LUND UNIVERSITY
School of Economics and Management

_____

Department of Economics
Master essay
January 2015

Is income inequality an important health status determinant in the OECD?

Author: Daniel Hedén

Supervisor: Carl-Hampus Lyttkens

Abstract

The proposed adverse impact of income inequality on health has long been an important topic in health economics. A negative correlation between inequality and health has been found in several empirical studies but the issues regarding causality and causes are yet to be resolved. The widespread theory that the effects on health goes via disinvestment in social capital and trust is heavily researched and highly debated.

Many studies have found strong correlation between population health and income inequality using state level US data. Inconsistent results have been found using country-level data on mortality rates and income inequality in Europe or OECD. Using cross-sectional data it seems like the correlation is dependent on the countries/states chosen. The ambiguity of the results has led some researchers to disregard inequality as irrelevant when dealing with population health. Others have intensified their search for new evidence.

In this study I exploit the fact that yearly estimates of the GINI-coefficient from 2004 and forth are available in the OECD database. It allows for the use of panel data regression with country-specific fixed effects to investigate whether the weak simple correlation observed between income inequality and population health in the OECD could be caused by identification problems. I find strong and significant results indicating that income inequality should indeed be accounted for when dealing with population health in OECD. The link between income inequality and health has important policy implications.

Keywords: income inequality, health status determinants, health economics

Table of Contents

1. Introduction

1.1 Background

The proposition that the distribution of income have effects on health is the topic of a large and growing pile of literature in different fields of social science from the last decades. Results from a number of studies, on both individual and macro-level data show a negative correlation between income inequality and health (Wagstaff & Doorslaer, 2000). However, the results are not unambiguous and the data problems are severe.

OECD has contributed heavily to this research field, not only with reports and papers, but also with data collection from the member countries. However, in many studies, e.g. Jourmand et al (2008) and Lynch et al (2001), it is pointed out that in a European or an OECD context, the correlation between income inequality and health do not seem to be as great as in for example the USA.

In this paper I will dig deeper into this particular issue and by the use of panel data from the OECD database test whether income inequality on the country level should be regarded as an important health status determinant within the OECD. In the OECD working paper *"Health status determinants: Lifestyle, environment, health care resources and efficiency"* (Jourmand et al 2008), the authors construct a model with important population health status determinants, although excluding income inequality from the model due to data paucity. They also argue that the weak correlations between income inequality and health, at those points in time where data are available, indicate that it probably do not belong anyway.

The data set of the working paper mentioned is extracted from the OECD databases from 1981-2003. Nowadays however, dating back to 2004, the OECD database actually contains yearly estimates of the GINI coefficient from its member countries. This can be exploited to construct, however still rather short, panel data on health status determinants from the OECD database – including income inequality. The use of panel data regression can help resolve some identification problems in a simple correlation and can therefore give further leads to whether country level income inequality qualifies as an important health status determinant within the OECD context or not.

The explanation behind the proposed link between income inequality and health are debated. Some argue that the correlation between income inequality and health is the effect of a concave production function of health from income (the marginal health benefit of an extra dollar is decreasing). Others argue that there is indeed something about the income inequality per se that affects health in a society (Wilkinson, 2010; Marmot, 2002). This is sometimes called the income inequality hypothesis (the IIH) and the effect on health is believed to run via effects on social relations and interpersonal trust. The argument goes that a more unequal distribution of income will cause increased gaps between people, making it harder to see yourself in others, and hence making interpersonal trust less likely. Trust, on the other hand, affects human interactions. In the marketplace trust will decrease costs of transactions, promoting business and growth, which have its own health effects. But the presence of trust or lack thereof is important in every interaction between people. Distrust will cause feelings of insecurity, worry and stress in a given interaction, which have adverse health effects (Schneider et al, 2011).

The evidence of such a link between income inequality via trust to health and growth is in large parts very compelling, but not unambiguous. In the theoretical part I will look a little deeper into the literature regarding this proposed link.

In this paper I find that income inequality does belong as an important health status determinant within an OECD-context. My results from the empirical analysis show that there is a relatively large and significant effect running from income inequality to longevity, controlling for other important health status determinants. A 1 % increase in the GINI-coefficient corresponds to a 1,9 % decrease in longevity, or 1,5 years. The data sample of this study is however not very large and the results should therefore be regarded as preliminary.

1.2 Purpose and question at issue

The purpose of this essay is to provide theoretical and empirical evidence on whether income inequality should be regarded as an important health status determinant in an OECD context.

The main questions at issue are:

- What are the theoretical grounds to include income inequality as an important health status determinant?
- Is there empirical support in an OECD context to include income inequality as an important population health status determinant?

I also wish to provide some theoretical arguments why the possible health effects of inequality are important for economic policy in a broader sense. The questions are relevant for two reasons. First since there is an ongoing debate regarding the significance of income inequality in explaining health inequality. Second since availability of yearly data on the GINI coefficient in the OECD database provide an opportunity to better test the empirical support.

1.3 Method

I review (parts of) the literature on the correlation between income distribution and health outcomes. I put extra weight on the literature exploring the income inequality hypothesis.

I collect data, mainly from the OECD database, on important determinants of health, including the GINI-coefficient, and analyze it using panel data regression.

1.4 Material

All data is collected from open databases, mainly from the OECD. Printed and unprinted sources are found in the bibliography.

1.5 Delimitations

The empirical study is made during the period where longitudinal data on income inequality can be found on OECD member countries. This time period is relatively short, 8 years long, and spans from 2004-2011.

1.6 Structure

In chapter 2 I review the growing pile of literature on the health effects of income inequality. In sections 2.3-4 I look specifically at the literature on the so called income inequality hypothesis, emphasizing the importance of the trust concept to understand the mechanisms at work. In chapter

3 I discuss how the theory of market failures can be applied to the issue of income inequality and health. Chapter 4 provides the estimation strategy and the results from the empirical analysis. Chapter 5 provides discussion and concludes. In appendix one, the reader can find some additional discussion on some of the conceptual issues involved in the measurement of income and income inequality.

2. The effects of income inequality on health outcomes

2.1 Income and health

Empirically income is positively related to health, both on an individual level and on a country level. The higher the income, the better the health, on average. Two common measures of health and income on a population level is life expectancy at birth and real GDP per capita. A curve with life expectancy on the y-axis and GDP per capita on the x-axis is commonly known as a Preston curve, named after Samuel Preston who first described it in Preston (1975). Figure 1a shows the relation between health and national per capita income (purchase power adjusted) in the 34 OECD countries. In the literature the Preston curve usually looks more like figure 1b (from Deaton, 2003), with larger circles for larger populations. Notably, there seems to be a positive relation between health and income, but it is nonlinear.

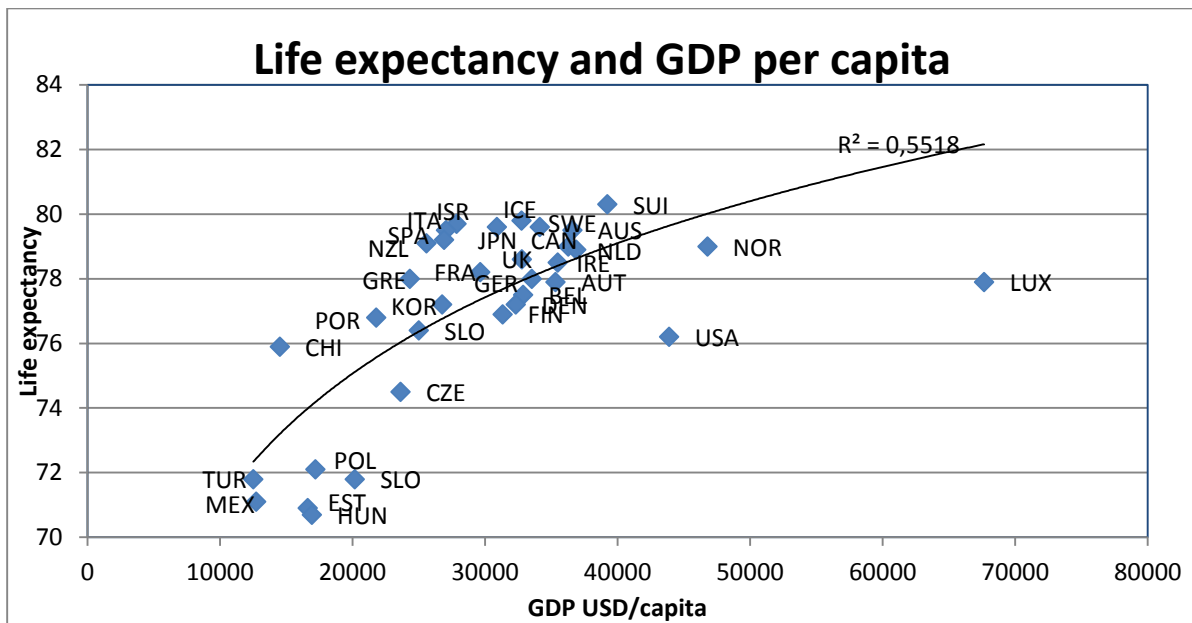## Life expectancy and GDP per capita

$R^2 = 0,5518$

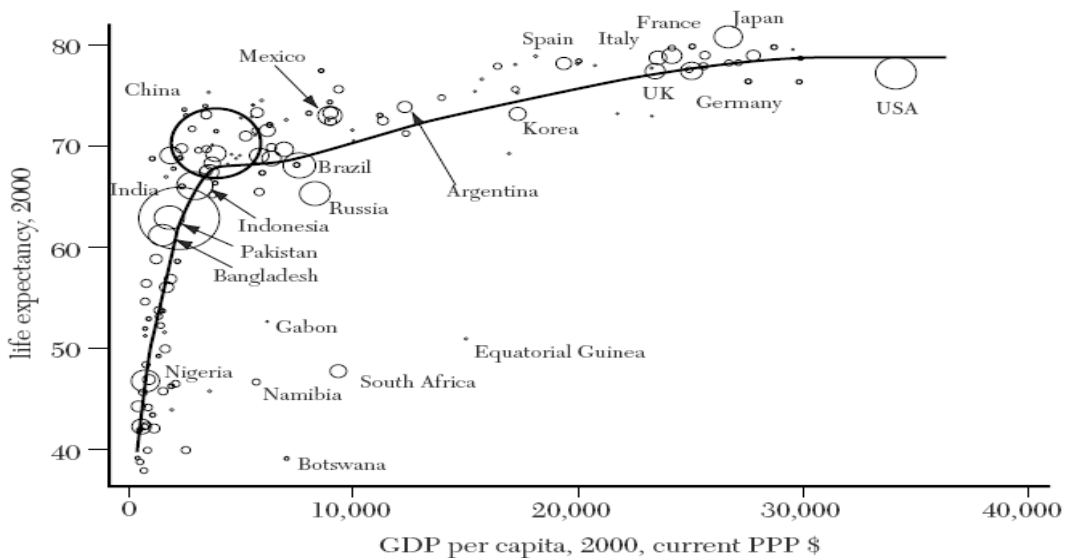*Figure 1a. Life expectancy and GDP per capita 2010. Source: OECD*

