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A ,Health Kuznets‘ Curve‘? Cross-Country and Longitudinal Evidence

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Abstract

The distribution of health inequalities appears to exhibit a different pattern when samples of developing countries are examined. One explanation is the existence of a health Kuznets' curve. This paper sets out as an exploratory analysis to test the latter hypothesis of an inverse U shape pattern between both economic and health development and income inequalities in health. We draw upon two rich datasets and we use two measures of health, self-reported health and Body Mass Index (BMI). Our results are suggestive of a socioeconomic health Kuznets' curve on self-reported health but not on BMI. We find robust evidence of both cross country and time series heterogeneity which display a turning point of GDP per capita varying between US \$26,000 -38,200.

JEL-Code: I180, O100, I300.

Keywords: inequality, health, health inequalities, Kuznets' curve, Body Mass Index (BMI).

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1. Introduction

The evolution of health inequalities has attracted significant attention in the economics literature ever since the World Health Organisation employed its measurement to compare health systems performance (WHO, 2000). A large number of studies in both developed and developing countries (e.g. van Doorslaer et al, 1997; Montoya-Diaz, 2002; van Doorslaer and Koolman, 2003, 2004; Islam et al, 2010), find that the position an individual status in the income distribution influences its capacity to produce health, and its intensity determines the magnitude of income inequalities in health¹. However, we know very little about how such inequalities vary across both countries economic and health development, though this is a very relevant question given its policy implications on what policies to prioritize depending on a country's position in the economic and health transition. In other words, in prescribing health care reforms, one needs to balance out what countries can afford, and set priorities accordingly. As a result, it can be hypothesised that not all countries can 'prioritize' the health of poorer individuals in the same way, which we label as 'affordability of health care equity' argument. More specifically, we contend that changes in macro-determinants such as progress in terms of improvement in the average standards of living and aggregate health transitions exert a very important effect.

In considering health inequalities, one option is to focus on 'pure inequalities' in health, which are largely the results of determinants, some of which are out of policy action, and income related inequalities in health, which can be influenced by redistribution mechanisms that government can have some influence on. Hence, in what follows we draw

¹ This typically is expected to exert its influence through budget and non-budget constraints and other unobservable pathways

upon measures of conditional inequality in health (e.g. Gini coefficient of self-reported health) given that in our view, the spirit of the original Kuznets' curve as applicable to health would be on income related inequalities. In developed societies, income-related inequities are already showing signs of stagnation, at best of moderate expansion (Hernández Quevedo, Masseria, & Mossialos, 2010). The latter is the case despite government policies have been put in place to curb emerging health inequalities, it is paradoxical that such inequalities have not fallen accordingly, which altogether calls for a better understanding of the underlying causes. Nonetheless, explanations for this phenomenon are not clear-cut, and include a combination of micro and macro determinants. Arguably, it is possible to argue that inequality aversion declines with income (Clark, 2003). However, there are important macro determinants, such as the impact of a country's economic development to changes in health inequalities. This latter hypothesis has been widely overlooked in the health and development economics debate. Indeed, if the level of economic development explains the emergence of health inequalities, then it is a fundamental question to ascertain whether there is an empirical basis for a health Kuznets' curve.

A classic Kuznets' curve reflects a quadratic relationship between income inequality and economic development². In the original study, Kuznets' (Kuznets', 1955) relied on data from only three countries (UK, US, Germany) to test the hypothesis empirically. Since, a long list of studies has followed using both cross-sectional and time series data, but support for a Kuznets' curve is far from evident or clear-cut (Morrison, 2000). While some studies confirm a Kuznets' curve (Anand & Kanbur, 1993; Saith, 1983), others find mixed results

² Graphically, this is shown to be an inverted-U-shape (see Figure A1), such that as the economy develops, inequalities rise, reach a turning point, and only after this turning point (once a certain level of income is attained), do inequalities begin to fall.

(Acemoglu, Johnson, & Robinson, 2002; Ravallion, 2005). Given the strong association between income and health, one would expect health related income inequalities to exhibit a Kuznets' curve, but perhaps with significant differences across countries depending on institutional set-ups and policy reactions to health inequalities.

Some earlier research using the body mass index (BMI) as an indicator of wellbeing fails to find evidence of a Kuznets' curve (Sahn & Younger, 2009). Instead, Sahn and Younger (2009) find that, as overall mean BMI or income per capita increase, the level of inequality in BMI also rises. They compute measurements both at country and household levels, but generally, as they recognize their measure of inequality draws heavily on intra-household deviations and tends to underestimate inequality among households. These results are consistent with similar studies examining the association between per capita income and inequalities in calorie consumption (Haddad, Kanbur, & Bouis, 1995).

This paper aims to document empirical evidence and test for the existence of a 'Health Kuznets' curve'. Given that the literature has already clarified a positive association between income and health (e.g. Adams et al, 2003; Buckley et al, 2004; Contoyannis et al, 2004a, b;), we attempt to contribute by making use of a wider testing of the health inequality determinants that exceeds the country specific case study. Since there is some ambiguity as to what we should call a "Health Kuznets Curve," we test several possibilities. In particular, we test for a concave relationship between health inequality, measured two different ways, and GDP per capita, and also between health inequality and health status. We take advantage of two rich datasets – the World Health Survey (WHS) and European Commission Household Panel (ECHP) – containing records of several countries, namely a cross sectional database

with a large heterogeneity in countries' economic development, and another that takes advantage of time-series – cross-section heterogeneity. We provide the first countrywide empirical specification of such a phenomenon, to document the effects at a given point in time and then examine the same question using a longitudinal perspective.

We hypothesise some form of negative association between health inequalities and both economic (per capita gdp in US \$) and health development (average health). However, its mechanisms are difficult to explain. On the one hand, countries with better health achievement may decide to invest less in health as fewer productive advantages are seen after a certain level of income. Evidence on this is given by the seminal Preston curve (Preston, 1975), where an association between income and health is identified but such an association flattens at higher levels of development. Hence, once countries exhibit fewer absolute health improvements they would be expected to switch investment to reducing inequalities. Several studies have been carried out to ascertain and measure the existence of income-related health inequalities. However, given the diverse literature and heterogeneity, it is difficult to ascertain how useful these studies for policy analysis. A second mechanism through which to understand the relationship between income and inequality is the inverse care law (Hart, 1971; Victora, Vaughan, Barros, Silva, & Tomasi, 2000). Hart (Hart, 1971) originally hypothesised that any new treatments may initially generate health care inequalities which are only later resolved. In an extension, Victora et al (Victora, et al., 2000) name this phenomenon the 'inverse care law': when new interventions are introduced, richer socioeconomic groups tend to benefit first, thus widening the inequality. It is only after a time lag that poorer socioeconomic groups are able to access interventions, eventually lowering inequality. Examples of interventions include cervical cancer screening,

immunisations and primary health care quality improvements. Lyratzopoulos et al., (2011) document further such a case for cancer survival between 1973 and 2004. They find evidence of an inequality-equality' lag cycle, primarily due to the rate of diffusion of new treatments among individuals with different socioeconomic status.

The remainder of the paper will examine different specifications of the Kuznets' curve, measures of health, controls and unobserved heterogeneity. The structure of the paper is as follows. The next section provides a literature review. Section 3 contains a description of the data and methods. Section 4 reports the results and the final section concludes.

2. Kuznets' curve: background and rationale

The seminal work of Simon Kuznets' (Kuznets', 1955) suggested a specific shape - an inverted-U - depicting the relationship between income per capita and income inequality. This implies that during the early stages of economic growth, inequality rises and it is only after a certain level of economic development that the trend reverses. Other empirical studies followed, which provided some more robust evidence of an inverted-U- relationship (Bourguignon & Morrisson, 1990; Robinson, 1976).

The Kuznets' curve, other than those related to income and income inequality, is frequently found in literature. In the environmental literature, for example, a number of studies show the relationship between per capita income and the rate of environmental degradation to be a quadratic shape. Initially, with lower levels of income per capita,

environmental degradation increases but after a turning point, degradation decreases. Grossman and Krueger (G. M. Grossman & Krueger, 1995) perform a similar analysis for urban air quality to show that inequality worsens as income increases, but after reaching a maximum point and level of growth, inequality declines. They found that “economic growth tends to alleviate pollution problems once a country’s per capita income reaches about \$4,000 to \$5,000” (Grossman and Krueger, 1995). However, Perman and Stern (Perman & Stern, 2003) criticise that such a curve does not exist, due to causality problems and the lack of any theoretical foundation.

Despite these mixed results, there are reasons to believe that a “Health Kuznets’ Curve” exists. Given the relationship between health and economic development - whether linear (Pritchett & Summers, 1996) or concave (Preston, 1975, 2007), the literature suggests that in early stages of economic development, countries focus on producing health and wellbeing and it is only after a certain level of economic development that other sources of health improvements - such as technology expansion and the reduction of health problems of the lowest socioeconomic groups - become a priority.

