Explaining the Health Equality Paradox of the Welfare State

Kjell Arne Brekke
Department of Economics

Leo A. Grûnfeld
Oslo School of Management &
MENON Business Economics

Snorre Kverndokk
Ragnar Frisch Centre for Economic
Research

**UNIVERSITY
OF OSLO**
HEALTH ECONOMICS
RESEARCH PROGRAMME

Working paper 2011: 3

HERO

Explaining the Health Equality Paradox

of the Welfare State

Kjell Arne Brekke
Department of Economics, University of Oslo
P.O. Box 1095 Blindern, 0317 Oslo, Norway, e-mail: k.a.brekke@econ.uio.no

Leo A. Grünfeld
Oslo School of Management and MENON Business Economics,
P.O. Box 5250 Majorstuen, 0303 Oslo, Norway, e-mail: leo@menon.no.

Snorre Kverndokk
Ragnar Frisch Centre for Economic Research,
Gaustadalléen 21, 0349 Oslo, Norway, e-mail: snorre.kverndokk@frisch.uio.no

Health Economics Research Programme at the University of Oslo
HERO 2011

ABSTRACT

A growing body of empirical studies have reported that social inequalities in health are as large (or even larger) in the Nordic welfare states than in many less egalitarian societies. This is highly surprising since the welfare state is rooted in income equality, free access to education and health services, and a generous social benefit system. This paper reviews this literature, and provides an explanation of this paradox based on the most common causal mechanism studied, namely the one that goes from income (or another socio economic variable) to health. We start by showing that the concentration index is much more sensitive to health contingent income transfers than income contingent health transfers. Then, we introduce a simple model where health is caused by status (relative income) and show that there actually exists as possibility that stratified societies may have lower health inequality than egalitarian societies, everything else equal, if class is unobservable. Thus, there may be a tradeoff between income and health equality. However, due to the insensitivity of the concentration index of health transfers, this tradeoff may not be shown by such inequality measures. A higher social health inequality as found in empirical studies, may therefore just be a sign of a more equal income distribution.

1. Introduction

The correlation between socioeconomic status and health is now well documented through a large number of empirical studies within the fields of epidemiology, social medicine, sociology and economics (see, e.g., Marmot et al., 1991; Wilkinson, 1996; Smith, 1999; Wagstaff and van Doorslaer, 2000; Deaton, 2003; Subramanian and Kawachi, 2004; Marmot, 2004; Marmot and Wilkinson, 2006). The identification of a clear social gradient in health reveals that wherever you are in the socioeconomic hierarchy, those above you have better health than you, whereas those below you have worse health. Moreover, studies show that this pattern has become more pronounced over time (Mackenbach et al., 2003). That is, even though we get richer and more educated, the role of socio-economic status in explaining health is gradually becoming more important.

On this background it is viewed as highly surprising that a growing number of comparative cross-national studies find that social inequality in health appears to be as strong or even stronger in the Nordic countries than in most other European countries. (e.g., Mackenbach et al. 1997; van Doorslaer and Koolman, 2004; Lynch et al. 2001; Kunst et al., 2005; Eikemo et al. 2008; Mackenbach et al. 2008). Even though income and education, as well as health services are more evenly distributed among the citizens of these countries[2], relative differences in health are not, according to these studies. It appears that relatively small differences in socio-economic status produce large relative differences in health in the Nordic welfare states. In other words, smaller differences in income and education make the slope of the social gradient steeper. The same result is found by using other bivariate measures of social inequality in health such as the concentration index (CI) and the odds ratio. This has been seen as the health equality paradox of the welfare state.

Even if the correlation is well documented, the literature on the causal relationship between socio-economic status and health is still limited. One strand of literature argues that health condition affects socio-economic status (Grossman, 2000; Deaton, 2003; Behrman and Rosenzweig, 2004; Case et al, 2005; Black et al., 2007), another and more pronounced strand argues that socio-economic status affects your health (see Smith, 1999, for a review), while a third points out that shared underlying factors (like genetics, self control, preferences etc.) can

---

[2] The income inequality in the Nordic welfare states (Norway, Sweden, Denmark, Finland) is lower than in other OECD countries, see, e.g., Förster and d'Ercole (2005) and OECD (2010).

explain the social gradient in health (see, e.g., Barsky et al., 1997). Finally, some argue, with good reason, that all these causal relationships coexist. In a companion paper, Brekke and Kverndokk (2011), we find that with the causality running from health to socio-economic status or income, or even caused by a common factor, the paradox can be explained as a statistical artifact. When other factors causing inequalities in socio-economic status are reduced, poor health may remain as the main reason why individuals end at the bottom of the socioeconomic status ladder in egalitarian countries such as the Nordic. This means that what is reported as an increase in health inequality according to the bivariate measures, may just as well be a reduction in income inequality. While this explanation will resolve the apparent paradox, it does not rule out the possibility that there is something to the initial interpretation of the steep gradient in Nordic countries, as the causality may also go from socio-economic status to health.

However, in this paper we show that the problems with bivariate measuers are independent of the causal relationship between health and socio-economic status. We concentrate on the most used bivariate measure of socioeconomic health inequality in the economic literature, namely the concentration index. This measure has certain unfortunate properties that are independent of causal relationships. The problem is that it behaves differently to contingent transfers. We show that the concentration index is insensitive to income contingent health transfers, meaning transfers of health between individuals of equal income. The concentration index is however sensitive to health contingent income transfers, that is *equalizing* income between individuals of equal health will increase measured health *in*equality, even when the health of no individual is affected. While a common condition for social health inequality measures have been that inequality should decline when health is transferred from a rich to a poor person (Erreygers, 2009), as far as we know, nobody has studied the impacts of transferring health from a healthy person to an unhealthy of the same income level.

To illustrate this problem, we start by looking for a mechanism that can explain the results from the empirical studies. The model formalizes the idea - akin to cognitive stress theories (Eriksen and Ursin, 2002;2004) - that a low social standing due to unsuccessful career may be harmful for health. The basic idea of our model is that career and hence income is a signal of private abilities and achievement. In a society (egalitarian) where all individuals have equal opportunities, this is a perfect signal, as with equal opportunities there is no one else to blame.