Figure 1. The Preston Curve: Life Expectancy versus GDP Per Capita
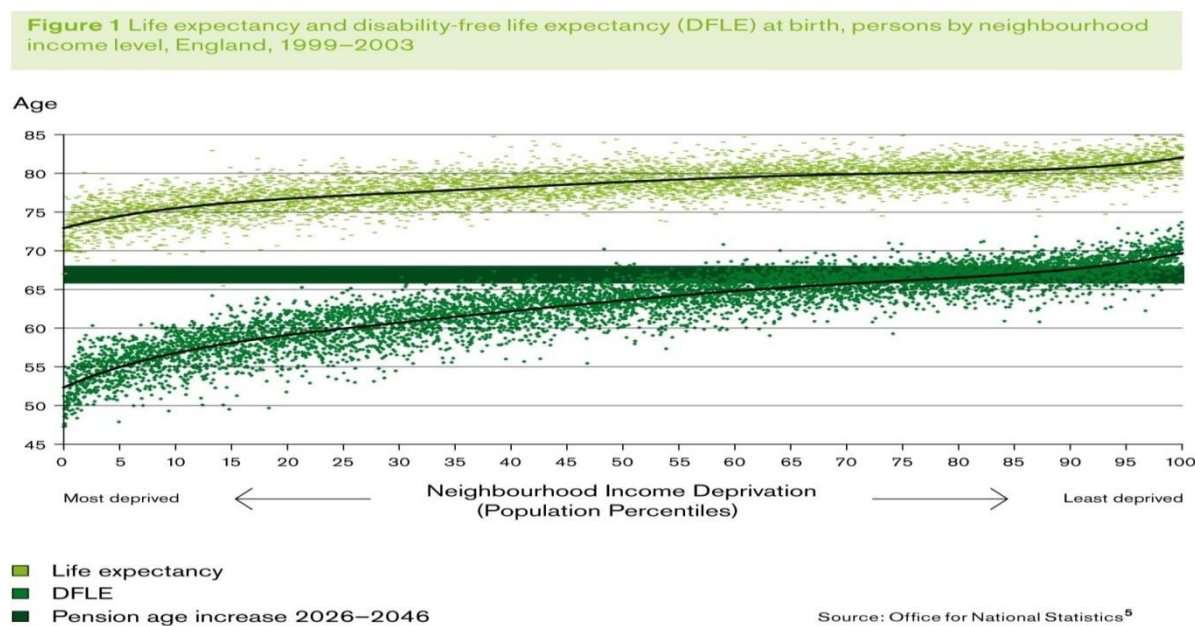
Figure 1b. The Preston curve. Source: World Bank (from Deaton, 2003)

Preston reasoned about the non-linear relationship (Preston, 1975, p 241-242):

When individual-level factors are pertinent in mortality and when the individual-level dose- response relations are non-linear, as they almost certainly are in this case, then the distribution of income will affect the aggregate life expectancy. If the dose-response relations were all linear and identical from individual to individual and nation to nation, it is easy to show that a nation with a particular average income would have the same life expectancy regardless of how incomes were distributed.

Preston's reasoning thus suggests that the non-linear correlation on the population level is a reflection of a non-linear correlation on the individual level. It turns out that this prediction was head-on. Individual level data from later studies confirm the positive and non-linear relation between income and health also within countries. In figure 2, this is exemplified by a result from the Great Britain, borrowed from the Marmot review of 2010 (Marmot et al 2010).

We see in the figure that persons living in lower income neighborhoods (to the left on the horizontal axis) do indeed on average live shorter lives (further down on the vertical axis) than persons living in higher income neighborhoods. The pattern, that persons living in higher income neighborhoods[1] is expected to live longer, would be similar regardless of the country chosen.

Figure 1 Life expectancy and disability-free life expectancy (DFLE) at birth, persons by neighbourhood income level, England, 1999−2003

Figure 2 – Within country income-health correlation, Source: Marmot et al (2010)

Whether the correlation in figure 2 represents a causal relation, and if so in which direction causality goes, has long been topic for debate and research. Income can affect health in a number of ways. Jourmand et al (2008) argues that on a country level, a higher GDP per capita will facilitate better access to goods and services that improves health and longevity, e.g. food, housing and transportation. But it may also reflect different working conditions in richer and poorer countries, where richer countries tend to have a higher share of less health damaging jobs in the service sector (p. 28). On an individual level income may affect health in two ways, which following Marmot (2002), can be labeled "poor material conditions" and "lack of social participation". Obviously higher income will permit a higher consumption of goods that are necessary for good health, like clean and healthy

---

[1] This of course is a proxy for people with higher income.

living conditions, food, clothes and medicine. But looking at figure 2, we see that it seems like income affects health far beyond the level of income that would ensure the possibility of consuming some "healthy" level of these goods. This could then not be the effect of poor material conditions, but must be caused by some other mechanism. Marmot (2002) argues that above this threshold, "*there still could be substantial inequalities in health that are related to differing opportunities for social participation, for leading a fulfilling and satisfying life, and for control of one's life*" (p. 32).

This view, that it is not only income per se, and the enhanced consumption possibilities for individuals, but also the effect income has on human interpersonal relations and activities that affects health outcomes, is important when dealing with the health effects of income inequality and trust. It is also highly debated.

Notably, given that citizens in richer countries today most often have good access to necessities like clean water, food and health care, the lion part of the income related health inequalities within OECD cannot reasonably be explained by poor material conditions in this regard.

Even if most would agree that there is some causal relation running from income to health, causality is very likely to be bi-directional. Obviously good health will help in pursuing a long education and a high status job. On the other hand bad health can lead to early retirement and people leaving the workforce, which has a negative impact on income. Jourmand et al (2008) argues that the reversed causality problem is less of an issue when dealing with the macro level, at least when dealing with developed countries, as is the case in this paper. This particular argument is left unsupported and is not a literature consensus (see e.g. Herzer & Nunnenkamp 2011).

2.2 Income inequality and health

Besides the income levels of nations and of individuals, the distribution of income within a given society is from multiple studies empirically linked with average health outcomes. Many of these however are performed within the USA. Performing similar studies with data from other countries commonly yield ambiguous results (Lynch et al 2001). The most common measure of income distribution in a country is the GINI-coefficient (see appendix 1), running from 0 to 1, with 0 corresponding to total equality of income (everybody earns the same amount of money) and 1 corresponding to maximum inequality (one person earns 100 % of all income). Figure 3a depicts life expectancy and GINI-coefficients in OECD 2010.
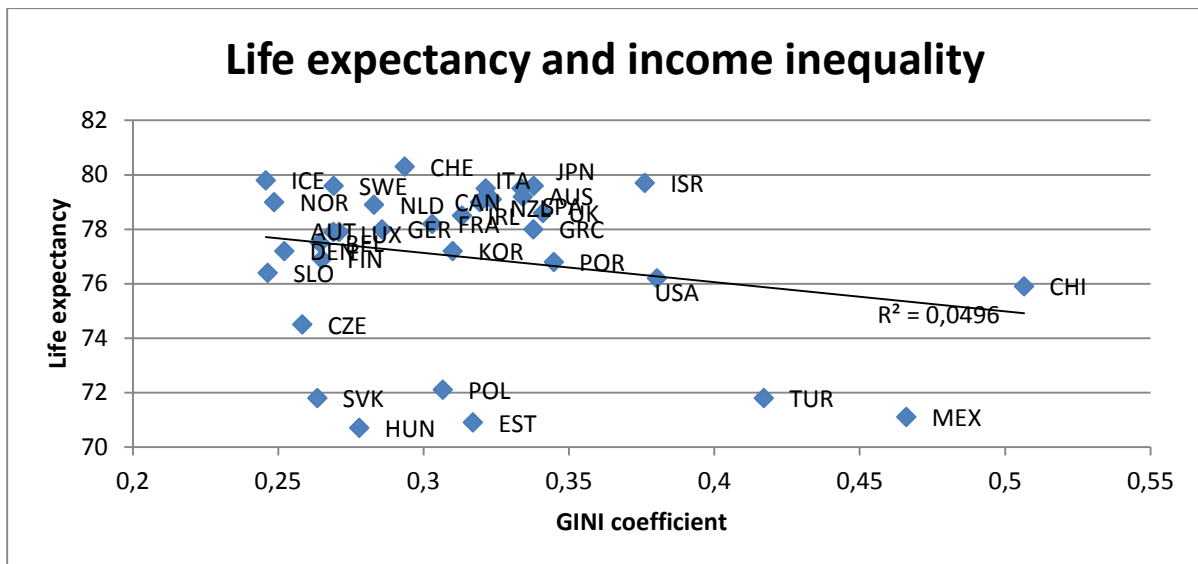
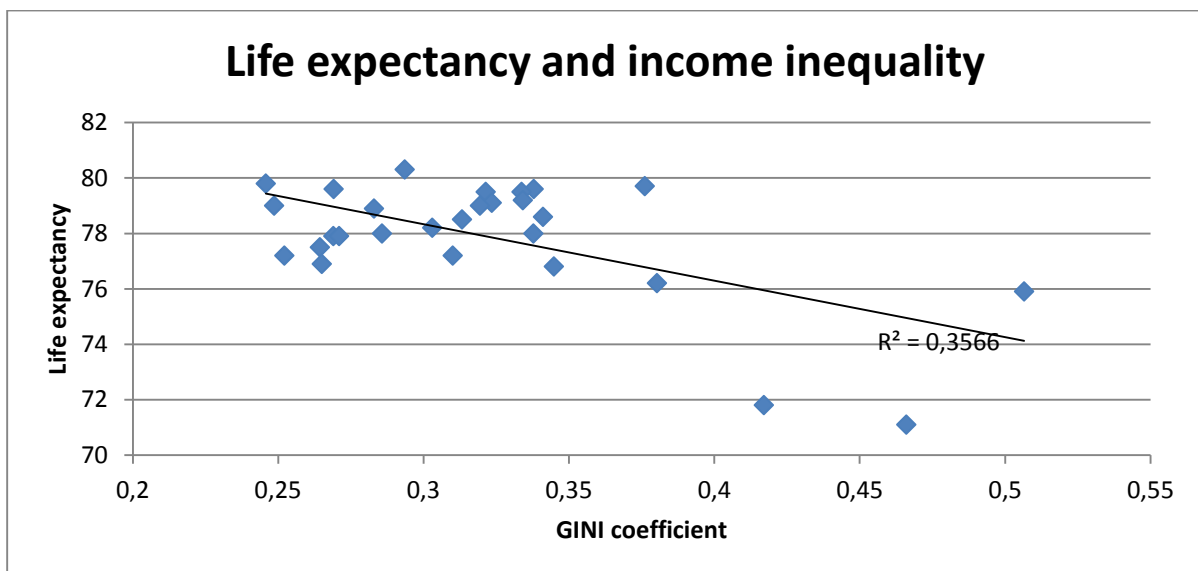*Figure 3a Life expectancy and income inequality 2010. Source: OECD*

