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Master Thesis

ECONOMIC INEQUALITY AND PUBLIC HEALTH: EVIDENCE FROM 14 COUNTRIES

Prepared by: Gintare Morkute S 2116294

g.morkute@student.rug.nl

Supervisor: E.U.B. Kibele

Master Population Studies

Population Research Centre,

Faculty of Spatial Sciences, University of Groningen

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Abstract

Objective: explore the associations between economic inequality and all- cause mortality and between economic inequality and external- cause mortality in 14 selected countries in 1985-2009. *Methods:* data from HMD, WHO MD, ISSP social inequality module is used. Cross- sectional time- series analysis is performed (between, mixed and random effects models). It is also checked if income inequality perceptions are a mediator in the association between income inequality and mortality. *Results:* Income inequality is (insignificantly) positively related to mortality in the between effects models but negatively related in fixed and random effects models (except for external- cause mortality for males). After controlling for GDP per capita, total health expenditures per capita and countries formerly belonging to Soviet bloc: higher inequality is significantly associated with higher mortality in between effects model. The relative effects are greater for males than for females and for external- cause mortality than for all- cause mortality. In fixed and random effects models higher inequality is significantly associated with higher males' all- cause and external- cause mortality but negatively associated with that of females. The negative effects are again stronger for external- cause mortality than for all- cause mortality. Perceiving conflicts in one's country meets the requirements to be the mediating variable in the between and random effects model but not in fixed effects models. *Conclusions:* When countries are compared higher inequality is related to higher mortality but the increasing mortality in an individual country is not necessarily linked to higher mortality. Overall, the association is dubious and differs a lot for individual countries.

Keywords: public health, economic inequality, income distribution, mortality, health inequalities, external causes of death, cross- sectional time- series analysis

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List of abbreviations

GDP – gross domestic product

HMD – Human Mortality Database

ICD – International Classification of Diseases

ISSP – International Social Survey Programme

WHO, WHO MD - World Health Organization, World Health organization mortality database

SWIID – Standardized World Income Inequality Database

SES - socioeconomic status

1. Introduction

1.1. Background

The negative effects of inequality became a hot topic among epidemiologists and other social scientists after the landmark book 'Unhealthy societies: the afflictions of inequality' by Wilkinson in 1996 arguing that unequal societies are simply unhealthier for their members. Since then socioeconomic inequality has been blamed with bringing many miseries: shorter life expectancy, higher rates of disease, homicide, infant mortality, obesity, teenage pregnancies, emotional depression and crime, poor education standards, lower social mobility (Wilkinson, Pickett, 2009), higher prevalence of smoking and sedentary lifestyle (Diez-Roux et al, 2000, cited by Kawachi et al, 2003), less trust within the society (Elgar, 2010) and lower social capital (Kawachi et al, 1997, cited by Salverda et al, 2009).

Economic inequality has been growing steadily in all modern societies since 1970s (Beck, 2007; Beck & Poferl, 2010; Grusky & Kanbur, 2006; Korzeniewicz & Moran, 1997; Morris & Western, 1999, cited by Castillo, 2011, Subramanian and Kawachi 2004, cited by Torre & Myrskylä, 2011). It has been increasing rapidly in such important cases as China, the U.S.A. or the former Soviet bloc (Babones, 2009). However, while those more deprived were willing to tolerate the differences during the economically good times it is now changing. During the recent economic recession the contrasts between the wealth and the growing poverty appear to be unacceptable to many (Dorling, 2012).

The recent developments show how inequality is becoming more of an issue: the income inequality is addressed often as an important problem by politicians and media and ultimately in the Davos World Economics Forum in 2012 (Miller, 2012). The Occupy movement with the main message about the rich 1% ruling over the other 99% as well as the whole Wall Street scandal portrayed as the bankers getting rich at the expense of their clients losing money have revealed what social tensions socioeconomic inequality can cause. Regardless of this indirect evidence that economic inequality does undermine the social cohesion and trust most of the questions about the deleterious effects (among them those on the public health) of inequality still remains open and very controversial. Since 1996 the association between inequality and public health has generated a vast body of research with no definite general conclusions. Since then it has remained highly ideological it has received a lot of attention not only from academia but also from the general public.

1.2. Research objective and research questions

Building up on the aforementioned controversies of economic inequality the research aims to further examine the epidemiological effects of income inequality. The objective of the research is then formulated as to *explore the associations between economic inequality and all- cause mortality and between economic inequality and external- cause mortality in 14 selected countries in 1985-2009.*

From there stems the main research question:

How is income inequality linked to all- cause and external- cause mortality in 14 selected countries in 1985-2009?

More specific aspects of the association are examined as follows in the subquestions:

- How does the association differ between genders?
- How do the effects on all- cause and external- cause mortality compare?
- What is the effect of inequality perceptions on the relationship?

2. Theoretical framework

2.1. Theories

In epidemiology the researchers have developed three main interpretations of how inequality can influence population health. Lynch et al (2000) classify them as follows:

- **The Individual Income Interpretation** argues that aggregate level associations between economic inequality and public health are nothing more than a sum of individual level associations. It is widely accepted that the income of individuals has a big impact on their health on an individual level, that is those earning higher income tend to be of better health. Imagine two countries with the same GDP per capita but different income distribution: in the more unequal country the worse health of the poor majority will then dominate the picture as compared to the more equal country (based on Gravelle, 1998; Heerink, Mulatu and Bulte, 2001; Gravelle et al, 2002).
- **The Psychosocial Interpretation** suggests that a lower position in a social hierarchy (influenced strongly by earnings) creates negative emotions which can influence health in a few ways: stress per se is harmful; it can encourage other harmful practices, e.g. smoking and lower the levels of cohesion among the members of the society (based on Wilkinson 1992; Porta et al, 2002).
- **The Neo-material Interpretation** asserts that in an unequal society the population health gets worse due to lack of public resources and underinvestment in social and environmental conditions. The public sector is poorly financed while all the wealth accumulates in the hands of the wealthy few (based on Lynch et al., 2000).

This paper draws on the psychosocial interpretation to provide the framework needed to research the role of the psychosocial reactions in the relationship. Besides, the paper examines the influence of inequality on external- cause mortality and external reasons of death are often related to aggression, violent behaviour, inadequate risk taking, drugs/ excessive alcohol consumption, negligence and hence are very closely and directly related to psychosocial factors.

According to the psychosocial interpretation, an unequal society is believed to create a steep social ladder where people struggle to maintain or improve their position. People perceive their position as fragile and vulnerable. The steep social ladder creates feelings of insecurity, anxiety, damages personal relationships and deteriorates social cohesion and trust within the society. People feel the pressure to show off their status and prestige symbols in order to be accepted, respected and develop a sense of self- worth and pride. Even though inequality is said to be harmful for every member of society needless to say it affects the most deprived the most undermining their self-esteem and making them feel shame. This leads to chronic stress which in turn (directly or through e.g. smoking) undermines mental and physical public health (Wilkinson & Pickett, 2009, Wilkinson, 2009).