3

In a society where both achievements and initial privileges matter for the career and income, income is an imperfect signal, unless initial privileges are fully observable.

In the model we assume that health is affected by how your achievements are assessed by an observer. We show that this would indeed cause health to be more unequal in an egalitarian society than in a society where unobservable initial privileges matters to income. There are two key differences between these societies; in the latter, initial privileges matter (a) and are unobservable[3] (b). We show that if we remove the last of these assumptions, then the health distribution will be identical in the two societies (under the additional assumption of the model). In fact, making privileges observable causes a series of income contingent health transfers, and these will not affect the concentration index (Theorem 1). Removing (a) - the impact of initial privileges - will cause income to become more equal, as only achievements matter, and this will cause the concentration index to increase (Theorem 2).

The model thus describes a mechanism where health is indeed most unequal in the egalitarian society, and where the concentration index does report more health inequality in the egalitarian society. But the concentration index gets it right for the wrong reason. We are able to decompose the difference between the two societies in a series of income contingent health transfers - to which the concentration index is insensitive - and a series of health contingent income transfers - to which the concentration index does respond. Thus, the higher concentration index only reports that the egalitarian society is indeed more egalitarian, the concentration index is silent about the implied redistribution of health. Again, a higher social health inequality as found in empirical studies, may therefore just be a sign of a more equal income distribution.

The paper is organized as follows. In Section 2, we review the most important empirical literature that provides cross-country evidence on the relationship between socio-economic status and differences in health. Then, in Section 3, we prove that the concentration index is insensitive to income contingent health transfers, but sensitive to health contingent income transfers. We then turn to the application of these characteristics in a model. Section 4 presents the model and discusses its predictions and relevance. The final section concludes.

---

[33] In the egalitarian society observability of privileges does not matter as the privileges do not impact income. Thus the key difference is whether achievements as such are observable.

4

2. The starting point: Cross-country evidence

There exists a long standing debate on the impact of income inequality on population health. Research on these matters has predominantly been based on aggregated data (see, e.g., Wilkinson 1996). However, if the ambition is to investigate how socio-economic status affects individual health, we need micro data at the individual level, and first at the end of the nineties such data became available across countries. In this section we briefly discuss the cross country evidence with a focus on the patterns representing the Nordic countries. Note that these studies are not designed to investigate the causal relationship between socio-economic status and health, only the correlations.

The most cited cross-country study on socio-economic status and differences in health is Mackenbach et al. (1997). It covered 11 European countries and mapped mortality and self reported morbidity (predominantly for men) according to level of education, occupational class and income level. The authors estimated a set of odds ratios that compare those with lower socio-economic status with those with a higher socio-economic status. As opposed to earlier studies, the paper explicitly takes into account the presence of economically inactive men, which are believed to play an important role in the Nordic countries. The general finding is that Sweden and Norway had larger relative inequalities[4] in health for both morbidity and mortality. With regards to self-reported morbidity in terms of perceived general health, Norway, Netherlands and Sweden had the highest odds ratios. Sweden also ranked high on chronic conditions, while Norway listed on the top with respect to long-term disabilities. Using a relative index of inequality (also a ratio), comparing perceived general health in different educational classes, the index ranked Norway, Sweden, Finland and Denmark among the 5 countries with the largest relative inequalities. When socio-economic status was analyzed in relation to mortality, the differences between countries were significantly smaller. However, for men younger than 45, socioeconomic differences in mortality was once again highest in Finland, Sweden and Norway. In the case of Sweden, income related differences in health are small, but education and occupational class play a very strong role in determining health according to the study.

---

[4] Even if they had higher relative inequalities, the absolute inequalities were lower. An example can illustrate this. Assume that there exists a measure of health where a low number indicates good health. In country A, the health of the best individual is 10 and the worst off is 15, while in country B, the similar numbers are 30 and 40. Then country A has less absolute inequality (5 compared to 10 in country B), but the relative inequality is higher in country A (15/10=1.5 compared to 40/30= 1.33).

The Mackenbach evidence came as a surprise to the Nordic research and policy communities since one would expect that social inequalities in health were small in welfare states where income differences are small, education and healthcare is free, and social benefits are generous. During the years following the study, several new studies have been published, largely supporting the findings, including a new and updated study by Mackenbach et al. (2008). These studies focus on alternative measures of social status and health, they study different time periods, they look at new countries and they utilize alternative data sources. In Tables 1, we present a systematic review of the most important characteristics in many of the studies using cross country or cross regional micro-data. In most of the studies, the Nordic welfare states report higher social inequalities in health than countries with a less egalitarian profile.

<Insert Table 1 here>

Empirical evidence also point to an increase in the slope of the social gradient in health in the Nordic countries. Mackenbach et al. (2003) compares relative socioeconomic differences in mortality during the periods 1981-1985 and 1991-1995, and find that the differences are widening in most countries, including the Nordic countries. This pattern is surprising in light of high economic growth and only marginal changes in income distribution. On the other hand, Kunst et al. (2005) show that social inequalities in health has widened in many European countries, but not the Nordic.

As shown in Table 1, several of the cross country studies use odds ratios or rate ratios. However, not all the studies apply these measures, and the concentration index seems to be the most popular bivariate measure in economic studies on health inequality. One such study is van Doorslaer and Koolman (2004) that studies income related health inequalities in 13 European countries, using a more recent data set than Mackenbach et al. (1997), but mainly arrives at the same conclusion. The study computes concentration indices and decomposes inequality into its determining factors. There is a positive correlation with income inequality *per se* and self-assessed health, but the relationship is weaker than in previous research. The effect of education and occupational class matters more. Socioeconomic differences in health are found to be relatively strong in Denmark. Only UK and Portugal have a more pronounced pattern. Denmark is the only Nordic countries included, but Grasdal (2003) runs the same tests for Norway. The Norwegian study places Norway right in the middle of countries when

it comes to socioeconomic differences in health. The non-working population adds a lot of differences to health in the population both in Denmark and Norway (see also Christiansen et al., 2009).[5]

3. Is the concentration index more sensitive to income distributions than health distributions?

In this section, we study properties of one of the most used bivariate measures of social inequality, namely the concentration index (CI). Even if several studies have looked at properties of this index, (e.g., Brekke and Kverndokk, 2011; Erreygers, 2009), we will show new properties that turn out to be very useful in interpreting results for country comparisons.