Figure 3b Life expectancy and income inequality, excluding former communist countries. Source: OECD

What is noted in figure 3a is that the correlation is rather weak, since the variance is quite large[2]. It is often argued that income inequality affects health mainly through disinvestments in social capital and trust (Uslaner 2002). Therefore it is interesting that Morrone et al (2009) observed in a similar fashion that social capital, measured using interpersonal trust as a proxy, do not seem to have as large effects on health in OECD as in a pure US context (p 30):

At the OECD level, there is only a weak connection between these two variables [interpersonal trust and age-adjusted mortality] *and data doesn't reproduce the same linear pattern showed by Kawachi et al in their study of US states. Many countries, such as Mexico, Czech republic, Hungary, Poland, Slovak republic, have very high level of mortality in comparison to their level of interpersonal trust.*

---

[2] Obviously, this is why income inequality was disregarded as irrelevant in Jourmand et al (2008).

Looking again at figure 3a it is indeed noted that the former communist states do not seem to comply with the stated theory of income inequality and health. If we exclude these countries, which may or may not be advisable for a number of reasons, this results in Figure 3b.

When the former communist states are excluded from the sample, we are left with an explanation power of 35 %. Of course, one may then wonder, what other countries should we exclude just to strengthen (or weaken) the argument? Following the reasoning of Marmot (2005, p 190ff), exclusion may actually be the way to go. Marmot argues that the situation in the former communist states in fact strengthens the general argument regarding inequalities and health. Laying out the hypothesis (mentioned above) that the effect on health goes via lack of control and lack of participation; he shows that this is exactly what is missing for large parts of the population in these countries[3].

For our purpose it is sufficient to note that the weak correlation between income inequality and health in an OECD context, laid forward by many, is very much influenced by what is going on in the former communist states. The inclusion of country fixed effects in a panel data regression may be an important contribution in this regard.

The empirical relationship found in many studies and in figure 3b states that the more unequal the distribution of income in a given society, the worse health outcomes, on average. Thus the same national (per capita) income in two countries will on average not give the same population health outcomes, rather it will depend on how this income is distributed among individuals and households within countries. Why is this?

There are some different theories and approaches to how income inequality affects health outcomes. In a literature review, economists Wagstaff and van Doorslaer (2000) summarized the different suggested theories and put them into five main categories. They were the absolute income hypothesis (AIH), the relative income hypothesis (RIH), the deprivation hypothesis (DH), the relative position hypothesis (RPH) and the income inequality hypothesis (IIH).

The AIH states that what seems to be the effect of income inequality is rather an effect of a concave relationship between health and income. There are diminishing returns to income in the production of health. The implication, shown in figure 4, is that taking 100 dollars (or whatever amount) from a high earner and giving it to a low earner, will yield a positive health effect at the society level, simply because of the shape of the production function. But it is still the income of the individual, and not the income distribution, that affects individual health[4].

---

[3] Which relates to the rather extreme political and economic history that these countries have in common.
[4] Note that this is exactly what Preston suggested, as we saw earlier.
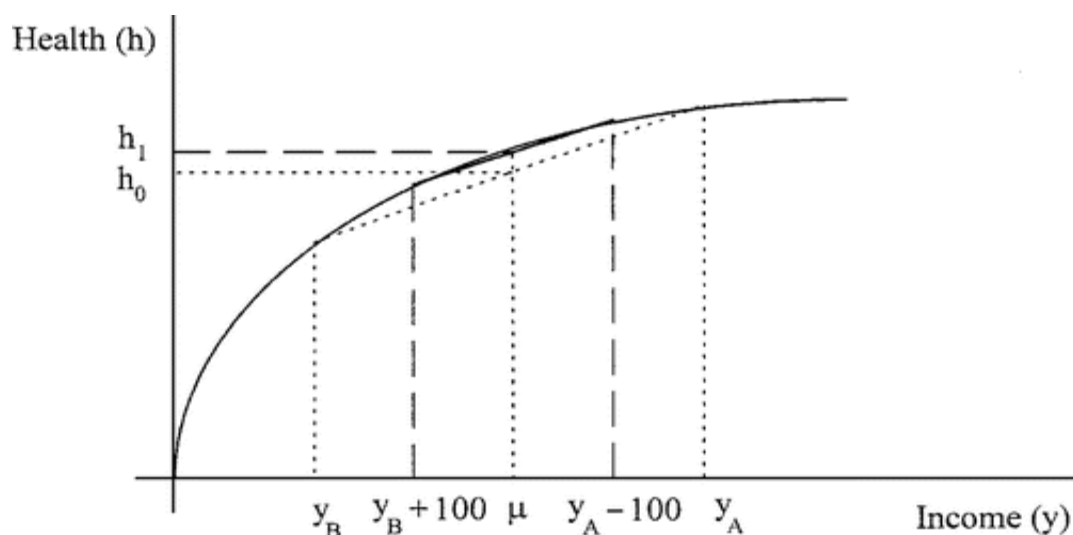
Figure 4. Implications of the concavity of the health-income relationship. Source: Wagstaff and Doorslaer (2000), p 546

The latter four theories all state that income distribution have its own health effects, and that not only absolute income matters, but also some relative measure. Put differently, it is not only your own income that matters for your own health, it is actually also the income of others. Clearly, if true, this effect cannot go through poor material conditions. It must be working through some other mechanism.

Wagstaff and Doorslaer (2000) show that the different theories on what this mechanism might be yield different health functions for individuals. The RIH states that health is associated with relative income per se, i.e. the deviation of individual income from income mean in a given reference group. The DH states that adverse health effects will occur if individual income and hence living standard falls below some critical level, or poverty line[5]. The RPH states that it is not the income deviation from mean income, but rather a person's rank on the income scale that matters. Finally the IIH states that income inequality in itself has adverse health effects for everyone, in that it causes disinvestment in social capital. It should be noted that none of the above theories are mutually exclusive and might all bear a piece of the truth. If relative income matter, probably absolute income do too, and the effect of the relative income may be manifold.

The main contribution of the paper is the insight that to discriminate between different theories, one must use individual level data and cannot rely on population level or community level data. This is since all of the theories predict that population health will depend on average population income and income inequality[6]. It is only with data on individual income that we can investigate further whether it is the absolute income, the deviation from mean or the rank that matters for individual health outcomes.

Reviewing the literature (back in 2000) Wagstaff and Doorslaer find strong evidence for AIH, some evidence for DH and IIH, and nothing to support RIH and RPH. Also striking is that every study mentioned in the review do find, whatever the cause, the same correlation between higher income inequality and worse health.

---

[5] E.g. 50 % of median income.
[6] In addition, of course, to any other health determinant that we can think of.

In a more recent study emphasizing the cross-country perspective and using a dataset with information on 16 000 individuals from 21 countries, Karlsson et al (2010) find strong support for the RIH and the IIH, although they conclude that the IIH seems more of a high-income country phenomenon. Specifically they find evidence of heterogeneity in the way income inequality affects health in different countries, mostly depending on level of development.

Since I am dealing with population (national level) data in this essay I do not aim to try to discriminate between the different theories with my empirical results. To make the point that income distribution matters for population health it is sufficient to show a significant correlation between the two[7]. For policy decisions this may not be enough. For making policy the link matters. For comprehensiveness[8] I will in the next section further pursue the debate and research on the proposed links, focusing on the income inequality hypothesis where disagreements in the literature have been the largest.

If any of the four relative income theories tell some part of the story, that effect is most probably mediated through some effect of inequality on human relations. Not unlikely (and often argued) that effect is what is caught in the concept of social capital and trust to which we now turn.

2.3 Trust, inequality and health

Interpersonal trust is commonly used as a proxy for the perhaps a little fuzzier concept of social capital (Morrone et al 2009). The concept of social capital is not distinctly defined across the literature. In his paper Bowling alone (1995), Robert Putnam states that social capital "*refers to features of social organization such as networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit*." The Swedish political scientist Bo Rothstein, states that social capital has a quantitative dimension as well as qualitative, where the former refers to the number of social connections between individuals and the latter to the level of trust embedded in those connections (Rothstein 2002).

Trust can be broadly defined as the tendency of trusting other people to do as we expect them to do (Morrone et al, 2009, p. 5). The most common measure of trust is responses to the so called Rosenberg question (Ibid, p 10), which goes like this: "Generally speaking, do you think most people can be trusted or that you need to be very careful in dealing with people?" The percentage of the respondents who think that most people can be trusted differs greatly across countries and correlates positively to other measures such as income[9] as seen in Figure 5.

---

[7] Preferably one that is stronger than the one in figure 3a.
[8] And because it is truly an interesting debate and research field.
[9] Intuitively trust in other actors in the market will lower costs of transaction, since the need for control mechanisms will decrease. This is an obvious link between trust and growth.

