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The relative income hypothesis: does it exist over time?
Evidence from the BHPS.

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Abstract

The relative income hypothesis suggests that income inequality has a detrimental affect on people's health. This previously well accepted relationship has recently come under scrutiny. Some claim it is a statistical artefact, while others argue that aggregate level data are not sophisticated enough to adequately test for its existence. This paper adds to the debate by estimating the relationship between income inequality and health using panel data. A random effects ordered probit is used to estimate the relationship between net household income, regional income inequality and self-reported health, for 3736 individuals over 9 years, while controlling for individual socioeconomic characteristics like gender, social class and age. Significant differences in income inequality across regions and considerable changes in health are found across years, however, the panel data estimating regressions find no significant association between any of the measures of income inequality and self-reported health. Therefore, it would appear that the relative income hypothesis does not exist over time and does not exist within Britain.

Keywords: Self rated health, income inequalities, random effects ordered probit, BHPS

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Introduction

The absolute income hypothesis suggests that health improves with average income but at a decreasing rate, that is there is a ‘curvi-linear’ relationship between income and health. The relative income hypothesis (also known as the Wilkinson hypothesis) suggests otherwise, arguing that health depends on the degree of income inequality in society (Wilkinson, 1996); that is, for any given average level of income the more equally distributed this income the higher will be the average standard of health.

There are three potential mechanisms that underlie this relationship: one school of thought argues that large disparities in income result in disinvestment in human capital (the interests of the tax payers diverge from those on low income, resulting in lower taxes and reduced public spending) (Kaplan, Pamuk, Lynch, Cohen & Balfour, 1996); others believe inequalities are detrimental because they erode social capital (the features of an organisation that facilitate cooperation) (Kawachi & Kennedy, 1997, 1999); while some argue that inequalities in income result in health harming social comparisons (James, 1998; Schor, 1998).

Irrespective of the pathway, there has been a vast amount of research investigating the existence of a relationship between health and income inequality. Statistical associations have been reported using cross-sectional and longitudinal data; both within and between countries; in high, middle and low income countries; for numerous indicators of mortality and morbidity; and various measures of income inequality (see Ellison, 2002; Wagstaff & van Doorslaer, 2000). This apparent support lead Wilkinson to conclude that the “income distribution relationship is now firmly established” (Wilkinson, 1996, p.105).

More recently, however, this consensus has become diluted. Empirical studies at an individual level are no longer reporting such strong support (Mellor & Milyo, 2003; Macleod, Lavis, Mustard & Stoddart, 2003; Daly, Duncan, Kaplan & Lynch, 1998). Moreover, a theoretical debate has arisen that suggests that the reported associations are actually a statistical artefact. Gravelle (1998) argues significant relationships between income inequality and health at the population level (using aggregate data) are the result of the nonlinear (concave) relationship between absolute income and health. He suggests that further research into the independent effect of income inequality is required and that such research should use a combination of individual and population level data.

Wagstaff & van Doorslaer (2000) also advocate the use of individual level studies. In a review of the literature on the effect of income inequality on health, they identify a number of hypotheses – the relative income hypothesis, the deprivation hypothesis, the relative position hypothesis and the income inequality hypothesis – which might give rise to a link between income inequality and health. They argue that only individual level studies have the potential to discriminate between the absolute income hypotheses and the different versions of the relative income hypothesis.

From a policy perspective it is important to distinguish these effects. While both the absolute income hypothesis and the relative income hypothesis predict that a reduction in inequality can improve the health of a population, the relative income hypothesis suggests that such redistribution can have a double effect. As Gravelle explains "…if policies that alter the distribution of income are to be judged at least partly by their effects on population health, knowing how large these effects are is important" (Gravelle, 1998, p.384).

This paper attempts to add to the debate on the relationship between income inequality and health in a number of ways. First, we use individual level data from the British Household Panel Survey (Taylor, Brice, Buck & Prentice-Lane, 2002), so we can appropriately test for and distinguish between the absolute income hypothesis and the relative income hypothesis. Secondly, the data are longitudinal, and as such allows us to investigate whether the hypotheses exist over time. Finally, previous within country studies have used North American data (e.g. Kennedy, Kawachi, Glass & Prothrow-Stith, 1998; Macleod, et al., 2003), and to our knowledge few researchers have exploited British data to this effect before (e.g. Wildman, 2003; Weich, Lewis & Jenkins, 2002).