Although health necessarily deteriorates with age and strongly depends on the socioeconomic status of the individual, the nature of this relation is complex and controversial. The association between health and socioeconomic status is widely debated, in particular, between health and education (see M. Grossman, 2000; Smith, 2004) and health and income or wealth (Smith, 1999, 2004). Further, a positive relationship between health and socioeconomic status has been extensively documented (Deaton, 2003; Smith, 1999). An inverted-U shape has also been found for the relationship between suicides and GDP (Shah,

2011). Nonetheless, the causal mechanisms underlying this relationship are difficult to disentangle. Socioeconomic status can affect health through the direct influence of material deprivation in the health production function and on the access to health care of education, as well as on the uptake and compliance with medical treatments. Health, in turn, can affect socioeconomic status through labour market outcomes such as unemployment, early retirement (Bound, 1991; Disney, Emmerson, & Wakefield, 2006) and earnings (Cotonyannis & Rice, 2001). Further, “third factors”, such as time preference and risk aversion rates (which do not infer any causal relationships and cannot easily be observed or measured), may be the underlying causes of this relationship (Hernandez-Quevedo, Jones, & Rice, 2008).

Moreover, there is a large and growing literature on socioeconomic determinants of health inequalities, which takes an absolute income approach, suggesting a strong link between income inequalities and health inequalities. In health, a Kuznets’ curve should reflect the non-linear trade-off between health and health inequalities. Parallel to this, Wilkinson (Wilkinson, 1996, 1997) developed an alternative explanation for health inequalities based on the effect income inequalities exert on individual health status (known as “relative income hypothesis”, RIH). Although longitudinal studies seem to point towards evidence for the AIH (“absolute income hypothesis”) (Gerdtham & Johannesson, 2004), both explanations are not mutually exclusive and suggest that to reduce inequalities in health, it may be important to design interventions that address both psychosocial and determinants of material health production. Other studies, however, do not support the RIH (Fiscella & Franks, 1997; Gravelle, 1998; Gravelle & Sutton, 2006; Judge, 1995). Indeed, some argue that not all inequalities in health are determined by socioeconomic position (Le Grand, 1987). Further, some inequalities are unavoidable, such that public policy interventions have little effect on individual health production. This is the case for inequalities resulting from the

depreciation of health capital over time; the same would apply to biologically-driven gender differences in health (Wagstaff, Paci, & Vandoorslaer, 1991), environmental or genetic features.

Existing studies, which implicitly refer to a health Kuznets' curve, are fairly limited. Molini *et al* (Molini, Nube, & van den Boom, 2010) estimate an association between the Human Development Index (HDI) and the concentration index of BMI in developing countries using quadratic specifications. Importantly, they find an inverted-U relationship between inequalities in BMI and HDI for Vietnam. In contrast, Sahn and Younger (Sahn & Younger, 2009), they found no evidence of a quadratic curve for BMI-inequality. However, the Mean-Logarithmic-Deviation of women's BMI increased significantly over the entire GDP range.

3. Data and Methods

3.1 Measures and Variables

Tables A1 and A2 contains a description of the data sources, as well as a description of how the data was transformed in order to produce the relevant indices. In addition, we report definitions used to compute the dependent variable and controls used. We report the definitions and descriptive statistics of the dependent variables (i.e. the concentration index).

Another source of heterogeneity lies in the measure of health employed. We have utilised common measures— self-reported measures of health - for the purpose of

investigating socioeconomic inequalities. Studies providing evidence on socioeconomic inequalities in self-perceived measures of health status include: Adams et al. (2003), Buckley et al. (2004), Frijters et al (2005), Hernández- Quevedo et al. (2006), Costa-Font et al. (2011). Self-assessed health is the most common subjective measure of individual health, providing an ordinal ranking of perceived health status, and is generally available in socioeconomic surveys both at national and international levels. In the literature, it has been used to study the relationship between health and socioeconomic status (Smith, 1999; Adams et al, 2003; Benzeval et al, 2000; Deaton and Paxson, 1998; Ettner, 1996); the relationship between health and lifestyles (Kenkel, 1995; Contoyannis et al, 2004); and the analysis of socioeconomic inequalities in health (van Doorslaer et al, 1997). Some interesting results have been found: self-reported health is a powerful predictor of subsequent mortality (Idler and Kasl, 1995; Idler and Benyamini (1997); its predictive power does not vary across socioeconomic groups (Burström & Fredlung; 2001; van Doorslaer et al, 2000) and it is a good predictor of subsequent use of medical care (van Doorslaer et al, 2000) and mortality (van Doorslaer and Gerdtham, 2003).

Inequality is measures using concentration curves (CC) and concentration indices (CI) , which have been extensively used for measuring inequalities and inequities (Wagstaff and van Doorslaer, 2000). The health CC and CI provide measures of relative income-related health inequality (Wagstaff, Van Doorslaer and Paci, 1989). Wagstaff, Paci and van Doorslaer (1991) have reviewed and compared the properties of the CC and CI with alternative measures of health inequality. They argue that CC and CI capture the socioeconomic dimension of health inequalities; enable the use of information from the

whole income distribution rather than just the extremes; allow for the possibility of visual representation through the concentration curve; and finally, allow checks of dominance relationships.

The CI is derived from the concentration curve, CC. This is illustrated in Figure 1 for a measure of ill health. The sample of interest is ranked by socioeconomic status. If income is used as the relevant ranking variable, the horizontal axis begins with the poorest individual, and progresses through the income distribution, up to the richest individual. This relative income rank is then plotted against the cumulative proportion of illness on the vertical axis. This assumes that a cardinal measure of illness is available, and it can be compared and aggregated across individuals. The 45-degree line shows the line of perfect equality, along which the population shares of illness are proportional to income, such that the poorest 20% of individuals experience 20% of the illness in the population. “Pro-poor” inequality is illustrated by the concave curve in the figure which corresponds to the concentration curve. In the example shown, the poorest 20% of income earners experience more than 20% of illnesses. The size of inequality can be summarised by the health CI, which is given by twice the area between the CC and the 45-degree line. The CI is an index that quantifies the degree of socioeconomic-related inequity in a health indicator (Kakwani, Wagstaff, & van Doorslaer, 1997; van Doorslaer, et al., 1997; Wagstaff, 1989). Different datasets at the individual and household level were therefore merged to ascertain self rated health and household socioeconomic status, respectively. The individual questionnaire in the World Health Survey (WHS) asks, ‘in general, how would you rate your health today?’, answers to which are ordinally scaled from 1 to 5, where 1 indicates ‘very good’; 2 ‘good’; 3 ‘moderate’ 4 ‘bad’ 5 ‘very bad’. For socioeconomic status, we use household expenditure, which is a widely

accepted measure of income especially where such data are difficult to collect (Falkingham & Namazie, 2002; Filmer & Pritchett, 2001). The WHS asks, ‘in the last 4 weeks, how much did your household spend in total’. This amount is then equivalised by the number of adults (individuals aged 18 and over) in each household to create a new variable ‘adult equivalised expenditures’ (aee)³. Where countries have not reported this data (Hungary, Kenya, Turkey), the sum of all available expenditures (eg food, housing, education, health costs and so on) was used in place.

The CI for each country is computed using the convenient regression formula (Kakwani et al 1997; O’Donnell et al 2008), in which a fractional rank variable is created. We correct for cross-cluster correlation as a form of serial correlation is likely to be present owing to the rank nature of the regressor (Kakwani, et al., 1997) To correct the standard errors for this, we use the Newey-West (Newey & West, 1994) variance-covariance matrix, which corrects for autocorrelation, as well as heteroscedasticity. In STATA, the command *newey* produces OLS regression coefficients with Newey-West standard errors.

There are various ways of expressing the CI algebraically. The most commonly found within literature for its convenience is:

$$CI = \frac{2}{\mu} \sum_{i=1}^N (y_i - \mu) \left(R_i - \frac{1}{2} \right) = \frac{2}{\mu} \text{cov}(y_i, R_i) \quad (3.1)$$

³ Except in the case of Norway, for which there were no data on the number of adults available.

(3.1) shows that the value of the CI equals the covariance between individual health (h_i) and the individual's relative rank (R_i), scaled by the mean of health in the population (μ)², to ensure the CI ranges between -1 and +1. Equation (3.1) indicates that the CI is a measure of the degree of association between an individual's level of health and their relative position in the income distribution. It is important to highlight that a value of $CI = 0$ does not mean absence of inequality, but an absence of the socioeconomic gradient in the distribution, that is, an absence of inequality associated to the socioeconomic characteristics.