Trust and GDP per capita
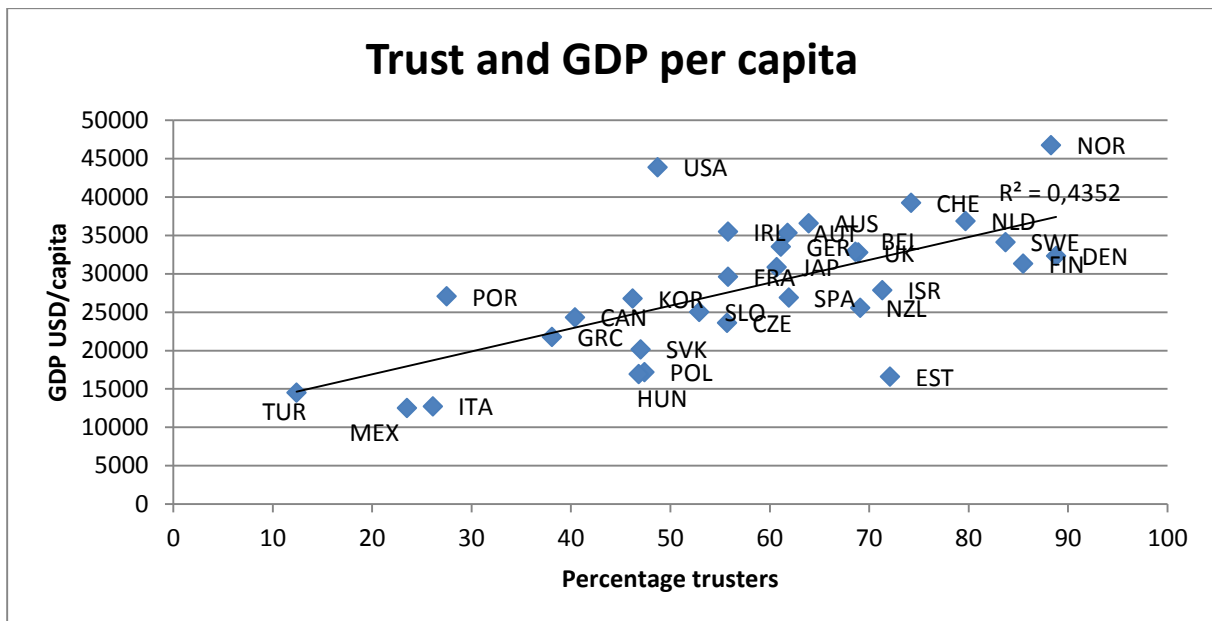
Figure 5. Percentage of responders who agree that "Most people can be trusted" and GDP per capita, 2008 or closest year available. Source: OECD

Uslaner (2002) shows that this particular relationship is much stronger on a national level than on an individual level, where different measures of optimism are better predicators of trust than income.

Within the field of political science a lot of research has been made to explore and understand the causes of a strong social capital and of interpersonal trust. Putnam viewed the civic society as the most important producer of trust and social capital. Using individual level data from USA, Uslaner (2002), finds evidence that membership in an organization in fact do not increase trust levels. This is, he argues; because a lot of organizations are built on the exclusion of others on e.g. religious, political or ethnic grounds. He goes on to show that individual income level too is a bad predictor of social trust. Instead it seems like optimism and control in life are the best predicators of propensity to trust others.

Returning to the issue of income inequality and population health, trust do not just correlate with total income, it is also highly correlated with income inequality as measured by the GINI index. This is shown in Figure 6. Looking at cross-national data, Uslaner (2002) concludes that income inequality is the strongest determinant of interpersonal trust within a country (p. 22). There are two reasons that more equal economic conditions links to higher trust levels. First it fosters optimism about the future, in the sense that people become more optimistic that they too can share the wealth of the society. And, as Uslaner shows, "optimism is the basis of trust" (p. 22). Second, equality creates stronger bonds between different groups in society, a sense of a shared fate. Inequality, on the other hand, makes people view others as very different from themselves and this makes people less likely to trust each other.

Trust is also strongly correlated with health, measured as the life expectancy, which is shown in figure 7. The more trust, the longer lives. The question is whether this is a spurious relation, reflecting trusts positive effect on GDP (or some other variable) or if there in fact is a causal link between trust and health outcomes. If there were, this could indeed be an important factor explaining the relation between income inequality and health outcomes.
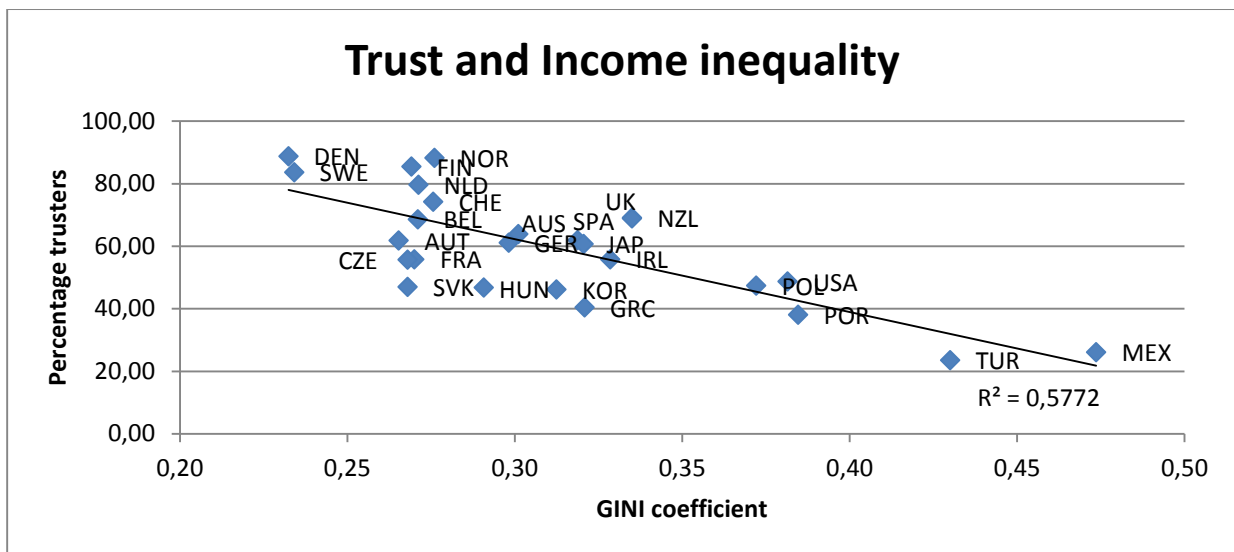
Figure 6 – Trust and income inequality in OECD 2007/08, Source: OECD
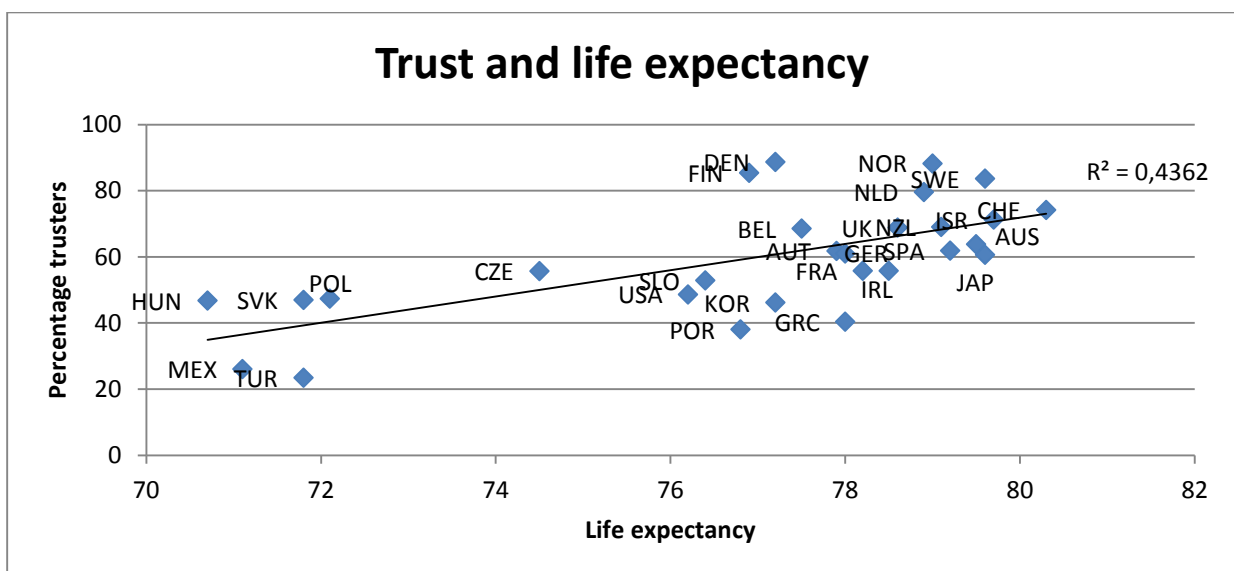
Figure 7 – Trust and life expectancy Source: OECD

There are in fact many studies on the topic of income inequality, trust and health. Barefoot et al (1998) performed a study on a sample of 100 Americans aged 55-80 where cross-sectional data confirmed the association between trust[10] and (self-rated) health and life satisfaction and where a mortality follow up 14 years later confirmed a higher survival rate among the high trusters. The authors conclude that the trust concept is important to understand successful and healthy aging.

Kawachi et al (1997) perform a pathway analysis[11] on social capital as the mediating link between income inequality and mortality in 39 states in USA. They use group membership (civic participation)

---

[10] Here measured with the Rotter interpersonal trust scale where the respondents are asked to agree or disagree on a 5-graded scale to 25 statements.
[11] see e.g. Pedhazur (1973)

and interpersonal trust as measures of social capital and the so called Robin Hood index[12] as the income inequality measure. The results from the path analysis indicate that the effect from income inequality on health is mediated through disinvestment in social capital[13]. This result, as noted by Wagstaff & Doorslaer (2000) is highly contradictional to the absolute income hypothesis, which states that there is no such link, just a concave production function. It is more in line with the income inequality hypothesis, that income inequality in itself causes bad health[14].

Another suggested link between income inequality and health is that income inequality inhibits or reduces public spending on services (like health care) and infrastructure that promotes health. Elgar (2010) examines this link. In a study that in large parts resembles the Kawachi et al (1998) he performs two pathway analyses to see which link is the strongest – via public expenditures or via disinvestments in social capital. He finds no evidence of a link going through public health care expenditures but strong evidence of a link going through interpersonal trust[15].

Schneider et al (2011) look closer into the actual effects on physical health from trust and distrust. They study the effects of interpersonal trust and distrust within the setting of a romantic relationship. They follow 187 couples over a period of 14 years. The main finding is that low trust in one's partner causes anxiety and depression, which over time will translate into worse physical and self-reported health, and finally into increased mortality rates. The suggested reason is captured within this quite intuitive passage (p 669):

We suggest that when individuals enter into diagnostic interactions with trusting expectations, they feel relatively more secure and relaxed about the interaction. For example, when Mary knows that she can rely on John to be responsive to her needs, she is likely to feel more relaxed during conversations about their plans – not only their plans for Thursday evening, but their plans for life. In contrast, distrustful expectations should be associated with insecurity and anxiety. For example, when Mary knows that John is unlikely to be responsive to her needs – when she believes that he is likely to place his personal interests above her needs and the needs of their relationship – such negative expectancies are likely to yield unease and worry.

And while the setting here is a romantic relationship; this line of reasoning is easily transmitted to any (important) interaction between people. The mediating link between distrust and physical health is likely to be the same, and it seems to be via anxiety and depression, i.e. worse mental health[16].

