Health and Economic Inequality*

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1. Introduction

More than 100 articles have been published over the past two decades on whether changes in economic inequality lead to changes in health (Lynch et al, 2004a).[1] A somewhat smaller literature has looked at whether changes in health affect economic inequality. An even smaller literature looks at whether economic inequality predicts the size of health disparities between educational or economic groups.

This chapter first reviews the most common hypotheses about how inequality might affect health and vice versa. Hypotheses about how income inequality might affect health fall into three broad classes: those that focus on the implications of diminishing marginal health benefits from increases in individual income, those that focus on relative deprivation, and those that focus on society-wide effects of income inequality. Theories about how health might affect inequality also focus on three potential mechanisms: labor market effects, educational effects, and marriage market effects.

The chapter then turns to assessing empirical evidence for a link between health and inequality. Although most of this literature is motivated by the hypothesis that inequality affects health, it often employs the same empirical techniques that one would use to detect a causal impact of health on inequality. We therefore regard many of these studies as effectively testing only the hypothesis that the two measures are causally linked in some way, without investigating the direction of the causal arrow.[2] Since both hypotheses predict a negative relationship between inequality and health, studies that find no relationship between inequality and health can be regarded as evidence against both

[1] For a recent review from a more sociological perspective see Neckerman and Torche (2007).
[2] Smith, 2004, tries to unravel these simultaneous effects.

hypotheses (at least insofar as these hypotheses assume relatively immediate effects). If studies find a significant negative relationship between inequality and health, however, it is usually necessary to probe further to determine the direction of causation.

Because income inequality and health are likely to have common causes that cannot all be measured, the cross-sectional relationship between inequality and health is quite likely to provide a biased estimate of how changes in income inequality affects health. Until relatively recently, data limitations (particularly on economic inequality) led many researchers to analyze the relationship at a single point in time. With better data, however, the empirical literature has now largely moved beyond cross-sectional and time series studies to use panel data techniques. Such panel studies are now available for US states, European regions, and rich countries.

Most of these studies use mortality or expected longevity to measure population health, but some use self-reported health.[3] While self-reports of poor health are a fairly strong predictor of subsequent mortality, poor health and death are not identical and may not have the same relationship to income inequality. Self-reported health does, however, predict other outcomes that individuals care about, such as their happiness (see Chapter 17). The individual-level outcomes of death are, in contrast, completely speculative!

We should also emphasize at the outset that assessing the effects of economic inequality is not the same as assessing the effects of poverty. Furthermore, even if economic inequality does not affect health, poverty may well do so (and in extreme cases clearly does so). There is a strong negative relationship between health and absolute

[3] As more surveys begin to collect data on both biomarkers and socioeconomic measures from the same respondents, studies using these biomarkers as proxies for health are also likely to become more common.

poverty[4] and this may also hold for relative poverty (Eibner and Evans, 2005). There is evidence that poverty and poor health limit intergenerational mobility (Case and Paxson, 2006). But high levels of absolute poverty are often found in poor countries where incomes are relatively equal. Even in rich countries high levels of inequality are not invariably linked to high levels of poverty, although the two measures are in most cases strongly correlated.

To preview our conclusions, we argue that although there are plausible reasons for anticipating a relationship between inequality and health (in either direction), the empirical evidence for such a relationship in rich countries is weak. A few high-quality studies find that inequality is negatively correlated with population health, but the preponderance of evidence suggests that the relationship between income inequality and health is either non-existent or too fragile to show up in a robustly estimated panel specification. The best cross-national studies now uniformly fail to find a statistically reliable relationship between economic inequality and longevity. Comparisons of American states yield more equivocal evidence.

[4] Some of the best known of these include writings of Alan Williams, Alan Maynard, A. Donabedian, A. J. Culyer, and Julian Le Grand. See the references in van Doorslaer, Wagstaff and Rutten (1993), Wolfe (1994), the *Future of Children* (1998, volume 8, number 2 on Children and Managed Health Care) and *Health Affairs* (2004, volume 23 number 5 on Child Health: A Progress Report), Smith (1999), Adler and Newman (2002), Mullahy, Robert, and Wolfe (2004), Institute of Medicine (2004) and Phipps, et al. (2006), See also the review of evidence on poverty and poor health in Gould, Smeeding and Wolfe (2005) The majority of these studies are based on correlations with some controls for exogenous influences. Few try to identify the causal effects of health on poverty, but that is typical of the vast literature on this income and health.