Methods

The relationship between income inequality and health is estimated using a random effects ordered probit model (Butler & Moffitt, 1982; Greene, 2000). This regression technique is built around a latent variable model, where Y_{it}^{*} is the unobserved dependent variable, individual health status, X is a vector of explanatory variables, including income and income inequality, and β an unknown parameter vector and ε the error term, *i* and *t* index individuals and time respectively

$$Y_{it}^{*} = X_{it}\beta + \varepsilon_{it} \qquad (i = 1, \ldots, \mathrm{N};\ t = 1, \ldots, \mathrm{T}) \qquad (1)$$

However, Y_{it}^{*} is unobservable, so instead we observe the following

$$Y_{it} = \begin{cases} 0 & \text{if } Y^{*} \leq 0 \\ 1 & \text{if } 0 < Y^{*} \leq \tau_1 \\ 2 & \text{if } \tau_1 < Y^{*} \leq \tau_2 \\ . & \\ . & \\ J & \text{if } \tau_{\mathrm{J-1}} \leq Y^{*} \end{cases} \qquad (2)$$

where Y_{it} is self rated health of individual *i* at time *t*. τ is the vector of unknown cutpoint parameters which are to be estimated with the β's.

The log-likelihood function for the problem is

$$L = \sum_{i=1}^{N} \log[prob(Y_{it}, \ldots, Y_{iT})] \qquad (3)$$

where

$$prob(Y_{it}, \ldots, Y_{iT}) = \int_{a_{i1}}^{b_{i1}} \ldots \int f(\varepsilon_{i1}, \ldots, \varepsilon_{iT}) d\varepsilon_{iT} \ldots d\varepsilon_{i1} \qquad (4)$$

and $a_{it} = -X_{it}\beta$ and $b_{it} = \infty$ if $Y_{it} = 1$, $a_{it} = -\infty$ and $b_{it} = -X_{it}\beta$ if $Y_{it} = 0$, and $f(\cdot)$ is the normal density function. Conditioning on the permanent component allows the integral to be simplified

$$
\begin{aligned}
&prob(Y_{i1},\ldots,Y_{iT}) \\
&\qquad = \int_{a_{i1}}^{b_{i1}} \cdots \int_{-\infty}^{\infty} \prod_{T=1}^{T} f(v_{it} \mid \mu_{it}) f(\mu_i) d\mu_i dv_{iT} \ldots dv_{i1} \qquad (5) \\
&\qquad = \int_{-\infty}^{\infty} f(\mu_i) \prod_{t=1}^{T} [F(b_{it} \mid \mu_i) - F(a_{it} \mid \mu_i)] d\mu_i
\end{aligned}
$$

where $F(\cdot)$ is the normal cumulative distribution function. This expression can now be approximated with the Gauss-Hermite quadrature in a maximum likelihood estimation (Frechette, 2001).

Data

The British Household Panel Survey (BHPS) is a longitudinal survey of households in Great Britain (England, Scotland and Wales) (Taylor et al., 2002). The first wave of data was collected in 1991 and repeated each year, such that currently there are 11 waves of data available (1991-2001). Initially, a nationally representative sample of some 10,000 individuals in over 5,000 households were interviewed. In subsequent years these same individuals were re-interviewed, as were any new members of their household (and members of newly formed households). Information is collected at both the individual and household level, and includes questions on income, employment, health and wellbeing, demographics, neighbourhood, and values and opinions.

Health status

The self completion questionnaire component of the BHPS includes a range of health questions that cover various dimensions of health. In this instance, individual health status is proxied by a subjective assessment of one's general health. In each wave respondents were asked: "Compared to people of your own age, would you say that your health over the past 12 months has on the whole been excellent, good, fair, poor or very poor?" Unfortunately, in wave i (1999) the SF-36 questionnaire (Ware, Snow, Kolinski & Gandek, 1993) was included in the survey, resulting in a rewording of this question to: "In general would you say your health is excellent, very good, good, fair or poor?" To deal with this anomaly it is necessary to recode the variable, creating four categories: excellent, good, fair and poor. The categories poor and very poor are combined for all waves; and for wave i, a random sample of 33% of the very good's are recoded as excellent, 20% of the good's recoded as fair, and 20% of the fair's recorded as poor. These recodings and weights were chosen to maintain the averages (for wave a to h) for each category.[1]

Thus the dependent variable, individual health status, is an ordered categorical variable of self assessed health, with values ranging from 1 (poor) to 4 (excellent). Self rated health has repeatedly been found to be a strong predictor of subsequent mortality (Idler & Benyamini, 1997); and although the relationship between self rated health and mortality has not yet been established within the BHPS data set, we undertook an initial investigation of its validity and found that it is strongly correlated with GP visits (ρ=-0.48).

