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The association between income inequality and mental health: Social cohesion or social infrastructure?

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The Association Between Income Inequality and Mental Health: Social Cohesion or Social Infrastructure?

Richard Layte and Bertrand Maître

Abstract: A large literature has emerged around the strong association between income inequality and average life expectancy and a range of health outcomes including mental well being. Three possible explanations for the association have been offered: that the association is a statistical artefact; the 'social cohesion hypothesis' and lastly, the 'neo-materialist hypothesis'. We examine the ability of these hypotheses to explain the link between income inequality and mental well being in data from 30 countries from the European Quality of Life Survey (2007). Our results offer support to the social cohesion and neo-materialist explanations but evidence for the neo-materialist hypothesis is strongest. Measures of expenditure on social protection and the quality of a range of social services reduce the coefficient measuring income inequality by over two thirds and render it insignificant. However, variables measuring social cohesion such as trust in others, civic participation and social contact reduce the income inequality coefficient by 44% and provide the best fitting model as measured by AIC value.

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The Association Between Income Inequality and Mental Health: Social Cohesion or Social Infrastructure?

1. Introduction

There is now a well-established relationship between individual measures of socio-economic position, health status and life expectancy (Acheson 1998; Kunst et al 1998). Though there is still considerable debate about the relative importance of direct material conditions, psycho-social processes and behavioural and cultural explanations, there is now agreement that a number of different dimensions of individual socio-economic position determine health and life expectancy. The same could not be said of the 'income inequality hypothesis' which holds that economically more egalitarian societies and communities have longer life expectancies and better health outcomes than less egalitarian societies (Wilkinson 1996) and moreover, that the health of even the better off in more unequal societies is reduced as a result of higher levels of income inequality. The hypothesis has received some support from studies comparing states or cities in the US (Kaplan et al 1996; Kennedy et al 1996; Lynch et all 1998) but others using data from further afield have been more negative (Daly et al 1998; Judge 1995; Fiscella and Franks 1997; Lynch et al 2000, 2001).

The income inequality hypothesis has been applied to mental illness in a number of recent papers (Kahn et al 2000; Fiscella and Franks 2000; Weich et al 2001) with the main proponent of the 'income inequality hypothesis' arguing in a recent paper that "higher national levels of income inequality are linked to a higher prevalence of mental illness and, in contrast with studies of physical morbidity and mortality, as countries get richer rates of mental illness increase" (Pickett, James and Wilkinson 2006: 646). Three main hypotheses have been put forward to explain the association between income inequality and higher levels of mental ill health. The first argues that the association is a statistical artefact of the convex relationship between income and health at the individual level. The 'social cohesion' hypothesis on the other hand argues that inequality damages individual health by creating status hierarchies which impact on psycho-social health at the individual level and social cohesion at the societal level. The third hypothesis has been termed the 'neo-materialist' explanation and explains the association via the systematic under investment in social infrastructure and services in more unequal

societies. The extent of information required to test these hypotheses means that all tests to date have been aggregate and ecological (Lynch et al 2000, 2001; Kawachi et al 1997, 1999) and there have been no tests of their validity in terms of mental well being. In this paper we use data at the individual level from the European Quality of Life Survey, a 31 country comparative data file which includes all the relevant variables, plus aggregate data from different sources, to examine the hypotheses above.

The paper proceeds as follows: in the next section we examine the income inequality hypothesis in more detail before describing the data and variables used in the third section. In the fourth section we undertake a number of descriptive analyses to examine the relationship between measures of income inequality and mental health plus other possible intervening processes. In the fifth section we model the cross-country relationship between income inequality and mental health using multi-level models before drawing some conclusions and implications in the sixth and final section.

2. Income Distribution, Social Cohesion and Health

The literature on socio-economic inequalities in health is now a well established with a large number of studies showing that by almost any measure of social and economic advantage including income, those lower down the social hierarchy have worse health and are more likely to die prematurely (Acheson 1998; Kunst et al 1998). Analyses of this association have examined the role of a host of processes operating at the individual level such as differences in the material environment (Doniach et al 1975; Martin et al 1987), health behaviours and cultural difference (Woodward et al 1992; Lynch et al 1997) and psycho-social processes associated with the experience of low esteem, stress and control (Brunner 2000; Siegrist 1995). Some researchers have also suggested that income inequality at the societal level may have a direct impact on individual health (Rodgers 1979; Flegg 1982; Waldmann 1992; Wilkinson 1996; Kaplan et al 1996). The notion that individual health may be influenced by an aggregate or collective characteristic of societies or communities has created substantial interest among researchers. The association between income inequality and mortality has been reported on for at least three decades but its most developed form can be found in the work of Richard Wilkinson (1996). He argues that beyond a given threshold, increases in average income per person at the country level do not lead to increases in life expectancy. Rather, within wealthier countries the distribution of income becomes a more important determinant of

life expectancy[1]. The result is that countries with the same overall level of income per capita will differ in terms of life expectancy, child mortality and overall health as a function of their income distribution (Wilkinson 1996). Subsequent work has confirmed the relationship between inequality and health in the US (Kaplan et al 1996; Kennedy et al 1996; Lynch et all 1998), Britain (Stainstreet et al 1999) and Brazil (Szwarcwald et al 1999) although some contrary evidence has also been presented (Daly et al 1998; Judge 1995; Fiscella and Franks 1997; Lynch et al 2000, 2001).

The income inequality hypothesis has been applied to mental rather than physical illness in a number of recent papers. As with physical illness, the findings of these papers have provided mixed support for the hypothesis. Kahn et al (2000), Fisicella and Franks (2000) and Weich et al (2001) have all reported an association between depression/anxiety and general mental health. Sturm and Gresenz (2001; 2002) on the other hand, found no relationship between level of income inequality and mental well-being. Differences in methodology used across these studies make it difficult to draw an overall conclusion from the findings[2].