---

[12] See appendix 1.

[13] Both income inequality and trust (social capital) is strongly correlated to mortality, the size of the gap between the rich and the poor are powerfully and negatively related to level of (dis-)investment in social capital and the path coefficients from the pathway analysis strongly suggest that social capital act as a mediating link between income inequality and mortality.

[14] But as we remember, the two hypotheses are not mutually exclusive.

[15] Although he concludes that the effects via trust cannot account for the entire effect from income inequality on health.

[16] Anxiety and depression are widely known to be significant predictors of, for example, cardio-vascular diseases. Marmot (2005) show that increased mortality in cardiovascular diseases is indeed related to economic inequality, and is even the main explanation why economic inequalities cause health inequalities.

The advocates of the income inequality hypothesis thus argue that an important link between income inequality and health is that inequality causes disinvestment in social capital and that this in turn affects health. Low trust, i.e. distrustful expectations on human interactions, causes stress and mental illness which in turn affects physical health and mortality. Like this:

Income inequality → Disinvestments in social capital → Mental illness → Physical illness → Increased mortality

Adding to this the view that trust is also connected to more efficient markets and growth, we find a second link:

Income inequality → Disinvestments in social capital → Lower income (GDP per capita) → Increased mortality

But everyone is not convinced.

2.4 The sceptics

As mentioned many of the results regarding the causality running from income inequality and health have been questioned and challenged by a number of studies. Although some of the results above can be quite convincing, the issue remains unresolved.

Lynch et al (2001), using data from 16 industrialized countries find no significant correlation between income inequality and cause-specific mortality rates, self-rated health or life expectancy. Only infant mortality was significantly and positively correlated with inequality. The authors conclude that earlier findings by e.g. Wilkinson (1992) are a statistical artefact, dependent on the countries chosen.

In a short text in British medical journal, Mackenbach (2002), points to the results of Lynch et al (2001), but also several others, concluding that what once seemed like an open and shut case for some effect running directly from income inequality to health is now suffering from most of the evidence dissipating. Remaining is the effect running from income to health – in a curvilinear manner.

Deaton (2003) reviews the theory and the evidence in a long article and concludes that the evidence do not support any effect from income inequality per se to health. Several studies from USA have strongly suggested otherwise, but Deaton finds that this is almost certainly an effect from something that is correlated to income inequality, but is not income inequality itself. Supporting his conclusions is for example a historical pattern of mortality and inequality in USA and Britain in the mid-1900s that do not fit the theory. In the end it is the extent of poverty that affects health and the proposed link between income inequality and population health is merely an artefact of that high inequality indicates a higher share of poor people[17]. This and perhaps that the link between income and health is nonlinear.

Cutler et al (2006) set out to determine the causal relation between income and health using mainly a historical development approach. The main conclusion is that it is differences in the political

---

[17] Notably this finding seems to be in line with the Deprivation hypothesis, while contradicting the Income inequality hypothesis.

willingness and institutional ability to implement new technologies that determine the health inequalities between countries – neither of which is an automatic consequence of rising income. The causal effect therefore runs from health to income, while the reverse is downplayed. While the authors do admit that the evidence is weak and even missing in parts, the conclusion would, if correct, exclude the possibility of income inequality being an important explanation to population health. It is in this case the availability to new health technologies and medicine that explains differences in mortality rates, which certainly can be correlated to income inequality, but is not income inequality per se (compare Deaton's conclusions above).

Lorgelly and Lindley (2007) explore a large individual data set from the British Household Panel Study (BHPS) to find evidence to the RIH and IIH and find none, again only the AIH is confirmed.

The above studies, and many more, either questions the correlation between income inequality and population health per se, or questions that there are any causal effect between income inequality and life expectancy that depends on something that is created by income inequality, e.g. disinvestment in social capital and public goods.

To summarize: Income and income inequality have been shown in several studies to be strongly correlated to health. It has been highly debated whether the results represent a causal relation or not. Most disagreements have been surrounding the income inequality hypothesis, that income inequality per se has societal adverse health effects. Many studies confirm a causal relation running from income inequality via lower interpersonal trust to worse health, but they are not unambiguous. There is a stronger literature consensus on the absolute income hypothesis.

If income inequality has effects on health and trust (regardless of how this happens), and these features have positive effects on growth, this is an important part of the puzzle regarding the sometimes highlighted negative correlation between income inequality and growth[18]. In the next chapter I will sketch down the arguments of why the proposed health effects of income inequality may be important for economic policy in a broader sense.

---

[18] Note e.g. the recently published and much talked about paper by Cingano (2014).

3. Income inequality and efficiency

3.1 A big trade-off?

"The conflict between equality and economic efficiency is inescapable." (Okun, 1975)

The quote above is from the book, "Equality and efficiency – the big trade-off". In it, Arthur M. Okun, proposes a leaky-bucket game to help establish anyone's preferences regarding income redistribution. It goes like this: If an income tax is imposed on the top 5 % in the income pyramid and is distributed to the bottom 20 % - this will mean an increase in the income of the poor households by $1000. (Which should be compared to average income of $45000 and $7000 respectively in 1974). The problem is that the money has to be carried from the rich to the poor in a leaky bucket. And the task of the game is to determine how much leakage would be acceptable. The leakage of money during the transfer is of course meant to represent the adverse effects on incentives to work and invest that such redistribution scheme will cause. So the actual amount received by the poor families is not $1000, but some smaller amount, depending on the size of the leakage. And the economy as a whole will as an effect get smaller. Being a proponent of increased equality in America, Okun himself states that he would support the transfer up until 60 % leakage, in this particular example (from the richest to the poorest in the income distribution.) Those who have no preferences towards equality will of course never support such governmental intervention and those who have no preferences for efficiency would support the transfer at any leakage less than 100 %. Everyone else will end up somewhere in between.

While the game, although hypothetical, is intriguing, it might be that we do not have to play it like this. The downward sloping curve in figure 8 tells another story. It actually says that inequality may be bad for growth.
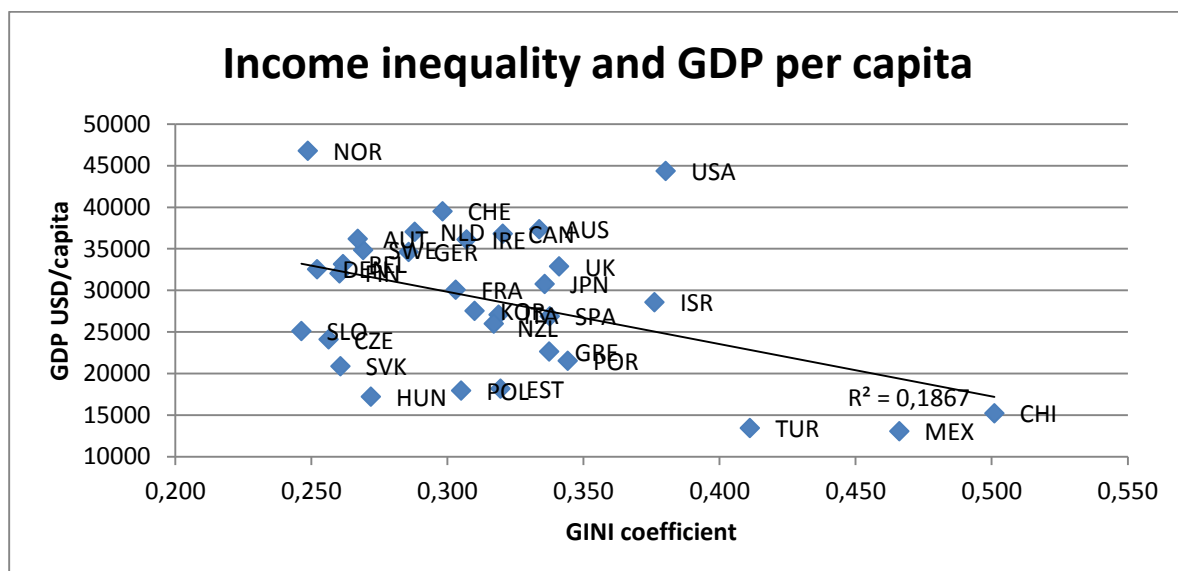
Figure 8: Income inequality and GDP per capita 2011. Source: OECD

In a recently published paper Federico Cingano (2014), shows that increasing economic inequalities in the OECD the last 30 years have had adverse effects on growth. He also finds evidence that disinvestments in human capital (education) is one important channel through which inequality harms growth. In previous chapter I provided some of the evidence that disinvestments in health and social capital may be other channels. For an economist the natural way to think about this is to

consider the income distribution as a public good, or the effects of income inequality as a negative externality.

3.2 The income distribution as a public good

The view that the income distribution can be seen as a public good is certainly not new. The oldest article on the subject that I can find is Thurow (1971). He notes that the income distribution meets all of the tests of a pure public good. "*Exclusion is impossible; consumption is non-rival; each individual must consume the same quantity.*" (p. 328-329) And of course everyone has an interest of disguising their own true preferences in order to avoid paying their share of the income transfers needed to increase equality.

There are two ways to think of the production of equality in the efficiency sense. One way is to think of it as a matter of mere taste; something that turn up in people's utility functions and therefore something that they are prepared to pay for. This is very close to the leaking bucket game. Regardless of any other consequences we value not only our own income, but also to some extent the income of others. The economic solution to this problem is to vertically add the individual benefit curves into a net social benefit curve from the income distribution and then to find the solution where this curve is parallel to the social marginal cost curve, or a market constraint curve (in terms of the transfer payments needed), to achieve this particular distribution.

The second way is to think in terms of positive and negative externalities that springs from income redistribution. On the negative side we would consider the adverse effects on the work-leisure choices by individuals and on the positive side we would consider the positive effects on health, education and trust. The total effect on productivity is thus ambiguous. It is easy to imagine that the gains are decreasing and the costs are increasing in larger redistribution. In this case we should increase the income transfers towards the poor until the marginal gains equal the marginal costs.

Thurow concludes that economic theory can tell us as much about the optimum income distribution, as it can about the optimal amount of any other pure public good, which is not much. We simply cannot know the exact size of people's preferences for equality; and the externalities affecting productivity, both positively and negatively, are hard to isolate and measure.

3.3 The externalities

The positive externalities can come in two shapes. Either higher income equality has a direct effect on the production of human capital, in which case equality in itself can be regarded as a public good, or income inequality leads to underproduction of some other public goods like health insurance or public education. Or both.