We use two variables to measure health, the first of which is self-reported health and the second, BMI. Both are commonly found and quantified in the literature and contained in the datasets, alongside an extensive list of economic and health development indicators including: per capita GDP, and life expectancy. The three health-related variables should allow us to examine whether there is a health Kuznets' curve. Other controls include: the standard error of the CI and the number of observations of the estimates, to account both for precision and study characteristics. Finally, the gini index on income and investment in health care, proxied by the percentage of health expenditure on a country's GDP, is used, as well as the country's population, to reflect alternative explanations that have previously been identified to explain cross-country differences in income-related inequalities in health.

3.2 Testing for a Kuznets' curve (an inverted-U-Shaped relationship)

Empirical studies have also used various functional forms to test the Kuznets' hypothesis. Some attempts regress inequality measures on per capita income and its inverse.

However, in health care, the efficiency-equity trade-off, or the change the association between health inequalities and economic development, might not only involve socioeconomic development or per capita GDP. Additionally, one can imagine a similar association with regards to health development as per the inverse care law (Hart, 1971; Victora, et al., 2000), giving rise to a health-health inequalities Kuznets' curve.

We estimated a variety of different specifications that include the following parameters:

$$CI_{it} = \beta_0 + \beta_1 y_{it} + \beta_2 y_{it}^2 + \beta_3 z_{it} + \varepsilon_{it} \quad , \quad (3.2)$$

where CI refers to concentration index estimates of two separate measures of health (self-reported health and BMI); y_{it} refers to measures of economic development (e.g., GDP) which are hypothesised to follow a quadratic relationship (y_{it}^2); and z_{it} relates to other variables which influence health inequalities. From this specification, it is possible to test whether an inverted-U-shaped relationship is identified such that $\beta_1 > 0$ and $\beta_2 < 0$. Other possible specifications include $\beta_1 = \beta_2 = 0$ (a flat pattern where no relationship exists) and a monotonic relationship ($\beta_1 > 0$ and $\beta_2 = 0$). Further to this, the turning point can be obtained. This is the level of per capita GDP (or a health measure if examining health development instead) where inequalities stop increasing and begin to decrease. It is obtained as follows:

$$y^* = \frac{-\beta_1}{2\beta_2} \quad (3.3)$$

In addition to measuring the standard trade-off between economic development and health inequalities, an alternative way of thinking about a health Kuznets' curve is to hypothesize a trade-off on health development. That is, health inequalities might vary with socioeconomic position. In fact, there is a large and growing literature on socioeconomic determinants of health inequalities following an absolute income approach, suggesting a strong link between income inequalities and health inequalities ("absolute income hypothesis", AIH). Parallel to this, Wilkinson (Wilkinson, 1996, 1997) developed an alternative explanation for health inequalities based on the effect income inequalities exert on individual health status (known as the "relative income hypothesis", RIH). Although longitudinal studies seem to point towards evidence for the AIH (Gerdtham & Johannesson, 2004), both explanations are not mutually exclusive and suggest that to reduce inequalities in health, it may be important to design interventions that address both psychosocial and purely material health production determinants. Other studies, however, do not support the relative income hypothesis (Fiscella & Franks, 1997; Gravelle, 1998; Gravelle & Sutton, 2006; Judge, 1995). Indeed, some argue that not all inequalities in health are determined by socioeconomic position (Legrand, 1987). Further, some inequalities are unavoidable, such that public policy interventions have little effect on individual health production. This is the case for inequalities resulting from the depreciation of health capital over time; the same would apply to biologically driven gender differences in health (Wagstaff, et al., 1991), or environmental or genetic features.

To illustrate the potential variation of health inequalities with socioeconomic position, some research has focused instead on using BMI as a measure given its simplicity and comparability (Molini, et al., 2010; Sahn & Younger, 2009). Thus, we estimate a Kuznets' curve on health and health development, using alternative specifications. Anand and Kanbur

(Anand & Kanbur, 1993) suggest a specification that regresses an inequality index on income and its inverse. More precisely:

$$CI_{it} = \gamma_0 + \gamma_1 y_{it} + \gamma_2 (1/y_{it}) + \beta_3 z_{it} + \varepsilon_{it} \quad (3.4)$$

The advantage of this specification is that a direct estimate of the turning point can be obtained by taking the square root of the ratio between two regression coefficients. That is:

$$y^* = \sqrt{\frac{\gamma_2}{\gamma_1}} \quad (3.5)$$

Furthermore, as in Fields and Jakubson (Fields & Jakubson, 1994) but applied to health, one could expect a similarly shaped Kuznets' curve across countries but with differing intercepts. If so, one would expect to find significant differences between cross-section and pooled samples, and panel regressions with controls for fixed effects.

Finally, another important point to examine is that of subsamples, so as to examine how developed countries compare to developing countries. In part, fixed effect estimates in panel data regression will pick up some of these effects.

3.3 Specification strategy

We have estimated a range of different equations, which control for country-specific heterogeneity. The advantage of using data from a wide range of countries is that they differ widely in the magnitude of the coefficients estimated. Furthermore, given that the range of the dependent variable varies between -1 and 1, we have accounted for censoring by estimating Tobit models (Greene, 2011). The structural equation in the Tobit model is:

$$y_i^* = X_i\beta + \epsilon_i \quad (3.6)$$

Where y^* is a latent variable that is observed for values greater than τ and censored otherwise. The observed y is defined by the following;

$$y_i = \begin{cases} y^*, & \text{if } y^* > \tau \\ \tau, & \text{if } y^* \leq \tau \end{cases} \quad (3.7)$$

Where data are censored at -1 and +1:

$$y_i = y_i = \begin{cases} y^*, & \text{if } y^* > 0 \\ \tau, & \text{if } y^* \leq 0 \end{cases} \quad (3.8)$$

We have additionally taken advantage of CI of health measures for different European countries included in the ECHP, which contains data from 1994 to 2001. The existence of longitudinal data allows us to account for country specific fixed effects and hence isolate the effect of country specific unobserved heterogeneity. The latter refers to a country specific effect in the error equation (3.2) and includes a country specific fixed effect defined as $u_i + e_{it}$

3.4 Data Sources

The World health survey data draws upon cross sectional data from the World Health Survey (WHS). The WHS is the first major survey program to explicitly recognize the importance of comparability in the development of the instrument in addition to the important concerns about validity and reliability. Populations in-group quarters, on military reservations, or in other non-household living arrangements will not be eligible for the study. People who are in an institution due to a health condition (such as a hospital, hospice, nursing home, home for

the aged, etc.) at the time of the visit to the household were interviewed either in the institution or upon their return to their household if this is likely within a period of two weeks from the first visit to the household. Participation in the survey was voluntary and the respondent can refuse to be interviewed though interviewers were highly skilled and several strategies were performed to minimise non-response (See WHO. The interviews were done face-to-face with the selected respondents in the local language(s), using paper and pencil questionnaires,

The WHS is a standardized series of questionnaires compiling comprehensive baseline information on the health of populations worldwide. Long and short versions are available at both individual and household levels. In the last round (2003), WHO collected data from 71 countries and that was followed as a benchmark for future waves. Further information is available at WHO website (<http://www.who.int/healthinfo/survey/en/>).

To test using longitudinal data for the existence of a Kuznets curve, we draw upon data from the only available survey that contains a large number of cross country data points over time, namely the European Community Household Panel (ECHP). The ECHP Users' Database (ECHP-UDB) is a standardised annual longitudinal survey, designed and coordinated by the European Commission's Statistical Office (EUROSTAT). It provides up to 8 waves (1994 - 2001) of comparable micro-data on living conditions in the pre-enlargement European Union Member States (EU-15). The survey is based on a standardised questionnaire that involves annual interviewing of individuals aged 16 and older from a representative panel of households (Peracchi, 2002). National Data Collection Units implemented the survey in each

of the member countries. Approximately 60,000 households, with 130,000 adults, were interviewed. The survey covers a wide range of topics including demographics, income, social transfers, individual health, housing, education and employment. The information provided in the ECHP-UDB can be compared across countries and over time, making it an attractive dataset for the purpose of our study. The first wave included all EU-15 Member States with the exception of Austria and Finland. Austria joined in 1995 and Finland, in 1996. For the first three waves, the ECHP ran parallel to existing national panel surveys in Germany (GSOEP), Luxembourg (PSELL) and the United Kingdom (BHPS). From the fourth wave onwards, the ECHP samples were replaced by data harmonized ex-post from these three surveys. Hence, there were two versions of the ECHP database for Germany, Luxembourg and the United Kingdom. Although Sweden did not take part in the ECHP, the Living Conditions Survey is included in the UDB.