Consider a population with n individuals with income and health for individual i denoted (x_i, h_i) We also defines the persons income rank λ_i with the best off ranked first and the worst off ranked last (in case of a tie all are given the average rank). In the literature λ_i is often named the socioeconomic rank, but we focus on the income rank to study the effect of income redistribution. We define an *income contingent health transfer* as a transfer of health from i to j contingent on $x_i = x_j$ for some n. The new health is $h'_i = h_i - \Delta h$ and $h'_j = h_j + \Delta h$ with $\Delta h > 0$. The transfer is a Dalton transfer[6] if individual i has better health both before and after the transfer. Similarly we define a *health contingent income transfer* as a transfer of income between two individuals of equal health. The transfer is a Dalton transfer if income is taken from the person that is richest both before and after the transfer.

Let us first start with a rather trivial observation.

Theorem 1: *An income contingent health transfer has no impact on the concentration index.*

Proof: The concentration index is defined as

$$C = 1 - \frac{\sum_{i=1}^{n}(2\lambda_i - 1)h_i}{n^2\mu} \tag{1}$$

Where μ is average health. Now, if two individuals have the same income or socioeconomic status, their rank is equal, thus

$$(2\lambda_i - 1)h_i + (2\lambda_j - 1)h_j = (2\lambda_i - 1)(h_i + h_j)$$

and the two individuals contribution to the index is independent of how their health is distributed. **QED**

To state our next theorem we need some more assumptions. A very robust finding is that health is increasing with status/income (see Section 1 above). The purpose of measures of social health inequality is to measure the extent to which this is true. Since this is the case we want to study, we assume that health in general is increasing with income. On the other hand, we want to study a transfer of income between individuals of equal health but unequal income, thus we must allow for poor individuals to have high health and vice versa.

Assumption: *We assume that health can be decomposed as structural component H_i that is increasing with income, i.e., $H_j < H_i$ whenever $\lambda_j > \lambda_i$, and a random term ε_i with zero expectation. Actual health is $h_i = H_i + \varepsilon_i$. The population is sufficiently large so that the structural component is continuous in income rank $H_j \approx H_i$ whenever $\lambda_j \approx \lambda_i$. A small income transfer is one where both individual changes their rank, but the rank changes only one unit for at least one.*

Theorem 2: *Consider a small health contingent income transfer from a rich i, to a poorer individual j. Under the assumption above, the expected change in the concentration index is positive if:*
1) The income distribution is uniform so each individual's rank is changed one unit

2) The rank of the poor changes more than one unit, and $\varepsilon_j > 0$.

3) The rank of the rich changes more than one unit, and $\varepsilon_j < 0$.

Proof: Note first that income redistribution changes the income rank, and hence the weight of different health levels, see equation (1). The change of the concentration index is thus a linear function of the health of the affected individuals, and thus a linear function of the random terms. As these terms have zero expectations, the expected change depends only on the structural component, except for the two individuals involved in the transfer. The expectation is conditioned on these two individuals having equal health.

Consider now the case of a uniform distribution of income. If we redistribute income from the rich *i* to the poor *j* both with equal health, such that we move the rich rank to $\lambda_i + 1$, then the rank of the poor will change equally much to $\lambda_j - 1$. From equation (1) we see that the contribution to the concentration index from these two individuals is unchanged, since their health is equal. However, another individual *i'* with initial rank $\lambda_i + 1$ will now get one unit lower rank, and an individual *j'* with initial rank $\lambda_j - 1$ will get one unit higher rank. As the rich by the assumption is healthier than the poor and the random term is zero for all adjacent individuals, $H_{i'} > H_{j'}$. Thus, $\sum_{l \neq i,j} (2\lambda_l - 1)H_l$ will decline and hence *C* will increase, i.e., the concentration index shows more inequality in favor of the rich due to the health contingent income transfer.

Now, suppose that the rank of one of the individuals is moved two places, i.e., the income distribution is no longer uniform. For concreteness we assume that this applies to the poor, as in case 2 of the Theorem. Thus, in addition to switching place with *j'* as discussed above, the poor who receives the money will switch rank with one more individual *j''*. Now, by continuity - $H_j \approx H_{j''}$ as $\varepsilon_j > 0$ and since we consider expected changes, which is equivalent to setting $\varepsilon_{j''} = 0$ - the expected change will be computed with *j* healthier than *j''*, and when they switch place the concentration index would then increase. If the poor moves one more place, the same argument applies once more. The proof of case 3 in the Theorem is similar. **QED**.

Note that cases 2 and 3 are the most likely cases. As the two individuals have equal health, the poor has to be healthier than implied by the structural component, or the rich has to be less healthy than the structural component (both these may apply at the same time). Thus in general, a health contingent income transfer is likely to increase the concentration index.

To see the importance of the theorems, consider transfers between i and j, where $x_i > x_j$ and $h_i < h_j$. Thus, individual i is rich and unhealthy and individual j is poor but healthy. If both health and income is important for a person's well-being, then we cannot tell who is better off. How should we then evaluate the impact of a health or income transfer between the two individuals? An axiomatic foundation for the concentration index was provided by Erreygers (2009) where one of the axioms concerns transfers of health. The crucial axiom is that a transfer of health from i (the rich) to j (the poor) should reduce measured inequality. Adding some more axioms of a more technical nature, Erreygers shows that only the (transformation of the) concentration index satisfies this and his other axioms. Note that this implicitly takes a stand that i (the rich) and not j (the healthy) is the one that is better off. The concern is thus exclusively on *relieving income inequality*. Moreover, the axioms only consider health as a mean of transfer. Brekke and Kverndokk (2011) show that it is impossible to construct a measure that also satsifies an axiom that a transfer of income from i (the rich) to j (the poor) should reduce measured inequality. Actually, some Dalton transfers of income increases inequality as measured by the CI. In particular this applies to Dalton transfers between individuals of equal health.