2.2. Literature review

2.2.1. Main trends in literature on the association between income inequality and public health

The idea of association between inequality and health outcomes was first suggested by Rodgers in 1979 and further developed by Wilkinson starting with 1996. Much research has been done in this field but consensus has not yet been reached (Kawachi et al, 2003, de Maio, 2008). There are still very clear differences in opinion and the tone of the recent reviews on the literature on the subject varying ‘from critical through sceptical to enthusiastic’ (Babones, 2008). De Maio in 2012 counts more than 200 statistical studies in this area. Most of them have been interdisciplinary combining biomedical, sociological, economic, philosophical approaches (de Maio, 2012).

It can be argued that this hypothesis has gone through certain phases. At first it received a lot of support throughout the ten years after publishing which was followed by a wave of criticism as academics started pointing out that the discovered correlation of inequality and life expectancy cannot be replicated and criticizing the methods of the earlier studies (e.g. Lynch et al, 2003). However, the most recent studies using large scale reliable data and multilevel designs have come up to mixed results, which suggest the correlation exists but not to such extent as it was deemed (De Maio, 2008). Some of the issues that raise the most intense debates in the methodology are the indicators of the public health, the appropriate geographical level to test the hypothesis, the operationalization of income distribution (de Maio, 2012).

In summary, about 90% of the aforementioned more than 200 statistical studies have found at least some support for the income inequality- public health hypothesis but after including the control variables this drops to approximately 40% (Wilkinson & Pickett, 2009, cited by de Maio, 2012).

The most recent changes in this research area were using a broader range of countries (mostly including the developing countries while the research at first has been conducted on developed countries, primarily the U.S.A. (Kawachi et al, 2003)) and more health indicators (Babones, 2008), more specific analyses have been performed, e.g. for age groups or causes of death.

2.2.2. Indicators of public health previously related to income inequality

Various public health indicators were previously related to income inequality, most usually life expectancy, mortality or their derivatives (for instance, e^{\dagger} , a dispersion measure that equals the average expected lifetime lost at death (Shkolnikov et al, 2011)) but also disease rates, disabilities, smoking, sedentary lifestyle, depressive symptoms, per capita expenditures on protection and medical care, self-rated health (Kawachi et al, 2003). All of them have their drawbacks. Life expectancy, mortality or self- rated health seem to be the most comprehensive but it has been argued that self- rating of health is far from objective. For example, people in Kerala, the wealthiest state in India report poorer reported health levels than in more deprived state of Bihar which could refer both to subjectivity of health rating and to confusion between mortality and morbidity (Sen, 1999, cited by De Maio, 2008). Self- rating is problematic for the reason that poorer people tend not even to be aware of some disorders they have, e.g. hypertension (Johnston et al 2007, cited by Salverda et al, p.393).

Life expectancy or mortality numbers however do not say much about the health of the living (Salverda et al, 2009, p. 393). A time lag has been often used to account for this assuming that the harm to the public health is reflected in the mortality numbers after a certain number of years. There exists, of course, a big variation in the duration of the lag making it impossible to pinpoint when the effects of inequality manifest (Zheng (2012) argues that the effects of inequality are the strongest after 7 years but remain significant up to after 12 years) and primarily depends on the nature of the disease. It can be argued however that the mortality developments are usually smooth and gradual and strongly correlated to those of earlier years (further here the time lag is not used to enable easier comparability between all- cause mortality and external- cause mortality where the effects are assumed to be contemporaneous).

More recently the specific reason of death have been started to be researched more deeply offering more precision in unmasking the pathways in which the inequality manifests. This is done for a number of reasons. Firstly, if the mortality is dominated by one or a few main causes (e.g. heart and coronary diseases, a common dominant cause of death) the existing effects on other causes of mortality might be left unobserved. Secondly, different causes of death respond differently to inequality. Some might be more sensitive than the others, (e.g. in the common practise it is known that for example alcohol while being a risk factor for some diseases can also alleviate others), and therefore analyzing all- cause mortality only masks the true effects of inequality (Spijker & van Wissen, 2010).

Thus besides all- cause mortality also external- cause mortality is used further in this research. The external causes of death include (according to WHO mortality database ICD10) death from transport accidents, falls, accidental drowning and submersion, exposure to smoke, fire and flames, accidental poisoning by and exposure to noxious substances, intentional self-harm, assault and other.

Analysing external cause mortality with regard to inequality is extremely relevant as it seems to be very sensitive to the socio- economic and political changes (Peck et al, 2007). As the name itself indicates, the reason of death lies by definition outside the person affected. The social instability seems to correlate with the deaths rates due to injury, an example of this is the fluctuations in mortality immediately prior and after the Cold War. Another example is change in mortality in the post- communist countries after the transition to the market economics. The age- standardized mortality increased 33% for men in Russia 1990-1994 and mortality from injuries constituted one third of the decrease in life expectancy (Peck et al, 2007). As mentioned previously, psychosocial factors are assumed to play an important role regarding the external- cause mortality as the external causes of death are often associated with aggression, violent behaviour, inadequate risk taking, drugs/ excessive alcohol consumption or negligence: factors that are more of psychosocial than biomedical (as for most of the other causes of death) nature.

2.2.3. Gender differences in the association between income inequality and mortality

The recent research in this field has been striving for more precision and revealing the interaction of mechanisms producing the association between inequality and mortality. Consequently, the effects of inequality and mortality were examined separately for genders, age groups and causes of death.

The differences in mortality between men and women are well known which applies for both external and internal reasons mortality (Krugger & Nesse, 2006). As long as no artificial barriers for women are created (e.g. infanticide, neglecting the female children) women tend to live longer, especially in developed countries where the risk of dying due to reasons related to maternity are low (Omran, 2005).

The differences in mortality are partly explained by the theory of sexual selection. Males (especially the young males) compete for the females, often engaging in violent and risky behaviours creating real threats for their lives. (Krugger & Nesse, 2006) The competition (and the mortality) gets harsher if the stakes are higher, e.g. under the circumstances of polygyny ((Plavcan, 2000; Plavcan and van Schaik 1997; Plavcan, van Schaik, and Kappeler 1995, all cited by Krugger & Nesse, 2006) an analogy to which of course in this case would be high inequality.

Even in the modern humans' societies high social status increases the chances to find a mate more for men than for women. Besides in the societies with the man as the bread winner model men feel more responsibility to maintain or improve the socioeconomic status of the family (Torre & Myrskylä, 2011) and thus are more subject to the adverse effects of inequality.

Examining the effects of inequality on external- cause mortality gender is extremely important. Besides the theoretical reasons the empirical external- cause mortality data also shows an age- sex pattern distinct from that of other causes (Jakubonienė & Gurevičius, 2010 for Lithuania, Kruger & Nesse for the USA) which cannot be explained in terms of the development level of the country and is likely to be determined by the societal environment.

2.2.4. Mechanisms of association between income inequality and mortality

Further in this paper a causal relationship is assumed to exist between inequality and mortality. Based on the psychosocial interpretation this causal interpretation and its mediators are further

researched. This is however not to be taken for granted, in studies that have discovered correlation between income inequality and health outcomes there were different opinions on if the relationship is causal (Babones, 2008, Mellor & Milyo, 2001, de Maio, 2012).

It has been often argued that both inequality and public health depend on the same underlying factors (Salverda, et al, 2009, p.385, Babones, 2008). Cultural and historical factors determine the distribution of the income in a country. The income distribution systems grown organically from the environment and it would be too easy to think that Sweden would be just like U.K. was only the income distribution changed (Saunders, 2010). While there is a lot of research on the pathways that link the inequality and public health the underlying factors of income inequality have been researched fairly little (de Maio, 2012).

