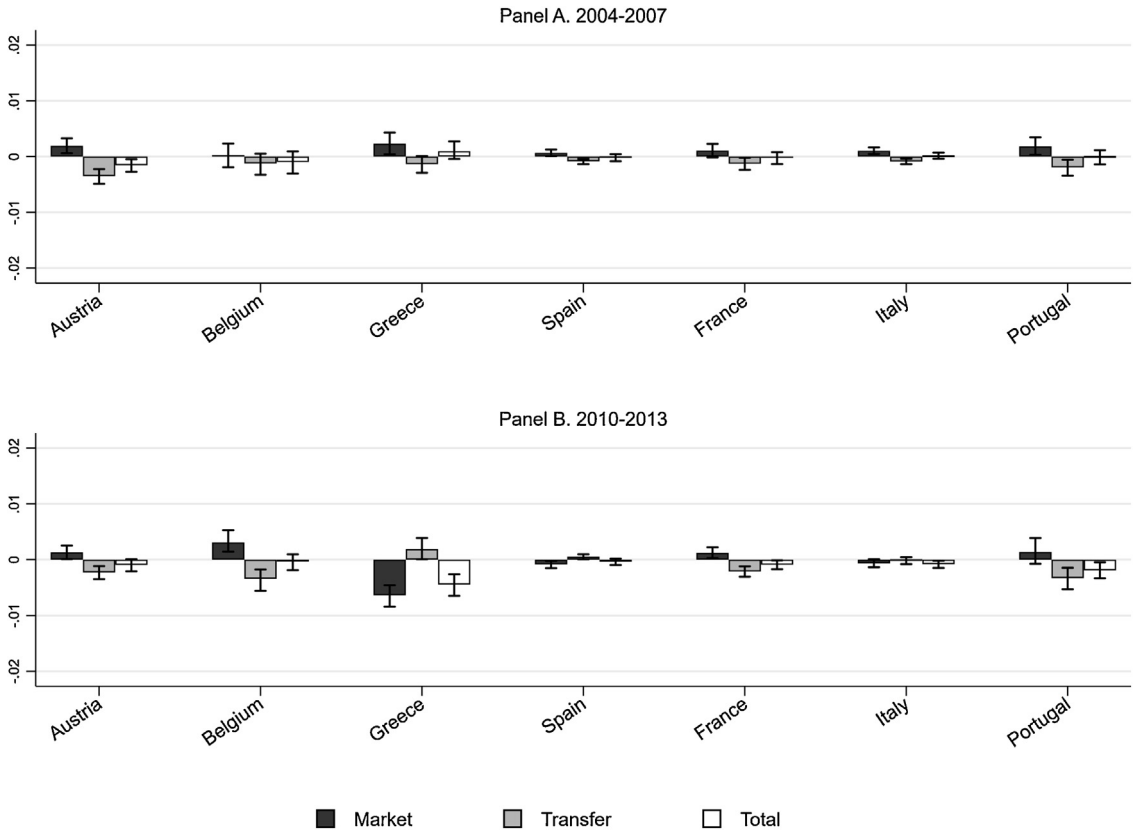

Fig. 3. Income inequality terms.
Figure shows decomposition results for income inequality terms (expressions 4 and 5 of Eq. (7), and their sum) for 2004–2007 and 2010–2013 rotation groups, per country.

they are young, further stressing the importance of the *rank change* terms.

In contrast, the *residual changes* term is consistently positive. This term measures how changes in health not captured by our OLS model, and the association with their *total* income rank in the first period, impacts on the evolution of IRHI. The consistently positive value of this term implies that this unexplained portion of health tends to worsen for individuals in the bottom of the *total* income distribution, and vice versa. When this is taken into account, IRHI is higher than it otherwise would have been, represented by the positive *residual changes* terms.

This increase in the *residual change* term is particularly notable in 2010–2013 compared to the 2004–2007 comparison in the 4 crisis countries Spain, Greece, Italy, and Portugal. This is primarily due to two reasons. First, individuals with lower incomes in these countries began to report worse health between 2010 and 2013, and these health changes were not accounted for by changes in the covariates in our simple model for health. Secondly, especially in Greece, the health of the initially very rich remained higher than expected, despite the income effects of the crisis (table A16). We note that this large *error residual* term in the crisis countries (primarily in Greece and Italy) is often responsible for the *total error* contribution being large and positive in the 2010–2013 comparison.