The individuals i and j, with $x_i > x_j$ and $h_i < h_j$ are not typical, and the concern behind the concentration index is that health inequality adds to the inequality of income as when $x_i > x_j$ it is typically also the case that $h_i > h_j$. An interesting question is to what extent this is so. One measure of this would be to take the income distribution as given and compare the actual health distribution to a hypothetical one where all individuals have the same health defined as average health. The actual health distribution would then be derived by a transfer of health between individuals of different income, and due to the correlation between health and income, the transfers will be from the poor to the rich, and each such transfer will increase the concentration index according to Erreygers' axiom. The index thus does indicate to what extent the health distribution adds to the inequality created by income inequality. But the absolutely essential assumption for this argument is that the income distribution is given. That

assumption is not justified in comparing two economies or even the same economy at different points in time.

To illustrate the importance of the theorems, below we consider a model where causality runs from income to health, using the logic of cognitive stress theories. These theories have informally argued that there may be a tradeoff between income equality and health equality. We show that under certain conditions this is indeed the implication of our model, the more we equalize income the more unequal becomes health. The changes can be decomposed into a health contingent redistribution of income and – under certain condition – an income contingent redistribution of health. Consistent with the theorems above, we find that the CI reports higher health inequality in the egalitarian society, but for the wrong reason. The measure only responds to equalizing income. It does not matter for the concentration index if there is a cost of egalitarianism in terms of health distribution or not.

4. Is there a trade-off between income equality and health equality?

In Brekke and Kverndokk (2011) we show that increases in measures like odds ratios or concentration indexes can be interpreted as either increased health inequality or reduced income inequality. The argument was based on the assumption that lower health is causing lower income or that there is a common cause of both. Now we want to consider the last causal case, where low income causes bad health. Would it then be possible to provide an explanation for the finding that the Nordic countries – that appear to be the most egalitarian – are also the ones with highest reported health inequality? And if such a mechanism exists, will the CI show it?

Let us start with a simple linear model as in Brekke and Kverndokk (2011), where

(1) $h_i = \phi a_i + \mu y_i + u_i$.

Here, h is health, y is income, a is other factors affecting health, and u is a stochastic term, all for individual i. In this model health is a function of *absolute income*.

In Brekke and Kverndokk (2011), we found that if the variance in y is reduced due to egalitarian policies, the correlation (or another bivariate measure) between h and y should

decline. Moreover, the Nordic welfare states attempts to provide the same access to health services irrespective of income, and hence the impact of income, i.e., μ, is reduced. This should similarly reduce the correlation (the social gradient). Thus, this model is inconsistent with the empirical results stating higher health inequality in the most egalitarian countries.

To be able to explain such results with this causal link, we turn to a model where the *relative income* and not the absolute income, determines health. This is in line with cognitive stress theories (e.g., Eriksen and Ursin, 2002; 2004) that argue that stress may explain the gradient in health. Low relative income may give low status and this creates stress that may affect health negatively (Marmot, 2004). For instance, animal studies show that low status males (with poor perspectives of mating) have high levels of stress hormones (Sapolski, 1993). High levels of stress hormones may be detrimental to health.

We set up a simple model, rather informally, to show that if low relative income is the cause for poor health, there is a mechanism that can explain why health inequality is higher in Nordic countries, without assuming that the μ coefficients are higher in Nordic countries as in equation (1). For this purpose, we use the simple model

$$(2) \qquad h_i = \frac{y_i}{\bar{y}_i},$$

where $\bar{y}_i$ is the average income of 'relevant others' for individual i. The definition of relevant others is essential to explain the apparent paradox.

The society consists of three classes, the upper class (U), the middle class (M) and the labor class (L), where the class defines your possible income range. For simplicity we assume that the three classes are equally large. For each class there are N individuals, let y_{ci} denote the income of individual i in class $c \in \{U, M, L\}$. Income is determined by class and individual abilities,[7] and we assume that abilities are equally distributed between the classes. To simplify notation, let the index i rank individuals by ability, such that the income of an individual can be written

---

[7] We assume that effort is equal among the individuals, e.g., that everybody works the same number of hours per day. In an earlier version of the model, effort was endogenous. While this complicated the model significantly, the qualitative results were similar.

(3) $y_{ic} = b(c)a_i$,

where the mean level of ability a is 1. It thus follows that $\bar{y}_c = b(c)$ and $a_i = \dfrac{y_{ic}}{\bar{y}_c}$.

We further assume in line with cognitive stress theory, that health is determined by social standing, but assume more specifically that social standing is based on relevant others assessment of the persons abilities. If everybody knows how class affects income, i.e., the $b(c)$ function, and income is observable, as well as class, abilities can be directly observed.

There are two cases where $b(c)$ is observable. The first is when income is independent of class, such that $b(c) = \bar{b}$ for all c. We denote this the **egalitarian society**. Next, in a **clearly stratified society**, $b(c)$ is not constant but depends on c. In both societies a_i is observable as income is observable, and health is a function of i's abilities in the eyes of others, hence

(4) $h_i = f(a_i)$

Assuming that

(5) $b(U) > b(M) > b(L)$ with $b(U) - b(M) = b(M) - b(L) = m$,

it follows that we would arrive at the egalitarian society from the clearly stratified society through a series of Dalton income transfers, i.e., taking m from individual iU and give to individual iL, for all i (transfers between individuals with the same ability and therefore health level). Such Dalton transfers would not affect the health of any individual as health is a function of ability only, see (4). Based on Dalton's principle of transfer, i.e., with a social welfare function that is increasing with Dalton transfers,[8] we can conclude that an egalitarian society is better than the clearly stratified society.

---

[8] Dalton's "principle of transfers" means that transferring income from rich to poor should decrease the value of the inequality measure, see Dalton (1920). Lower inequality is supposed to increase social welfare.