There has been a variety of the underlying factors determining both the inequality and the public health suggested: level of trust in the society as the level of trust in the society is negatively associated with inequality and positively associated with better public health (Elgar, 2010); IQ: more intelligent societies both create more egalitarian societies and are healthier (Kanazawa, 2006). The latter was severely criticised, for instance Marks described Kanazawa's data as 'allegedly supporting a racist version of evolutionary psychology' (2007).

According to Mellor & Milyo, inequality in different contexts can be related with both better and worse population health. Economic growth on one hand tends to increase the distribution of income, on the other hand also increases population health. Industrial restructuring or other employment shocks could, however, increase unemployment or force people into working lower paid jobs and simultaneously worsen the population health (2003).

In the light of the psychosocial interpretation it can be assumed that the underlying factors can be the traits and predispositions of the society that determine how it accepts and deals with the economic inequality. The social justice ideas the society holds, the power distance and masculinity dimensions in its culture (as described by Hofstede, 1980), the political and economic regime (e.g. a socialistic versus aristocratic or plutocratic) can determine what perceptions and psychosocial reactions are then formed in response to a given inequality (see e.g. Paškov, 2008).

2.2.5. Perceptions of inequality

The interpretation of the psychosocial reaction is based on the assumption that the inequality causes a mental reaction. This mechanism however has not been very well researched (Davidson et al, 2006).

The main evidence so far stems from biomedical research, Wilkinson and Pickett give examples of biomedical research conducted on monkeys and humans showing how artificially manipulated individuals' position in the social hierarchy could result in hormonal changes and developing stress-related diseases. (Wilkinson & Pickett, 2009, p. 71-72, 192, Dickerson & Kemeny, 2004, cited by Wilkinson, 2009, p.164). Little however is done to explore how the perceptions of inequality affect the public health though it could plausibly be the missing link representing the psychosocial reaction to inequality.

One of the scarce pieces of evidence was produced examining the determinants of smoking. It has been shown that those perceiving high inequality are more likely to smoke (Siahpush et al, 2006).

The second example is a qualitative research by Davison et al (2006). Based on the psychosocial interpretation, focus group discussions about inequality and its effects on health were conducted with high and low SES participants separately in Scotland and Northern England. The study revealed that the low SES respondents were quicker to acknowledge that sharp inequalities exist in the society and support the idea that health depends on the socio-economic inequalities. They

reported a whole range of negative emotions stemming from their position in the society and claimed those feelings lead them to ‘sleeplessness, fear, anxiety and stress’. The people of high SES were reluctant to accept the idea that inequality affects health. They did not have any problems in talking about the social classes and distanced themselves from the more deprived. The authors report finding support for Wilkinson’s thesis but only for the poor, the rich should also be affected by the skewed income distribution according to Wilkinson but they did not appear to be (Davidson et al, 2006).

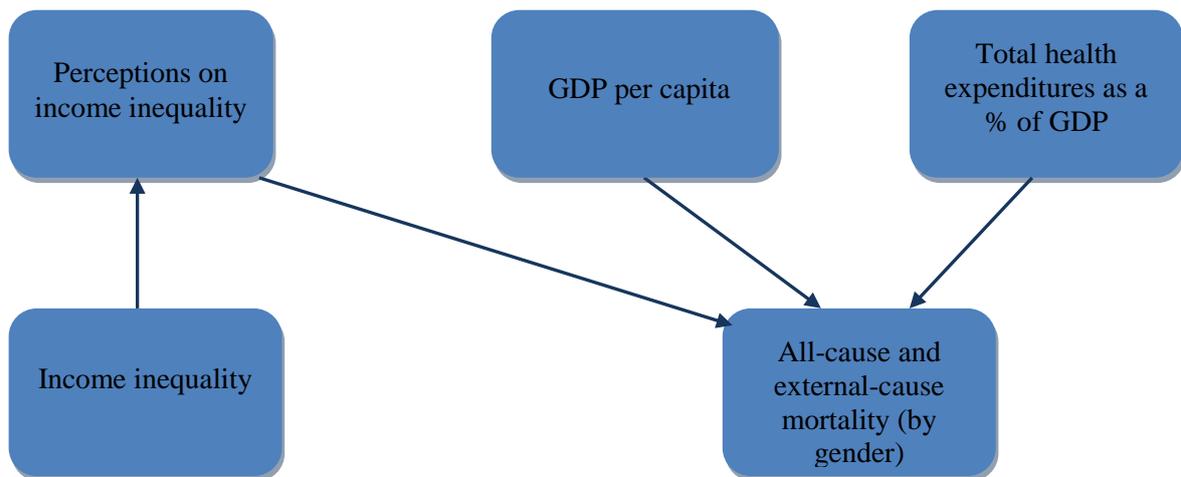
2.2.6. Relevance of this study

This research adds to the knowledge on the association between the economic inequality and mortality. It explores both the differences between countries and developments in time (most of the previous research is only cross-sectional) and goes more into detail to explore the pathways specific for genders and different causes of death. The psychosocial interpretation, discussed in detail in literature but rarely and inadequately empirically tested, is examined using the perceptions of the economic inequality.

2.3. Conceptual model

In order to developed to visualize the relationships between concepts the conceptual model has been developed, as shown in figure 2.

Figure 1 Conceptual model



This model assumes an income inequality effect on mortality. The other explanatory variables of mortality variation included in this model are GDP per capita and total health expenditures as a percentage of GDP. Including the GDP per capita analyzing the association between income inequality and public health is a common practice as it is known that the absolute wealth of the country is an extremely important predictor of the public health. The literature is rife with the discussions on the interaction between absolute (GDP per capita) and relative (distribution of the income and wealth) wealth in explaining the public health differences (see e.g. Spijker & van Wissen, 2010, Wilkinson & Pickett, 2009).

Even though the relationship between GDP per capita and external- causes mortality is not as obvious as for many other causes mortality it is assumed that wealthier countries have better abilities to implement security systems, health and safety regulations, prevent violence.

The health expenditures measure is used as a proxy of the level of the medical care in the country. While possibly affected by other factors such as the population age structure, the type and efficiency of the financing system of the health sector, it is also most probably the best indicator of the healthcare level in the country.

Based on the psychosocial interpretation, this model then theorizes the economic inequality perceptions to be a mediating factor in the income inequality- mortality association.

2.4. Hypotheses

The hypotheses of this research are:

- Economic inequality is associated positively with both all- cause and external- cause mortality;
- The association is stronger for external- cause mortality. As mentioned already, external- cause mortality is less affected by the biomedical factors but more by psychosocial factors and is more sensitive to the developments in the society.
- The association is stronger pronounced for men. As previously discussed, in many species scarce resources and harsh competition for females increase males' mortality compared to that of females. Also in modern humans' societies males are more pressured to gain high social status in order to find a partner and support the family which exposes them more than females to the detrimental economic inequality effects.
- The association between inequality and mortality is mediated by the inequality perceptions, as suggested by the psychosocial interpretation;
- The association becomes weaker but remains after controlling for GDP per capita, total health expenditures and from the former Soviet Bloc countries in the between effects models but becomes stronger in fixed and random effects models. It has been argued that studies find less support for the income inequality- public health hypothesis after including control variables (Wilkinson & Pickett, 2009, cited by de Maio, 2012). Those studies were, however, mostly-cross sectional. When the time dimension is added the situation changes. We know that in the period examined income inequality has been mostly increasing and mortality has been generally decreasing. Hence a positive association between the two can be hardly expected unless the decrease in mortality can be also affected by the dynamics of the other explanatory variables.