Why did IRHI not rise during the Great Recession?

Despite fears to the contrary, a striking feature of the IRHI trends in Fig. 1 is the lack of any consistent sign of IRHI rising post crisis. This holds even in the crisis countries. The above results help to shed light on why IRHI remained relatively flat in the post-crisis period.

The two most influential terms in the crisis countries between 2010 and 2013 are the *transfer mobility* and *residual changes* terms, particularly in Greece, Italy and Portugal. As anticipated by the European Commission (2009a), the health of the poorest does indeed appear to have suffered during the crisis, as captured by the *residual changes* term. However, the surprising finding of little IRHI change in the crisis countries post 2008 appears to be due to the fact that the *transfer mobility* term dampened the IRHI increases from the *residual changes* term. As the relative incomes of the elderly – those in lowest health – tended to improve, this reduced IRHI. At the same time, self-reported health (unrelated to gender, age, region, and income) began to systematically deteriorate among the poor, exerting an upward pressure on IRHI. As a result, the IRHI-increasing effect of the *residual changes* term (Fig. 4) during the 2010–2013 period in Greece, Spain, Italy and Portugal is approximately halved by the *transfer income mobility* term (Fig. 2), leading to little change in the overall levels of IRHI.

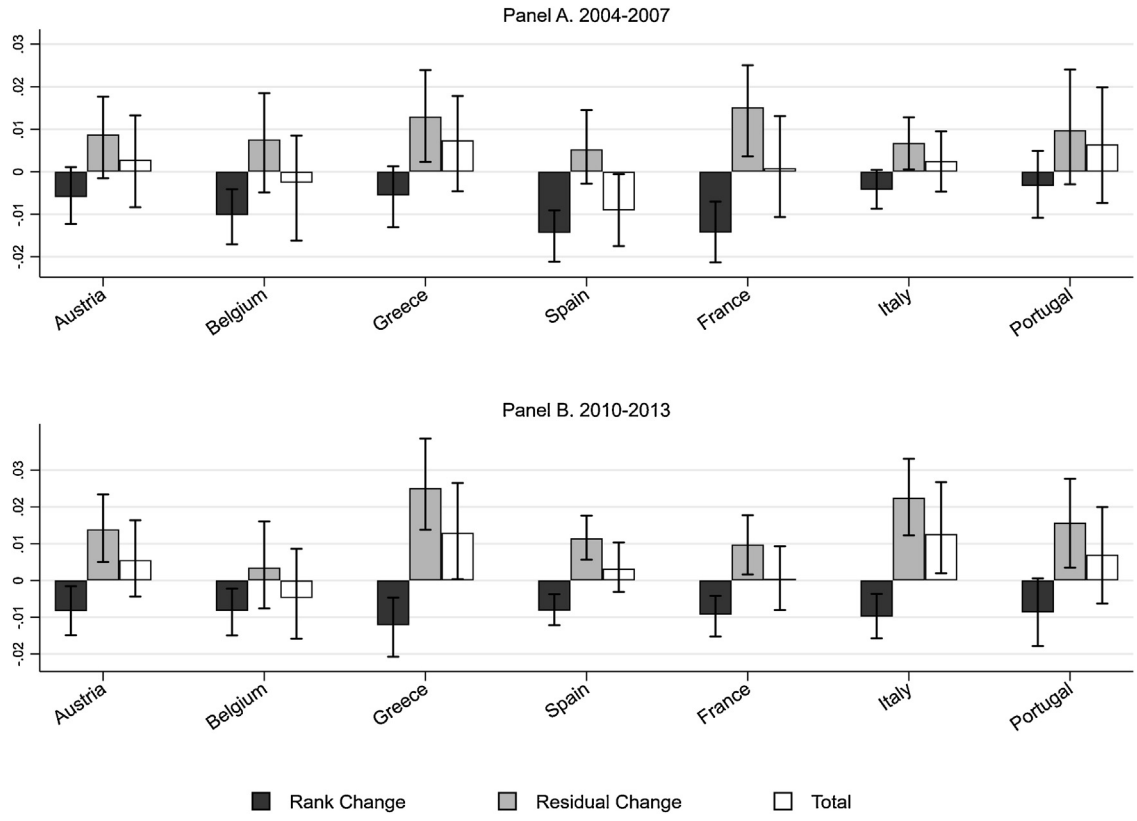

Fig. 4. Error terms.
Figure shows decomposition results for error terms (expressions 6 and 7 of Eq. (7), and their sum) for 2004–2007 and 2010–2013 rotation groups, per country.