Income

Annual total household income, as given in the BHPS data set, is a derived variable which sums all income (labour and non-labour, including income from rent and investments, etc) for all individuals in the household for the 12 months prior to the start of the interview period (the 1st of September in each reference year). It refers to gross income, however, net income provides a more accurate reflection of economic status and purchasing power. Derived net annual household income, which deducts income tax, national insurance and pension contributions from gross income, is available as an unofficial supplement (Bardasi, Jenkins & Rigg, 2001) and thus is used instead. This measure has been equivalised using the McClements before housing costs scale (to take account of household composition and size) and has been deflated to January 1998 prices.

To test the absolute income hypothesis, that there is a 'curvi-linear' relationship between income and health, household income is included in the regression in logarithmic form. While the relationship between income and health is expected to be nonlinear, it may not be to the degree of a log transformation, that is it may not be strictly concave.[2] To allow for this, the equation is also estimated using other nonlinear relationships, namely polynomials of income (quadratic and cubic) and income categories.

Income inequality

The primary measure of income inequality that we employ is the Gini coefficient. It is one of the more common measures of income inequality and has been widely used to test the relationship between inequality and health (Kennedy et al., 1998; Soobader & LeClere, 1999; Mellor & Milyo, 2001). In the BHPS individuals are grouped into one of 18 regions (16 within England, plus Scotland and Wales) such that regional Gini coefficients can readily be calculated (Jenkins, 1999).[3,4] A number of other regional inequality indices (generalised entropic measures, GE(α) for α=-1, 0, 1, 2; Atkinson indices, A(ε) for ε=0.5, 0, 1; and the 90th/10th percentile ratio) were also calculated to control for sensitivities in different areas of the distribution (Laporte, 2002).

Although these indices are commonly employed, it is possible that they are too complex, and are, therefore, failing to pick up what is in essence a simple relationship. If, for example, the theory of social comparison is to be believed then the relationship between income inequality and health is one whereby an individual's health suffers as a result of comparing their own (lack of) income with those of others; if this is the case then indices like the Gini coefficient may not necessarily reflect this. Therefore, as an alternative, a more basic measure of inequality is also employed; the difference between each individual's household income and the average income within their region, that is, a regional income gap.

Furthermore, many of mechanisms that underlie the relationship depend on an individual's reference group (Merton & Kitt, 1950; Deaton, 1999, 2001). The indices described above imply that an individual's frame of reference is others in their region. This is simply because the data lend itself to regional analysis, however, comparisons can be undertaken, and may be more appropriate, at a more refined level, say neighbourhoods, or at a much more aggregated level, e.g. nationally. Neighbourhood reference group analysis is not possible (due to sample size and ethical issues), however, it is possible to combine local area authorities (the most narrowly defined geographical areas available in the data set) into 'counties', such that county level Gini coefficients are estimated and employed in subsequent analyses.[5]

Reference group analysis at the national level can be represented by a number of alternative measures. The position of individuals in the income distribution is one such proxy. This was undertaken by ranking individuals, across the whole sample, in terms of their net household income. These ranking were then normalized to lie between 0 and 1, such that the wealthiest individual has a ranking of 0 and the poorest a ranking of 1. Another population based measure which was employed, and is similar to a measure described earlier, is a variable which calculates the difference between an individual's income and the average income for the population as a whole, that is, a national income gap, rather than a regional one as described above.

Two further population based indices are also estimated. These are modelled on deprivation measures described by Hey & Lambert (1980) and used by Wildman (2003) and Wildman & Jones (2002). It involves estimating an individual's deprivation by combining their (lack of) income with the proportion of people with income greater than their own, and then normalizing the scale. There is one measure for the whole sample, where the least deprived individual has a value of 0 and the most deprived a value of 1; and a measure just for those individuals below some poverty line (deemed to be half of the average income in the sample), such that that individuals who are not in poverty have no deprivation (a value of 0) and the individual with the greatest deprivation again has a value of 1.