While the egalitarian society is preferred and there is no difference in individual health, the CI will show higher inequality in the egalitarian society according to Theorem 2. This is in accordance to the results in Brekke and Kverndokk (2011) where the standard measures of health inequality show higher inequality in the egalitarian society. This is, thus, a case where the concentration indexes will erroneously show increased health inequality, while the underlying cause is Dalton transfers in income. As discussed in Brekke and Kverndokk (2011) this is typically the case when health causes income. Here we see that it can also be the case with income causing health.

Next, consider a **weakly stratified society**. In this case income is influenced by class exactly as in the clearly stratified society, but only income is observable and not class. Then, in the eyes of others, a person with income y_i will be judged to have abilities[9]

$$(5) \qquad a_i = \begin{cases} y_i / \overline{y}_u & \text{with probability} \quad 1/3 \\ y_i / \overline{y}_m & \text{with probability} \quad 1/3 \\ y_i / \overline{y}_l & \text{with probability} \quad 1/3 \end{cases}$$

Assuming, as above, that the cognitive stress is related to how the individual is seen by others, health will be a function of this probability distribution. For simplicity, we assume that the individual's health will be equal to the expected ability level

$$(6) \qquad h_i = \frac{1}{3}\frac{y_i}{\overline{y}_u} + \frac{1}{3}\frac{y_i}{\overline{y}_m} + \frac{1}{3}\frac{y_i}{\overline{y}_l},$$

which is the mean health at that income level, i.e., y_i, in the clearly stratified society.

For a given income level, a person in the upper class will have better health and a person in the labor class will have worse health compared to a clearly stratified society. The reason is that there is a positive probability that the upper class person belongs to the labor class and therefore has higher abilities, as for a given income level, a labor class person must have better abilities than an upper class person to earn the same income level. In the same way

---

[9] This assumes that the income must be within the range of all classes, i.e., it should not be higher than the highest possible income for the labor class or lower than the lowest possible income for the upper class, see Figure 1 below.

there is a positive probability that the labor class person belongs to the upper class, and it is, therefore, a positive probability that he has lower abilities.

Note that if we move from the clearly stratified society to the weakly stratified society, no individual's income has changed and the mean health level at all income levels (i.e., in the population) is maintained. This implies that we can reach the income-health distribution of the weakly stratified society from the clearly stratified society through a series of Dalton transfers of health, i.e., transfers of health from a healthy person (in the labor class) to an unhealthy person (in the upper class) at the same income level, without changing the mean. Based on Theorem 1, this reduction in health inequality will give no effect on the concentration index, in spite of the fact that the move from the clearly stratified to the weakly stratified society indeed involves a series of Dalton transfers of health.

By comparing the weakly stratified and the egalitarian societies, we see that either one can be derived from the clearly stratified society through a series of Dalton transfers. A move to the weakly stratified society involves a series of health transfers, while a move to the egalitarian society involves a series of income transfers. Note that health inequality actually will be lower in the weakly stratified society than in the egalitarian society, and unobservable class can, therefore, be an explanation for higher health inequality in egalitarian societies. This means that if stratified societies are only weakly stratified, a move toward a more egalitarian society implies a tradeoff between income and health equality. However, the CI is not able to show this mechanism or the tradeoff. The CI will actually show higher inequality in the egalitarian society than in the weakly stratified society, but for the wrong reason, namely the more equal income distribution in the egalitarian society.

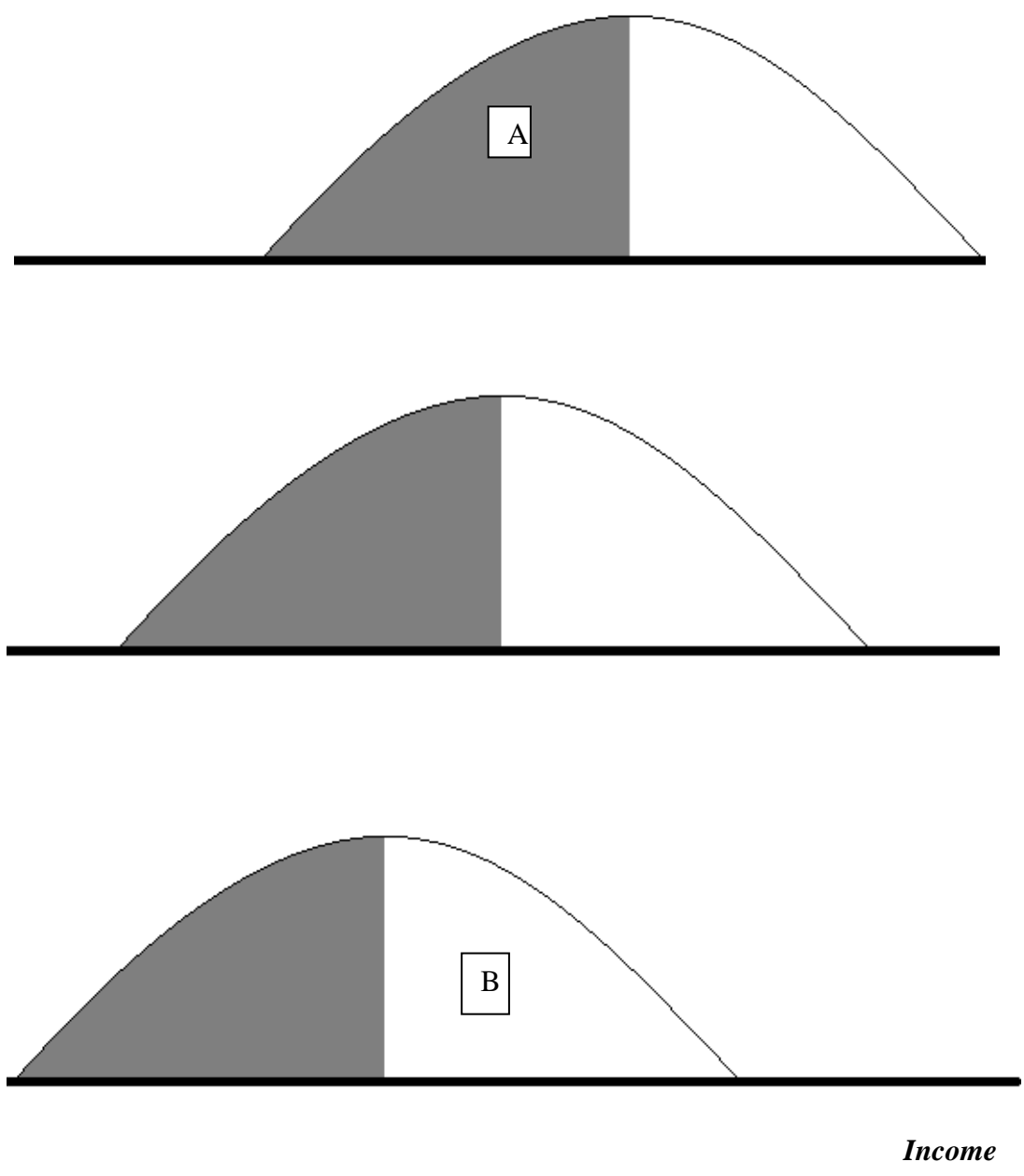The model can be illustrated in Figure 1 below.

