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Abstract

The distribution of income related health inequalities appear to exhibit varying patterns when developing countries and developed countries are examined. One explanation is the existence of a health Kuznets' curve. This paper sets out as an exploratory analysis to test the hypothesis of an inverse U shape pattern between both economic development (as measured by GDP per capita) and income inequalities in health (as measured by concentration indices). We draw upon two datasets, the World Health Survey and the European Community household survey. Our results show that income-related inequalities in self-reported health rise but tail off once a threshold level of economic development has been attained. Thus, there is a health Kuznets' curve on per capita income, with a polynomial association where the tipping point lies around $26,000 to $38,700.

JEL-Code: I180, O100, I300.

Keywords: concentration indices, self-reported health, health inequalities, Kuznets' curve, income related health inequalities.

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1. Introduction

The evolution of income related 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, 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 health (van Doorslaer et al, 1997; Montoya-Diaz, 2002; van Doorslaer and Koolman, 2003, 2004; Islam et al, 2010). However, we know very little about how such inequalities vary across countries economic development.

One can hypothesise 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, 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 direct effect as well as indirect effects on the introduction of health insurance schemes. In considering health inequalities, one might focus on 'pure inequalities' in health, which are largely the results of wider socio-economic determinants, some of which are out of policy action (Schultz, 2003), 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 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. We leave it to another research project, a wider understanding of potential different mechanisms underpinning the association of economic development and 'pure' health inequalities.

The hypothesis of a health Kuznets curve (an inverse U shape association between health inequalities and economic development) has been widely overlooked in the literature. 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. At early stages of industrialisation inequality is bound to increase, and it decreases when the effects of economic development spread across the entire population.

A classic Kuznets' curve reflects a quadratic relationship between income inequality and economic development. 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 (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, focusing in developing countries draws upon the body mass index (BMI) and calorie

consumption as an indicator of wellbeing fails to find evidence of a Kuznets' curve (Sahn & Younger, 2009) (Haddad, Kanbur, & Bouis, 1995).

This paper attempts to examine how the most widely used measure of income related inequality, namely concentration indices of self-reported health vary with income and average health of the population. The latter allows testing for a "Health Kuznets Curve" in income (socio-economic Kuzents curve). In particular, we test for a concave relationship between health inequality, measured as income related inequality and income (measured as GDP per capita). We take advantage of two rich datasets _ the Wold Health Survey (WHS) and European Commission Household Panel (ECHP). The former is a cross sectional database with a large heterogeneity in countries' economic development, and latter that takes advantage of time-series – cross-section heterogeneity (cross country characteristics driving the relationships).The datasets- contain a representative sample population records of the world population sample in the survey and Europe. We believe 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. Other older analysis were carried out using cross sectional data from different surveys (van Doorslaer, *et al*, 2007).

We intend to advance the understanding of the relationship between income related health income inequalities and economic development. We hypothesise some form of negative association between health inequalities and both economic (per capita GDP in US $). 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 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) documents 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.

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.

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. Section 2 contains a description of the data and methods. Section 4 reports the results and the final section concludes.

2. Data

To gather cross sectional evidence we use te 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. 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 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). *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.

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).

Inequality is measured using concentration indices (CI) , which have been extensively used for measuring inequalities and inequities (Wagstaff and van Doorslaer, 2000). The CI is an index that quantifies the degree of socioeconomic-related inequity in a health indicator (Kakwani, Wagstaff, & vanDoorslaer, 1997; vanDoorslaer, *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 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).

3. Testing for a Kuznets' curve

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), however the mechanisms at play are far less straightforward, insofar that whilst economic development is measurable and observable, health development is not equally measurable and well identified to ground generalised policy making trade-offs at a county level.

Hence, our strategy has been to estimate a variety of specifications drawing from simplest quadratic specification the coefficients of which are straightforward to interpret so as it generated an inverted U-curve as follows:

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

CI refers to concentration index estimates of two separate measures of health (self-reported health); y_{it} refers to measures of economic development (e.g., GDP) which are hypothesised to follow a quadratic relationship (y^2_{it}); 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 that health inequality might vary with socioeconomic position of the majority of the population.

To illustrate the potential variation of health inequalities with socioeconomic position, 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:

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

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, we have estimated a range of different equations, which control for country-specific heterogeneity. 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 existence of longitudinal data allows us to account for country specific fixed effects and hence isolate the effect of country specific unobserved heterogeneity.

3. Results

The simplest results of our strategy can be illustrated by **Figure 1** that 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 calls for further empirical analysis. When the same association is examined with a sample of European countries in **Figure 2** we also find no clear linear association and again, a specific polynomial association can be drawn out.