Three main mechanisms have been put forward to account for the relationship between income inequality and physical health and life expectancy, and by extension, to the relationship between inequality and mental health. The first argues that the relationship at the aggregate level is artefactual. Assuming the same convex association between income and health at the individual level, different distributions of income will produce different average levels of health at the population level without the need to posit any additional process. This account assumes that the determinants of health are completely specified by processes at the individual level and that the association between inequality and average health is simply an artefact of the sum of the individual effects (Diez-Roux 1998; Koopman and Lynch 1999). There is some research support for this hypothesis: Fiscella and Franks (1997) found that the effect of income inequality on mortality was completely explained once they controlled for the distribution of income in a longitudinal cohort study using US data. However, the effect of measures of income inequality on individual health and mortality have remained after adjustment for individual income across a

[1] He argues that inequality is important in poorer societies also but that its effect is outweighed by the effects of low income.
[2] Studies have used different measures of mental health ranging from non-specific distress measures to clinical screening instruments and have varied significantly in terms of the confounding factors for which they control.

number of other studies (Daly et al 1998; Waitzmann and Smith 1998; Kennedy et al 1998).

A second group of processes forward to explain the inequality-health relationship revolve around the negative effect of perceived relative social position (proxied by their place in the income distribution) on psycho-social processes at the individual level and social cohesion at the community level. This approach is strongly associated with the work of Richard Wilkinson (Wilkinson 1996) but has been promoted by others, most notably, Michael Marmot (2005) and Kawachi and Berkman (2000). Proponents of this approach adopt an essentially Durkheimian concept of social cohesion in terms of the extent of connectedness and solidarity between individuals and groups in society (Kawachi and Berkman 2000: 175). Kawachi and Berkman (2000) follow James Coleman (1990) in seeing a socially cohesive society as one that is rich in stocks of social capital which is defined as the absence of latent social conflict and the presence of strong social bonds. Proponents tend to quote Durkheim's classic study of suicide and research from the Chicago school of sociology from the 1940s (Shaw and McKay 1942) to argue that the 'social facts' of aggregates such as communities and societies like levels of inequality and its impact on social cohesion are stable over time and thus precede individual experience.

Wilkinson (1996), for example marshals an impressive level of evidence on the ecological relationship between national income (usually expressed as GDP per capita) and a number of measures of health including life expectancy, standardised mortality rates and survey measures of self-assessed health and chronic illness. The relationship is certainly robust. Income inequality turns out not only to be a good predictor of mortality cross-sectionally. Changes in income inequality at the country level over time also predict changes in mortality.

Proponents then develop a conceptual link from inequality to social cohesion. Wilkinson (1996) uses a range of anthropological evidence and psychological research to argue that the development of markets within societies fosters the emergence of a moral framework that values individuals according to the narrow yardstick of their income or economic worth. These valuations are internalised by individuals producing emotions of shame and distrust which damage health at the individual level via psycho-endocrine mechanisms and social cohesion within the society by damaging social efficacy, trust and

cooperation[3]. Lower levels of social cohesion also decrease available levels of social support thus decreasing individual's capacity to deal with hardship and contributing to poor health behaviours such as smoking and drinking alcohol.

The third and final mechanism put forward as explaining the link between inequality and health is what has been termed the 'neo-materialist' explanation (Davey Smith 1996; Kaplan et al 1996; Lynch et al 1997; 2000). This holds that the relationship between inequality and health stems from differential levels of investment and development of social and institutional infrastructure in communities and countries where inequalities are high. The relationship between investment and inequality is not an accident. This point is put well by Lynch et al (2000: 1202):

> *"An unequal income distribution is one result of historical, cultural and political-economic processes. These processes influence the private resources available to individuals and shape the nature of public infrastructure – education, health services, transportation, environmental controls, availability of food, quality of housing, occupational health regulations – that form the "neo-material" matrix of contemporary life."*

Kaplan et al (1996) examine variation in income inequality and mortality among US states and relate this to a number of other dimensions of infrastructure that vary between states such as levels of social welfare payments and working of the welfare system, work disability payments, health insurance and even the structure and function of the state library system. All these factors could have a direct bearing upon the living conditions of citizens and their health outcomes.

Though Kawachi and Berkman (2000) and Wilkinson (1996) were taken above as proponents of the social cohesion argument they too are well aware of the impact which better social infrastructure and services may have on health outcomes. Both cite Robert Putnam's work on the impact of inequality and social cohesion on the effectiveness of regional government in Italy and its impact on outcomes for citizens. As with Kaplan et al (1996) Kawachi and Berkman (2000: 186) also make reference to the ecological relationship between income inequality, levels of trust and state welfare assistance rates.

The three mechanisms discussed above provide the basis for the development of a set of hypotheses that can be tested. Translating the conceptual models into empirical analysis

[3] Wilkinson (1996) uses research on primates to link human hierarchies to higher levels of different diseases and particularly cardio-vascular disease.

is not simple however. Although there has been research conducted on each there has not been a study to date which has had access to data necessary to examine all three mechanisms together. Past research on the effect of income distribution relative to individual or household income has largely worked by modelling the impact of an aggregate measure of income distribution (usually a GINI coefficient) or an aggregation of this on health controlling for individual income (Daly et al 1998; Waitzmann and Smith 1998; Kennedy et al 1998; Gresenz, Sturm and Tang 2001).

Hypothesis One: Controlling for the distribution of income at the individual level will explain the effect of the measure of income inequality at the aggregate level.

Analyses of the impact of social cohesion on health and mortality have tended to analyse data at the ecological level. Kawachi et al (1997) for example used average levels of interpersonal trust, norms of reciprocity and associational membership at state level drawn from the US General Social Survey (GSS) to predict state mortality rates. Similarly Kawachi et al (1999) predicted less than good self-assessed health at the individual level but using state level social cohesion data, drawn again from the GSS.