We use a balanced sample of respondents, which has been constructed by including only those individuals from the first wave who were interviewed in each subsequent wave.

3.5 Data Manipulation

To calculate income-related inequalities in self-reported health status, we have considered a binary indicator of self-reported health status together with equivalised household income. The original SAH question asked respondents: “How is your health in general?”, with 5 possible answers: “very good”, “good”, “fair”, “poor” and “very poor”. We created a binary indicator of very good or good self-reported health status. The income variable is real household income, adjusted using the Purchasing Power Parities (PPPs) and the Consumer

Price Index (CPI). It is equivalised by the OECD modified scale to adjust for household size and composition.

4. Results

4.1 Socioeconomic Kuznets' Curve

Figure 2 shows a plot between CI (weighted, for self-reported health) and a country's per capita GDP. It appears as if graphically there is no specific linear relationship. Instead, at first sight, some polynomial association appears to be underpinning the distribution of the data. However, an alternative explanation could be the existence of noise-around-the-mean, which call for further empirical analysis. When the same association is examined with a sample of European countries in **Figure 3** we also find no clear linear association and again, a specific polynomial association can be drawn out. A similar picture emerges when inequalities on BMI are specifically examined in **Figure 4**. We can identify three observations at the upper tail of the distributions that we regard as outliers, and examine its exclusion later on.

[Insert Figure 2-4 about here]

We proceed with regressions analysis drawing upon Ordinary Least Squares (OLS) and then accounting for the censoring of the data through Tobit models. Table 1 reports the empirical estimates of (3.3). In all specifications, we find conclusive evidence that a quadratic functional form fits the data when weighted CI are regressed against GDP per capita. The

final column provides the estimates of an inverse GDP per capita specification as per (3.4). In addition, we have clustered standard errors by country and provide robust standard errors to account for potential heteroscedasticity in the data. Importantly, all controls appear insignificant, suggesting that, unlike previous studies (van Doorslaer et al., 1997), income inequalities do not explain income-related health inequalities. Robustness and study characteristics are mostly insignificant, as well as the development of the health system. We find that excluding the three-country observations that are regarded as outliers does not change the qualitative conclusion of the results. The latter is consistent with the view that investment in health care does not appear to reduce health inequalities. Yet, this evidence is not causal and hence results should be interpreted with some level of caution. Altogether, results suggest evidence of a Kuznets' curve with a per capita GDP cut –off point ranging from 26,000 and 38,700. In other words, these results suggest that income-related inequalities in self-reported health rise but tail off once a threshold level of economic development has been attained.

[Insert Table 1 about here]

Table 2 uses the same empirical strategy as in Table 1 but using BMI as a measure of health. Consistently with Molini et al (Molini, et al., 2010) and Sahn and Younger (Sahn & Younger, 2009), we find no evidence of a Kuznets' curve on BMI. Instead, we find that inequalities decline with income with some non-linearity and these results are not robust to different specifications. As before, controls do not appear to be significant.

[Insert Table 2 about here]

A further specification to check results from Table 1 controls for the longitudinal dimension of the data and allowing for fixed effects. Table 3 reports similar estimates to that of cross-sectional data, namely a Kuznets' curve on self-reported health. Importantly, the GDP cut-off points are very much in line with those found in Table 1, ranging from 30,000 to 35,200.

[Insert Table 3 about here]

4.2 Health Kuznets' Curve

Figures 5-9 provide evidence of a Kuznets' curve on self-reported health and BMI. These results show negative associations between health inequalities and health outcomes that are if anything suggestive of an inverse Kuznets' curve on health development. However, when BMI is employed as a proxy for health, no clear pattern emerges. Interestingly, a linear association between self-reported health and income related health inequality can be inferred from Figure 5 though not evident and it can only be confirmed when we later perform a regression analysis as suggested before. The peak of health inequality appears to take place around an average self reported health scaled at 2.5 that is a self-reported health status ranging between good and fair. However, in Figure 6 it become evident that the association before does not correspond to European countries when longitudinal evidence is examined, in

which case we observe a reduction of health inequalities with self reported health. Figures 7, 8 and 9, focus on Kuznets curves on BMI consistently with previous literature both on GDP and average BMI. Importantly, no clear curv evidence of an association can be identified graphically.

[Insert Figure 5-9 about here]

Tables 5-8 suggest that the association between income-related health inequality on self-reported health and life expectancy is empirically founded, and we find evidence of an inverted Kuznets' curve, the exception being when data from a panel of European countries are regressed against life expectancy alongside a long list of controls. However, when the same association is estimated at the cross-sectional level we find an inverted-U shape. Consistently, we find no significant effects when BMI is used as a measure of health (Tables 4, 5 and 6). Similarly, when European longitudinal BMI data is employed no clear pattern is found, and in contrast to the previous literature we find no consistent linear pattern (Tables 7-8).

[Insert Tables 4-8 about here]

5. Discussion

This paper set out to document evidence of a health Kuznets' curve on both economic (labelled 'Socio-economic Kuznets' curve on health ') and health development. Drawing upon several specifications, which employed a rich set of controls, we find evidence of a Kuznets' curve when self-reported health is employed as a measure of health, and income-related concentration indices are employed as a measure of inequality. In other words, a significant quadratic structure is found between self-reported health inequalities and economic development, which is robust to both cross-country and time series heterogeneity.

Furthermore, we find a turning point at a GDP per capita varying between 26,000 and 38,200. However, no evidence of such an association is found on BMI, consistent with previous literature both when cross section and longitudinal data are examined. One interpretation of these findings is that only when countries exceed a certain level of income, can they afford to prioritise the health of poorer individuals. Some potential explanations include arguments from the wider political economy literature, such as the role trade unions play and specifically, the influence of the introduction or expansion of health insurance in the interplay between health inequalities and economic development. Insurance expansion not only reduces the cost of accessing health care by creating larger risk pools, but can affect access to health care, and influence preventive activities. One potential concern lies in that self-assessed health might vary across the income distribution. If income is associated to the ability to identify an illness symptoms, then self reported health measure will systematically underestimate health inequality.

A second important finding of this paper is that there is no evidence of an inverted health Kuznets curve on health when self reported health is used as a measure of health and

similarly no clear pattern when BMI is used instead. An explanation for the later might be that BMI is a valid measure of well being when the level of development in the country is low, as it basically measures under nutrition. BMI might change its meaning as a proxy for wellbeing, and can provide another type of information notably that regarding the relation between obesity and poverty. Results would be consistent with the idea that at early stage of development few people are well nourished so that inequality in this welfare measure tends to increase. Only when improvements in dietary patterns and basic health care start to be equally distributed we can see a decline in inequality. After a certain threshold BMI inequality doesn't have any particular relevance since inequalities tend to increase in other in other welfare spaces. .

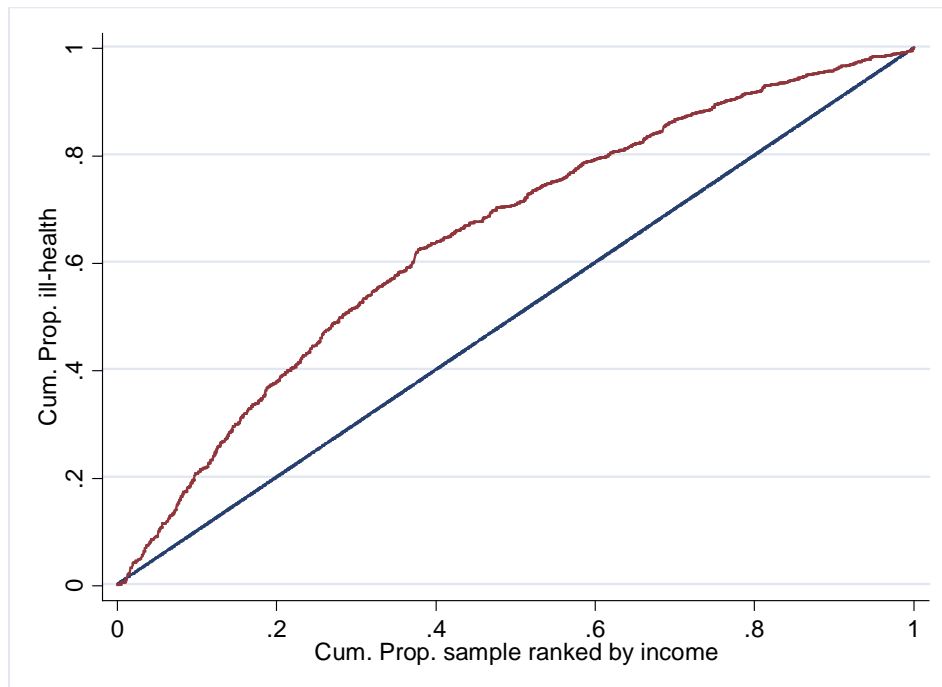
More generally, we do not find evidence that countries are not able to prioritise the reduction of inequities until basic primary health care services are provided (Gwatkin et al 2007). Rather, we find that at lower levels of health development, improvements in health are associated with reductions in health inequalities until a certain level of health is reached, at which point health improvements no longer reduce health inequalities. The latter result is consistent with other evidence, which shows some flattening or even increasing health inequalities in more developed countries. From a demographic standpoint, results are suggestive of a non-linear epidemiological transition (Olshansky & Ault, 1986; Omran, 1971). Other events explaining the trends found in time-series data include effects of changes in life expectancy - for example, in sub-Saharan Africa, war, genocide and HIV have had major impacts on the health of the population; and in Eastern Europe, alcohol intake also significantly reduced life expectancy (Caselli, 1996). Frenk et al (Frenk & Chacon, 1991) argue that we should replace the epidemiological transition concept with the wider 'health transition' which includes the development of epidemiological characteristics within the

overall health situation and the ways in which societies respond to the health situation, and vice versa (Caselli, 1995; Mesle & Vallin, 2000).