2. Hypotheses about inequality and health

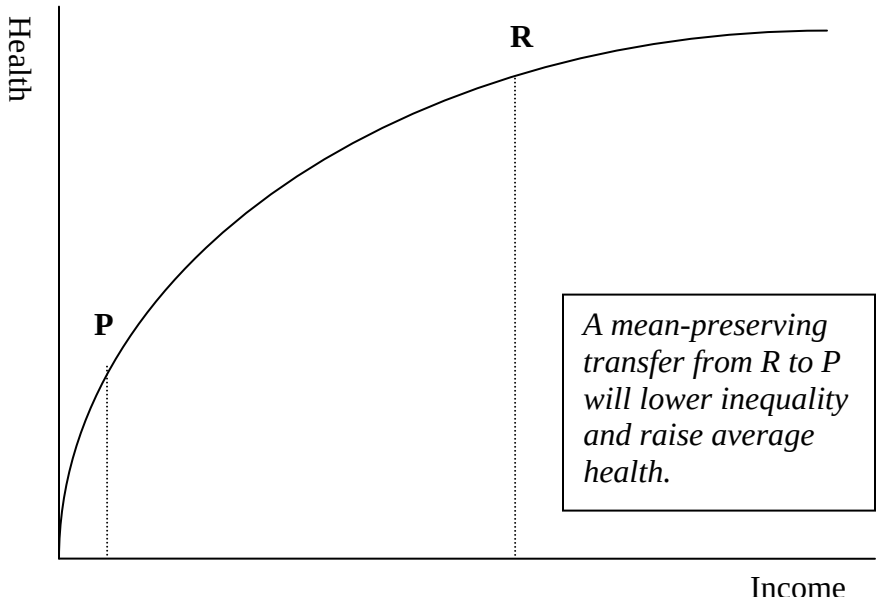
2.1 The effect of inequality on health

Epidemiologists and social scientists have proposed numerous mechanisms by which income inequality might affect an individual's health.[5] We group these mechanisms under three broad headings: absolute income, relative income, and society-wide effects of income inequality.

The absolute income hypothesis. If health depends on individual income, standard economic models predict that the health gains from an extra unit of income will diminish as an individual's income rises. Figure 1 shows a stylized version of such a relationship. A mean-preserving transfer from the richer individual (R) to the poorer individual (P) raises the health of P by more than it lowers the health of R. Holding total income constant, therefore, a more equal distribution of income should improve population health.

[5] This section draws on Leigh and Jencks (2007).

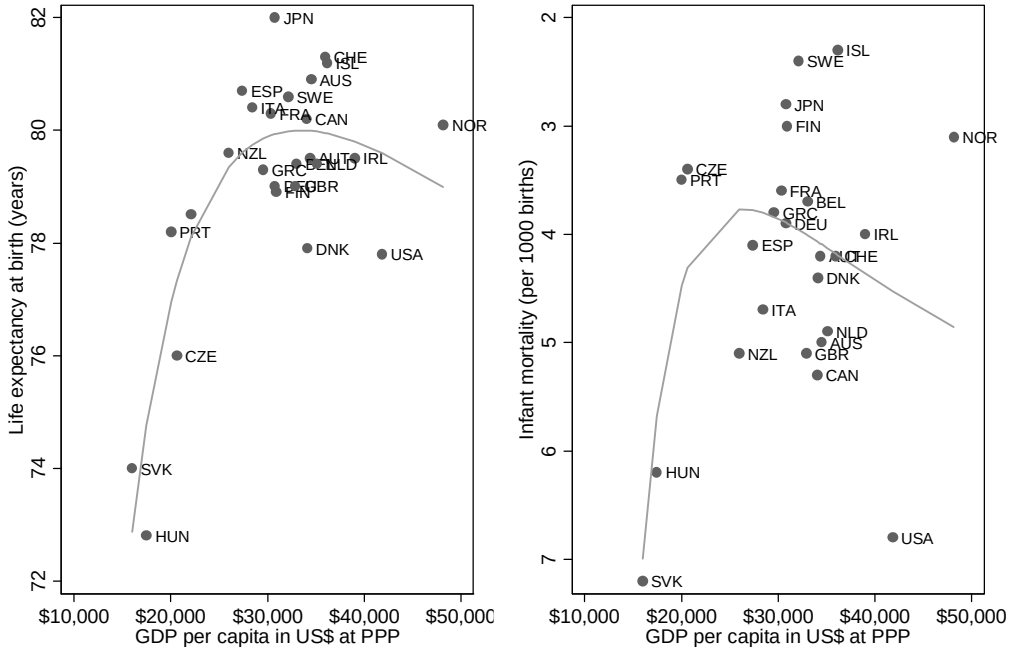
Figure 1: A Non-Linear Relationship Between Income and Health



When one compares countries, the relationship between *average* income and *average* health follows the pattern in Figure 1. Figure 2 shows the relationship for OECD countries. (For ease of comparison, we reverse the scale for infant mortality, so a move up the y-axis always represents better health.) We exclude the three poorest OECD nations (Mexico, Poland, and Turkey) and the richest (Luxembourg) and weight the remaining countries equally when we estimate the slope. Using either life expectancy or infant mortality as a measure of population health, the protective effect of income on health appears substantial as countries move from about $15,000 to $25,000 US dollars per capita, but appears small or non-existent above that point.[6]

[6] The apparent downturn in longevity when per capita GDP exceeds $35,000 is largely attributable to one country, namely the United States, which is an outlier on many measures besides per capita GDP.

Figure 2: GDP and Mortality in OECD Countries (circa 2005)



Note: Infant mortality is scaled in reverse, to allow comparability with life expectancy. We exclude the three poorest countries in the OECD (Mexico, Poland, and Turkey), and the richest (Luxembourg). Source: OECD Health Data 2007.

When one compares individuals within the US, the relationship between family income and age-specific mortality also exhibits a pattern similar to Figure 1 (Backlund et al, 1996). However, neither the comparisons of countries nor the comparisons of individuals take account of all the factors that could affect both income and health.[7] Furthermore, the nonlinear relationship between income and health at both the country level and the individual level could be driven by a strong nonlinear effect of health on income rather than a strong nonlinear effect of income on health. Thus while there are

[7] Deaton (2006), for example, concludes that there is no evidence economic growth alone will reduce infant and child mortality on a global scale unless growth is accompanied by additional education and higher quality public health institutions, which presumably affect both future growth and health.

strong theoretical reasons for expecting additional income to have less effect on health as income rises, the empirical evidence supporting this assumption is not conclusive.