[Insert Figure 1-2 about here]

We then proceed with regression analysis drawing upon Ordinary Least Squares (OLS) and then accounting for the censoring of the data through Tobit models. In all specifications, we find conclusive evidence that a quadratic functional form fits the data when weighted CI is regressed against GDP per capita. The final column provides the estimates of an inverse GDP per capita specification as per. In addition, we have clustered standard errors by country and provide robust standard errors to account for potential heteroscedasticity in the data. 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. 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 and 2 about here]

A further specification to check results lies in adding a longitudinal dimension of the data. Again, we find as reported in Table 2 evidence of as 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.

4. Discussion

This paper set out to document evidence of a health Kuznets' curve reflecting an association between incomes related health inequalities economic development. Drawing upon several alternative cross section and longitudinal specifications we find empirical evidence of a Kuznets' curve

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 political economy explanations include the role of democracy (Przeworski, 2004) and 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

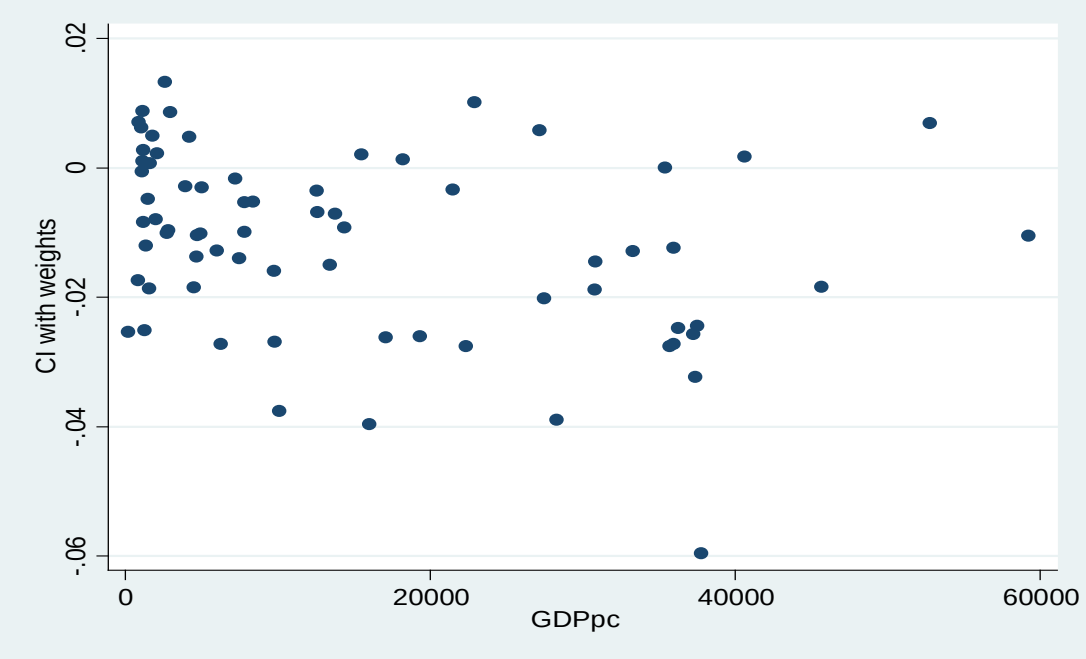
cost of accessing health care by creating larger risk pools, but can affect access to health care, and influence preventive activities. One potential limitation lies in thatself-assessed health might vary across the income distribution. If income is associated to the ability to identify illness symptoms, then self-reported health measure will systematically underestimate health inequality.

5.Conclusion

We know reasonability little about what explains the variation in income related inequalities in health. This paper has explored one explanation, namely the existence of a health Kuznets curve on economic development. Empirical evidence suggests that health inequalities increase with economic development but they drop after a turning point at a GDP per capita varying between 26,000 and 38,200. Our preferred explanation lies in that after such a threshold counties are more likely to be democratic and widespread insurance schemes tend to be introduced to curve the expansion of income related health inequalities.