Altogether, our paper reports some fresh evidence of a health Kuznets curve when widely accepted measures of health are used. However, our findings are exploratory and calls for further research using richer measures of health to refine and verify our results. Our inequality estimates draw upon concentration index measures, which might be problematic. For instance, concentration indexes are mean dependent, and one could think of alternative ways to correct for such an association in future work.

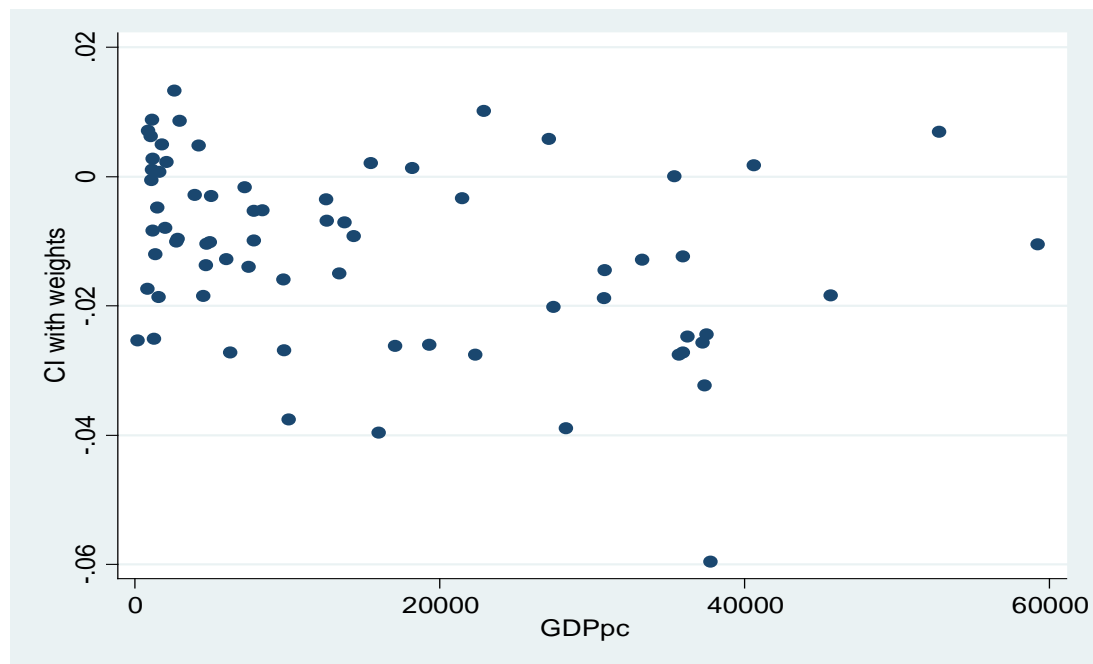
Figures and Tables

Figure 1: Concentration curve for ill-health (Y-axis)



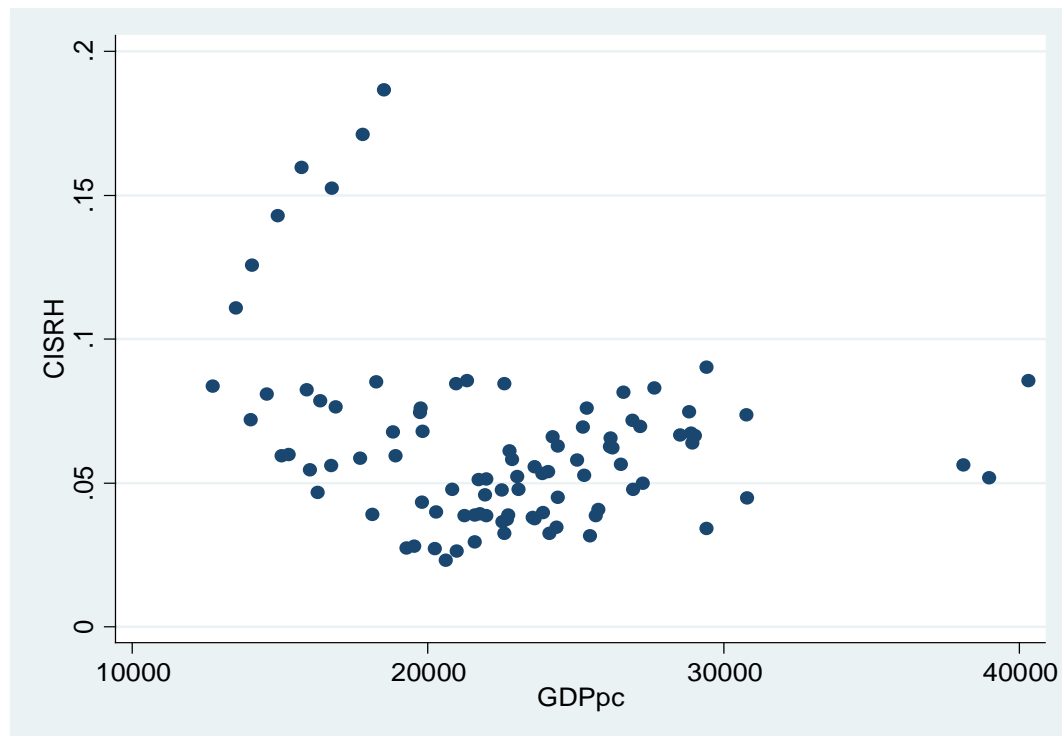
Source: Authors' elaboration

Figure 2. Socioeconomic Worldwide Health Kuznets' Curve on Self Reported Health- Polynomial Health inequality (CI_{HW}) and Economic Development



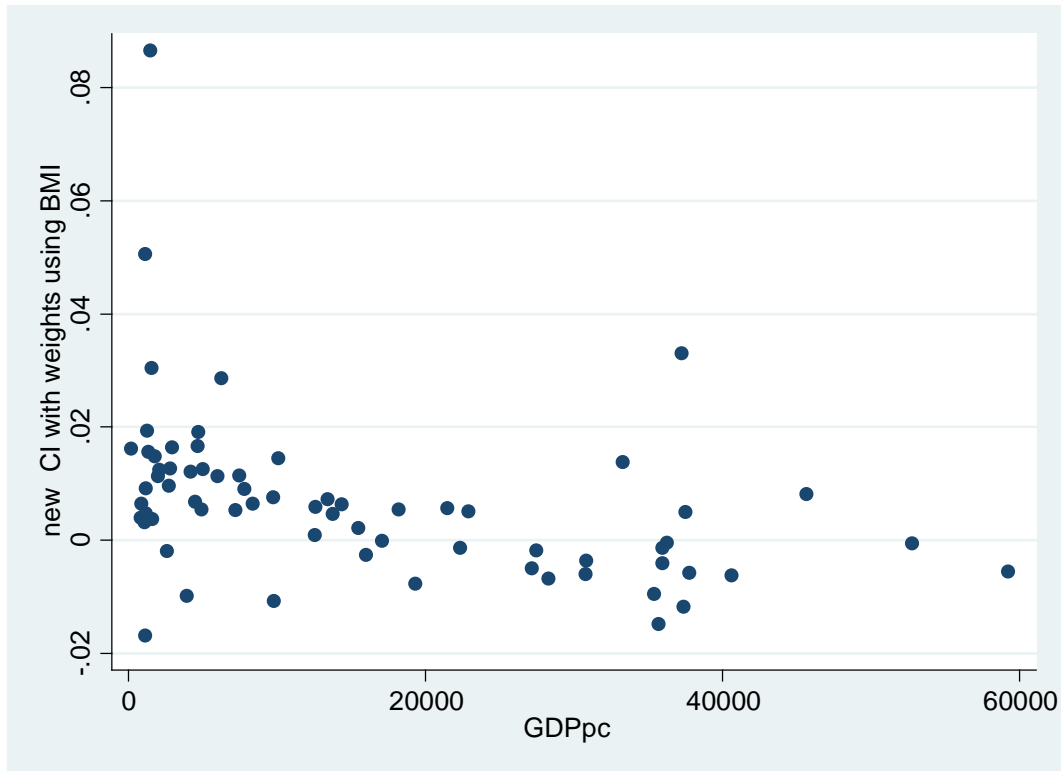
Source: Own calculation on the WHS (2002).