This finding points to the crucial role of the *transfer income mobility* term in holding IRHI steady during times of crisis, and avoiding what may have otherwise been a large increase in the disparities in health by income.

While one should not conclude from these findings that the other terms are unimportant, i.e. both the *market mobility* and *rank change* terms do matter as well, we do see that *ageing and migration* and both *inequality change* terms are quantitatively unimportant in all countries, except Greece. Another important result of our decomposition is thus that, despite income being strongly predictive of our health measure (table A4), the in- or exclusion of income in the health model in Eq. (5) does not affect our main findings.[33]

Our more detailed results point to pensions and other old age benefits as the transfers that lead to the relative improvement of the elderly during the financial crisis. Their relative immunity to market fluctuations when compared to wages led to gains on the income ladder for the elderly relative to younger groups. The exact reason for the decreasing health of the already-poor remains unobserved. We note that it cannot be attributed to first-order effects stemming from a decrease in income, as any such effects would be captured by our *inequality change* terms, which prove to be unimportant. Instead, we speculate that these drops in reported health may stem from mental health effects of the threat of income or job loss. Using suicides as a proxy for mental health, there is some evidence to suggest that rising unemployment rates across Europe in 2008 were associated with increased suicide rates (van Gool and Pearson, 2014; Toffolutti and Suhrcke, 2014). If these effects were more concentrated amongst the poor, this may explain at least part of the deterioration in health that we observe. Further discussion is provided in the next section for the Greek context.

Greek austerity measures and IRHI

The most drastic policy changes in this period were enacted in Greece. In exchange for two bailout packages in 2010 and 2011, the Greek government introduced a wide-ranging set of austerity measures. Among these were cuts in social transfers such as pensions and unemployment benefits, taxation of pensions above €1400 a month by 5–10 %, and freezing mandatory increases in public pensions between 2011 and 2015 (OECD, 2013). We present the year-by-year decomposition results between 2010 and 2013 in Greece to explore the potential impact of these austerity cuts in figures A6-A8.

[33] We note that this is not simply a result of the second-order income polynomial used in table A4. Experimenting with other income functions, such as a flexible set of income dummies, yielded similar results for the *error* and *inequality change* terms.

As mentioned above, the pattern for the *inequality change* term (see figure A7) for Greece between 2010 and 2013 is noticeably different from other countries, as the transfer term is positive while the market term is negative. The decrease in absolute income inequality deriving from the large drop in income from work over this period means that market *inequality change* is negative, leading to reductions in IRHI. The positive sign for transfer *inequality change* indicates that the reduction in inequality between 2010 and 2013 was larger due to market income-related health changes than considering total income-related health changes. In other words: the redistributive effect of transfers declined as a result of cuts in social transfers due to the austerity measures, especially for pensions.

The consequences of the austerity measures are less obvious when looking at the *mobility* results between 2010 and 2013, though they are visible in the 2010–2011 comparison when the *transfer mobility* term is large and positive (figure A6). The immediate impact was a worsening of the incomes of the elderly relative to the young, as the drop in pensions between 2010 and 2011 was larger than the drop in income from work. This worsened the relative income position of older groups, and increased IRHI. However, the *transfer mobility* term switches sign to become negative between 2011 and 2012. This is due to the sudden nature of the cut in transfer incomes, compared to the more gradual decline in market incomes. While incomes were already falling in Greece between 2010 and 2011, it is in the subsequent two years that the largest falls occur (see figure B2). Between 2011 and 2013, incomes from work in Greece shrunk sufficiently to outweigh the initially IRHI increasing effects of the austerity measures.

The error terms are the largest contributors to IRHI change in Greece during this period (figure A8), and while they show similar patterns to the earlier rotation groups, there are some idiosyncrasies that may be attributable to the austerity policies. Most notable is that the *error rank changes* term is zero in the 2010–2011 comparison, in stark contrast to the later comparisons. This may reflect the sudden shock of the austerity policies administered in 2010–2011, which disproportionately affected the income ranks of those in the worst health. This appears to have reduced the IRHI dampening effect of the *error rank changes* term. However, as with the *transfer mobility* term above, the effects of the austerity measures are washed away in the subsequent two years as incomes continue to decline for the healthier groups.