While it is truly hard to discriminate between the two effects, evidence of the existence of positive externalities from income inequality is brought forward by many. Wilkinson & Pickett (2009) and Marmot (2005) show in a number of ways how economic equality seem to be connected to good societal outcomes in terms of growth, happiness, knowledge, health, violence and more. Overall there seems to be a lot of of empirical evidence that support the notion that higher level of economic equality is very efficient in producing benefits, both economic and otherwise, for individuals and populations. Thus, if it is not produced in the correct amount on the market, there would be an

efficiency case for government intervention to produce more of it. And hence there would be no big trade-off.

3.4 Income distribution and sustainability

Besides the short to medium run effects on health and growth, a common way to argue against rising income inequalities is the long run effects on the social contract and sustainability of a civilized society (Molander, 2014 and Östergren, 2012). When inequalities reaches over a certain point, i.e. when differences in living conditions between people gets too large, people will no longer feel bound by laws and norms of a common society and social disturbances will arise. This is clearly not good news for any economy or welfare state. This line of arguing can of course not be tested using short time series data, and is perhaps rather a task for economic historians or political scientists.

If data is collected and made available, the short and medium run effects can be tested using panel or time series data. This is what we turn to next.

4. Empirical analysis

Jourmand et al (2008) performed panel data regressions on health status determinants collected in the OECD database, to find the various impacts of the determinants. Data on income inequality were not included in the model, partly because of data paucity and partly because of skepticism on behalf of the authors. In this section I repeat the analysis from Jourmand et al, with the exception that I include the GINI-coefficient which is now available in the OECD database. It is available from 2004 and forth and the analysis will be performed on data stretching from 2004-2011.

4.1 Data

The data used here are all gathered from the OECD database and, with the exception of the GINI-coefficient, it is the same variables that were used in Jourmand et al (2008). They are life expectancy at birth (men, women and total) in years, purchase power adjusted GDP per capita expressed in USD (income), the share of population with tertiary level examina (education)[19], national spending on healthcare (private and public) per capita in USD, tobacco consumptions per capita in grams, alcohol consumption per capita in liters, consumption of fruits and vegetables per capita in kilos and pollution expressed in emissions of nitrogen oxide per capita in kilos. All variables have been shown in previous studies to be strongly correlated to population health. An extensive exposition of the available evidence is given in Jourmand et al (2008). Here it is sufficient to declare that each variable are widely believed to have strong impact on population health.

To the analysis of Jourmand et al (2008) I add, as previously mentioned, a measure of income inequality. It is natural to choose the GINI-coefficient, since it is the measure that is reported in the OECD database. The GINI takes on values between 0 and 1 where lower numbers correspond to a higher degree of equality. It is, however, not the only measure that has been suggested for income inequality. The reader can find a brief discussion on the topic of measurement of income and income inequality in appendix 1.

The time series are not complete over all. Above all is the data on tobacco consumption incomplete, since it is reported in grams per capita for some countries, in share of population who are daily smokers for some and not at all for a final few. Grams per capita is reported for a small majority of the member countries and is therefore chosen here. This means that 19 countries[20] are used in the main analysis.

Some time series exhibit some missing data. Where appropriate (where previous and later data seems to be following a reasonably stable trend) I have imputed the missing values as the mean value of surrounding numbers. Other blanks have been left as is. Regressions have been run with and without such imputation without any significant differences in the main results.

Table 1 summarizes some main characteristics of the data collected

---

[19] Jourmand et al (2008) uses share of population with upper secondary degrees as a proxy for education. I use tertiary level instead due to data availability.

[20] They are Australia, Czech republic, Denmark, Finland, France, Germany, Hungary, Iceland, Ireland, Israel, Japan, Korea, Netherlands, New Zealand, Norway, Switzerland, Turkey, United Kingdom, United states. I do not find any reason to believe that there are any systematical differences between the groups of countries for which tobacco consumption are reported in different ways in the database.

Variable	Mean	Standard deviation	Min	Max
Life expectancy at birth (year)	79,56	2,44	72,7	83
Life expectancy at birth, men	76,91	2,71	68,7	80,7
Life expectancy at birth, women	82,18	2,33	74,8	86,4
Infant mortality (per 1000 births)	4,48	2,98	0,9	26
Spending per capita (dollars)	3227	1466	495	8136
Tertiary degree, share of population	31,58	8,88	9,85	46,39
Tobacco, grams per capita	1602	488,2	660	2760
Alcohol, litre per capita	9,22	3,08	1,2	13,6
Fruits and vegetables, kg per capita	216,9	56,34	132,9	404,6
GDP per capita, PPP adjusted, dollars	32333	8503	10642	49135
Emissions of nitrogen oxides, kg per capita	30,95	19,77	9,6	93,6
Income inequality, GINI coefficient	0,309	0,0461	0,231	0,43

Table 1: Data characteristics

4.2 Estimation strategy

As mentioned I will use the same model as in Jourmand et al (2008), with the exception that I will add the GINI coefficient and use a different time period. My model is thus the following

$$HEALTH_{it} = \alpha_i + \beta * HCR_{it} + \gamma * LIFE_{it} + \theta * SOCIO_{it} + \varepsilon_{it}$$

Where indexes i and t refer to country and year.

HEALTH is a measure of population health, and is measured by life expectancy at birth, in years, for men and women. I will also use infant mortality, deaths per 1000 live births as a different measure.

α_i is a country specific effect that accounts for time-invariant differences across countries. In practice it is 19 dummy variables, one for each country included.

HCR is health care resources, private and public, measured in dollars per capita.

LIFE is a vector of lifestyle factors, containing the variables TOBACCO, ALCOHOL and DIET, with TOBACCO being the tobacco consumption, ALCOHOL is the alcohol consumption and DIET is proxied by a variable of fruit and vegetable consumption.

SOCIO is a vector of socioeconomic factors, containing the variables INCOME, INEQUALITY and POLLUTION, where income is the GDP per capita, INEQUALITY is measured by the gini coefficient and POLLUTION is proxied by the emissions of nitrogen oxides.

I run generalized least squares panel regressions on the logs of the variables, with corrections for heteroscedasticity and error terms following a country-specific AR(1) process. I thereby repeat the strategy of Jourmand et al (2008). In this context, the R-squared value is biased and therefore irrelevant. Since the variables are in logs, the coefficients should be interpreted as elasticities.

4.3 Panel data regression with country fixed-effects

The main purpose of the empirical analysis is to investigate whether the inclusion of country-specific fixed effects can help determine whether the weak correlation between income inequality and health within the OECD is due to identification problems. The ability to reduce identification problems is the main advantage with using panel data[21] (Verbeek, 2012, ch 10), compared to a cross-sectional data set. It is more robust in dealing with omitted variables bias and endogeneity problems than cross-sectional data.

Identification problems can come in different shapes. We may be worried that there is some variable missing in our model that affects not only life expectancy, but also one or more of the covariates. That would make us either over- or underestimate the effect from those covariates on life expectancy. This is the omitted variable problem. The unobservable efficiency and quality of the healthcare sector may be such a variable in our model, affecting health as well as spending and lifestyle factors. The country-specific effects picks up all the time-invariant variables that affect outcome and that is not included in the model. Thus it is robust against (or reduces the effect from) such omitted variables bias. The assumption that the unobserved country-specific effect is time invariant seems reasonable in general and even more so given the short time span used here.

We may also worry that α_i is correlated to one or more of the covariates. This is an endogeneity problem, which can be interpreted as heterogeneity between countries in the way an observed regressor affects population health, due to unobserved country-specific characteristics. Let's say that the effect of income inequality on health is dependent on the "level of development", as has been suggested. Then the size of α_i will depend on, among other things, national income. This could be dealt with using instrumental variables, but it is often hard to find good instruments. We note that the country-fixed effects strategy is algebraically the same as estimating in deviations from means (Verbeek, 2012, p 377). This can be exploited as a way of providing internal instruments, since the transformation of the original variables can be assumed to be uncorrelated to the error term, but correlated to the variables themselves (which is what makes a good instrument). Thus, in general, the use of country-specific effects eliminates all endogeneity problems related to α_i.

The main drawback of the fixed effect strategy is that it inflates the problems with measurement errors and attenuation to zero (Angrist & Pischke, 2009, p 225). Nor does it resolve the issue of

---

[21] Data including multiple observations over both units and time.

reversed causality. We may on good grounds believe that it is income inequality that affects health. But the estimation strategy chosen here do not per se tell us anything useful of whether this is indeed the true direction of the predominant causality. Longitudinal data from a (much) longer period of time would better allow us to perform this kind of analysis.

The estimation strategy chosen here is deliberately chosen to resemble the model in Jourmand et al (2008). This makes it very different from most other model strategies in earlier work on income inequality. Both in the sense that it uses panel data regression and that it controls for a number of covariates not commonly included in previous work. It is therefore a possibly important addition to the existing stock of evidence.

An additional problem may be in separating confounding from mediating. For example if income inequality affect education, which affects health, then education is placed somewhere on the mediating road from income inequality to health and the inclusion of it will bias the true effects of income inequality downwards. However, the level of educational attainment is probably not exclusively an effect of the income distribution, so there is probably confounding here as well. The inclusion of variables that are likely to be both confounders and mediators is not unproblematic, and the line of reasoning is applicable on many of the control variables included. This is another reason not to make overly strong claims based on the results provided in the next section.

4.4 Results

Main results are presented in table 2.

Overall we get the expected signs and mostly the coefficients are significant. Perhaps surprisingly, the coefficient for smoking is not significant. Income inequality is highly significant, and especially so regarding mortality rates among females and infants. On average a one unit rise in the GINI-coefficient correlates to a 1,9 % (about 1,5 years) fall in life expectancy. For women the fall is 2,3 % while for infants the impact on mortality is as large as 45 %(!). Changes in the socioeconomic factors have the strongest effects on life expectancy, while lifestyle factors seem less relevant. This is in line with the view, and may be an indication of, that lifestyle factors are an important mediating link between social determinants of health and actual health outcomes.

Comparing the results in column 1 and 2 (with and without country dummies) highlights the importance of the fixed effects strategy. INEQUALITY is highly insignificant in column 1, while significant at the 1 % level in column 2. Healthcare spending, education and national income remain highly significant throughout all specifications, but the estimated coefficients become smaller when country-specific effects are accounted for.

Robustness of the results is checked by running additional regressions (not shown) excluding some variable(s) or including time-fixed effects. The results for income inequality remain remarkably stable across specifications, while some surprising results appear for some other variables[22]. The health effect for men remains insignificant while there are significant negative effects for females and infants. The regression is also run in levels which further confirm the results (except that the TOBACCO-variable is positively signed in the level version of the model). Regressions run excluding the former communist states do not alter the main results either.

---

[22] The coefficients for life-style factors are not stable over specifications.