Figure 1: *Health in a clearly stratified society with an upper class (top), middle class and labor class (bottom). The shaded areas are individuals of low health. $h_i = f(a_i) = 1$ if $a_i > 0$ and $h_i = 0$ otherwise. A represents an unhealthy individual in the upper class, while B represents a healthy individual in the labor class at the same income level.*

Figure 1 shows the income distribution for a clearly stratified society. Here the health function $h_i = f(a_i)$ is particularly simple, with health being 1 if ability is above 0 and zero otherwise.

The shaded areas are thus the unhealthy ones in the clearly stratified society. The egalitarian society is like three copies of the middle panel of the figure.

In the egalitarian society, CI is equal to 0.5 as the concentration curve does not pick up any aggregated health until it reaches the median income, but then goes in a straight line to (1,1).[10] In the clearly stratified society the concentration curve starts to pick up aggregated health form the median income of the labor class, and moves in a straight line to (1,1) only from the median income in the upper class. At income around the median for the whole society we find both unhealthy individuals like individual *A* and healthy once like individual *B*. As a consequence, the curve dominates the curve from the egalitarian society, and the CI is significantly lower, meaning lower inequality with this measure.

Does this indicate that there is a social welfare cost of egalitarianism? It does not! As above a society with only a middle class (an egalitarian society) can be achieved by a series of *Dalton transfers of income between individuals of equal health*. If we transfer income from the poorest in the upper class to the poorest in the labor class until their income is equal, they both end at the income of the poorest in the middle class. Similarly, we can transfer income for the second poorest etc. When we have transferred income from all individuals in upper class to all individuals in the lower class, we end with two extra copies of the middle class, and no individual will change health status. All transfers are between individuals of equal health. Thus, if such transfers increase social welfare, the social welfare in the egalitarian society is the highest, in spite of a lower score on the health inequality index. Moreover, the transfers that caused the drop in measured health inequality were between individuals of equal health and did not change anyone's health.

Now, suppose that 'relevant others' does not see the difference between *A* and *B*, as in the weakly stratified society. Observing someone of median income, they conclude that it may be a person that got what it takes, like *B*, or someone who does not, like A. If this assessment in the eyes of others is what drives the health effect, then this would be like a Dalton health transfer from B to A, that is *a health transfer from a healthy person to an unhealthy one of equal income*. If health is proportional to the probability that the person got it (is above average in his class) then this would be a pure transfer. Clearly, assuming that Dalton health

---

[10] Note that the concentration index is between 1 and -1, where a positive number means that health is distributed in favour of the rich.

transfers improve social welfare, then the society where class is unobservable is preferable to the society of in Figure 1. However, according to Theorem 1 in Section 3, the concentration index does not respond to these Dalton transfers.

Moving from a clearly stratified society to a weakly stratified society implies a series of Dalton health transfers. On the other hand, moving from the clearly stratified society to the egalitarian implies a series of Dalton income transfers. That is, to get from the weakly stratified society to the egalitarian; we would first have to do a series of reverse Dalton transfers of health (increasing health inequality) to get to the clearly stratified society and then a series of Dalton income transfers (reduced income inequality) to get to the egalitarian society. Thus, if stratified societies are weakly stratified, there is indeed a tradeoff between income inequality and health inequality. The concentration index does not inform us about this tradeoff, as it is insensitive to the health transfers. The only insight we get from observing that the concentration index is higher in the egalitarian society than in the stratified society is that the egalitarian society is egalitarian – in income.

5.   Conclusions

This paper studies the health equality paradox of the welfare state, namely that cross country empirical evidence shows that egalitarian countries, such as the Nordic welfare states, have higher or no less social inequality in health than less egalitarian countries. While Brekke and Kverndokk (2011) explained this as a statistical artifact, based on the causal effect running from health to income (or another socioeconomic variable) or from a common factor affecting both variables in the same direction, this paper also includes the causal effect mostly studied in the literature; the one from income to health.

We concentrate on the concentration index, as this is a frequently used bivariate measure in economic studies of socioeconomic health inequality, and show that this measure has some unfortunate properties; it is insensitive to income contingent health transfers, while health contingent income transfers from rich to poor will increase inequality. As these properties are independent of the causal mechanism, it may explain why an egalitarian society may have higher socioeconomic health inequality based on the concentration index, even if the causality runs from income to health. We illustrate this by constructing a model where health is determined by social status, such as relative income, and where relative income within a class

follows from abilities. Not surprisingly, the stratified society where class is observable will have higher income inequality than an egalitarian society. The concentration index will, however, show higher social inequality in health in the egalitarian society as explained above, even though the health distribution is equal in the two societies. Thus, this result is also consistent with Brekke and Kverndokk (2011).