The relative income hypothesis. Holding individual income constant, the income of others can affect people's health if they evaluate either their income or their lives as a whole by comparing themselves to others. The relative income hypothesis assumes that, at least in the economic domain, upward comparisons are more salient than downward comparisons and that upward comparisons are more likely to be stressful than soothing.[8] Wilkinson (1997) argues, for example, that if individuals assess their well-being by comparing themselves to others with more income than themselves, increases in economic inequality will engender '[l]ow control, insecurity, and loss of self esteem.' When upward economic comparisons are distressing, they are said to produce 'relative deprivation.' The most frequently suggested physical mechanism linking relative deprivation to mortality is chronic stress, which appears to lower resistance to many forms of disease in a variety of species.[9]

One potential objection to this hypothesis is that most studies of relative deprivation suggest that social comparisons are most stressful when they involve people who have a lot in common, such as co-workers, relatives, and neighbors.[10] Income differences within such reference groups are likely to be much smaller than differences between random members of national populations. Nonetheless, when income inequality changes in society as a whole, it is also likely to change in the same direction within reference groups composed of co-workers, relatives, or neighbors. If such changes lead to

[8] Upward comparisons can be soothing if they lead people whose current economic circumstances are stressful to think that their future circumstances could be better. We are not aware of any persuasive evidence on whether upward economic comparisons are more salient than downward comparisons or on whether they are more often upsetting than soothing.
[9] Marmot (2005) provides numerous references.
[10] Martin (1981) provides some relevant references for earnings. See also Eibner and Evans(2005)

increases in chronic stress, higher inequality at the national level could increase mortality and lower inequality could decrease mortality.[11]

Society-wide effects of inequality

a) Violent crime: Violent crime accounts for a tiny fraction of all deaths in developed countries, but it could have larger second-order effects on mortality if it increases chronic stress among those who worry that they or their kin may become victims of violence in the future. The empirical literature on inequality and violent crime has produced mixed findings. Cross-sectional studies tend to report a positive association across countries, but panel studies produce mixed results.

Fajnzylber et al. (2002) use changes in various measures of inequality from the Deininger-Squire data set to predict changes in homicide and robbery for 20 industrialized countries and 19 middle-income countries between 1965 and 1994. To measure change they use average levels of inequality and crime for non-overlapping 5-year periods in each country.[12] They find a robust relationship within countries between trends in inequality, homicide, and robbery with a variety of controls. This relationship holds up regardless of how they measure inequality. They also report a strong serial correlation between measures of violent crime in successive five year periods. The estimated half-life of a sudden change in violent crime is 17 years. This finding suggests that modeling the relationship between inequality and violent crime requires close attention to the possibility of very long lags.

[11] The relative income hypothesis also comes in a more extreme variant, where all that matters is ordinal rank, not the distance between ranks. In that variant any income hierarchy in which every individual has a unique income has the same effect as any other.

[12] Not all countries have data for all of the six possible periods.

More recently, Leigh and Jencks (2007) found no positive relationship between the income share of the richest decile and homicide using panel data on developed countries. That could be because, unlike Fajnzylber et al., they had no data on inequality within the bottom 90 percent of the income distribution, because they focused on lags of five years or less, or because of other methodological differences. However, Brush (2007) also failed to find a positive relationship between changes in inequality and changes in violent crime across US counties over a ten year period.

b) Public spending: If the Meltzer-Richard theorem is correct, greater economic inequality among voters should make the median voter more inclined to support government spending on health (Meltzer and Richard, 1981). Szreter (1988) shows, for example, that clean water was made available in much of the UK only after the franchise was extended to include the less affluent, for whom public spending on sanitation provided large health benefits at little cost to themselves.[13] However, Alesina, Baqir and Easterly (1999) show that the average value of public goods to members of a community will decrease when heterogeneity increases. If income inequality makes voters' preferences more heterogeneous, that could lower government spending on health. In addition, increases in economic inequality may allow the rich buy more political influence, which could lead to reductions in government spending on health. Schwabish et al. (2006) use cross-national data to show that the larger the distance between the 90th and 50th percentiles in market incomes, the less the rich support public expenditures. However the mechanisms accounting for this relationship are not well understood (see also Neckerman and Torche, 2007).

[13] The social capital and public expenditure channels do not posit any specific link between an individual's position in the income distribution and his or her health. Instead, they suggest that greater variance of incomes will adversely affect population health. This impact could conceivably affect individuals anywhere in the distribution.

c) Social capital and trust: Comparing American states, Kawachi et al. (1997) find negative cross-sectional relationships both between inequality and social capital and between social capital and mortality. Other studies have also found that people in more unequal places tend to be less trusting (Knack and Keefer 1997; Alesina and LaFerrara 2002; Leigh 2006). Low trust may make voters more skeptical about the claim that public spending will improve health. Low trust may also be linked to thinner friendship networks, which are associated with higher age-specific mortality (Berkman and Syme, 1979).