Of note also is the large magnitude of the *error residual changes* terms. In the 2010–2013, this is the term with the largest contribution of IRHI across all countries and comparison periods. This could reflect the fact that the cuts to the social safety nets and other programs, on top of the first-order effects stemming from the associated income drop, disproportionately affected the health of the already poor in Greece during this period. Tyrovolas et al. (2018) argue that mortality increases in Greece after 2010 may be due to the significant cuts to health care expenditure as part of the austerity measures. There is also indirect evidence that the austerity cuts may have worsened mental health, with a spike in the suicide rate in Greece at their implementation (Branas et al., 2015). While our results are in line with these findings, our descriptive analysis is unable to attribute them to the austerity policies.

Conclusion

We make a number of contributions to the literature on health inequalities, both in terms of methods and empirical results. First, we adapt previously used decomposition methods to better clarify the very different roles played by market versus transfer incomes for IRHI trends. Our two-step procedure further accounts for the role played by health changes unexplained by our model, and avoids our health measure being partly income-predicted.

Second, for a range of European countries, we show for the first time how IRHI has evolved between 2004 and 2013, a time period that covers the largest global economic contraction in the post-war era. We document distinct time and geographic trends in IRHI. Before the crisis, some crisis countries saw IRHI rising. After 2008, IRHI generally exhibited a flat trend across all countries. Notably, we do not even find large or significant persistent increases in IRHI in the crisis period for those countries hit hardest by the Great Recession.

Third, our decomposition method uncovers important new empirical regularities concerning IRHI rises or falls. We find that market income evolution tends to increase inequalities in health, while the relation between social transfers and IRHI reveals a more mixed pattern, in some cases decreasing and in other cases increasing IRHI. This occurs for two reasons: (i) because social transfers – most importantly pensions – are largely targeted at relatively older and other poorer groups who are typically excluded from gains in times of (especially market) income growth; (ii) because in some countries, the young tend to stay and live longer in their parental household and therefore co-benefit from their (grand)parent pension entitlements.

Fourth, we find indirect evidence – through residual changes in health not explained by income, age and migration – that the poorest individuals in some of the crisis countries reported larger health losses after the crisis. While this would otherwise have increased IRHI, this effect is largely neutralized by the protective effect of government transfer incomes. These counterbalancing effects explain why IRHI nonetheless did not significantly increase during the crisis. While the contribution of the residual changes term signals that the health of the already-poor does decrease, we do not find evidence that this decrease is driven by income losses. Health changes due to income loss prove to be relatively unimportant in describing IRHI change. It may be the fear of future loss rather than actual loss that causes this drop.

Finally, our results demonstrate that in at least one country austerity policies between 2010 and 2013 have had some effect on IRHI: the large reductions in pension entitlements that were enacted in Greece initially did increase IRHI, and have also countered the IRHI dampening effects of transfers in later years.

Based on these empirical findings, our results suggest that government transfer policies can and do appear to have a substantial effect on IRHI. Especially in times of cri-

sis, the sticky nature of pensions act as stabilizers that help to reduce IRHI by improving the relative income position of the elderly. In periods of economic growth, however, the stickiness tends to have the opposite effect, when transfer growth typically lags behind market income growth.

Our findings also point to two main potential policy levers for governments concerned with rising levels of IRHI during times of crisis. The first of these are policies that improve the relative incomes of the elderly, such as more generous pension schemes. The second are policies that prevent health deterioration for the poor. While the appropriate policy prescription depends on the reasons for these deteriorations, our method and data did not allow to further explore these unexplained health changes. We speculate that a more robust social safety net – which eases the stresses on mental health stemming from potential job and housing loss – as well as schemes which ensure access to quality healthcare, may help to stymie IRHI increases. Finally, it is worth highlighting that the Greek experience shows that austerity measures can kill much of the IRHI reducing effect of pensions during crises, and potentially exacerbate the health declines among the poor.

All in all, our findings suggest that European countries have not witnessed the rise in IRHI that could be expected from the Great Recession thanks to the stickiness of government transfers, especially pension incomes, in the short run: they increase slower in good times, but also decrease slower in bad times. If that stickiness can no longer be afforded in the longer run – as was the case in Greece post-crisis – then their income protection and IRHI reducing effect may be eroded.

Acknowledgements

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.jhealeco.2019.102259.

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