The measurement of social capital and cohesion presents a problem. Conceptually they are collective characteristics but most research, as discussed above, either uses measures at the individual level such as interpersonal trust or measures of the degree of association such as membership of organisations or church attendance. It would be possible to use data drawn at the aggregate level, e.g. number of associations in the local area or community rather than actual membership or attendance by individuals but this would assume that the community characteristic impacted on individual outcomes via another unmeasured pathway (i.e. not membership itself). A better test of the theory would be to use measures of social cohesion at the individual level so that variation across the community could be leveraged. No studies to date have attempted to use a direct assessment of the status comparisons made by individuals which are posited to lead to the breakdown of social cohesion that is at the core of the hypothesis. As explained above, the theory holds that the commodification of individual worth in market societies leads individuals lower down the income hierarchy to feel less valued in their own right thus diminishing trust between themselves and others in society and undermining the moral basis of social institutions.

Hypothesis Two: Controlling for status comparisons, levels of trust in others, levels of trust in institutions, civic participation and social contact will explain the effect of the measure of income inequality at the aggregate level.

Operationalisation and measurement of the neo-materialist hypothesis also presents a challenge. The primary problem is the sheer number of measures that could be used of social infrastructure. Given that health is influenced by experience across the lifecourse (Kuh and Ben Shlomo 1997) across a number of domains it is feasible that almost all areas of local and national governance could play a role and each of this vast set could be represented along a large number of dimensions. Degree of access and functioning of the health care system would seem to be an important dimension but the structure and functioning of the education system, social welfare and pension systems and child and older person's care services could actually be seen as acting prior to healthcare in the aetiology of differences in health (Mackenbach 2003). Even if we narrow down the type of social infrastructure which is important there are still important issues around how to measure these services. Should it be the extent of coverage, the generosity of benefits or functioning of services? Even a generous and all encompassing welfare system can be ineffective when administratively inept. Clearly, different services will need to be assessed in a different way. It may actually be that a measure of outcomes rather than processes may be a more effective predictor of health such as a measure of satisfaction with services.

Hypothesis Three: Controlling for the variation in social infrastructure, services and benefits will explain the effect of the measure of income inequality at the aggregate level.

In the next section we examine the data to be used for the paper and outline the measures that we construct to test the hypotheses above.

3. Data, Measures and Analytic Strategy

The data set used in this paper are taken from the European Quality of Life Survey (EQLS) carried out by the European Foundation for the Improvement of Living and Working Conditions in 2007. This survey is the follow up of the first EQLS that was carried out in 2003. The 2007 EQLS was conducted between September 2007 and February 2008 in thirty one countries, the twenty seven EU member states plus Norway as well as three candidate countries (Croatia, Macedonia and Turkey). Across countries the sample size varies from a 1000 cases in many countries like Romania, Norway,

Ireland to a maximum of 2000 cases, in two countries only, Germany and Turkey, which represents a total sample of just over 35 000 persons aged 18 or older.

The purpose of the EQLS survey is to provide a broad picture of the different dimensions of quality of life in Europe. So, the EQLS questionnaire covers a large range of issues including a large number relevant to the issues in this paper. The analyses in this paper use micro data derived from the survey itself as well as aggregate information drawn from a number of other sources. We describe now some of the measures we employ through the paper and we first focus on a measure of mental well being.

Measures

Measuring Income Inequality and National Income

National income is measured as Gross Domestic Product (GDP) per capita for 2008. Income inequality is measured in two ways: gini coefficients and the ratio of the incomes at the 80th and 20th percentiles, known as s8020. Both are measured in the latest year available, usually 2007. All data are drawn from the Eurostat database[4].

Measuring Mental Well-Being

We require a measure of mental health which is a reliable and valid measure and which is comparable across countries. The EQLS2 data contain responses to five questions which can be combined to form the World Health Organisation measure of mental well-being. The WHO–5 (WHO 1998) is a short, psychometrically sound scale for measuring positive psychological well-being (Bech, 2004). It consists of five items assessing positive mood, vitality and general interest over the past 2 weeks. Although a general measure of mental well-being, the scale has actually proven to be a good screening instrument for the detection of depression in the general population (Henkel et al, 2003; Loewe et al, 2004): The five items of the WHO-5 are:

- *I have felt cheerful and in good spirits*
- *I have felt calm and relaxed*
- *I have felt active and vigorous*

[4] http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/themes

- *I woke up feeling fresh and rested*
- *My daily life has been filled with things that interest me*

Respondents choose a response from "all of the time", "most of the time", "more than half of the time", "less than half of the time", "some of the time" to "at no time" which is closest to how they have been feeling over the previous two weeks. Answers are scored from 0 to 5 and summed to produce a score out of 25. Here individual scores have been rebased to vary between 0 and 100 to aid comparisons.

Perceived Social Position

The social cohesion hypothesis examined in Section 2 posited that income inequality was associated with health because of its impact on social cohesion via individual's negative assessment of their own position relative in others in their society. The European Quality of Life Survey contains a question that can be used to examine this process: "*Some people look down on me because of my job situation or income"*. The question stem asked respondents to the survey to say whether they agreed or disagreed with these statements and the extent of this agreement/disagreement. Respondents also had the option of stating that they 'neither agreed nor disagreed':

Civic Participation

A measure of social participation into the public life can be constructed from the EQLS survey by summing up positive answers to three questions on respondents involvement in civic involvement in the last year. The questions asked whether the respondent had:

- *"Attended a meeting of a trade union, a political party or political action group "*
- *"Attended a protest or demonstration, or signed a petition., including an e-mail petition"*
- *"Contacted a politician or public official"*

The three questions have a reasonable level of reliability as measured by an alpha coefficient at 0.56. The summed scale runs from 0 to 3 with more than three-quarters of respondents across countries scoring zero.