However, there may actually be a mechanism where an egalitarian society gets higher health inequality than a stratified society. We show that a weakly stratified society where class is not observable, will have less health inequality than an egalitarian society, everything else equal. Thus, there may be a tradeoff between health equality and income equality. The concentration index will in this case show higher inequality in the egalitarian society, but for the wrong reason, namely the equal income distribution. This follows from the property that it is insensitive to income contingent health transfers, but sensitive to health contingent income transfers. While, there may be cases where egalitarian countries have more health inequality than stratified societies as indicated by the empirical evidence, bivariate measures used in the empirical literature may not be able to inform us about this. Rather, higher social inequality in health reported by these measures may just reflect a more equal income distribution.

The above discussion illustrates that the concentration index is not very helpful in comparing socioeconomic health inequality in two different societies or in the same society over time. Health inequality measured by the concentration index may increase for several reasons such that education is accessible for everyone (dissolve the class structure), compressed income structure, or that high income groups are given priority in health treatment. Only some of these reasons are unfair. If one takes socioeconomic inequality in health seriously, one should model the unfair mechanisms and then estimate them. This would also take the causality seriously, which is important for effective policy measures.

References

Bamra, C. and T. A. Eikemo (2008): Welfare state regimes, unemployment and health: a comparative study of the relationship between unemployment and self-reported health in 23 European countries, *J Epidemiol Community Health*, 63:92-98 .

Barsky, R. B., F. T. Juster, M. S. Kimball and M. D. Shapiro (1997): Preference Parameters and Behavioral Heterogeneity: An Experimental Approach in the Health and Retirement Study, *Quarterly Journal of Economics*, 112(2): 537-79.

Behrman, J. R. and M. R. Rosenzweig (2004): Returns to birth weight, *Review of Economics and Statistics*, 86(2), 586-601.

Black, S. E., P. J. Devereux and K. G. Salvanes (2007): From the cradle to the labor market? The effect of birth weight on adult outcomes, *Quarterly Journal of Economics*, 122(1): 409-439.

Brekke, K. A. and S. Kverndokk (2011): Inadequate Bivariate Measures of Health Inequality: The Impact of Income Distribution, *Scandinavian Journal of Economics*, forthcoming.

Case, A., A. Fertig and C. Paxson (2005): The lasting impact of childhood health and circumstance, *Journal of Health Economics*, 24: 365-389.

Cavelaars, A. E., A. E. Kunst, J. J. Geurts, R. Crialesi, L. Grötvedt, U. Helmert, E. Lahelma, O. Lundberg, J. Matheson, A. Mielck, A. Mizrahi, A. Mizrahi, N. K. Rasmussen, E. Regidor, T. Spuhler and J. P. Mackenbach (1998): Differences in self reporting morbidity by educational level: A comparison of 11 Western European countries. *Journal of Epidemiology and Community Health*, 52, 219-27.

Christiansen, T., J. Lauridsen and U. Häkkinen, U. (2009): Determinants of inequalities in health with focus on retired - with particular regard to retired Danes, Health Economic Papers 2009: 4, University of Southern Denmark.

Dalton, H. (1920): The measurement of the inequality of incomes, *Economic Journal* 30, 348-361.

Deaton, A. (2001): Relative deprivation, inequality and mortalityInequalities in income and inequalities in health, NBER working paper 71418099, National Bureau of Economic Research.

Deaton, A. (2003): Health, Inequality, and Economic Development, *Journal of Economic Literature*, vol. XLI: 113-158.

Eikemo, T. A., C. Bambra, K. Joyce and E. Dahl (2008): Welfare state regimes and income-related health inequalities: a comparison of 23 European countries, *The European Journal of Public Health,* 18(6):593-599

Eriksen, H. R. and H. Ursin (2002): Social inequalities in health: Biological, cognitive and learning theory perspectives, *Norsk Epidemiologi*, 12(1): 33-38.

Eriksen, H. R. and H. Ursin (2004): The cognitive activation theory of stress, *Psychoneuroendocrinology*, 29(5): 567-592.

Erreygers, G. (2009): Correcting the Concentration Index, *Journal of Health Economics* 28, 504-515.

Grasdal, A. (2003): Sosial ulikhet og ulikhet i helse. Hva viser komparative studier?, *Økonomisk forum*, 2, 26-33.

Grossman, M. (2000): The Human Capital Model, in: A. J. Culyer and J. P. Newhouse (eds.) *Handbook of Health Economics*. Elsevier Science B.V., Amsterdam, pp. 347-408.

Huisman, M., A. E. Kunst, M. Bopp, J-K. Borgan, C. Borrell, G. Costa, P. Deboosere, S. Gadeyne, M. Glickman, C. Marinacci, C. Minder, E. Regidor, T. Valkonen and J. P. Mackenbach (2005): Educational inequalities in cause-specific mortality in middle-aged and older men and women in eight western European populations, *Lancet*, 365: 493-500.

Kunst, A. E., F. Groenhof and J. P. Mackenbach (1998): Mortality by occupational class among men 30–64 years in 11 European countries, *Social Science & Medicine*, 11:1459-1476.

Kunst, A. E., V. Bos, E. Lahelma, M. Bartley, I. Lissau, E. Regidor, A. Mielck, M. Cardano, J. A. A. Dalstra, J. J. M. Geurts, U. Helmert, C. Lennartsson, J. Ramm, T. Spadea, W. J. Stronegger and J. P. Mackenbach (2005): Trends in socioeconomic inequalities in self-assessed health in 10 European countries, *Int. J. Epidemiol.*, 34 (2): 295-305.

Lynch, J., G. D Smith, M. Hillmeier, M. Shaw, T. Raghunathan, G. A. Kaplan (2001): Income inequality, the psychosocial environment, and health: comparisons of wealthy nations, *Lancet*, 358: 194-200.

Mackenbach, J. P., A. E. Kunst, A. E. J. M. Cavelaars, F. Groenhof and J. J. M. Geurts (1997): Socioeconomic inequalities in morbidity and mortality in Western Europe, *Lancet* 349, 1655-59.