One further and final measure of inequality which is included in repeated analyses, is an interaction term between income quartiles and the (regional) Gini coefficient. Previous work (Kennedy et al., 1998; Soobader & LeClere, 1999) has shown that the detrimental effects of income inequalities are more pronounced for those in the bottom of the income distribution. This interaction term, combining both income inequality and the position of the household in the income distribution, should capture this and allow for this assertion to be investigated.

Other explanatory variables

Age, gender, martial status, ethnicity, education and socioeconomic status are included in the estimating equation to represent individual and demographic factors that are thought to affect health.

Age and its square are included in the basic regression equation, as initially health is expected to improve with age and then decline in later life. This nonlinear relationship is tested further in repeated analyses, by including higher order polynomials (cubic) and categorising age into bands.

Gender is included as an explanatory variable, taking a value of 1 if female and 0 if male. An interaction between gender and age is also included in a subsequent analysis to control for a childbearing effect, that females of childbearing age may self rate their health differently from other females.

Martial status is categorised into four variables, married or living as a couple, widowed, divorced or separated and never married. Married is the excluded category in the regression equation and thus the reference case.

Due to limitations in the original sampling, it is only possible to categorise ethnicity into white and other. The dummy variable included in the model takes a value of 1 if an individual is non-white.

Education, defined as an individual's highest education qualification, is categorised into four different variables representing different levels of attainment (higher or first degree, A-levels or apprenticeship, O-levels or similar, and no qualification). No qualification is the excluded category.

Socioeconomic group is a derived variable in the BHPS whereby individuals are classified according to their occupation. We further aggregated these groups into variables representing professionals, non-manual employees, skilled manual workers, unskilled and semi-skilled occupations and other (own account workers and farmers etc). If an individual's socioeconomic group was recorded as "not applicable", due to the fact they were not employed, then these individuals are classified as either unemployed or not in the labour market (from information on their current labour force status). Unemployed is the excluded category and, therefore, the reference case.

Finally, time dummies, derived from the wave identifiers, were also included to pick up any effect of time on self rated health across the panel.

The full set of explanatory variables, along with the dependent variable, are summarised in Table 1. Note a number of these variables are time invariant, or show little variation over time, but are included in the panel data estimation to control for possible omitted variable bias.

Analysis

All analyses are undertaken using Stata 8.0 (Stata Corporation, 2003). A balanced panel is employed, such that only individuals from the first wave who were interviewed in each subsequent wave are included.[6] This, together with the exclusion of individuals with missing values on variables of interest, combined with the fact that net household income data are only currently available for the first 9 waves, resulted in a sample of 3736 individuals, across 9 years, giving a total sample of 33624 observations. Although, some households recorded zero income such that the log of income is undefined so the regression analysis is conducted on a sample of 33607.

Results

Table 2 reports the proportions of self rated health for each year and for the sample as a whole. It appears that over time there has been some change in the way that individuals self rate their health. Fewer individuals are reporting excellent health, while proportionately more are reporting fair health. Income inequality during this period has also varied significantly. Figure 1 presents one representation of this. It is necessary to test, however, whether these changes in health and inequality are independent or are in fact correlated. A random effects ordered probit addresses this, the results of which are presented in Table 3.

Table 3 reports the results of our initial investigation into the existence of a relationship between health and income inequality, using regional Gini coefficients as the measure of income inequality. As a number of other researchers use the Gini coefficient and investigate the relationship at a state/regional level, this specification assists comparisons.

As discussed previously the maximum likelihood estimation of an ordered probit model, where self rated health is regressed on income, income inequality, age, gender, martial status, education, social class and time dummies, does not fail the Ramsey RESET test (Ramsey, 1969) and, therefore, is not considered to be misspecified. The coefficient on rho is found to be significantly different from zero, implying the data should not be pooled across individuals; while the likelihood ratio test comparing the restricted and unrestricted models shows strong overall significance for the set of explanatory variables.

The regression results in Table 3 show support for the absolute income hypothesis; there is a significantly positive relationship between self rated health and the log of household income. There is a similar positive and significant relationship between education and health. Furthermore, the coefficient on higher education is greater than the estimated coefficient on A-levels which is greater than the coefficient on O-levels. Thus relative to having no qualifications, gaining a degree or some form of higher education has a greater impact on an individual's self rated health than achieving A-levels and similarly for gaining A-levels compared to O-levels.