Trust in Others

Trust in others is a measure of social cohesion which has been frequently used in analyses of income inequality and health/mortality. The EQLS survey carried an item

which asked respondents "*[G]enerally speaking, would you say that most people can be trusted, or that you can't be too careful*". Respondents were asked to give a score ranging from 1 to 10 where 1 represented very low trust in others and 10 very high trust.

Trust in Institutions

Respondents were also asked how much they personally trusted five different institutions in their country: the legal system, the press, the police, the government and lastly, political parties. As in the item on inter-personal trust, respondents were asked to report how much they personally trusted each institution on a scale from 1 (do not trust at all) to 10 (trust completely).

Anti-Social Behaviour

Within the social cohesion hypothesis one mechanism through which inequality impacts on health is through the breakdown in 'collective efficacy', i.e. the absence of community policing of behaviour, particularly by younger age groups. The EQLS asked respondents whether "you have very many reasons, many reasons, a few reasons or no reasons at all to complain about each of the following problems" and they were then given a list of problems. Two problems from this list: a. crime, violence or vandalism and b. litter or rubbish in the street can be used to create an index of anti-social behaviour. We take the mean of these questions where a high score now signifies high levels of anti-social behaviour.

Social Contact

Another mechanism through which inequality and adverse status comparisons is hypothesised to impact on health is through reductions in social contact. The EQLS survey asked questions about face to face contact with people outside the household with friends or family. Groups of people (children, mother/father, siblings, other relatives, friends/neighbours) were then identified and contact frequency was measured from 'more than once a day' to 'less than several times a year' with options for 'don't have such relatives'. The mean of the combined questions was taken with higher scores representing more social contact.

Income and Lifestyle Deprivation

Income was measured by asking respondents to state their households net income per month or to choose an approximate range if the exact amount was unknown. The figure

generated was then equivalised using the modified OECD equivalence scale. Income was then divided by the country standard deviation to produce a more easily interpreted measure which was abstracted from the absolute mean level of country income.

Lifestyle deprivation was assessed using a measure which asks about the absence and affordability of six items:

- Keeping your home adequately warm.
- Paying for a week's annual holiday away from home.
- Replacing any worn-out furniture.
- Buying new, rather than second-hand clothes.
- Eating meat, chicken or fish every second day, if you wanted to.
- Having friends or family for a drink or meal at least once a month.

Absence of an item because it could not be afforded was scored as one and the scale summed so that deprivation could vary between zero and six. Deprivation was then grouped: 0, 1, 2 to 3 and 4+ to create deprivation groups for analysis.

Labour Market Status and Highest Education

Labour market status was measured by asking respondents for their principal economic status and grouping responses into employed, unemployed, ill/disabled, retired, carer or in education. Highest level of education was measured using the ISCED (1997) scale which was grouped into primary, lower secondary, upper secondary, post secondary and tertiary.

Social Infrastructure

As discussed, operationalising the neo-materialist hypothesis is challenging. We use two types of information to measure social infrastructure. First we measure the generosity of welfare systems at the country level using expenditure on social protection per capita in purchasing power standards in 2005 using data published by Eurostat (Eurostat 2008).

The quality of social infrastructure was assessed using a question "*[I]n general, how would you rate the quality of each of the following public services in [our] country?*". Respondents were then asked to give a score from 1 (very poor quality) to 10 (very high quality) each for health services, the education system, public transport, child care services, care services for elderly and the state pension system. Each scale was used separately. Note that the question does not differentiate between the public and private provision any of these services.