Figure 3. Socioeconomic European Health Kuznets' Curve on Self Reported Health - Polynomial Health inequality(CI_{HW}) (Y-axis) and Economic Development (X-axis)



Source: Own calculation on the ECHP (1994-2001).

Figure 4. Socioeconomic Worldwide Health Kuznets' Curve on BMI- Polynomial
Health inequality (Y-axis) and Economic Development (X-axis)



Source: Own calculation on the WHS (2002).

Table 1. Socioeconomic Kuznets' Curves on Worldwide Self –Reported Health (CI_{HW}) – Cross Section Data

	OLS	OLS	Tobit	Tobit	Tobit	Tobit
	Coef. (s.e.)	Coef. (s.e.)	Coef. (s.e.)	Coef. (s.e.)	Coef. (s.e.)	Coef. (s.e.)
Y_i	7.67E-07 ^a (2.47E-07)	5.17E-07 ^a (2.78E-07)	7.67E-07 ^a (2.44E-07)	5.03E-07 ^a (2.55E-07)	5.17E-07 ^a (2.66E-07)	2.84E-07 ^a (1.11E-07)
Y_i^2	-1.16E-11 ^a (4.68E-12)	-9.87E-12 ^a (4.90E-12)	-1.16E-11 ^a (4.62E-12)	-9.65E-11 ^a (4.64E-12)	-9.87E-12 ^a (4.68E-12)	
$1/Y_i$						1.89302 ^a (1.09907)
Ni		6.70E-09 (6.51E-08)		-1.95E8 ^a (5.87E9)	0.0047 (0.0061)	
$GINI_i$		0.004704 (0.00643)		1.53318 (0.91487)	0.000077 (0.00070)	
$\sigma(CI_{HW})$		1.534748 (1.04691)			6.70E-09 (6.22E-08)	
HE_i		0.00008 (0.0007)			1.534748 (1.0004)	
Intercept	0.00755 ^a (0.00168)	0.00204 (0.005)	0.00755 ^a (0.00165)	0.005035 (0.00297)	0.002046 (0.0048)	0.0089 ^a (0.00183)
Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R ²	0.15	0.2				
Pseudo R ²			0.75	0.03	0.03	0.03
Log -Likelihood			219.31	221.09	221.26	219.74
Cut-off Y_i	33,100	26,200	33,100	26,100	26,000	38,700

^a Significant at 5% level.

Table 2. Socioeconomic Kuznets' Curves on Worldwide Body Mass Index (CI_{BMIw}) – Cross Section Data

	OLS	OLS	Tobit	Tobit	Tobit	Tobit
	Coef. (s.e.)	Coef. (s.e.)	Coef. (s.e.)	Coef. (s.e.)	Coef. (s.e.)	Coef. (s.e.)
Y_i	-9.59E-07 ^a (3.46E-07)	-4.55E-07 ^a (2.50E-07)	-9.59E-07 ^a (3.41E-07)	-9.87E-07 ^a (3.70E-07)	-4.55E-07 (2.39E-07)	-3.69E-07 ^a (1.13E-07)
Y_i^2	1.26E-11 ^a (5.99E-12)	4.81E-12 (3.94E-12)	1.26E-11 ^a (5.90E-12)	1.33E-11 ^a (6.57E-12)	4.81E-12 (3.76E-12)	
$1/Y_i$						1.396582 (0.9878)
Ni		0.000953 (0.00626)		(5.50E-08) 6.72E-08	0.000953 (0.0060)	
$GINI_i$		-0.00063 (0.00052)		(5.50E-08) 6.72E-08	-0.00063 (0.0005)	
$\sigma(CI_{BMIw})$		-1.96E-08 (6.55E-08)			-1.96E-08 (6.25E-08)	
HE_i		0.602533 ^a (0.102901)			0.6025 (0.0982)	
Intercept	0.015853 ^a (0.00400)	0.012668 ^a (0.0049)	0.015853 (0.0039)	0.0185 ^a (0.0068)	0.01267 (0.0047)	0.012105 (0.0028)
Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R ²	0.19	0.56				
Pseudo R ²			0.02	0.03	0.03	0.03
Log -Likelihood			196.3	221.09	221.26	219.74

^a Significant at 5% level.

Table 3. Socioeconomic Kuznets' Curves on European Self –Reported Health (CI_{HW}) – Longitudinal Data

	GLS		GLS		Tobit		GLS	
	Coef.	(s.e)	Coef.	(s.e)	Coef.	(s.e)	Coef.	(s.e)
Y_i	8.73E-06 ^a	(2.98E-06)	0.00001 ^a	(2.97E-06)	0.00001 ^a	(2.79E-06)	6.36E-06 ^a	(3.00E-06)
Y_i^2	-1.24E-10 ^a	(6.15E-11)	-1.71E-10 ^a	(6.32E-11)	-1.62E-10 ^a	(5.86E-11)	-1.06E-10 ^a	(5.76E-11)
Ni								
Year							1.35E-06	(4.50E-06)
$\sigma(CI_{HW})$							0.0000164	(0.000015)
HE							20.52198	(3.14629)
Intercept	-0.06959	(0.035290)	-0.11305	(0.03384)	-0.10514	(0.033370)	4.007049	(3.397992)
R ²	0.13		0.137				0.67	
Fixed effects	No		Yes		No		Yes	
Pseudo								
Log -Like								
Cut-off Y_i	35,200		34,8000		34,600		30,000	

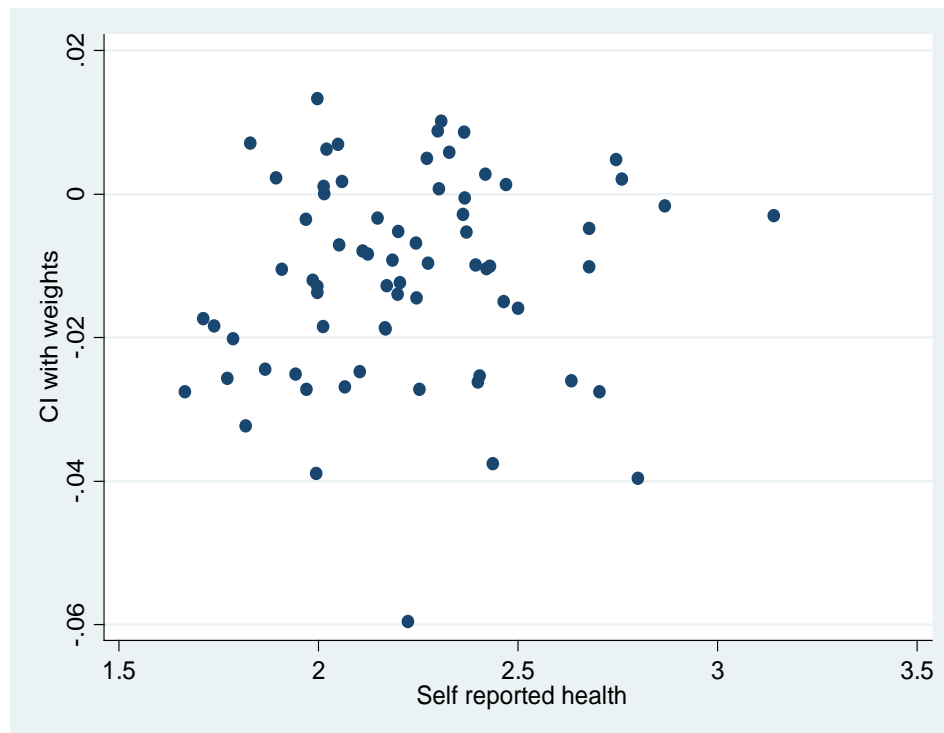
^a Significant at 5% level.