2.2 The effect of health on inequality

The theoretical literature on how health might affect economic inequality is less developed than that on how economic inequality might affect health, but a number of plausible hypotheses have been proposed. We divide these into three broad categories: labor market effects, educational effects, and marriage market effects.[14]

Labor market effects

Poor health can make it more difficult for prospective workers to search for jobs, less likely that employers will hire them, and more physically or mentally costly to work. Illness may also increase absenteeism and harm job performance, which can affect earnings, increase the probability of dismissal, and reduce the chance of promotion. Employers may also discriminate against workers who have a physical or mental disability even when their performance is satisfactory. Finally, poor health might reduce

[14] Other inequality related mechanisms such as neighborhood location, may also affect infant mortality adversely (Mayer and Sarin, 2005), but the three categories in the text encompass the vast majority of the research on this issue.

earnings if sicker workers tend to have sicker children who are more likely to require care at times when the parent is supposed to be at work.

Educational effects. Poor health in childhood can also affect educational outcomes through direct physiological channels, since health in the womb and in the early years can affect brain development. Health may also affect school performance through reduced school attendance or inability to concentrate while at school. Haas (2006) reviews much of this evidence.

The marriage market. As we shall see, healthier members of a given population are more likely to marry and less likely to divorce. We have not found evidence on whether this pattern also holds at the population level, but if it does, an adverse shock to a population's health will lower the marriage rate and thereby alter the level of household income inequality. Likewise, adverse health shocks to economically disadvantaged subgroups are likely to lower these groups' household incomes and increase overall household income inequality.

3. Empirical evidence

Most studies of the relationship between income inequality and health rely on aggregate data. Under normal circumstances such studies cannot distinguish empirically between the absolute income hypothesis, the relative income hypothesis, and hypotheses about society-wide effects of inequality.[15] Our discussion of empirical evidence therefore focuses largely on reduced-form models that estimate the net effect of a change in income inequality on population health or vice versa. For the most part, the panel

[15] See Gravelle, Wildman, and Sutton (2002) or Leigh and Jencks (2007) for a mathematical treatment. Miller (2001) has shown that the argument in the text holds only if the second-order approximation in Leigh and Jencks's equation 1 is exact. However, while the second-order approximation is unlikely to be exact, investigators would need much better data than they normally have to distinguish the two effects.

studies that we discuss (and the new evidence we present) assumes that the effects occur without much lag. However, including lags does not generally change the conclusions, at least in the panel studies discussed below.

3.1 Data quality

Poor data on inequality has been a major problem in studies of the relationship between income inequality and health. As Judge, Mulligan and Benzeval (1998:569) note in their review of the literature:

> 'Many of the studies use multiple sources of income distribution data and/or data from a wide range of years, which makes comparability between countries questionable. Only five of the studies [available in 1998] use data based on a measure of equivalent disposable income. In fact, we believe it is the generally poor quality of the income data that poses the most serious weakness in most of the studies we have reviewed.'

Most cross-national studies have used measures of inequality from the Deininger-Squire dataset (Deininger and Squire 1996) or the World Income Inequality Database (WIID). Atkinson and Brandolini (2001) have shown that using higher-quality inequality data can substantially alter results based on these two sources. The Luxembourg Income Study (LIS) provides a more consistent and appropriate measure of income inequality for comparing countries and years, namely disposable household income adjusted for household size. However, while the LIS dataset is expanding, it still covers a relatively small number of nations and years, reducing the number of degrees of freedom in statistical analyses.

Leigh and Jencks (2007), in contrast, use data on the income share of the richest 10 percent to measure inequality. Such data are now available on an annual basis for a dozen rich countries, sometimes going back to the early 20th century. The disadvantage of this approach is that some theories about how inequality affects health and most theories about how health affects income predict a stronger relationship between health and inequality in the bottom part of the income distribution than in the top part, and the income share of the top decile is an imperfect proxy for inequality in the bottom half of the distribution. Most investigators therefore prefer measures of inequality like the Gini coefficient, which is sensitive to income disparities throughout the distribution. Still other studies use a commonly constructed panel dataset for two or more countries to examine differences both within and across nations (Banks, et. al, 2006a; 2006b)

A number of studies have also compared US states, where income data collected by the decennial census provide comparable measures of state-level inequality. Income surveys of the European Union can also be used to create consistent national and sub-national inequality measures (e.g. Hildebrand and Van Kerm 2005). The drawback of looking at the sub-national level in either the US or the EU is that some theories about the relationship between inequality and health (e.g., public health expenditure, relative comparisons) may be more applicable at the national than the state or regional level. There is also considerably more migration between sub-national jurisdictions than between nations, making long-term effects of inequality on health harder to detect in sub-national jurisdictions.

Measuring population health also poses numerous problems. Mortality rates are generally thought to be quite well measured in developed nations, but mortality rates do not capture variation in the health status of the living except insofar as the two are

correlated at the aggregate level. One alternative is to use 'quality adjusted' or 'disability adjusted' life years (often called QALYs and DALYs respectively), but such measures are not available for many countries and are seldom available as far back in time as data on mortality or life expectancy.