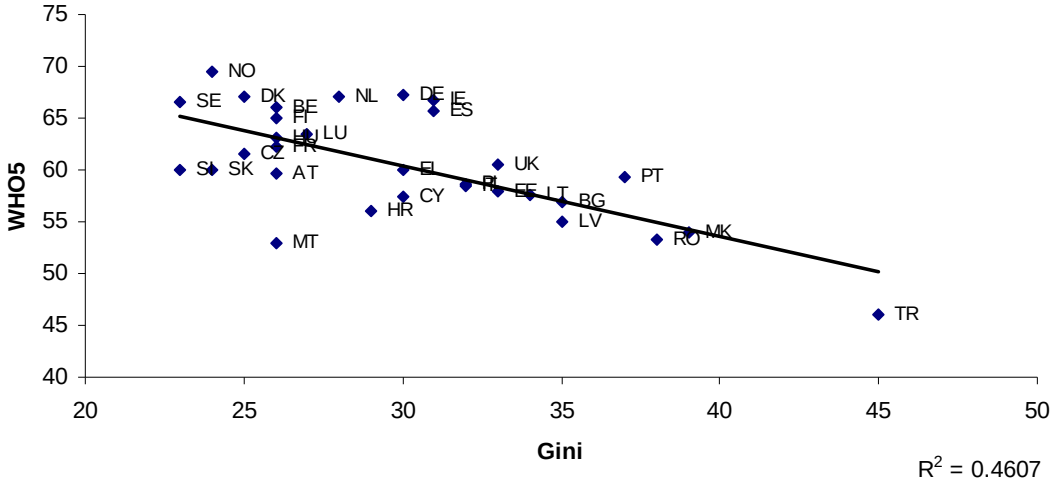
Analysis Strategy

We have three hypotheses to be tested: first that the association between inequality and mental health is artefactual; second that it reflects social cohesion processes; third that the association reflects the development of social infrastructure. We will model the WHO5 mental well being scale using multi- level models which will control for the correlation between individuals at the country level using a random effects maximum likelihood estimator. Although a fixed effects estimator would control for all country level effects we would not be able to estimate the effect for income inequality at the country level or control for overall country wealth. Our analysis strategy is to first fit a model which controls for the age and sex distribution of the country population plus the GDP per capita and the measure of inequality. This functions as a base model to which all subsequent models can be compared. Second, we then fit a model controlling for income, deprivation, labour market status and highest education. This model assesses hypothesis 1 by controlling for the distribution of income plus other measures of living conditions that may be associated with level of inequality. Social cohesion variables (trust, social status, social contact, civic participation, anti-social behaviour) are added to the base model to test the second hypothesis. The social infrastructure variables are added to the base model to test the third hypothesis. The proportionate reduction in the measure of income inequality (gini or the s8020) is used as the yardstick upon which to compare models. However, it could be argued that the use of more variables in some groupings biases the analysis to some degree thus we also apply the Akaike Information Criterion (Akaike 1974) (AIC) to assess the goodness of fit of the model controlling for the number of parameters estimated. The model with the lowest AIC score will be assessed to have the best fit.

4. Descriptive Analyses

Figure 1 shows that the average level of mental well-being varies enormously across the countries surveyed for the EQLS survey and also that there is a very pronounced association with income inequality as measured using a gini coefficient. The correlation for this association is -.66 suggesting a very substantial association. The correlation using the s8020 ratio is marginally higher at -.67.

Figure 1: Income Inequality (GINI) and Mental Well Being in 30 countries, EQLS 2007



Both these values are lower than the associations found by Pickett *et al* (2006) between s8020 and mental health (-.80) although their measure of mental health was the prevalence of any mental illness using the WHO Composite International Diagnostic Interview (WMH-CIDI). It is interesting to see that some countries, notably Ireland, Spain, Germany and the Netherlands seem to have better mental well being on average for countries with their levels of inequality. Similarly, Malta, Slovakia and Slovenia appear to have lower levels of well being than would be expected given their level of inequality. The social cohesion thesis holds that the causal pathway between income inequality and health begins with the commodification of individuals who come to define themselves by their worth in the labour market and so compare themselves to others. This leads to status negative comparisons. If true we would expect that higher levels of inequality would be associated with higher levels of individuals stating that they feel others look down on them because of their job or income.

Figure 2: Income Inequality (GINI) and % Agreeing that "others look down on me because of my job or income" in 30 countries, EQLS 2007

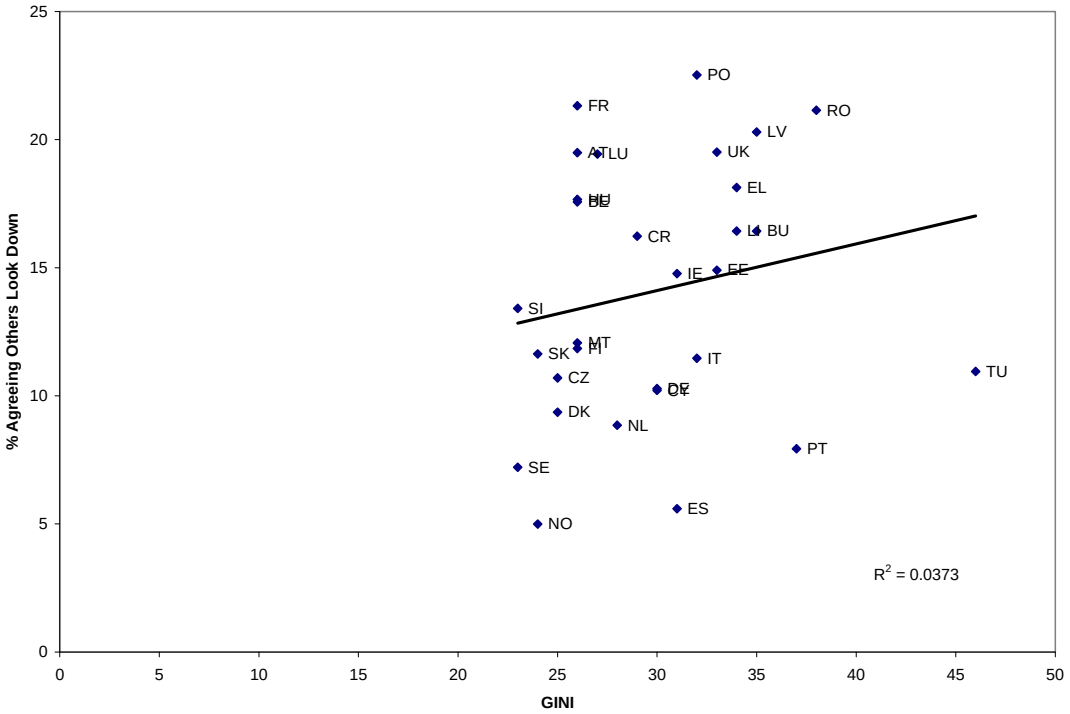


Figure 2 shows that this is only partially correct. With a correlation of 0.19 the proportion agreeing to the statement does increase with inequality but the relationship is not strong. Similarly, higher levels of inequality are also held to decrease levels of interpersonal trust. Figure 3 shows that there is indeed a relationship across countries with gini explaining 16% of the variance in trust (correlation of -.4). The Scandinavian countries with low levels of inequality are high in chart and Italy, Greece and Turkey are low but Ireland and Spain, both relatively high inequality countries have relatively high levels of trust.

The neo-materialist hypothesis argues on the other hand that the quality of social infrastructure within the society largely explains the relationship between income inequality and health.