Mackenbach, J. P., V. Bos, O. Andersen, M. Cardano, G. Costa, S. Harding, A. Reid, Ö. Hemström, T. Valkonen and A. E. Kunst (2003): Widening socioeconomic inequalities in mortality in six Western European countries, *International Journal of Epidemiology*, 32 (5), 830-837.

Mackenbach, J. P., I. Stirbu, A.-J. R. Roskam, M. M. Schaap, G. Menvielle, M. Leinsalu and A. E. Kunst (2008), Socioeconomic inequalities in health in 22 European countries. *The New England Journal of Medicine* 358, 2468-2481.

Marmot, M. (2004): *The Status Syndrome: How Social Standing Affects our Health and Longevity*, Times Books, New York.

Marmot, M.G., G.D Smith., S. Stansfeld, C. Patel, F. North, J. Head, I. White, E. Brunner and A. Feeney (1991): Health inequalities among British civil servants: the Whitehall II study, *Lancet*, June 8;337(8754):1387-93.

Marmot, M. G. and R. G. Wilkinson (eds.) (2006): *Social Determinants of Health*, 2. edition, Oxford University Press, Oxford.

Mellor, J. M. and J. Milyo (2002): Income inequality and health status in the United States – Evidence from the current population survey, *Journal of Human Resources*, 37(3): 510-539.

Förster, M. and M. M. d'Ercole (2005): Income Distribution and Poverty in OECD Countries in the Second Half of the 1990s, OECD Social, Employment and Migration Working Papers no. 22, OECD, Paris.

OECD (2010): OECD Factbook 2010: Economic, Environmental and Social Statistics, OECD Publishing, Paris.

Sapolski, R. M. (1993): Endocrinology alfresco: psychoendocrine studies of wild baboons, *Recent Progress in Hormone Research*, 48: 437-468.

Smith, J. P. (1999): Healthy Bodies and Thick Wallets: The Dual Relation Between Health and Economic Status, *Journal of Economic Perspectives*, 13(2): 145-166.

Subramanian, S. V. and I. Kawachi (2004): Income Inequality and Health: What Have We Learned So Far?, *Epidemiologic Review*s, 26: 78-91.

Van Doorslaer, E. and X. Koolman (2004): Explaining the differences in income-related health inequalities across European countries, *Health Economics*, 13: 609-628.

Wagstaff, A. and E. van Doorslaer (2000): Income inequality and health: What does the literature tell us?, *Annual Review of Public Health*, 21: 543-67.

Wilkinson, R. G. (1996): *Unhealthy societies: the affliction of inequality*, London: Routledge.

Table 1: Cross country / cross regional studies of social inequalities in health

Cross country (region) study	Countries covered	Period /source	Socio economic variable	Health measure	Estimate	Nordic country patterns
Mackenbach et al (1997)	11 European countries including Norway, Sweden, Denmark and Finland	1985-1992: Data from Working group on socio-economic inequalities in health	Income, education, ocupational class	Mortality and self reported morbidity	Odds ratios and rate ratios comparing lower and upper socioeconomic	Sweden and Norway had larger relative inequalities in health than most other countries for both measuresmeasures
Cavelaars et al. (1998)	11 countries including Norway, Sweden, Finland and Denmark	1985-1993: National data on morbidity by educational level	Education level	Morbidity: morbidity class	Regression based relative index of inequality	In general, there was a tendency for inequalities to be relatively large in Sweden, Norway, and Denmark and to be relatively small in Spain, Switzerland, and West Germany
Kunst et al. (1998)	11 European countries including Norway, Sweden, Denmark and Finland	1980-1989: Data from Working group on socio-economic inequalities in health	Occupational class: manual vs non manual	Mortality from specific causes	Rate ratios and mortality ratios comparing manual to non-manual	Mortaltity due to cardivascular diseases are much more common among manual workers in the Nordic Countries
Mellor and Milyo (2002)	USA	1995-199: March current population survey	Income			No evidence that income inequality affects health status of the population: Neither in the population generally nor among the poor
van Doorslaer and Koolman (2004)	13 European countries including Denmark	1996 EU household panel	Income	Morbidity; morbidity class	Interval regression analysis computing concentration indicies	Socioeconomic differences in health are relatively strong in Denmark (only UK and Portugal have a more pronounced pattern

Table 1: Cross country / cross regional studies of social inequalities in health (contd.)

Cross country / region study	Countries covered	Period/source	Socio economic variable	Health measure	Estimate	Nordic country patterns
Kunst et al (2005)	10 European countries, including Norway, Sweden, Denmark and Finland	1980-2000: National interview surveys	Income and educational level	Self assessed health	Odds ratios between first and third income tertile	Stable pattern over time. No tendency to increasing inequalities in health in the Nordic countries. Slight detoriation in Italy, Spain and the Netherlands. Indicates that the Nordic systems work to prevent inequality
Huisman et al. (2005)	8 European countries, including Norway	1990-1997: Mortality registers	Educational level	Cause specific mortality	Rate ratios for lowest against highest education goups	Austria and Norway had the highest rate ratios, but the small differences between countries. In Finland and Norway it is especially cardio vascular conditions that dominates among the lower educated. These are typically stress related conditions
Mackenbach et al. (2008)	22 European countries including 8 Eastern European countries and Norway, Sweden, Denmark and Finland	1990-2003: Mortality registers	Income, Educational level, occupational class	Mortality from specific causes + self assessed health	Relative indices for highest and lowest group, controlling for smoking and obesity	Relative social status has stronger impact on health in the Nordic countries than in Continental and Southern Europe
Eikemo et al. (2008)	Compares five regimes: Scaninavian, Anglo Saxon, Bismarckian, Southern and Eastern (23 countries)	2002 and 2004: Second round of the European Social Survey	Income	Self reported health and limited longstanding illness		Smallest inequalities in health are found in the Bismarckian regime, intermediate in Scandinavia and largest in UK
Bamra and Eikemo (2008)			Employment / unemployment	Self reported health and limited longstanding illness		Same findings as Eikemo et al. (2008) but focus is on unemployment