Table 4. Socioeconomic Kuznets' Curves on European Body Mass Index (CI_{BMIw}) – Longitudinal Data

	GLS		GLS		Tobit	GLS		
	Coef.	(s.e)	Coef.	(s.e)	Coef.	(s.e)	Coef.	(s.e)
Y_i	-6.52E+00	(5.00E-07)	-9.16E-07	(5.59E-07)	2.01E-06	(2.68E-06)	4.58E-06	(5.27E-06)
Y_i^2	1.28E-11	(1.00E-11)	1.71E-11	(1.09E-11)	-3.53E-11	(4.90E-11)	-9.25E-11	(1.00E-10)
N							-0.0000136	(0.00001)
Year of Data							1.77E-03 ^a	(4.96E-05)
$\sigma(CI_{BMIw})$							-0.37659	(0.16287)
HE_i							20.52198 ^a	(3.1463)
Intercept	0.00631 ^a	(0.00615)	0.01012 ^a	(0.00706)	-0.0296	(0.03649)	-4.19E-06	(2.59E-06)
R^2	0.08		0.1				0.23	
Fixed effects	No		Yes					
Pseudo R^2								
Log - Likelihood					34.994029			

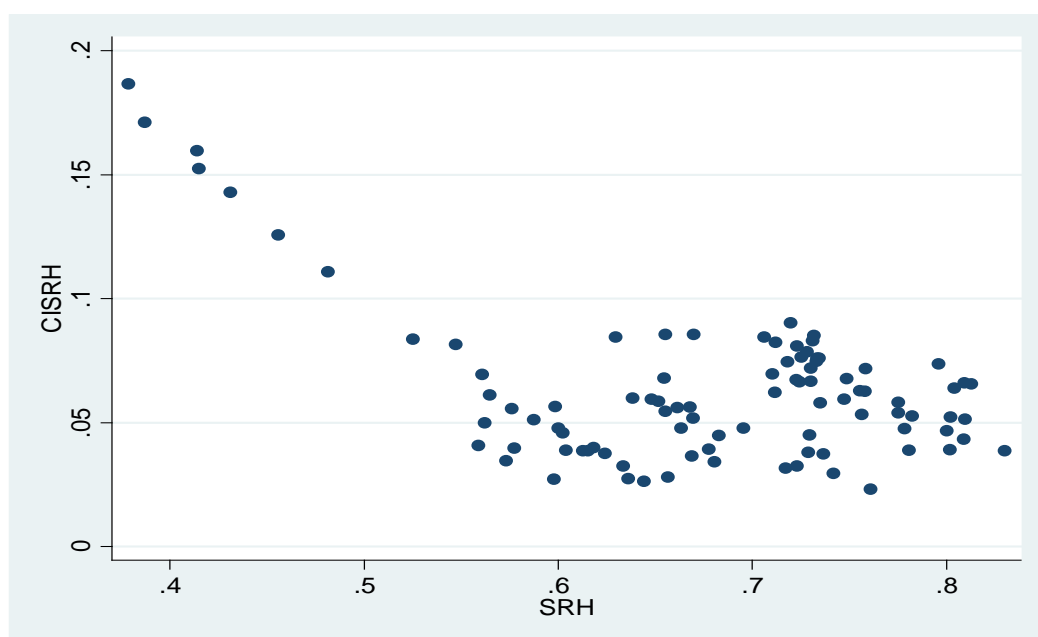
^a Significant at 5% level.

Figure 5. Health Worldwide Health Kuznets' Curve on Self Reported Health- Polynomial Health inequality (CI_{HW}) (Y – axis) and Self-Reported Health Development



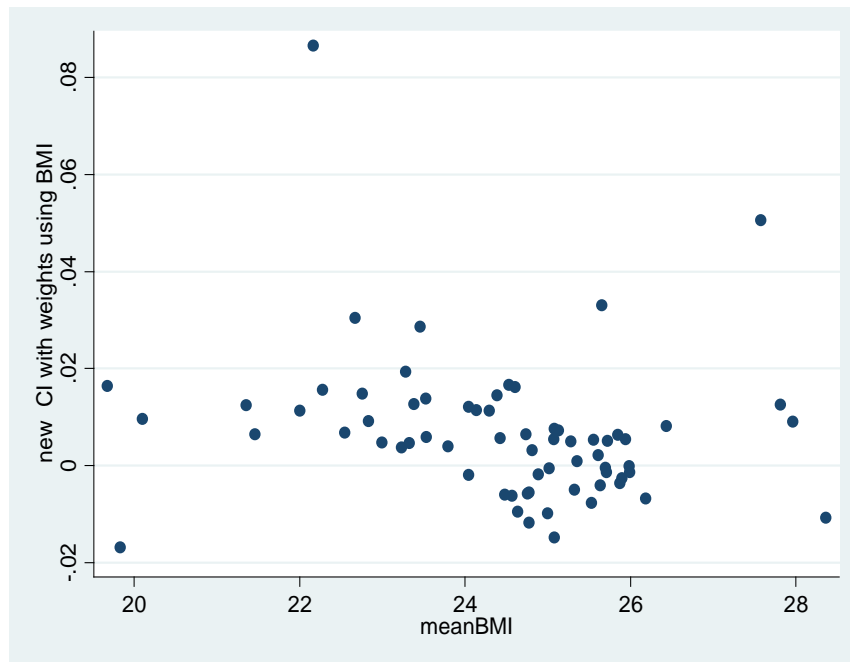
Source: Own calculation on the WHS (2002).

Figure 6 . Health European Health Kuznets' Curve on Self Reported Health - Polynomial Health inequality (CI_{HW}) (Y – axis) and Self-Reported Health



Source: Own calculation on the ECHP (1994-2001).

Figure 7 . Health Worldwide Kuznets' Curve on BMI- Health inequality (Y-axis) and Health Development (CI_{BMIw})



Source: Own calculation on the WHS (2002).

Figure 8. Socioeconomic European Health Kuznets' Curve on BMI- Polynomial Health inequality (Y-axis) and Economic Development

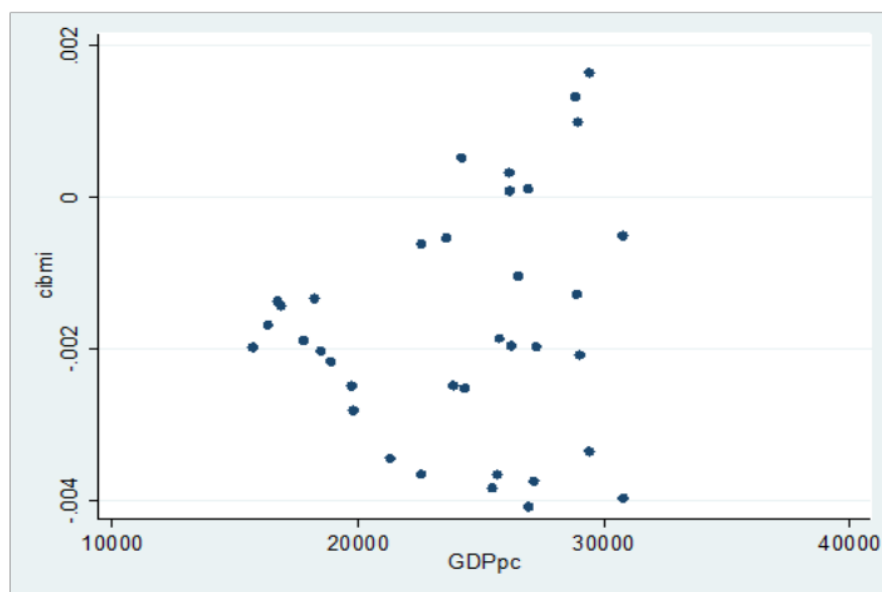


Figure 9 Socioeconomic European Health Kuznets' Curve on BMI- Polynomial Health inequality (Y-axis) and Health Development

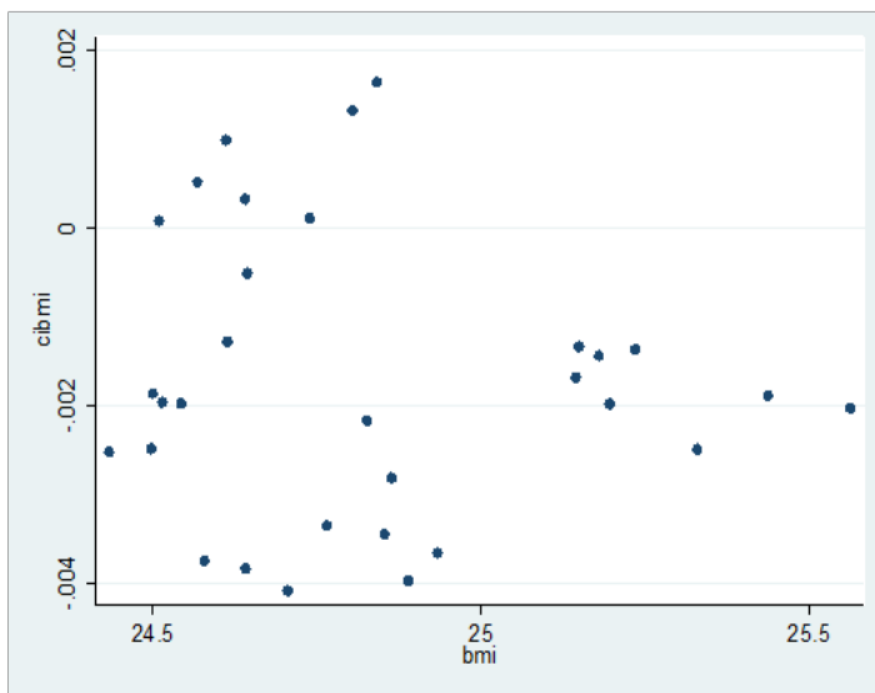


Table 5. World Health Kuznets' curve on Self-Reported Health (CI_{HW}) – Cross Section Data