Subjective health measures, such as 'How is your health in general: excellent, good, fair, or poor?,' have sometimes been used to fill this gap, but they implicitly require respondents to compare their health to some benchmark, which may be either the respondent's past health, the health of other people the respondent knows, or some mixture of these and other benchmarks. Those who report that their health is 'excellent' are therefore likely to mean different things in different times and places and at different ages. These implicit benchmarks may also be affected by changes in economic inequality. Suppose that Type A and Type B people live in the same community, have the same initial distribution of income, and are used to comparing themselves to one another. Now suppose that some exogenous shock doubles the income of Type A people, raising inequality. Type A people spend part of their extra income on improving their health. On all objective measures, Type B people are just as healthy as before. However, even if their objective health is unchanged, the improved health of some people in their reference group may cause them to rate their health lower than before.

Johnston, Propper, and Shields (2007) identify another problem with relying on subjective measures. Comparing objective and subjective measures of hypertension, they find that the poor are no more likely than the affluent to report hypertension but are much more likely to test positive for hypertension when examined by a medical professional. This suggests that the health gradient with respect to income can be quite sensitive to whether an objective or a subjective measure is utilized. If that is the case, and if higher

income inequality mainly affects the health of those with lower incomes, the estimated correlation between income inequality and the prevalence of hypertension in the population as a whole will be weaker in studies that rely on self-reports than in studies that rely on health exams.

3.2 Cross-country evidence

Judge, Mulligan and Benzeval (1998), Deaton (2003), and Lynch et al (2004a) have all done careful reviews of the cross-country relationship between inequality and health. They all conclude that while the evidence is not conclusive, studies with better data on inequality and better methods tend to observe a weak or non-existent relationship.

Because unobserved factors can affect both health and inequality, we focus here on studies that look at changes over time in multiple countries or regions. Econometrically, this means that we only review estimates that include country and year fixed effects. Country fixed effects capture stable differences between countries in both health and inequality, including stable differences in the way health and inequality are measured. Year fixed effects capture the influence of shocks that affect health in multiple countries at the same time. Examples of the latter might include major influenza epidemics, the spread of HIV/AIDS, the introduction of new vaccines, and the diffusion of antibiotics.[16] Country and year fixed effects cannot, of course, eliminate all possible sources of omitted variable bias, but they are more likely to do so than either time series

[16] Technological innovations do not, of course, reach all developed countries in exactly the same year. Deaton and Paxson (2004) argue, for example, that technological innovations tend to affect the UK about four years later than the US.

studies of a single country or cross-sectional studies of multiple countries at a single point in time.[17]

A number of studies have compared the UK and the US. Analyzing the last decades of the twentieth century in the US and the UK, Wilkinson (1996) argues that rising inequality during the 1980s was the main reason why the decline in infant mortality slowed after 1985. Deaton and Paxson (2004), in contrast, find no systematic relationship between inequality and health in either the UK or the US from the mid-1970s to the mid-1990s.

Leigh and Jencks (2007) look at the relationship between inequality and mortality for a panel of 12 developed nations between 1920 and 2000. They find no evidence that the income share of the top decile has any effect on population health. However, relying exclusively on a measure of upper-tail inequality is not ideal. Top income shares are quite strongly related to the Gini coefficient in recent years, but the relationship may not be as strong in earlier periods. And even the Gini coefficient may not be an ideal measure of inequality if inequality in the lower-tail of the distribution is what affects health.

Using income inequality data from the Luxembourg Income Study, Judge, Mulligan and Benzeval (1998) find no evidence that changes in inequality are negatively related to changes in life expectancy or positively related to changes in infant mortality. This remains true whether they measure inequality using the Gini, the 90/10 ratio, or the share of income going to the poorest 60 percent of the population.

Judge, Mulligan and Benzeval's data are mostly drawn from the 1980s, so we update their analysis, looking at changes in inequality and mortality from around 1980 to around 2000. Health measures are drawn from OECD Health Data 2007, while inequality

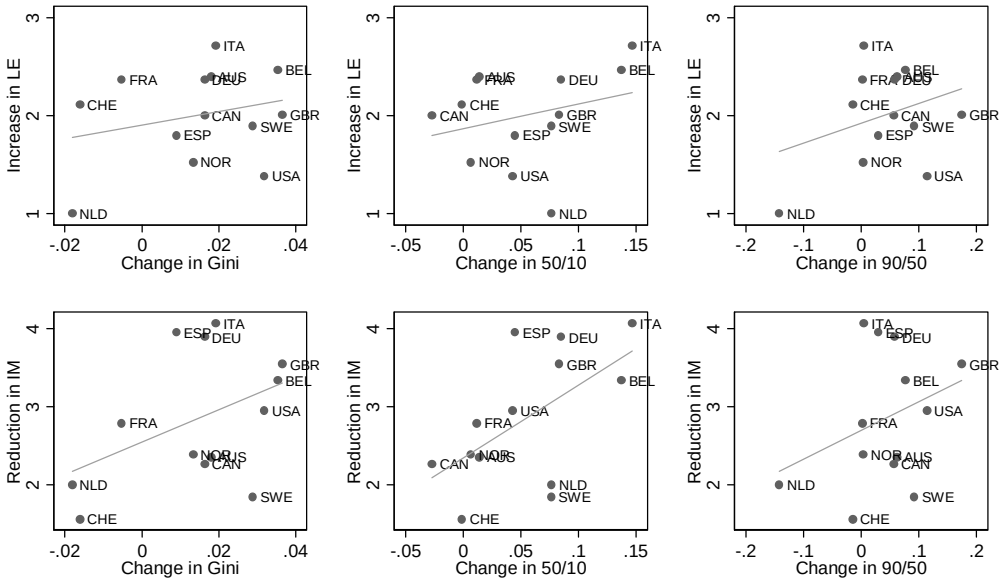
[17] For a discussion of the same issue in a different context, see Acemoglu et al (2005).