Negative and significant coefficients are reported for females and non-whites. Thus individuals who are female and are part of an ethnic minority are more likely to self rate their health worse than males and white individuals, respectively. A negative coefficient is also reported for those not in the labour force, implying that relative to the unemployed they are more likely to report worse health. The opposite is found for individuals in professional occupations and those in other occupations (own account workers and farmers), significant positive coefficients are reported for these explanatory variables suggesting they are more likely to self rate their health higher than the unemployed. Interestingly, a positive and significant coefficient is also reported for widowed, implying that relative to married people, widowed individuals are more likely to self rate their health higher. Finally, a significant quadratic relationship is found between age and health, implying health improves with age and then declines, the turning point for which is estimated to be 39 years.

More importantly, however, is the finding that while the estimated coefficient on the regional Gini coefficient has the expected negative sign it is insignificant. Moreover, this insignificance is robust to the numerous other measures of inequality; see Table 4. Each of the alternative more complex measures (the generalized entropy classes, the Atkinson indices and the percentile ratio) are not found to be significantly different from zero. Nor are the basic measures representing the difference between actual income and the regional or population average. Estimation of the model with Gini coefficients at the county level also result in an insignificant coefficient, implying that the insignificance of the relationship is not a result of aggregation. Furthermore, the interaction term between the regional Gini coefficient and income quartiles is also insignificant, as is the other variable reflecting one's position or ranking in the income distribution. Finally, the coefficient on the population deprivation measure is also insignificant (row 14, Table 4). The only (marginally – at the 10% level) significant relationship between health and income inequality evident in Table 4, rests with the variable representing relative deprivation for those in poverty. The coefficient on this variable is, however, positive, which contradicts the relative income hypothesis.

These results are also insensitive to the formulation of the model (the results of which are not presented but are available from the authors). Changing the specification of the non-linearity of income, that is including a quadratic and income categories (inclusion of a cubic resulted in non-cavity such that the ordered probit could not be estimated) did not alter the results, similarly when including a higher order polynomial for age (which incidentally gave nonsensical turning points). The inclusion of an interaction term between gender and age also did not significantly alter any of the reported correlations.

The results in Tables 3 and 4 would, therefore, appear to suggest that while there is a place for the absolute income hypothesis in determining how individuals self rate their health, there is no similar role for the relative income hypothesis, income inequality does not appear to impinge (or improve) individual health.

Discussion

Employing data from the BHPS has allowed us to overcome a number of problems associated with establishing whether there is an independent effect of income inequality on health. The aggregation problem and statistical artefact issues are addressed, such that we are able to appropriately distinguish between the effects of the absolute income hypothesis and the relative income hypothesis (and its variants). Furthermore, the use of longitudinal data has allowed us to take account of any unobservable individual effects that may confound the relationship between income and health. Household level income is included in the model in a nonlinear fashion, thus reducing the possibility that the relationship between health and income is misspecified and the coefficient on income inequality biased. A further test for misspecification, in the form of a RESET test, is also undertaken to inform us on the robustness of the results.

We use a random effects ordered probit, which allows us to maximise the variation in the ordinal dependent variable (compared to using binary data), while controlling for any random events or factors which may exist across the panel. The panel data regression results provide some understanding as to what factors affect self rated health, and whether there is evidence of the absolute income hypothesis and/or the relative income hypothesis.

Most of the significant findings are as expected (in terms of magnitude and sign) given our prior beliefs, in addition many of these relationships have been found previously (e.g. Kennedy et al., 1998; Gravelle & Sutton, 2003). This provides us with some confidence that the methodological framework and included explanatory variables provide an appropriate approximation for modelling the determinants self rated health. Specifically, with reference to the role of income and income inequality, we find a positive and significant relationship between self rated health and the log of net household income, that is support for the absolute income hypothesis. However, no significant relationship is found between the Gini coefficient and health. Furthermore, this insignificance is robust to the inclusion of numerous measures of income inequality, thus suggesting that there is strong evidence that the relative income hypothesis does not exist. This non-existence finds support from other researchers who have used individual level data (e.g. Mellor & Milyo, 2002, 2003; Daly et al., 1998) and also those who have used the BHPS to test the relationship between income inequality and health (Weich et al., 2002; Wildman, 2003; Wildman & Jones, 2002; Lillard & Burkhauser, 2003).