	Self-Reported Health				Life Expectancy			
	Coef.	(s.e)_	Coef.	(s.e)_	Coef.	(s.e)_	Coef.	(s.e)_
$\mu(H_i)$	-0.0417 ^a	(0.01584)	-0.01706	(0.04573)	-0.00366 ^a	(0.00168)	-0.0008738 ^a	(0.00206)
$\mu(H_i)^2$	0.00775 ^a	(0.00101)	0.00324	(0.00993)	0.00003 ^a	(0.00001)	7.11E-06 ^a	(0.000016)
N			1.60E-08	(5.36E-08)			1.30E-08	(5.82E-08)
GINI			0.00258	(0.00743)			0.002865	(0.00718)
$\sigma(CI_{HW})$			1.5074	(1.1889)			1.50365	(0.99327)
HE			0.00058	(0.00071)			0.00033	(0.00078)
Intercept	0.06764	(0.05094)	0.02444	(0.05428)	0.12092 ^a	(0.05437)	0.030153	(0.06660)
Cluster	Yes		Yes		Yes		Yes	
Robust	Yes		Yes		Yes		Yes	

^a Significant at 5% level.

Table 6 World Health Kuznets' curve on BMI (CI_{BMIw})

	Coef.	(S.e)	Coef.	(S.e)
BMI	-0.041724	(0.04584)	0.0056085	(0.02072)
BMI ²	0.0077589	(0.0102)	-0.0001295	(0.00043)
N			-6.02E-08	(6.48E-08)
GINI			-0.002269	(0.00849)
$\sigma(CI_{BMIw})$			-2.203351 ^a	(0.54941)
HE			-0.000798	(0.00087)
Intercept	0.0676437	(0.05094)	-0.0369845	(0.24789)
Cluster	Yes		Yes	
Robust Stad. err	Yes		Yes	

^a Significant at 5% level.

Table 7. European Health Kuznets' Curve (SRH)

	Self-Reported Health				Life Expectancy			
	Coef.	(s.e)	Coef.	(s.e)	Coef.	(s.e)	Coef.	(s.e)
$\mu(H_i)$	-1.105894 ^a	(0.20252)	-0.48639 ^a	(0.22118)	0.54680 ^a	(0.13618)	0.18687	(0.1201)
$\mu(H_i)^2$	0.6107751 ^a	(0.1616)	0.35556 ^a	(0.1380)	-0.00338 ^a	(0.0009)	-0.00120	(0.0008)
Year			0.0009576	(0.0012)			0.00116	(0.00139)
$\sigma(CI_{Hw})$			15.3738 ^a	(5.4837)			18.65419	(2.9229)
HEi			0.0000107	(0.0000)			5.94E-06	(0.00001)
Intercept	0.524643 ^a	(0.0643)	-1.800559	(2.42939)	-21.9947 ^a	(5.2840)	-9.623675	(5.91426)
Fixed effects	Yes		Yes		Yes		Yes	
R ²	0.43		0.57		0.06		0.26	

^a Significant at 5% level.

Table 8 European Health Kuznets' Curve (BMI) (CI_{BMIw})

	GLS		GLS		Tobit		GLS	
	Coef.	(s.e)	Coef.	(s.e)	Coef.	(s.e)	Coef.	(s.e)
BMI _i	0.078706	(0.126636)	-0.0088144	(0.16050)	-0.0088144	(0.160506)	0.0889575	(0.122816)
BMI _i ²	-0.0015931	(0.002532)	0.0001488	(0.003208)	0.0001488	(0.003208)	-1.80E-03	(0.00002)
N							2.41E-07	(1.97E-07)
Year of Data							0.0000938	(0.000167)
$\sigma(CI_{BMIw})$							-0.1258769	(0.993267)
HE _i							3.93E-07	(9.68E-07)
Intercept	-0.9699123	(1.58294)	0.1292051	(2.007228)	0.1292051	(2.007228)	-0.2518979	(1.839236)
Adjusted R ₂	0.04		0.05				0.17	
Fixed Effects	No		Yes		Yes		Yes	

Note: Highlighted values are significant at a conventional 5%.

Appendix

Figure A1. Kuznets' Curve

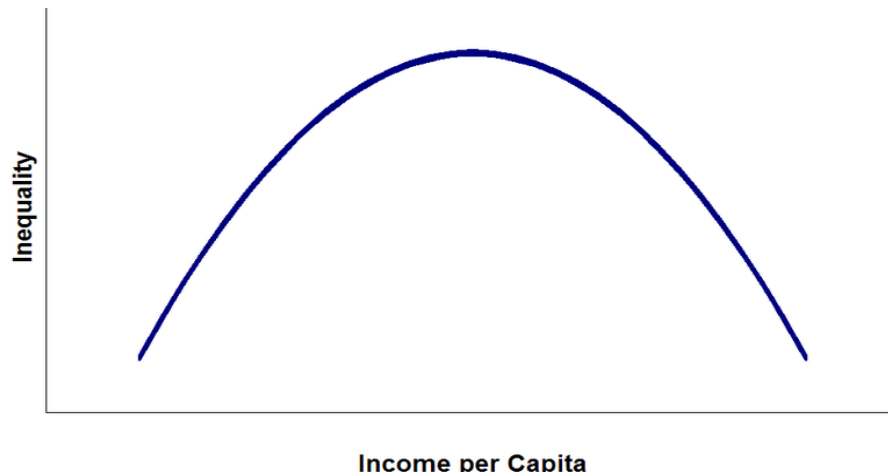


Table A1. Descriptive Statistics World Health Survey Sample N=70

Variable	Definition	Mean	(s.e)
<i>Inequality Measures</i>			
CI_{HW}	Weighted Concentration Index (CI) Self-Assessed Health	0.013936	0.001381
$\sigma(CI_{HW})$	Standard error Weighted Concentration Index (CI) Self-Assessed Health	0.003687	0.000278
CI_{BMIW}	Weighted Concentration Index (CI) Body Mass Index	0.006835	0.001833
$\sigma(CI_{BMIW})$	Standard error Weighted Concentration Index (CI) Body Mass Index	0.005345	0.001988
<i>Economic and Health Development Measures</i>			
Y_i	Per Capita Gross Domestic Product Sample 2003	15276.86	1807.068
LE_i	Life Expectancy	69.67143	1.257478

$\mu(H_i)$	Average Self-Reported Health	2.221103	0.035856
$\mu(BMI_i)$	Average Body Mass Index	24.4525	0.215901
IM_i	Infant Mortality	26.3	3.257948
Controls			
N_i	Sample Size of the CI estimate	9804	1554
HE_i	Health Expenditure % GDP	7.02	0.3024
$GINI_i$	Gini Coefficient for Income	0.47839	0.018364

Source: World Health Survey, 2006.

**Table A2.Descriptive Statistics European Union Household Panel Survey Sample
N=94**

Variable	Definition	Mean	(s.e)
<i>Inequality Measures</i>			
CI_{HW}	Weighted Concentration Index (CI) Self-Assessed Health	0.06281	0.00317
$\sigma(CI_{HW})$	Standard error Weighted Concentration Index (CI) Self-Assessed Health	0.00614	0.00013
CI_{BMIW}	Weighted Concentration Index (CI) Body Mass Index	0.016	0.0002
$\sigma(CI_{BMIW})$	Standard error Weighted Concentration Index (CI) Body Mass Index	0.0006	0.001
<i>Economic and Health Development Measures</i>			
Y_i	Per Capita Gross Domestic Product	22643.27	544.4499
$\mu(H_i)$	Average Self-Reported Health	0.6732	0.01054
LE_i	Life Expectancy	77.441	0.1137
BMI_i	Body Mass Index	24.9	0.53
<i>Controls</i>			
Year Wave of Data	Wave of the ECHP survey	6.237	
N	Sample Size of the CI estimate	5371.362	238.7461
POP_i	Population	23355.44	2398.082

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