3. Data and methods

3.1. Data

3.1.1. Country and time span selection

The analysis was performed with the data from 14 countries from two countries groups: the developed Western culture countries (Western European + developed English speaking countries: the USA, Australia, New Zealand) and the former soviet bloc countries. Those countries, especially the developed Western countries have been well researched with regard to the income inequality-health outcomes hypothesis as opposed to the developing countries but they still offer the best data availability and reliability.

The main limiting data source was the ISSP social inequality module for the economic inequality perceptions. The main criteria of inclusion of the countries was then participation in at least 3 (out of 4) waves of ISSP social inequality module. The criterion was met by the following countries: Australia, Austria, Great Britain, Hungary, the United States of America, Germany, Switzerland, Poland, Bulgaria, Canada, New Zealand, Norway, Russia, Slovenia, Spain, Sweden (note: The differences among the databases determined that the data for Great Britain is used for the inequality perceptions but the data for UK is used for mortality and inequality causing a slight geographical discrepancy.)

The time series 1985-2009 were chosen to be as recent as possible, long enough, to cover all the waves of ISSP and offer the best data availability from HMD, WHO mortality database and inequality database (for instance, the mortality numbers are still unknown for many countries for year later than 2009).

Since, as mentioned, the countries fall into two quite distinct groups, a time- constant dummy variable is used for the former Soviet bloc countries given different economic, social and political developments. It has been previously often suggested that the association between income inequality and health outcomes differ between countries. Wilkinson, for example suggests that the effects of inequality are only important for wealthy countries while for the poor countries the absolute wealth matters more (Wilkinson & Pickett, 2009). Preston, on the contrary, suggests that the economic inequality- population health relation might be stronger in less developed countries (1975, cited by Torre & Myrskylä, 2011). Spijker and Van Wissen, for instance analyse Eastern and Western European countries separately 'given the historical differences in economic development' (2009).

Germany is not considered here to belong to a former Soviet bloc since Eastern Germany is the smaller and less populous part of the United Germany. Besides, the further development of Germany as a whole was more like those of the Western European countries than those of the former Soviet bloc countries.

3.1.2. Data sources

The data for this research was used from a number of different datasets.

The SWIID is used for Gini coefficients. It is based on the United Nations university world income inequality database and Luxembourg Income Study is used as a standard. The original database was used in a number of papers on economic inequality but it was a set of hardly comparable observations since they did not cover the whole country (e.g. urban or rural areas only), different reference units and difference definitions are used (Solt, 2009).

The mortality data is obtained from HMD (population structure, all- cause deaths) and WHO MD (external- cause deaths) since HMD offers better coverage but only WHO MD has the classification by the cause of death.

The International Macroeconomic Data Set by Economic Research Service at United States Department of agriculture is used for adjusted for inflation GDP per capita data (expressed in 2005 dollars).

Two data sources are used to increase the completeness of health expenditures data: WHO global health expenditure database provides data for all the countries analysed 1995-2009 and OECD statistics cover with some gaps the period 1985-1994 for OECD member countries (all aforementioned countries except Russia and Bulgaria).

The data on economic inequality perceptions is obtained from ISSP social inequality module conducted in 4 waves in the years 1987, 1992, 1999, 2009.

3.1.3. Operationalization

- Income inequality

Income inequality is expressed as Gini coefficient. Gini coefficient describes the distribution of income in the population. It varies between zero and one where zero describes perfect equality (in a theoretical two people population both have the same income) and one corresponds to perfect inequality (in a theoretical two people population all of the income is received by one of them).

Theoretically Gini coefficient can be defined as a ratio of the area between Lorenz curve (cumulative share of income from the lowest to the highest) and 45° equality line and the area below the equality line (Peng, 2011).

While there are other inequality measures besides Gini index (e.g. Theil, Hoover, Atkinson), Gini is the most commonly used one. Gini coefficient is widely available compared to other existing inequality measurements but the choice of the inequality measure does not affect or only slightly affect the results (Kawachi & Kennedy, 1997, cited by Torre & Myrskylä, 2011) though Gini index is described as more precise (Zheng, 2012).

In this paper Gini index is based on household disposable income (as opposed to the other definitions of the reference unit or using the pre- tax income).

- Mortality

The following mortality indicators are used: age- standardized all- cause mortality, age-standardized external- cause mortality for both genders. The WHO population standard is used to directly age-standardize the mortality.

- Economic inequality perceptions

The following perceptions are going to be used:

- If the differences in income are perceived as too large (question: ‘to what extent do you agree with the following statement?’: ‘Differences in income in <country> are too large’ ,with the possible answer choices: ‘strongly agree’, ‘agree’, ‘neither agree nor disagree’, ‘disagree’, ‘strongly disagree’, ‘can’t choose’ from the source questionnaire 2008). It was operationalized as the percentage of the respondents that chose either ‘strongly agree’ or ‘agree’ excluding the missing answers. It expresses the normative estimation of the level of inequality.

- If there is much of a conflict perceived between the poor and the rich (question: ‘In all countries there are differences or even conflicts between different social groups. In your opinion, in <country> how much conflict is there between poor people and rich people?’ with the possible answer choices: ‘very strong conflicts’, ‘strong conflicts’, ‘not very strong conflicts’, ‘there are no conflicts’, ‘can’t choose’). It was operationalized as the percentage of the respondents that chose either ‘very strong conflicts’ or ‘strong conflicts’ excluding the missing answers. This shows how much social tensions the economic inequality is perceived to create.
- Perceived income inequality. It is operationalized as the ‘perceived earnings gap’ proposed by Castillo (2011):

$$\text{just earnings gap} = \ln \left(\frac{\text{just earnings}_{\text{high status occupation}}}{\text{just earnings}_{\text{low status occupation}}} \right) \quad (3.1)$$

$$\text{perceived earnings gap} = \ln \left(\frac{\text{perceived earnings}_{\text{high status occupation}}}{\text{perceived earnings}_{\text{low status occupation}}} \right) \quad (3.2)$$

The two occupations used as proxies are chairman of a large national corporation and unskilled manual worker (as originally suggested by Castillo for ISSP data). They meet the definition well and are included in the questionnaires of all the waves.

Such an operationalization allows to eliminate the differences in monetary units (Gijssberts, 1999; Kelley & Zagorski, 2004, cited by Castillo, 2011) or time periods (the national questionnaires ask for estimation in the national currency, some ask to estimate the annual, some the monthly earnings) while a minor disadvantage remains that the different taxes systems remain not controlled for (some national questionnaires ask to estimate the earnings before some after the taxation). The natural logarithm is used assuming that the same income differences have a lower weight when the incomes are high as compared to when they are low (Castillo, 2011).