Figure 3: Income Inequality (GINI) and Average Level of Trust in Others in 30 countries, EQLS 2007

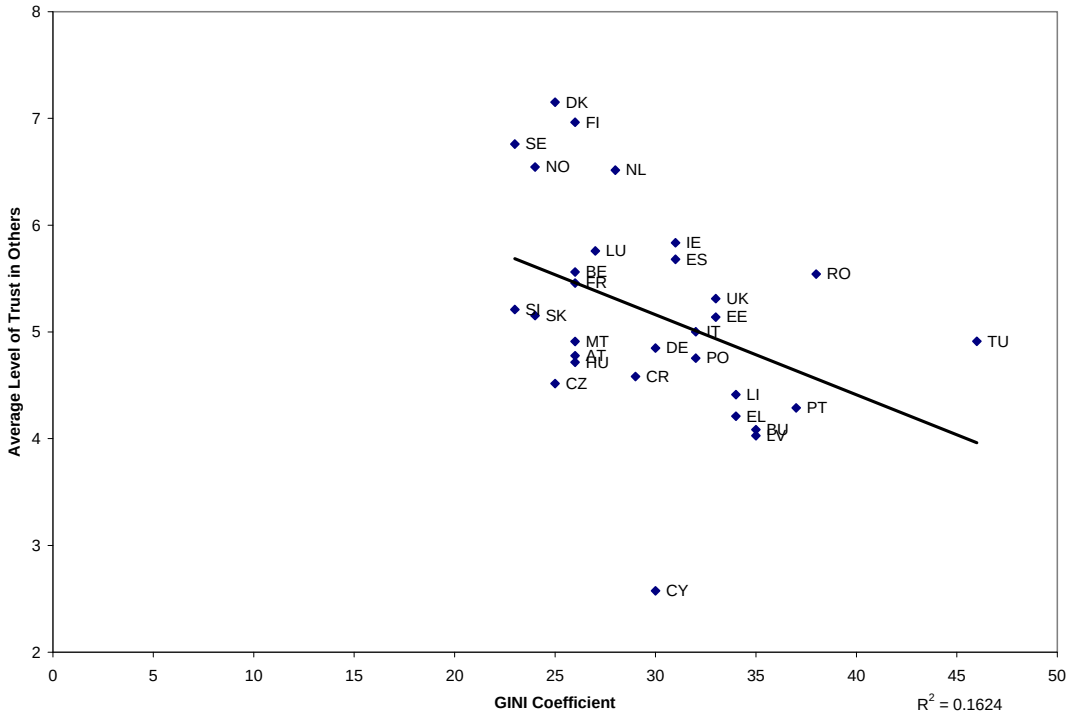


Figure 4 suggests that there is a quite considerable association between the perceived quality of services in the country and the level of income inequality with an overall correlation of -.61 and an R^2 of 0.37. The Scandinavian countries all get high quality ratings from their citizens and have low inequality whereas Bulgaria, Greece and Portugal all receive poor ratings and also have high levels of inequality.

There is clearly some merit in both the social cohesion and neo-materalist hypotheses in terms of their association with country level income inequality although the level of correlation is higher for the neo-materialist variable of perceived quality of public services. This forms the first part of the causal process from income inequality to mental well being. What relationship do we see in terms of the association between the different pathways and mental well being itself?

Figure 4: Income Inequality (GINI) and Average Quality Rating of A Range of Social Services in 30 countries, EQLS 2007

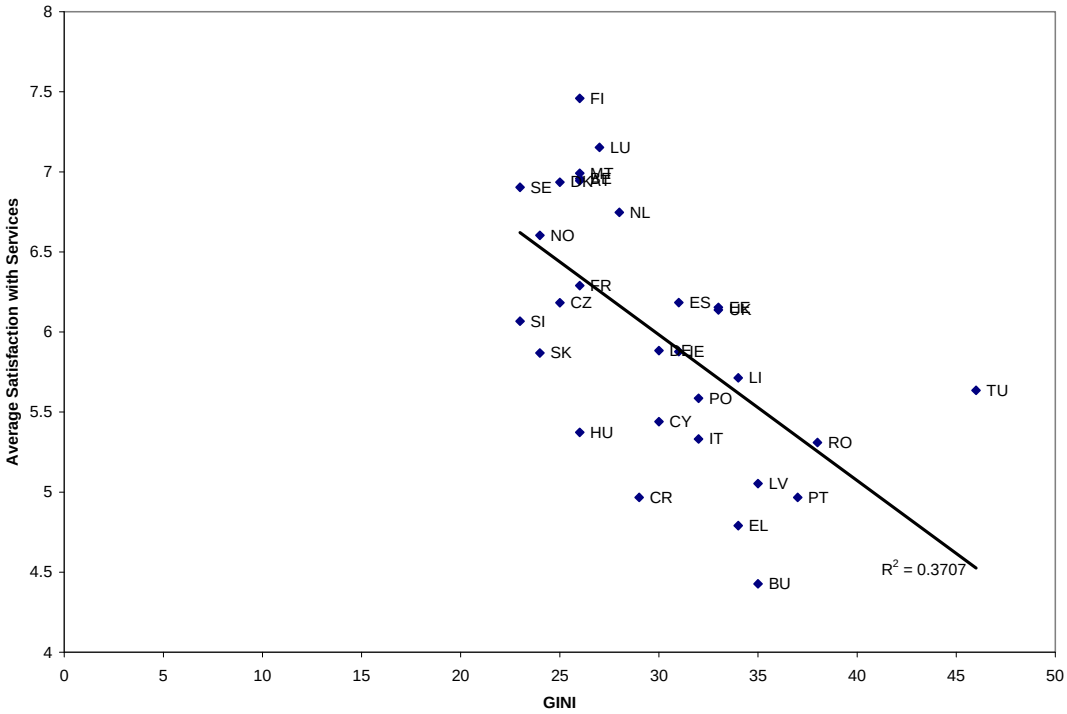


Table 1: National Level Correlation Coefficients by Pathway

	GINI	S8020	WHO5
Status Comparisons	0.19	0.17	-0.34
Trust in Others	-0.40	-0.35	0.59
Trust in Institutions	-0.27	-0.26	0.41
Anti-Social Behaviour	0.44	0.43	-0.39
Civic Participation	-0.53	-0.48	0.71
Social Contact	0.27	0.22	-0.31
Social Protection Exp.	-0.54	-0.55	0.72
Quality of Healthcare	-0.56	-0.53	0.44
Quality of Education	-0.64	-0.64	0.41