Weich, et al. (2002) found limited evidence of any relationship between inequality indices and self-rated health using the first wave of data from the BHPS. While the Gini coefficient is associated with worse self rated health when individuals living in higher inequality regions are compared to those in low inequality regions, the association is not robust to alternative inequality indices. Wildman & Jones (2002) employ the data set to test whether absolute income or relative deprivation is a driver of poor psychological wellbeing; and also find little evidence of the effect of relative deprivation on wellbeing. Although in a similar analysis Wildman (2003) finds increases in relative deprivation significantly decrease the mental health of women, but not for men. Interestingly, using a compendium of panel studies that includes the BHPS, Lillard & Burkhauser (2003) not only find no evidence of a positive relationship between greater income inequality and the likelihood of reporting poor health, but some support for an opposing association.

Such mounting evidence would indeed suggest that the income inequality/health link is "slowly dissipating" (Mackenbach, 2002, p.2). There are, however, some limitations with our research (as with others) that make such a conclusion a little too hasty. First, although we employ panel data we have not fully exploited the time dimension of the data. Our model is static rather than dynamic, such that only the contemporaneous relationship between income inequality and health is analysed. Blakely, Kennedy, Glass & Kawachi (2000) find evidence that the relationship between income inequality and health is stronger with a 15 year time lag, suggesting that the association is a long-run phenomenon.[7] Further work with individual level data is essential to fully analyse this, and it may be some time until there is a long enough time series of the BHPS with which to conduct such research.

Secondly, although we make an attempt to address the impact of various reference groups, by including county, regional and national measures of income inequality, it is likely that an individual's frame of reference varies widely. Group membership, within which individuals make income comparison which are potentially damaging to their health, may not be determined simply by locality, but possibly by age, gender, race, educational attainment, or some other feature of their peer group. The data set employed here does not readily lend itself to such an analysis, but it is important to consider this further, because as Blakely et al. highlighted "it is not unreasonable to expect the association of income inequality with health to vary by unit of analysis" (Blakely et al., 2002, p.66).

Finally, there is the implication that income inequality and its influences may manifest itself in a number ways such that much of the previous research may employ incorrect representations of the relationship. Wagstaff & van Doorslaer (2000) proposed this possibility when they purported four competing hypotheses: the relative income hypothesis, the deprivation hypothesis, the relative position hypothesis and the income inequality hypothesis. Therefore, before we can confidently dismiss any relationship between income inequality and health, we need to explore each of these hypotheses in turn. Research on this is currently underway (Jusot, 2003), but requires further understanding and refinement before it can contribute to the current debate.

Conclusion

The extensive literature on the effect of income inequality on health has begun to diverge from the consensus that income inequality is detrimental to health. There is a need for further research to inform this discussion, especially given the policy implications of the relative income hypothesis (versus the absolute income hypothesis). Furthermore, income and its effect(s) will be vital in informing the current debate on health inequalities.

The results presented here would suggest that while there are significant differences in income inequality across regions, and considerable changes in self rated health across time, there is no significant association between income inequality and health. There is strong evidence to support the absolute income hypothesis, but it would appear that the relative income hypothesis does not exist over time and does not exist within Britain.

Endnotes

1. Sensitivity analyses were conducted around this recoding, and the regression results were found to be robust to changes in proportions and categories.
2. Although, Wildman & Jones (2002) estimate the relationship between health and income using semiparametric and parametric models and they find that the log of income is a suitable parametrisation.
3. Inequality indices were estimated so individuals within the same region are assigned the same index, such that inequality differs across regions and across waves, but not across individuals within a region.
4. To minimise contamination and improve the robustness of the inequality indices, the top and bottom 1% of the income distribution were trimmed before the indices were derived (Cowell & Victoria-Feser, 1996).
5. While the BPHS was conducted as a nationally representative sample, not all local authorities are represented and some are more sparsely represented than others.
6. Estimating each alternative regression equation with an unbalanced panel, however, does not significantly change any of the results.
7. However, Mellor & Milyo (2003) find no consistent evidence of a lagged (or contemporaneous) relationship.