The 95% trimmed mean is used to aggregate the respondents’ estimations into the estimation representative of the country to eliminate the extreme outliers (usually on the high side) that would otherwise distort the data. The distribution still remained positively skewed but that is considered normal.

- Discrepancy between the perceived actual income inequality and the perceived just income inequality. The ratio perceived earnings gap/just earnings gap is used to operationalize it. It is assumed that inequality that is strongly not acceptable can have stronger negative effects that inequality that is tolerated by the population, regardless of it measured values.

Some countries for some years also provided weights to improve the representativeness of the sample. Weights are used whenever available though the differences between weighted and non- weighted results were small with one exception where huge differences were observed: the weighting has caused the perceived earnings gap decrease significantly in Bulgaria in 2009. In this case the result more consistent with the results of other waves was used.

The ISSP surveys were conducted by the participating countries independently and the sampling techniques differ.

3.1.4. Imputing missing values

For most of the variables there were some data missing. For all- cause and external- cause mortality there were 0.9 and 3.4 % values missing respectively, mostly for the most recent years though for the external- cause mortality there were also some values missing in the middle of the time series. There were 1.1% values missing for the Gini index, all for year 2008 and 2009.

The most problematic were though the total health expenditures and income inequality perceptions. There were 12.3 % values missing for the total health expenditures, mostly in the period 1985-1994 for the former Soviet bloc countries. The income inequality perceptions were only available for three to four data points from the four waves conducted in 1987, 1992, 1999, 2009.

Missing values in mortality and Gini index were imputed with STATA using linear interpolation (extrapolation). The missing values in total health expenditures were interpolated (extrapolated) manually from the whole data series of an individual country (from the linear equation calculated using the known data points for a country). The total health expenditures data sometimes had longer series of missing data and some irregular fluctuations therefore STATA interpolation (extrapolation) using only two closest values often led to long term rapid change in the beginning or the end of the data series based only on a small fluctuation. The missing values in inequality perceptions were not imputed as the missing values accounted for a big proportion of all the data and there was hardly any pattern in them.

3.2. Methods

3.2.1. Cross- sectional time- series analysis

Cross-sectional time-series analysis is performed to answer to the research questions combining the spatial and time dimensions. Fixed, between and random effects models are further applied.

- Fixed effects model. The changes in variables over time are used to estimate the effects of the independent variables on the dependent variable while the time- constant effects are captured in different constants for the countries. The time- constant variables are therefore dropped from a fixed effects model (in this case: former Soviet bloc countries dummy variable). While the constants are different for the countries the same slopes and constant variance is assumed; the error term and the constant are not correlated with the others. Thus it is expressed as:

$$e_{0ot} = \alpha_i + \sum_{k=1}^K \beta_k x_{kit} + \varepsilon_{it} \quad (3.3)$$

Where α_i is a country-specific constant, K is the number of explanatory variables, x_{ki} are independent variables, x_{ki} are their effects and ε_{it} is the error term.

- Between effects model. It explains the differences between the countries regardless of temporal developments. Between effects model equals calculating means of each variable for each spatial unit over time and the running a regression with the means:

$$\bar{e}_{0i} = \alpha_i + \sum_{k=1}^K \beta_k x_{ki} + \varepsilon_i, \quad (3.4)$$

- Random effects model. It explains the differences both in time and across spatial units. Random effects model combination of the between and fixed effects models. The variance, as opposed to fixed effects model, is not assumed to be constant. Rather the variance is estimated assuming the same constants and slopes.

It is expressed as:

$$e_{0ot} = \alpha + \tau_i + \sum_{k=1}^K \beta_k x_{kit} + \varepsilon_{it} \quad (3.5)$$

Where τ_i is a country-specific time-constant disturbance term.

The modified Wald test and the Wooldridge test are then performed to check for the heteroskedasticity (non- constant variance of errors terms) and autocorrelation (the correlation of error terms).

Further in the fixed and random effects models time is treated as a continuous variable as the time effects follow a linear trend fairly well.

3.2.2. Mediation

It is checked if the income inequality perceptions is the mediating variable in the income inequality and mortality association.

A mediating factor must meet the following requirements:

1. It is inside the causal chain,
2. It is associated with the outcome variable (at a significance level $p < 0.10$),
3. It is associated with the exposure variable (at a significance level $p < 0.10$),
4. Including it in the model changes the outcome of interest with at least 10%. In the case of full mediation including the mediating variable reduces the main association to zero. In the case of partial correlation the mediation only accounts for some, but not all, of the association between the exposure variable and outcome variable. That is, the main association becomes weaker but remains.

4. Results

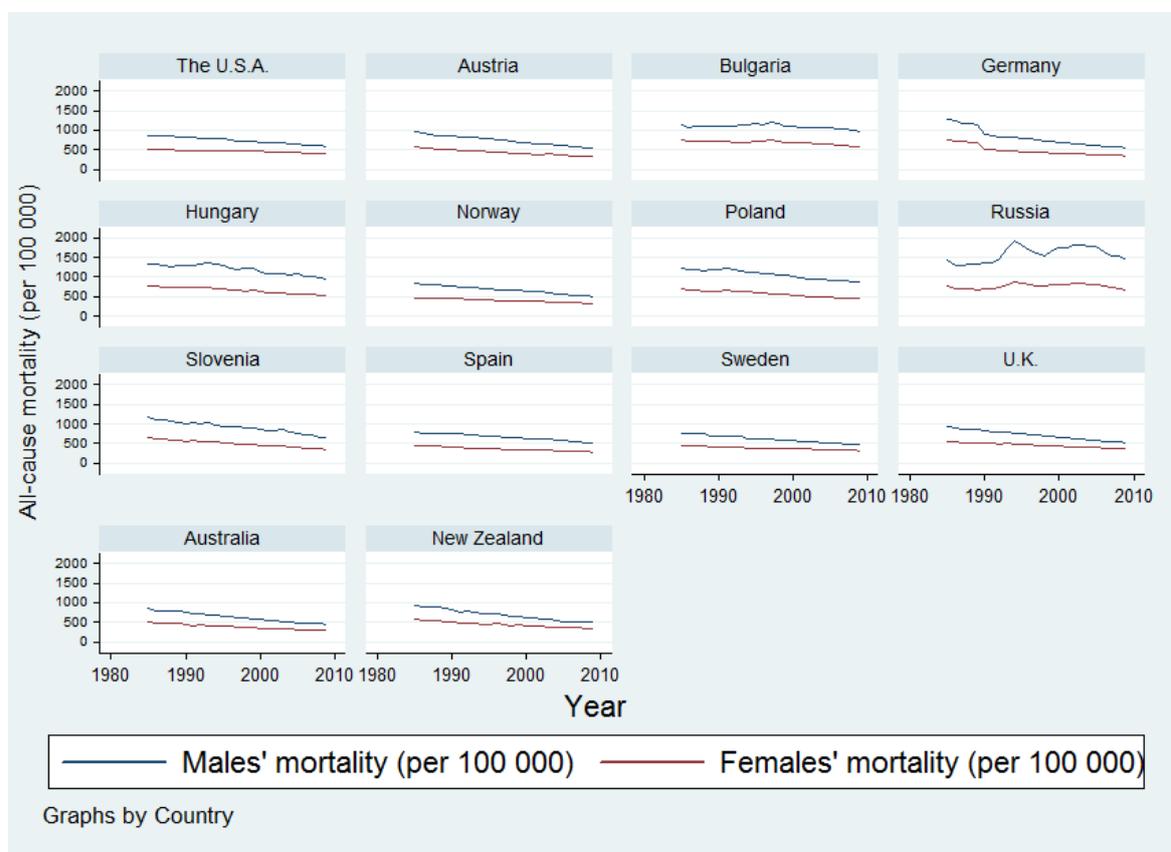
Firstly in this chapter the mortality, inequality, absolute wealth and health expenditures data and the relationships between variables are described. Secondly, the results of cross-sectional time-series analysis between inequality and mortality without control variables and controlling for the GDP per capita, total health expenditures and countries formerly belonging to Soviet bloc are presented. Lastly the inequality perceptions are introduced to check if income inequality perceptions are a mediating factor in the association between inequality and mortality.