measures are drawn from the Luxembourg Income Study. We choose the interval 1980-2000 because it is the longest span for which we can obtain LIS inequality data for a reasonably large number of countries. Because there is no consensus in the literature on the best measure of income inequality for predicting changes in health, we use the Gini coefficient, the 50/10 ratio, and the 90/50 ratio. The Gini is sensitive to all points of the distribution. The 50/10 is a measure of relative poverty. The 90/50 is a measure of top income inequality. Note that because our analysis looks at changes in both inequality and population health over the same period (1980-2000), it does not explicitly allow for the possibility of longer lags.

Figure 3 shows the pattern across OECD countries over this period (again, we reverse the scale for infant mortality, so a move up the vertical axis always represents better health). We find no significant relationship between changes in inequality and changes in mortality. Indeed, all three charts for life expectancy show that it rose more in countries where inequality rose more; and all three panels for infant mortality suggest that it fell more in countries where inequality rose more. (Again, we exclude Poland, Mexico and Luxembourg, and we do not have data on Turkey. Adding back the three omitted countries does not change the slope of the fitted line in the infant mortality plots, but it does make the relationship between changes in life expectancy and changes in inequality upward-sloping only for the 90/50 measure, and essentially flat for the Gini and 50/10.)

Figure 3: Changes in Inequality and Changes in Mortality in OECD Countries

(Changes are from circa 1980 to circa 2000, expressed in per decade terms)



Note: Changes in infant mortality are scaled in reverse, to allow comparability with life expectancy measures. LE is life expectancy at birth (years). IM is infant mortality (deaths per 1000). All changes are expressed on a 'per decade' basis (ie. annualized and multiplied by 10). We exclude the three poorest countries in the OECD (Mexico and Poland; and Turkey for lack of data), and the richest (Luxembourg). Countries and years covered are Australia (AUS) 1981-2001, Belgium (BEL) 1985-2000, Canada (CAN) 1981-2000, France (FRA) 1981-2000, Germany (DEU) 1981-2000, Italy (ITA) 1986-2000, Netherlands (NLD) 1983-99, Norway (NOR) 1979-2000, Spain (ESP) 1980-2000, Sweden (SWE) 1981-2000, Switzerland (CHE) 1982-2000, the United Kingdom (GBR) 1979-99, and the United States (USA) 1979-2000.

Sources: LIS Key Figures (as at 13 August 2007) and OECD Health Data 2007. Mortality figures for the UK in 1979 are from the Human Mortality Database (www.mortality.org) and cover only England and Wales.

3.3 Cross-regional evidence

Although several studies have estimated the relationship between inequality and population health across US states, few use a fixed effects approach. Across US states and MSAs, controlling for census region effects, Mellor and Milyo (2002) find no significant relationship between changes in inequality and changes in self-reported health status. Deaton and Lubotsky (2003) also exploit variation across MSAs and find that after

controlling for racial composition, there is no significant relationship between changes in inequality and mortality. Perhaps the most robustly-estimated results are those of Miller and Paxson (2006), who estimate a fixed effects model of mortality and inequality across metropolitan areas (PUMAs). They find no evidence that having wealthier neighbors is harmful to one's health. A less formal analysis of mortality trends across US regions (Lynch et al. 2004b) also shows little evidence of a causal relationship between income inequality and mortality.[18]

We are only aware of one other panel study of inequality and population health that uses intra-country variation with region fixed effects. Exploiting differences in inequality and population health across European regions over the period 1994–2001, Hildebrand and Van Kerm (2005) find a robust negative relationship between income inequality and self-reported health on a 5-point scale, although the magnitude of the estimated effect is very small.[19]

3.4 Health and the Distribution of Income

As we have noted, the literature on the relationship between health and inequality is largely presented as a test of the hypothesis that inequality affects health. However, in a specification that looks at levels or changes in the same time period, the studies discussed in sections 3.2 and 3.3 can also be regarded as a test of the hypothesis that

[18] Clarkwest (2008) argues that if income inequality slows either the rate at which new ideas diffuse in a state or the medical profession's commitment to high quality care for all residents of the state, the way to detect this effect is to regress the change in longevity over a given period on the initial level of inequality, not to regress the change in longevity on the change in inequality during the same period. Using this setup, which implicitly assumes fairly long lags, he finds a negative and statistically significant relationship between initial inequality and subsequent changes in longevity for US states between 1970 and 2000, as well as cross-sectional evidence that the negative association between inequality and longevity can be explained by between-state differences in adoption of health-enhancing medical innovations.

[19] Using a random effects specification, with the same dataset and time period, Etienne, Skalli and Theodossiou (2007) find the same result across 14 European countries.

health affects inequality, as argued for example by Smith (1999, 2004). Accordingly, if most panel studies conclude that the dispersion of income does not have a robust impact on the level of health, they also imply that the level of health does not have a robust impact on the dispersion of income. (In theory, the effects could cancel each other out, but virtually all theories assume that both relationships are negative.)

However, in addition to the studies discussed in the two previous sub-sections, a number of papers have looked specifically at the effect of health on income, education, and labor market outcomes.