Figures and Tables

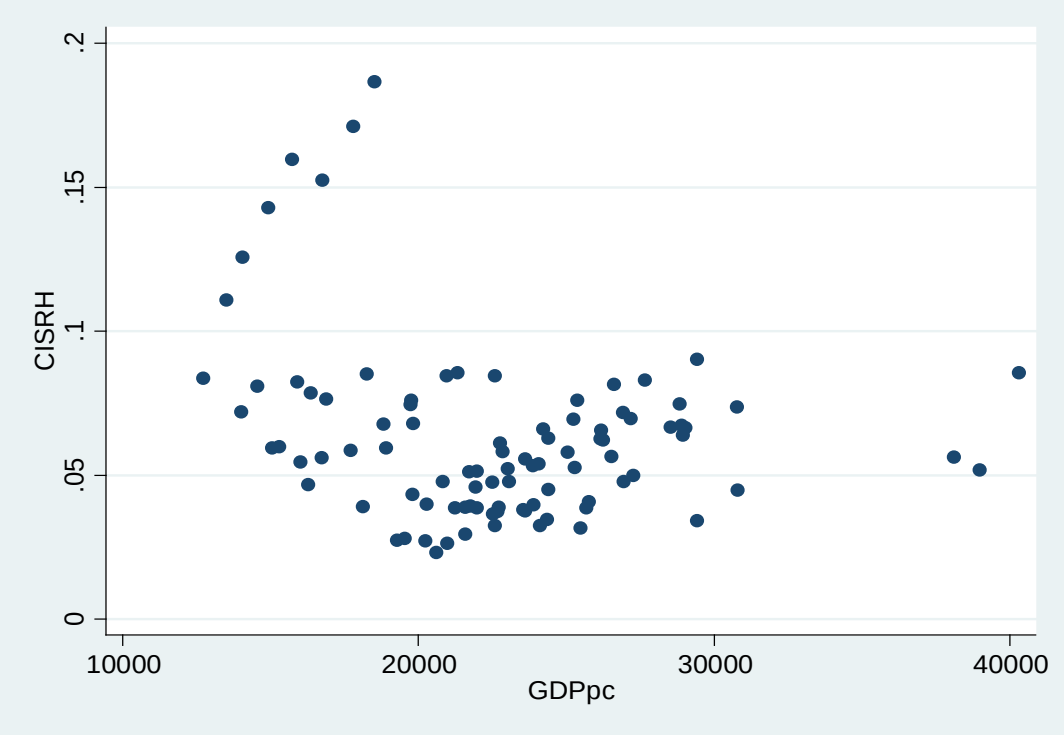
Figure 1. Cross- Section Health Kuznets' Curve on Self-Reported Health (World Health Survey)



Source: Own calculation on the WHS (2002).

Note: Income health inequalities are measured using a polynomial Health inequality (CI_{Hw}) (Y − axis) *and* Economic Development measures as Gross Domestic Products (GDP) per capita (X-Axis)

Figure 2. Longitudinal Health Kuznets' Curve on Self-Reported Health (European Community Household Panel)



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

Note: Income health inequalities are measured using a polynomial Health inequality (CI_{Hw}) (Y − axis) *and* Economic Development measures as Gross Domestic Products (GDP) per capita (X-Axis)

Table 1. Kuznets' Curves on Self –Reported Health (CI_{Hw}) – Cross Section Data from the World Health Survey

	World Health Survey					
	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-1)[a] (4.64E-12)	-9.87E-12[a] (4.68E-12)	
$1/Y_i$						1.89302[a] (1.09907)
Controls	No	Ye	No	Yes	Yes	Yes
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. Controls: Number of observations, standard error of the concentration indexes.

Table 2. Kuznets' Curves on Self –Reported Health (CI_{Hw}) – Longitudinal Data from the European Community Household Survey

	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)
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								
Controls	No		No		Yes		Yes	
Log -Like								
Cut-off Y_i	**35,200**		**34,8000**		**34,600**		**30,000**	

[a] Significant at 5% level.
Controls: Number of observations, standard error of the concentration indexes, and population

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Appendix

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

Variable	Definition	Mean	(s.e)
	Inequality Measures		
CI_H	Concentration Index (CI) Self-Assessed Health	0.014	(0.001)
	Economic and Health Development Measures		
Y_i	Per Capita Gross Domestic Product Sample 2003	15276.86	(1807.07)
	Controls		
N_i	Sample Size of the CI estimate	9804	(1554)
POP_i	Population	66801.4	(25529.9)

Source: World Health Survey, 2006.

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

Variable	Definition	Mean	(s.e)
	Inequality Measures		
CI_H	Concentration Index (CI) Self-Assessed Health	0.063	(0.0032)
	Economic Development Measures		
Y_i	Per Capita Gross Domestic Product	22643.3	(544.45)
	Controls		
N	Sample Size of the CI estimate	5371.36	(238.75)
POP_i	Population	23355.44	(2398.08)

Source: ECHP several years.