4.1. Data description

The age-standardized all-cause mortality is generally higher in the former Soviet bloc countries (Bulgaria, Hungary, Poland, Russia, Slovenia), especially in Russia. In almost all the countries it decreases over time fairly linearly. The exceptions from a linear pattern are Bulgaria with some irregular fluctuations and Germany showing a rapid mortality decline in the beginning of 1990s after the reunion of West and East Germany. The biggest exception, however, is Russia showing some irregular fluctuations with one peak starting in early 1990s after the collapse of the Soviet Union and the other one following the 1998 Russian financial crisis. The fluctuations are much more pronounced for males than for females (figure 3).

The differences between males' and females' mortality are the highest in the former Soviet bloc countries. In the other countries not only are they smaller but also show a clear convergence trend.

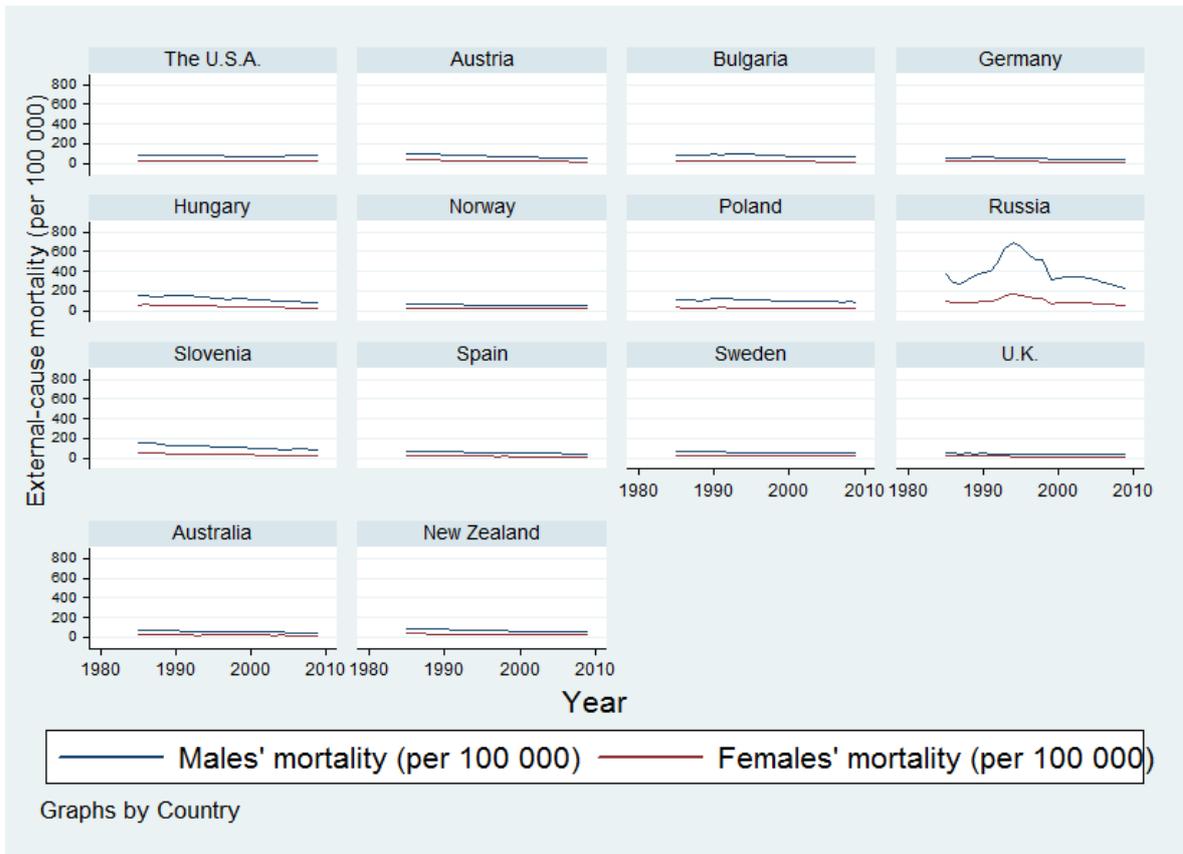
Figure 2 All-cause mortality time trends in selected countries 1985-2009



The external- cause mortality patterns are very similar to those of all-cause mortality: higher mortality and bigger differences between genders in the former Soviet bloc countries with the

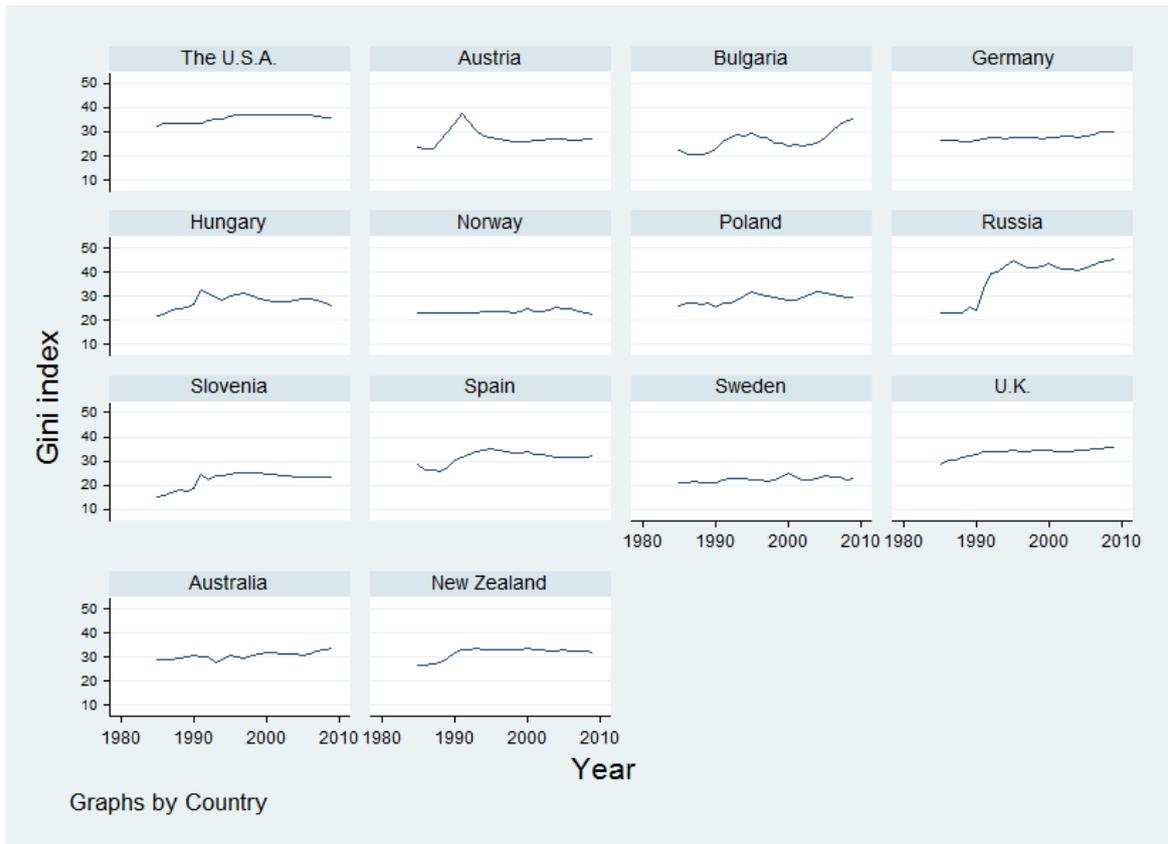
mortality in Russia standing out again, also among the former Soviet bloc countries. External-cause mortality also goes down linearly with Russia once again being the exception. The external-cause mortality in Russia rockets in the early 1990s but comes back to the previous level at around year 2000. These fluctuations are again much greater for Russian men than women (figure 4).