Income effects of poor health. Currie and Madrian (1999) review the literature on the relationship between health and labor income. They find studies that report a strong negative association between labor income and arthritis, asthma, hypertension, physical disabilities, psychiatric disorders, and self-reported health. These studies, although very numerous, seldom try to separate the effect of health on labor income from the effect of labor income on health. However, those that try to determine the direction of causation also tend to find an adverse effect of poor health on labor market outcomes. For example, Ettner et al. (1997) use parents' mental health as an instrument for children's mental health and find a reduced but still negative impact of mental health on employment and earnings. Similarly, Black, Devereux and Salvanes (2007) use variation in twins' birth weight in a specification that includes twin-pair fixed effects, and find that heavier babies, which are typically healthier at birth, also tend to have higher earnings as adults.

Disability. Economists have also studied the effects of disability benefits on economic outcomes. Since disability benefits are usually conditional on medical evidence that the claimant cannot work, the direction of causality might seem clear-cut. But because workers only claim disability benefits if they expect to be better off in some

broad sense, those with low potential wages are more likely to claim benefits than those with high potential wages.

Studies of US disability applicants in the 1970s and 1980s (Bound, 1989; Gruber and Kubik, 1997) suggested that tougher disability standards did not lead to large increases in employment among rejected applicants. Nonetheless, generous policies with regard to sickness and early retirement due to disability do reduce labor supply among workers who have reached middle age (Autor and Duggan, 2003). Similarly, laws barring discrimination against disabled workers, such as the Americans with Disabilities Act (ADA) in the US, are often counterproductive and may even reduce work (Acemoglu and Angrist, 2001; Hotchkiss, 2004).[20] Spending on disability benefits as a share of GDP rose during the 1990s in most OECD countries (OECD 2003). If disability benefits do not fully replace earnings, and if such programs have a negative impact on labor supply, then the growth of disability benefits and anti-discrimination laws could strengthen the link between ill-health and economic inequality – a result that is probably the opposite of what advocates for such laws intended.

Educational effects of poor health. A significant literature also explores the relationship between health status and educational outcomes. Most of these studies focus on how education affects health.[21] However, several studies also analyze the impact of health on education. Wolfe (1985) estimates a simultaneous model and finds that both physical illness and psychological disorders have a causal impact that reduces years of schooling. In a lagged specification using a rich dataset from Finland, Koivusilta,

[20] On the other hand, European laws that require large employers to hire the disabled, such as those in Germany tend to increase work for the disabled (Aarts, Burkhauser and DeJong,1992).

[21] Grossman and Kaestner (1997) and Cutler and Lleras-Muney (2006) review the literature on education's effect on health. For recent debates on the effects of exogenous changes in education on health status in the UK see Oreopoulos (2006) and Clark and Royer (2007). For the US debate see Lleras-Muney (2005) and Mazumder (2007).

Rimpela, and Rimpela (1998) find that poor health behaviors as a teenager are associated with lower educational attainment among respondents in their late-20s. Using a structural model, Gan and Gong (2007) find that having a serious illness before age 21 decreases the individual's education by 1.4 years. Together, the effect of early-onset ill health and disability can lead to a 'double penalty' involving both lower educational attainment and lower lifetime labor force participation (Burkhauser, Haveman and Wolfe, 1993). Haas (2006) shows that sibling differences in childhood health predict subsequent differences in both educational attainment and labor market success.

Marriage market effects of poor health. Numerous studies have analyzed the impact of marriage on health (see Ribar, 2004, and Wilson and Oswald 2005 for recent reviews). But those who marry also tend to be healthier before they marry than those who remain single (Waldron, Hughes, and Brooks 1996; Fu and Goldman 1996). Likewise, those who divorce tend to be less healthy before they divorce than those who remain married (Joung et al. 1998). However, we are not aware of any work on whether changes in population health lead to changes in marriage rates, much less on whether the resulting changes in marriage rates affect the distribution of income.

4. Conclusions

The theoretical literature has suggested three main ways in which inequality might adversely affect health: through diminishing returns to increases in absolute income, through relative income, and through society-wide effects of income inequality. Conversely, health can affect inequality by affecting earnings, educational attainment, and the probability of being married.

Empirical work on inequality and health has been hampered by both low-quality data on inequality and limited knowledge about the prevalence and correlates of health problems that affect household income. Data problems have, in turn, made it hard to use the best-available methods to eliminate spurious correlations and identify causal impacts. For developed countries, however, this appears to be changing. Setting aside natural experiments, the most convincing way to test for an effect of inequality on health is to use panel data econometrics, in which we observe the relationship between changes in inequality and changes in health for a number of countries or regions. Accordingly, we have focused primarily on these kinds of studies.

Unfortunately, these methods are not likely to detect effects of inequality that take a long time to manifest themselves. Suppose, for example, that economic inequality affects a society's institutional arrangements for providing high quality medical care to those with below-average incomes. Since hypotheses of this kind do not tell us how long it takes for inequality to affect institutional arrangements, it is not easy to test this hypothesis with a change-on-change model. If the hypothesis is true and the effects are large relative to other sources of variation in health, we may observe some cross-national association between inequality over long periods, institutional arrangements for the prevention and treatment of illness, and longevity. But even that is chancy.