As well as giving the correlation coefficients between income inequality and the different possible pathways, Table 1 also shows that there are substantial correlations between all the mediators and mental well being in the form of the WHO5 index. The lowest level of association is between level of face to face contact with friends and family and WHO5, but even here the correlation is -.31. Trust in others has a correlation of 0.59 (i.e. as trust increases so does average level of mental well being) and this rises to 0.71 for civic participation. Of the neo-materialist pathways the level of social protection expenditure has the highest correlation at 0.72 with quality of healthcare and education both having

correlations of around 0.4. Such bivariate correlations at the national level suggest that both the social cohesion and neo-materialist hypotheses glean some support. Such ecological associations do not control for the distribution of other factors that may influence the relationship between income inequality and mental well being such as age, sex and the average level of income in the country. In the next section we rectify these issues by through the use of multi-level random effects models.

Multi-Level Models of Mental Well Being

Table 2 gives the results of the coefficients and t-statistics for the six models of mental well being (WHO5). Model 1 sets out the base model which controls for the distribution of age and sex within countries as well as estimating the effect of country GDP and income inequality in the form of a GINI coefficient. All these variables are strongly significant with GINI having a negative relationship with mental well being as expected. Hypothesis 1 states that controlling for the distribution of income will render the aggregate level measure of income inequality insignificant. Model 2 shows that this is not the case with GINI reduced in magnitude but remaining significant once we control for household equivalised income (in standard deviations). Individual income itself is very significant with a standard deviation increase in equivalised income leading to a 2.14 unit increase in mental well being.

Model 3 fits household level of deprivation, individual employment status and individual highest education to the model. These variables further reduce the contribution which living conditions may contribute to the impact of income inequality by controlling for two important determinants of living conditions and actual level of lifestyle deprivation. The new variables reduce the effect of GINI by around 30% from the base model plus income suggesting that country living standards associated with higher levels of inequality rather than inequality itself account for the effect on mental well being.

Model 4 offers evidence on Hypothesis 2 with the introduction of the variables representing the social cohesion hypothesis. All of the new variables have a significant impact apart from civic participation. Greater disagreement that 'others look down on me because of my job or income' leads to a very significant increase in mental well being compared to agreement with this statement. Similiarly, increases in both trust in others and in institutions at the individual level leads to an increase in mental well being as does a higher level of face to face contact. On the other hand, an increase in anti-social

behaviour in the local area is negatively related to mental well being. Although the social cohesion variables are clearly significant predictors of mental well being, the impact on the GINI coefficient is quite small with a 10% reduction relative to the base model plus income and living conditions. This gives some, though limited support to the social cohesion hypothesis.

Model 5 offers evidence on Hypothesis 3 with the introduction of the variables representing the neo-materialist hypothesis. All are significant apart from the variables representing the level of social expenditure and the quality of childcare services. Moreover, controlling for these variables reduces the coefficient for GINI by 45% relative to the base model plus income and living conditions. The introduction of the neo-materialist variables also renders the GINI variable insignificant.

Table 2: Coefficients and t-Statistics for Multi-Level Random Effects Models of Mental Well Being (WHO5)

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	B	t-stat	B	t-stat	B	t-stat	B	t-stat	B	t-stat	B	t-stat
Aged 35-64	-4.77	-12.72	-4.69	-12.58	-3.06	-7.95	-2.66	-7.01	-2.85	-7.49	-2.45	-6.48
Aged 65+	-7.72	-17.71	-6.71	-15.27	-4.93	-7.95	-5.43	-8.91	-5.07	-8.28	-5.25	-8.66
Female	-4.41	-14.77	-4.11	-13.81	-3.31	-11.05	-3.50	-11.91	-3.17	-10.69	-3.39	-11.58
GDP Per Capita	0.00	4.31	0.00	4.35	0.00	2.19	0.00	1.54	0.00	-0.41	0.00	-0.25
GINI	-0.50	-3.67	-0.44	-3.06	-0.31	-2.62	-0.28	-2.18	-0.17	-1.18	-0.18	-1.24
Equiv Income/Std			2.14	14.36	0.66	4.41	0.51	3.45	0.63	4.24	0.51	3.47
2nd Level Deprivation					-4.18	-8.95	-3.32	-7.25	-3.88	-8.4	-3.24	-7.11
3nd Level Deprivation					-7.69	-18.78	-6.18	-15.29	-6.95	-17.14	-5.91	-14.69
Highest Level Deprivation					-14.85	-31.75	-12.32	-26.41	-13.55	-29.08	-11.75	-25.26
Unemployed					-2.19	-3.08	-0.88	-1.27	-2.20	-3.13	-1.13	-1.64
Ill/Diabled					-13.97	-15.72	-13.18	-15.13	-13.75	-15.66	-13.09	-15.12
Retired					0.26	0.52	0.10	0.21	-0.01	-0.02	-0.04	-0.08
Home Duties					1.01	1.65	0.74	1.24	0.43	0.72	0.47	0.78
Full-Time Education					1.61	2.16	1.13	1.56	1.35	1.84	1.05	1.45
Primary Education					-2.93	-5.13	-3.04	-5.34	-3.03	-5.35	-3.19	-5.63
Lower Secondary					-1.60	-3.18	-1.42	-2.84	-1.75	-3.53	-1.73	-3.49
Upper Secondary					-0.74	-1.76	-0.50	-1.2	-0.66	-1.58	-0.66	-1.59
Third Level (Lower)					0.56	0.91	0.83	1.39	0.74	1.24	0.84	1.42
Looked Down On: Disagree							2.01	14.51			1.92	13.94
Trust In Others							0.58	8.94			0.49	7.61
Trust In Institutions							0.64	7.91			0.14	1.64
Antisocial Behaviour							-1.69	-8.48			-1.34	-6.71
Face to Face Social Contact							2.48	15.13			2.46	15.1
Civic Participation							-0.07	-0.32			0.03	0.16
Social Prot. Exp. Per Capita									0.00	0.88	0.00	0.73
Quality of Health Care Services									0.29	3.22	0.17	1.97
Quality of Education Services									0.44	4.34	0.29	2.83
Quality of Public Transport									0.16	1.99	0.19	2.3
Quality of Child Care Services									0.08	0.76	-0.01	-0.07
Quality of Care Services for Older People									0.63	6.38	0.60	6.14
State Pensions									0.41	4.96	0.32	3.87
Constant	74.69	15.11	69.99	13.22	75.23	17.24	53.37	11.22	60.19	11.77	44.59	8.61
σ_u	3.262677		3.508729		2.829439		3.046949		3.256547		3.254127	
σ_e	20.57205		20.46182		19.65437		19.22744		19.39783		19.09551	
P	0.025		0.029		0.020		0.024		0.027		0.028	
LL	-86749		-86646		-85855		-85429		-85603		-85297	
N	19516		19516		19516		19516		19516		19516	