Figure 3 External- cause mortality time trends in selected countries 1985-2009



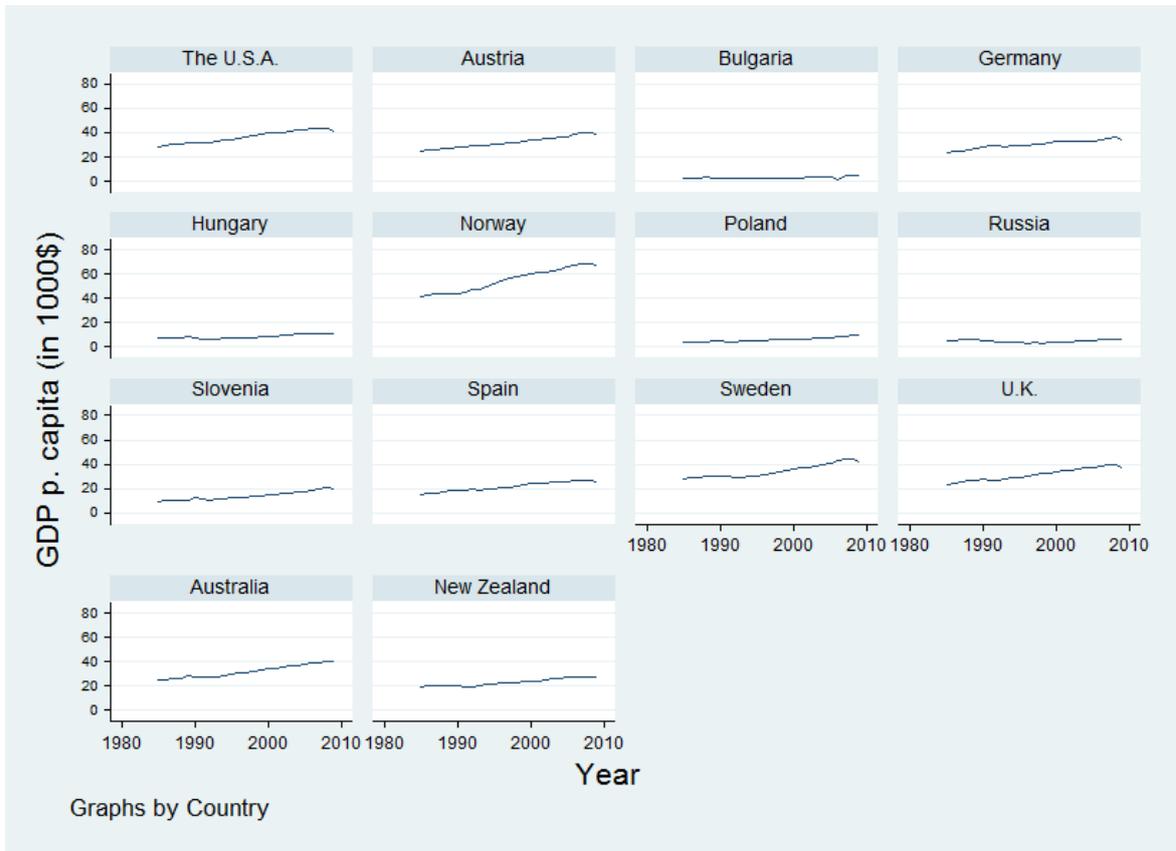
The Gini index is on the rise in the time span analysed and almost all countries have experienced a sudden increase in income inequality in the early 1990s but in general the changes in Gini index are quite erratic (figure 5), sometimes with very rapid changes (e.g in Austria 1987-1991).

Figure 4 Gini index time trends in selected countries 1985-2009



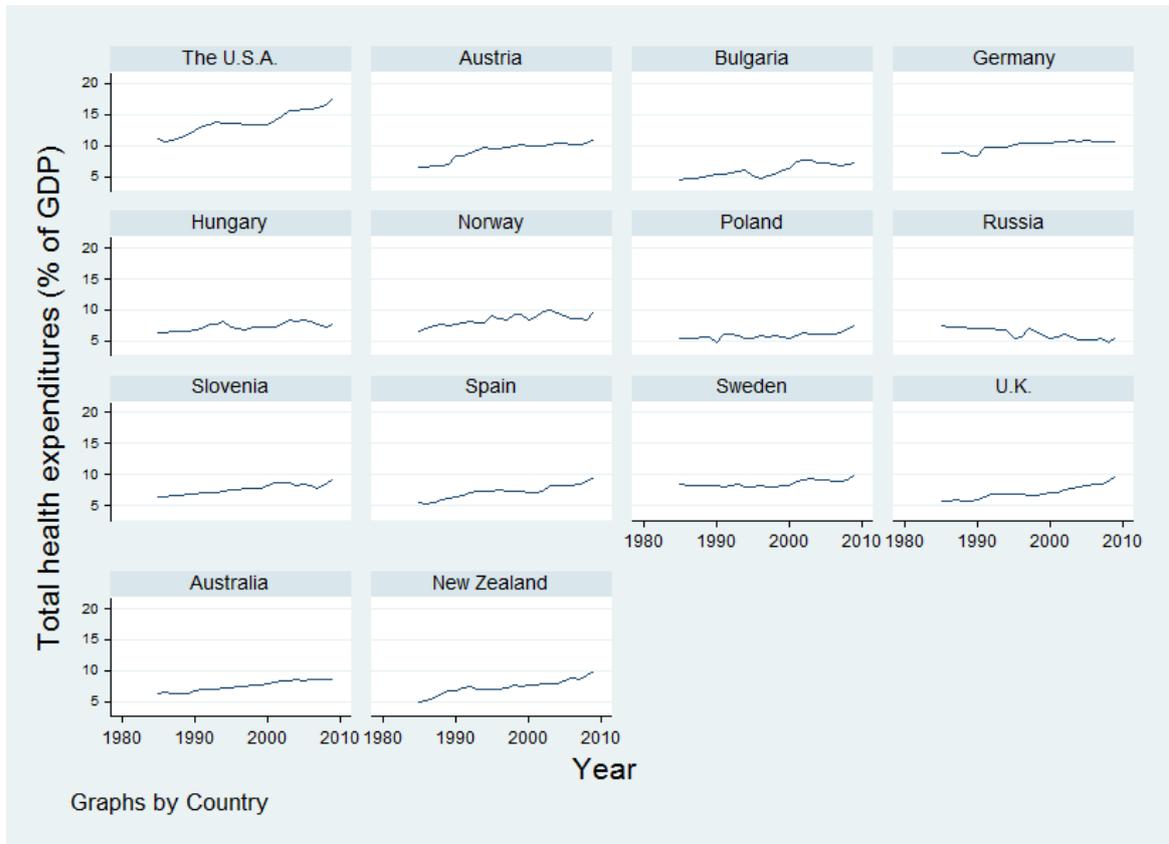
The GDP per capita has been increasing linearly. The GDP per capita developments only are much more modest in the former Soviet bloc countries: in Bulgaria it remained fairly stable over the period examined, showed only marginal growth in Poland and Hungary and a long- term decrease in Russia in late 1990s after which it only came back to the late 80s level (figure 6).