Our reading of the evidence is that most studies of health and inequality find no statistically significant relationship either across countries or over time. However, the confidence intervals in many of these studies include both positive and negative values large enough to be of considerable practical importance. Precisely estimated zeros are the exception, not the rule. Drawing firm negative conclusions may therefore be premature. This is a field with too many theories for the number of available data points.

In psychology, which also suffers from this problem at times, meta-analysis has often managed to reduce the range of uncertainty substantially, and the same might be possible for inequality and health. A formal meta-analysis of studies on inequality and health could be very valuable, especially if it tried to model the effect of different methods, data sources, and dependent variables on the point estimates for the coefficient of inequality reported in the literature.

Thus while the currently available evidence suggests to us that the relationship between inequality and health is either small or inconsistent, readers should bear in mind that not everyone agrees, especially social epidemiologists. Achieving more consensus will require more work with better data and better methods than have been usual in the past.

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Appendix Table 1: Income and Mortality circa 2005 (These data are used to create our Figure 2.)

Country	Year used	GDP per capita (US$, PPP)	Life expectancy at birth	Infant mortality per 1,000 births
Australia	2005	$34,484	80.90	5.00
Austria	2005	$34,394	79.50	4.20
Belgium	2004	$33,021	79.40	3.70
Canada	2004	$34,057	80.20	5.30
Czech Republic	2005	$20,633	76.00	3.40
Denmark	2005	$34,110	77.90	4.40
Finland	2005	$30,911	78.90	3.00
France	2005	$30,350	80.30	3.60
Germany	2005	$30,776	79.00	3.90
Greece	2005	$29,578	79.30	3.80
Hungary	2005	$17,484	72.80	6.20
Iceland	2005	$36,183	81.20	2.30
Ireland	2005	$39,019	79.50	4.00
Italy	2005	$28,401	80.40	4.70
Japan	2005	$30,777	82.00	2.80
Korea	2005	$22,098	78.50	
Luxembourg (not shown)	2005	$70,600	79.30	2.60
Mexico (not shown)	2005	$10,537	75.50	18.80
Netherlands	2005	$35,112	79.40	4.90
New Zealand	2005	$25,963	79.60	5.10
Norway	2005	$48,162	80.10	3.10
Poland (not shown)	2005	$13,915	75.10	6.40
Portugal	2005	$20,030	78.20	3.50
Slovak Republic	2005	$15,983	74.00	7.20
Spain	2005	$27,400	80.70	4.10
Sweden	2005	$32,111	80.60	2.40
Switzerland	2005	$35,956	81.30	4.20
Turkey (not shown)	2005	$7,711	71.40	23.60
United Kingdom	2005	$32,896	79.00	5.10
United States	2004	$41,827	77.80	6.80

Source: OECD Health Data 2007.

Appendix Table 2: Changes in Inequality and Changes in Mortality from about 1980 to about 2000 (These data are used to create our Figure 3.)

Country	Year	Gini	50/10	90/50	Life expectancy at birth	Infant mortality per 1000 births
Australia	1981	0.28	2.11	1.86	74.90	10.00
Australia	2001	0.32	2.14	1.99	79.70	5.30
Belgium	1985	0.23	1.68	1.62	74.60	9.80
Belgium	2000	0.28	1.89	1.74	78.30	4.80
Canada	1981	0.28	2.22	1.83	75.50	9.60
Canada	2000	0.31	2.17	1.93	79.30	5.30
France	1981	0.29	1.81	1.88	74.50	9.70
France	2000	0.28	1.83	1.88	79.00	4.40
Germany	1981	0.24	1.70	1.69	73.50	11.80
Germany	2000	0.28	1.87	1.80	78.00	4.40
Italy	1986	0.31	2.04	1.98	75.80	10.20
Italy	2000	0.33	2.25	1.99	79.60	4.50
Luxembourg (not shown)	1985	0.24	1.71	1.72	74.30	9.00
Luxembourg (not shown)	2000	0.26	1.76	1.85	78.00	5.10
Mexico (not shown)	1984	0.44	3.02	2.86	69.10	42.70
Mexico (not shown)	2000	0.49	3.14	3.31	74.10	23.30
Netherlands	1983	0.26	1.58	1.86	76.30	8.40
Netherlands	1999	0.23	1.70	1.63	77.90	5.20
Norway	1979	0.22	1.75	1.58	75.50	8.80
Norway	2000	0.25	1.76	1.59	78.70	3.80
Poland (not shown)	1986	0.27	1.99	1.77	71.00	21.10
Poland (not shown)	1995	0.32	2.14	1.89	72.00	13.60
Spain	1980	0.32	2.17	2.02	75.60	12.30
Spain	2000	0.34	2.26	2.08	79.20	4.40
Sweden	1981	0.20	1.61	1.51	76.10	6.90
Sweden	2000	0.25	1.76	1.68	79.70	3.40
Switzerland	1982	0.31	1.84	1.85	76.00	7.70
Switzerland	2000	0.28	1.84	1.82	79.80	4.90
United Kingdom	1979	0.27	1.96	1.80	73.38	12.90
United Kingdom	1999	0.34	2.13	2.15	77.40	5.80
United States	1979	0.30	2.50	1.86	73.90	13.10
United States	2000	0.37	2.60	2.10	76.80	6.90

Sources: LIS Key Figures (as at 13 August 2007) and OECD Health Data 2007. Mortality figures for the UK in 1979 are from the Human Mortality Database (www.mortality.org) and cover only England and Wales.