Dependent variable: Life expectancy at birth, men and women

No of observations: 137

(p-values in parenthesis)

Variable	Total	Total	Men	Women	Infant mortality
INEQUALITY	-0,012	-0,019***	0,002	-0,023***	0,45**
	(0,86)	(0,00)	(0,72)	(0,00)	(0,02)
SPENDING	0,0042	0,022***	0,024***	0,016***	-0,26***
	(0,24)	(0,00)	(0,00)	(0,02)	(0,00)
EDUCATION	0,051***	0,020***	0,017***	0,025***	-0,20***
	(0,00)	(0,00)	(0,00)	(0,00)	(0,00)
GDP	0,037***	0,027***	0,036***	0,026***	-0,81***
	(0,00)	(0,00)	(0,00)	(0,00)	(0,00)
TOBACCO	-0,01	-0,001	-0,001	-0,001	0,033
	(0,62)	(0,749)	(0,72)	(0,59)	(0,55)
ALCOHOL	-0,009	0,003	0,005	0,001	0,30***
	(4,46)	(0,398)	(0,27)	(0,69)	(0,00)
DIET	-0,008***	-0,009***	-0,008***	-0,006***	0,052
	(0,007)	(0,00)	(0,00)	(0,00)	(0,27)
POLLUTION	-0,016***	-0,024***	-0,030***	-0,019***	0,17**
	(0,00)	(0,00)	(0,00)	(0,00)	(0,02)
Controlled for country-specific effects	No	Yes	Yes	Yes	Yes

***p<0,01 **p<0,05 *p<0,1

Table 2: Regression results

5. Discussion

I set out to test whether income inequality should be regarded as an important health status determinant within the OECD. Basically this is done by extending the model in Jourmand et al (2008) by including the GINI-coefficient. This extension was made possible by the inclusion of yearly estimates of member country GINI coefficients in the OECD open database.

In chapter 2 and 3 I have reviewed the theory, the evidence and the implications of a causal relation between income inequality and health outcomes and put some extra weight on social capital and trust as an important part of the story. While the evidence is hardly unambiguous, I conclude that there is most likely something fishy going on in this regard. If I had to put my money somewhere, I would gamble on the existence of a causal link running from income inequality, via disinvestment in social capital and interpersonal trust to health.

My results from chapter 4 support the theory that income inequality is an important factor explaining health inequalities on the population level. A one unit rise in the GINI-coefficient corresponds to a decrease in life expectancy of about 2 percent or 1,5 years. This is clearly of some importance.

The empirical results do not however, add anything to the ongoing debate of why and how this is so, since population level data cannot discriminate between the different theories proposed (as is learned by Wagstaff & Doorslaer, 2000 and reviewed in chapter 2). In a sense my results add some support to all the hypotheses, since they are all incompatible with the belief that income inequality does not matter for health outcomes within the OECD.

Knowing the mechanism and being able to discriminate between the health effects of increasing inequality could be important for policy making. It should be noted, however, that the main issue of disagreement in the literature is not generally about the negative correlation between income inequality and health, but whether this is caused by something else than concavity in the income-health relation. Even if it is not, the combination of a negative correlation with the fact that health is an important production factor for both individuals and countries make income distribution an important consideration for economic policy makers. Increased economic inequalities may not only be an ethical problem, it could have adverse effects on growth and development, as is discussed in chapter 3.

Trust and social capital is possibly important factors left out of the model. This is mainly because of data paucity. Interpersonal trust levels for countries that can be used for cross-national comparisons are not measured on a yearly basis, but in waves and with irregular participation from different countries[23]. It was therefore not meaningful to try to include it here. For two reasons I argue that this does not affect the main results. First it is broadly argued in the literature that trust is a relatively stable value over time (Putnam, 1993; Uslaner, 2002; Bergh & Bjørnskov, 2011). This means that it can be assumed that high and low levels of interpersonal trust is picked up by the country-specific effects and do not create any omitted variable bias, especially since we are dealing with such a short time period. Second it is argued that variations in trust levels are on the mediating link between income inequality and health (Kawachi 1997, Uslander 2002). This means that including it might

---

[23] The surveys can be found at the World value survey (www.worldvaluessurvey.org) and at the European value study (www.europeanvaluesstudy.eu)

cause endogeneity problems and bias the main results. While better data on trust levels over time would be desirable, it is probably not a concern for the interpretations of the results of this essay.

The limitations of this study are plentiful. Data availability is of course the main one. I have studied 19 countries during a time span of 8 years, which is clearly too small a sample to make any strong claims, but still the largest sample available given the data. Although I find no reason to believe that differences in reporting data within the OECD is systematically correlated to any factor important to this study, selection bias cannot be precluded[24]. Furthermore, since health is affected by a complex and wide range of factors, with causality in many cases running in more than one direction, I run the same risk as Jourmand et al (2008) to suffer from endogeneity problems and multicollinearity.

It should also be noted that many of the variables in the model most likely affect health outcomes with a lag. This could mean that the model should include lagged independent variables, rather than present. The short time period make such an attempt less meaningful. We must in this case view present values as proxies for earlier values, which is arguably reasonable to some extent.

Despite the limitations, the results do shed doubt on earlier claims that income inequality is not an important health status determinant within the OECD. It seems that the weak correlations in cross-sectional data between the GINI coefficient and life expectancy within the OECD are at least partly the cause of identification problems and country-specific heterogeneity and that the use of longitudinal data is important in this regard. This result is also in line with the conclusions of Karlsson et al (2010).

Further research will use longer time series and larger samples to create stronger results. With larger and better data it will also use different modelling to overcome some of the econometrical problems sketched out above. But most importantly we need answers that cannot be given by macro data. We need more studies using individual longitudinal data on income and health, which still emphasize a cross-country perspective. It seems highly likely that the health effects of income inequality are not homogenous across country and cultural borders.

---

[24] This aside from the fact that OECD members is not a random draw of countries. This study, however, is explicitly performed within this context.

References:

Printed sources:

Angrist J. and J-S. Pischke (2009): *Mostly Harmless Econometrics: An Empiricists Companion*, Princeton Unversity Press

Barefoot J. C., K. E. Maynard, J. C. Beckham, B. H. Brummett, K. Hooker and I . C. Siegler (1998), Trust, Health and Longevity, *Journal of Behavioral Medicine*; 1998:21, p 517-526

Bergh A. and C. Bjørnskov (2011), "Historical trust levels predict the current size of the welfare state", *KYKLOS*, vol 64 – February 2011 – No. 1, p. 1-19

Cingano, F. (2014), "Trends in Income Inequality and its Impact on Economic Growth", *OECD Social, Employment and Migration Working Papers*, No. 163, OECD Publishing.

Creedy J. (1996), "Measuring income inequality", *The Australian Economic Review*, 2nd Quarter 1996, p 236-246

Cutler D M, A. Deaton and A. Lleras-Muney (2006), "The Determinants of Mortality", *NBER working paper* No. 11963, National bureau of economic research, Cambridge

Deaton A. (2003), "Health, inequality and economic development", *Journal of economic literature*, vol 41, March 2003, p 113-158

Deininger K. and L. Squire (1996), "A new data set measuring income inequality", *The World Bank Economic Review*, vol. 10, no. 3, p. 565-591

Elgar F J (2010), "Income inequality, Trust, and Population Health in 33 Countries", *American Journal of Public Health*, vol. 100, p 2311-2315

Herzer, D. and P. Nunnenkamp (2011), "Income inequality and health; new evidence from panel data", *Kiel working papers*, No 1736, Kiel institute for the world economy

Jourmand I., C. André, C. Nicq and O. Chatal (2008), "Health status determinants: Lifestyle, Environment, Health care resources and efficiency" *OECD Economics Department Working Papers*, No. 627, OECD, Paris.

Karlsson M., T. Nilsson, C H Lyttkens and G. Leeson (2010), "Income inequality and health: Importance of a cross-country perspective", *Social science & medicine* No. 70 (2010) 875-885

Kawachi I, B. P. Kennedy, K. Lochner and D. Prothrow-Stith (1997), Social capital, Income inequality, and Mortality, *American Journal of Public Health*, 1997:87, p 1491-1498

Lorgelly P K. and J. Lindley (2007), "What is the relationship between income inequality and health? Evidence from the BHPS", *Health economics* 2008, vol 17, p 249-265

Lynch J., Davey Smith, G., Hillemeier, M., Shaw, M., Raghunathan, T. and Kaplan, G. (2001), "Income inequality, the psychosocial environment, and health: comparisons of wealthy nations", The Lancet, vol 358(9277), p 194-200§

Mackenbach J P. (2002), "Income inequality and population health: Evidence favouring a negative correlation between income inequality and life expectancy has disappeared", *BMJ* 2002, vol 324, p 1-2

Maio F G. (2007), "Income inequality measures", *J Epidemiol Community Health*, vol. 61, p 849-852

Marmot M. (2002), The influence of income on health: Views of an epidemiologist, *Health affairs*, 21, no.2 (2002):31-46

Marmot M. (2005), *The Status Syndrome – How social standing affects our health and longevity*, Holt, New York

Marmot M. (2010) Fair Society, Healthy Lives: The Marmot Review, Strategic review of health inequalities in England post-2010, *The Marmot Review*; 2010, London.

Molander P. (2014), *Ojämlikhetens anatomi*, Weyler förlag, Stockholm

Morrone A., N. Tontoranelli and G. Ranuzzi (2009), "How Good is Trust?: Measuring Trust and its Role for the Progress of Societies", *OECD Statistics Working Papers*, 2009/03, OECD Publishing.

Okun A. (1975), *Equality and efficiency: The big tradeoff*, The Brookings institution, Washington D.C.

Pedhazur E. J. (1973), *Multiple regression in Behavioral research*, Holt, Rinehart & Winston, New York

Preston S. (1975), "The changing relation between mortality and Economic development", *Population studies*, vol 29, p 231-248

Putnam R., (1993) *Making democracy work – Civic traditions in modern Italy*, PrincetonUniversity Press.