The variables representing the neo-materialist hypothesis in Model 5 in Table 2 have a substantially greater impact on the GINI coefficient than the social cohesion variables in Model 4. This supports hypothesis 3 over hypothesis 2. It could be argued that the bigger impact of Model 5 on the GINI coefficient could be, at least in part, due to the higher number of parameters in the model. Given this we apply the Akaike Information Criterion (AIC, Akaike 1974) which allows comparisons of model goodness of fit whilst penalising models with higher numbers of parameters.

Table 3: Model Fit Statistics and GINI Coefficient/Significance

Model	Log-Likelihood	Parameters	AIC Value	GINI Model Coefficient	GINI Significance	% Reduction GINI Coeff.
1	-86749.1	5	173508.2	-0.50	0	-
2	-86646.4	6	173304.8	-0.44	0.002	10.7%
3	-85855.8	18	171747.6	-0.31	0.009	37.3%
4	-85429.9	24	170907.8	-0.28	0.029	44.3%
5	-85603.7	25	171257.4	-0.17	0.237	66.4%
6	-85297.6	31	170657.1	-0.18	0.213	64.7%

Table 3 shows that the model with the lowest AIC coefficient is number 6, i.e. the model which includes all variables. Of the hypothesis driven models (4 and 5), model 4 has the lowest AIC because of the smaller number of parameters and lower log-likelihood. This offers some support to hypothesis 2 suggesting that we cannot reject the social cohesion hypothesis completely. However, this model actually reduces the GINI coefficient less than model 5 (66.4% vs 44.3%) which contains the neo-materialist variables.

Conclusions and Discussion

The association between lower average life expectancy and higher levels of inequality has been well known for three decades or more and attracted a large amount of critical analysis and comment. In the mid-1990s Richard Wilkinson offered a credible causal story to explain this association in the form of the 'income inequality hypothesis' which held that income inequality produced shame and distrust at the individual level which impact on health via psycho-endocrine mechanisms and decrease social cohesion and capital at the societal level. Understandably this hypothesis attracted a great deal of interest as it offered a social mechanism through which a characteristic of societies could alter individual psychology, behaviour and health. We label this the 'social cohesion'

hypothesis'. The neo-materialist hypothesis on the other hand, offers an explanation for the association between income inequality and health based on the tendency of highly unequal societies to invest less in social infrastructure. We have followed a number of recent papers in applying the hypothesis to the issue of mental well being and used data from the European Quality of Life Survey (2007) to examine three hypotheses about the impact of income inequality.

Our results reject our first hypothesis: that the inequality-health relationship simply reflects the distribution of income over a convex income-health relationship. Our results give most support to the neo-materialist hypothesis which decreases the impact of the GINI coefficient by over 66% over the base model and renders the GINI insignificant as an explanatory factor in the model. The social cohesion hypothesis is not without merit however. The inclusion of variables representing trust in others, negative status comparisons, anti-social behaviour, civic participation and social contact decreased the effect of GINI by 44% over the base model and provides the best fit of the models judged by AIC value.

There are a large number of papers which examine the same hypotheses addressed in this paper but this paper breaks new ground by testing the social cohesion and neo-materialist hypotheses using data at the individual level rather than at the aggregate. This does not mean however that our results are conclusive. Ideally we would analyse the relationship between inequality and health longitudinally at the individual level and observe the way in which changes in levels of income inequality impact on the different pathways. This is very demanding in terms of data but would provide a definitive examination of the hypotheses.

It could be suggested that the manner in which the hypotheses are operationalsed in this paper is not ideal. It could be argued for instance that the social cohesion hypothesis should be tested at the level of the community using measures which reflect community social relations rather than using individual level variables and measures of inequality at the national level. This argument has some merit but surely low social cohesion at the community level would reflect national inequality rather than inequality at the community level? Neighbourhoods are not (with a few exceptions) walled off from the wider society and the status hierarchies which are said to damage social cohesion develop on a regional scale at the very least.

Overall this paper provides some important empirical analysis into one of the most important hypotheses around health inequalities. Although not conclusive our results do suggest that processes routed in social embeddedness and cohesion cannot be the main pathways through which inequality and health care linked. What may actually be more important is the structure and quality of the institutional fabric of the society and the impact it has on the living conditions of citizens.

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