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Table 1: Variable definitions and mean/proportion

Variable	Definition	Mean
HLSTAT	Self rated health	2.915
LOGINC	Log of annual net household income	9.551
GINI	Regional Gini Coefficient	0.258
GENEG	Regional Generalised Entropy class GE(-1)	0.128
GEZERO	Regional Generalised Entropy class GE(0)	0.111
GEONE	Regional Generalised Entropy class GE(1)	0.107
GETWO	Regional Generalised Entropy class GE(2)	0.114
ATKHLF	Regional Atkinson inequality index A(0.5)	0.053
ATKONE	Regional Atkinson inequality index A(1)	0.105
ATKTWO	Regional Atkinson inequality index A(2)	0.203
RATIO	Regional Percentile ratio p90/p10	3.513
BASIC	Actual income less regional average income	0.000
QUART	Gini*Income quartile (regional)	0.648
CGINI	County level Gini coefficient	0.253
RELDEP	Relative deprivation (whole sample)	0.287
RELDEP50	Relative deprivation (below the poverty line)	0.021
RELINC	Actual income less sample average income	0.000
POSIT	Relative position in the income distribution	0.500
AGE	Age at 1st December	46.75
AGESQ	Age squared / 100	24.58
FEMALE	Female	0.537
INTER	Female*Age	25.44
MARRIED	Married or living with a partner	0.733
WIDOW	Widowed	0.076
DIVSEP	Divorced or separated	0.065
NEVMAR	Never married	0.126
NONWHITE	Non-white	0.018
HIGHER	Higher degree, first degree or other higher qualification	0.340
A-LEVEL	A-levels or apprenticeship or other qualification	0.134
O-LEVEL	O-levels or commercial or CSE grade	0.274
NOQUAL	No qualifications or still at school	0.252
PROF	Manager or employer	0.159
NONMAN	Non-manual worker or foreman	0.236
SKILL	Personal service worker or foreman or skilled manual	0.116
UNSKILL	Semi-skilled or unskilled manual worker	0.069
OTHER	Own account worker or farmer	0.048
UNEMPL	Unemployed	0.031
NILSOC	Not in the labour market	0.340

Table 2: Self rated health for each year

	Excellent	Good	Fair	Poor
1991	30.70	46.73	16.22	6.34
1992	27.54	48.53	17.51	6.42
1993	25.51	50.27	18.09	6.13
1994	23.77	50.72	19.08	6.42
1995	22.32	51.20	19.91	6.56
1996	22.99	49.30	20.34	7.36
1997	24.33	46.92	20.50	8.24
1998	22.08	47.72	21.04	9.15
1999	24.44	48.50	19.57	7.49
All years	24.85	48.88	19.14	7.13

Table 3: Determinants of self rated health (random effects ordered probit) – regional Gini coefficient

	Coefficient	T-stat
LOGINC	0.117	6.20
GINI	-0.194	-0.31
AGE	0.022	3.88
AGESQ	-0.028	-4.98
FEMALE	-0.119	-2.99
WIDOW	0.176	3.01
DIVSEP	-0.050	-1.04
NEVMAR	0.010	0.26
NONWHITE	-0.473	-4.30
HIGHER	0.416	8.45
A-LEVEL	0.372	6.81
O-LEVEL	0.364	7.13
PROF	0.154	3.00
NONMAN	0.021	0.42
SKILL	0.022	0.43
UNSKILL	-0.026	-0.48
OTHER	0.122	2.01
NILSOC	-0.190	-3.99
1992	-0.088	-3.18
1993	-0.135	-4.90
1994	-0.196	-7.02
1995	-0.245	-8.72
1996	-0.269	-9.46
1997	-0.272	-9.49
1998	-0.358	-12.31
1999	-0.222	-7.50
Cut 1	-0.865	-3.17
Cut 2	0.456	1.67
Cut 3	2.441	8.93
rho	0.532	81.53
RESET $\chi^2(1)$	0.90	
LR $\chi^2(24)$	796.17	
Observations	33607	

Table 4: Results of repeated estimation with various income inequality indices

	Coefficient	T-stat
GINI	-0.194	-0.31
GENEG	0.078	0.14
GEZERO	-0.060	-0.08
GEONE	-0.137	-0.19
GETWO	-0.129	-0.22
ATKHLF	-0.235	-0.15
ATKONE	-0.070	-0.08
ATKTWO	0.060	0.13
RATIO	-0.009	-0.36
BASIC	-0.001	-0.51
CGINI	0.532	1.43
QUART	-0.032	-0.59
POSIT	-0.123	-1.57
RELDEP	-0.211	-1.40
RELDEP50	0.208	1.76
RELINC	0.000	0.13

Figure 1: Lorenz curves for Merseyside for 1991, 1995 and 1999