Putnam R., (1995), "Bowling alone: America's declining social capital", Journal of democracy 6:1, Jan 1995, p 65-78

Putnam R. (2001), "Social Capital: Measurement and Consequences" *The Isuma Canadian Journal of Policy Research,* 2001;2, p 41-51

Rothstein B. (2002), "Socialt kapital – ett genombrott för en ny samhällsvetenskaplig teori", published in ed. Holmberg S. and Weibull L., *SOM-rapport nr 30 - Det våras för politiken* (2002), p. 309-316., SOM-institutet 2002, Göteborg

Schneider I. K., E. A. Konijn, F. Righetti, C. E. Rusbult (2011), A healthy dose of trust: The relationship between interpersonal trust and health, *Personal relationships*, 2011:18, p 668-676

Thurow L. (1971), "The income distribution as a pure public good", *The quarterly journal of economics*, vol 85, p 327-336

Uslaner E. M., (2002), "*The moral foundations of trust*", Cambridge university press, Cambridge

Verbeek M. (2012), *A guide to modern econometrics*, 4th ed, Wiley, Cornwall

Wagstaff A., E. van Doorslaer, (2000), "Income inequality and health: What does the literature tell us?", *Annual review of Public Health*, 2000 No 21:543-567

Wilkinson R G. (1992), "Income distribution and life expectancy", *BMJ* 1992 vol 304, p 165–68.

Wilkinson R G. and K. Pickett (2009), *The spirit level: Why more equal societies almost always do better*, Allen Lane, London

Östergren P-O. (2012), *Hur hänger en socialt hållbar utveckling och hälsans jämlikhet ihop? Ett försök att besvara denna fråga med hjälp av en systemteoretisk ansats*, Delrapport till Kommission för ett socialt hållbart Malmö, Malmö stad

Unprinted sources

Desilver D. (2013), "The many ways to measure economic inequality", Pew research center, Electronic (Available) http://www.pewresearch.org/fact-tank/2013/12/18/the-many-ways-to-measure-economic-inequality/ Downloaded 5 January 2015

Reserve Bank of Australia, RBA website, Bulletin March 2012, Electronic (Available) http://www.rba.gov.au/publications/bulletin/2012/mar/3.html Downloaded 5 January 2015

Appendix 1 – some conceptual issues

Measuring income inequality

To measure income inequality one first have to measure income and then find a way to express the distribution of this income in a way that makes it possible to compare different distributions with each other, preferably a summary statistic. Both of these steps contain conceptual issues to be aware of and that may affect the value of any conclusions drawn based on those numbers.

Income can either be measured in a survey or by extracting data from national records. A survey can suffer from selection bias and from the fact that many people simply do not know their exact earnings. The national record on income is often collected from tax registers and may miss information on income that is not taxable. Furthermore income that is not monetary is seldom reported; not least the income from owned housing is hard to include (Deininger and Squire, 1996).

Next one must consider the income period and unit. Should we measure individual income or household income? It is not clear-cut, but without income one will probably be worse off living alone than in a household also including one or several wage earners. So household income divided on its residents is probably the best way to go. Annual income can be misleading if one consider a life-cycle perspective. Income can vary considerably over a lifetime and specifically, annual income may in many cases not give a good approximation of economic resources available to a household or a person (DeSilver, 2013). Accumulated wealth and credit availability should probably be considered as well or perhaps a measure of lifetime income should be used.

Different ways of collecting information and defining income in different countries can seriously impair the usefulness of the results for measuring inequality in general and for comparisons between countries. All the OECD data on income inequality is based on annual income after tax and transfers on the household level. They are therefore comparable. But they do differ in the way data is collected and may be affected by different tax laws and legal systems. For our sample of 19 countries the metadata is collected in the following manner:

For Czech Republic, Iceland and Ireland data is extracted from the "EU survey of income and living conditions".
For Norway and Denmark the data is collected from national registers.
For the remaining 14 countries the data is collected from national surveys on income and living conditions.

The above calls for some caution in the interpretation of the numbers.

The GINI coefficient

The GINI coefficient is the most popular measure of income inequality. For that reason alone it is the most practical measure to use in any empirical study, simply because of data availability. The GINI is based on the Lorenz curve, which maps share of total income on cumulative shares of total population. This can be seen in figure 9. The x-axis is the cumulative share of the total number of individuals or households in the population ordered by their share of total income from lowest to highest and. The y-axis is the share of total income in percent. If everyone have the same income (absolute equality), the "poorest" x % of the population will always earn exactly x % of total income and the corresponding Lorenz curve will be the "line of equality", which is the 45 degree straight line in the figure. If income is not equally distributed the Lorenz curve will be below the line of equality

and if inequality is absolute (one person holds 100 % of all income) the Lorenz curve will coincide with the x-axis and the vertical line to the right in the figure.

To compare different distributions it is convenient to have one simple summary statistic. One way of collecting such a statistic is to compute the area between the Lorenz curve and the line of equality. Multiply this area with 2 and we will have a number that varies conveniently from 0 to 1, with 1 corresponding to maximum inequality. This is the definition of the GINI coefficient[25]. Intuitively the wider the gap between the diagonal and the Lorenz curve, the more unequal is the distribution of income and the higher the GINI statistic.
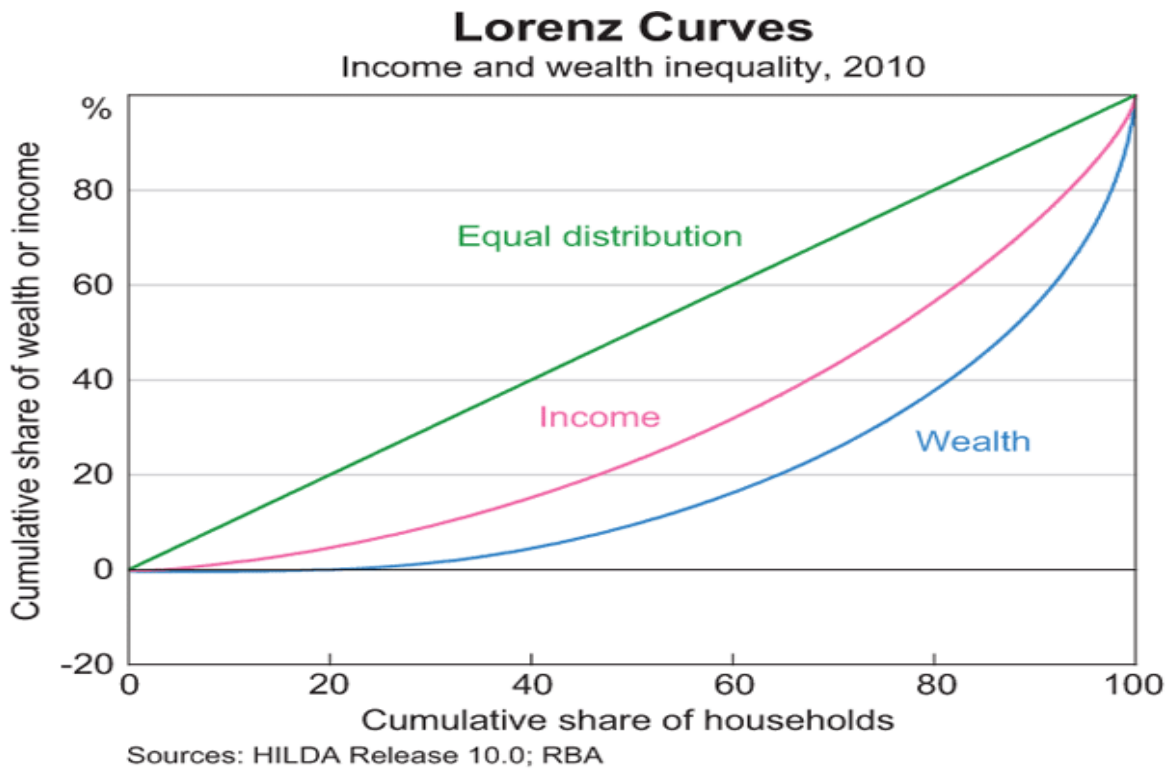
Figure 9: The Lorenz curve. From RBA (2012)

Figure 9 is collected from the bulletin from the Reserve Bank of Australia and is the actual Lorenz curves computed for income and wealth distributions in Australia 2010[26]. Note that accumulated wealth is more unevenly distributed than annual income, which is a common result.

Other measures of income inequality

The downside of an aggregate measure such as the GINI coefficient is that it cannot tell us anything about the shape of the Lorenz curve and hence about the plausible different kinds of inequalities. It is perfectly possible for inequalities in different parts of the income distribution to cause intersecting and quite differently shaped Lorenz curves but still produce very similar GINI statistics. This is a potential problem since it is also possible for different kinds of inequalities to have different effects

---

[25] One can also divide the area with the total area under the line of equality. But this is just dividing with 0,5, which amount to the same thing. Computing the area could be cumbersome, and it can be shown that the GINI can also be calculated using this formula (Creedy, 1996): $G = 1 + \frac{1}{N} - (\frac{2}{N^2}) \sum_{i=1}^{N}(N + 1 - i)(\frac{y_i}{\bar{y}})$

where N is the size of the population, i is the i:th unit in the population ordered by income, y_i is the income of the i:th person and $\bar{y}$ is the income mean of the population.

[26] It is based on the panel survey HILDA = Household, Income and Labour Dynamics in Australia

on health and other outputs. Indeed redistribution from the upper class to the middle class would probably have different effects than redistribution from the middle class to the lower class, but GINI changes could be the same.

Therefore a wide range of other measures have been suggested and used in several studies. They are briefly summarized in Maio (2007) and the vast majority aim to pick up some information about the shape of the distribution as well as the size of the inequality. The Atkinson index includes a sensitivity parameter (ϵ) that is meant to mirror some value judgment on the kind of inequality present. The higher ϵ the more concern is directed to those at the bottom of the income distribution. The interpretation of the Atkinson index is, given some assumption of the size of the preferences for equality, the share of total income that would be sufficient to produce the same amount of social welfare as present, if it were equally distributed[27].

Computing decile (or quintile or percentile) ratios are another way of describing the income inequality. It is simply to divide the top income decile with the bottom decile for a given population. Then it is possible to compare correlations between different ratios such as 10:90 and 30:70 to perhaps find essential information on the importance of the shape of the distribution for certain outputs.

The Generalised entropy index (GE), like the Atkinson index includes a sensitivity parameter with lower values for higher concern for those at the bottom of the distribution. The GE value ranges from 0 (perfect equality) to infinity.

The Robin Hood index measures the maximum vertical distance from the line of equality to the Lorenz curve and is interpreted as the income that has to be transferred from those above the mean to those below the mean to achieve an equal distribution.

Other important measures from the literature are the *Coefficient of variation (CV)*, the *Kakwani progressivity index*, the *proportion of total income earned* and the *Sen poverty measure*.

Maio (2007) concludes that the use of several different measures can help to nuance the discussion of the effects of income inequality and possibly help to solve some disagreements in the matter. Especially if results are sensitive to the shape of distribution, not picked up by the GINI-coefficient.

---

[27] An Atkinson index of 0,2 thus means that (1-0,2=) 80% of total income would produce the same amount of social welfare if equally distributed.