Figure 5 GDP per capita time trends in selected countries 1985-2009



The total health expenditures (expressed as a percentage of GDP) were generally increasing (except in Russia) though with some irregular fluctuations (figure 7). The former Soviet bloc countries generally spend a smaller percentage of GDP on the healthcare. The USA is far ahead of the other countries which can be attributable (as discussed in section 3.1.3.) more to the high degree of the privatization of the healthcare expenditures than exceptional quality of the healthcare. In general the Anglo- Saxon countries (U.K., the U.S.A., Australia, New Zealand) have shown a rapid growth in total health expenditures compared to the other countries.

Figure 6 Total health expenditures time trends in selected countries 1985-2009



4.2. Descriptive analysis of the associations between variables

The correlation coefficients between variables are calculated (shown in table 1) Gini index is positively correlated with mortality. The correlation is stronger for external- cause mortality than for all- cause mortality and stronger for men than for women (which also confirms the hypotheses). However, this association does not necessarily hold for all the countries. In fact, taken individually only in Russia and Austria the correlation is positive, its significance varies both for positive and negative correlations (not shown). That is, mortality decreases over time in most of the countries despite the increasing income inequality.

Higher GDP per capita is correlated with lower mortality, again more for men than for women. The GDP per capita has a stronger effect on all- cause than on external- cause mortality. The more there is spent on health the lower the mortality, the relationship is stronger for males (though the differences are quite small) and for all- cause mortality compared to the external cause mortality.

Table 1 Correlation coefficients between dependent and independent variables

	All-cause mortality males	All-cause mortality females	External cause mortality males	External cause mortality females
Gini index	0.20***	0.11**	0.35***	0.28***
GDP per capita	-0.75***	-0.75***	-0.48***	-0.44***
Total health expenditures	-0.49***	-0.48***	-0.26***	-0.22***

Note: *p< 0.10, **p< 0.05, ***p<0.01.

4.3. Cross- sectional time- series analysis

First in this section the regression is performed between income inequality and all- cause and external- cause mortality (for both genders), then the control variables are added to the regressions. Lastly it is checked if income inequality perceptions act as a mediating variable in the association with the control variables.

4.3.1. Cross- sectional time- series analysis without control variables

The β -coefficients, significance levels, R^2 's and the diagnostic tests results of the inequality – mortality regressions without control variables are summarized in table 2.

Table 2 The results β -coefficients, significance levels, R^2 's and the diagnostic tests results of the inequality – mortality regressions without control variables

		Fixed effects	Between effects	Random effects
All-cause mortality males	Gini index β -coef.	-2.59	17.53	-2.22
	R^2	0.0039	0.0867	0.0416
	Modified Wald test	695.71***		
	Wooldridge test		3594.23***	
All-cause mortality females	Gini index β -coef.	-5.23***	6.64	-4.94***
	R^2	0.0570	0.0630	0.0128
	Modified Wald test	637.62***		
	Wooldridge test		223.75***	
External-cause mortality males	Gini index β -coef.	.66	8.48	.80
	R^2	0.0030	0.1990	0.1223
	Modified Wald test	2.2e+05***		
	Wooldridge test		3594.23***	
External-cause mortality females	Gini index β -coef.	-.249	1.71	-.21
	R^2	0.0065	0.1599	0.0757
	Modified Wald test	97888.04***		
	Wooldridge test		379.28***	

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

In the between effects model (which explains the differences between countries) inequality is positively associated with mortality. The relation is relatively stronger for males than for females and for external- cause mortality than for all-cause mortality but insignificant. The model fit (R^2) is also higher for males than for females and for external- cause mortality than for all- cause mortality, except in the fixed effects model. The between effects model however shows the best fit.

The results using fixed effects model (that explains the changes in time) and random effects model (a combination of between and fixed effects) are similar. The effects of inequality on all- cause mortality are negative but only significant for females. The inequality effects on external- cause mortality are positive for males but negative for females, however, none of them is significant. This was however expected (see hypotheses section 4.2): the association can be hardly expected to be positive when the time dimension using models are applied. The mortality generally decreases in time in the time span of interest while the inequality increases. Therefore when no control variables are used the association is likely to be negative. The control variables would be useful in explaining the drop in mortality.

The modified Wald test and the Wooldridge test indicate the presence of heteroskedasticity and autocorrelation. This is allowed in the analysis. It is assumed that those dying in a certain year do not only are affected by the inequality at the year of death but also throughout their lives eliminating the need of independent observations.

4.3.2. Cross- sectional time series analysis with control variables

The β -coefficients, significance levels, R^2 s and the diagnostic tests results of the inequality – mortality regressions controlling for GDP per capita, total health expenditures and country formerly belonging to the Soviet bloc are shown in table 3.

Table 3 The β -coefficients, significance levels, R^2 s and the diagnostic tests results of the inequality– mortality regressions controlling for GDP per capita, total health expenditures and country formerly belonging to the Soviet bloc

		Fixed effects	Between effects	Random effects
All- cause mortality males	Gini index β -coef.	4.74***	24.87**	4.73***
	GDP per capita β -coef.	-14.86***	4.00	-14.38***
	Health expenditures β -coef.	-50.44***	-5.37	-49.13***
	Former Soviet bloc β -coef.	n/a	582.60***	1.09
	Model R square	0.6639	0.8539	0.5588
	Modified Wald test	5140.55***		
	Wooldridge test		58.84***	
All- cause mortality females	Gini index β -coef.	-1.66**	9.01*	-1.56**
	GDP per capita β -coef.	-6.61 ***	0.74	-6.54 ***
	Health expenditures β -coef.	-27.30***	1.14	-25.55***
	Former Soviet bloc β -coef.	n/a	239.69 ***	-13.01
	Model R square	0.6112	0.8257	0.4977
	Modified Wald test	10070.49***		
	Wooldridge test		62.68***	
External-cause mortality males	Gini index β -coef.	1.27*	11.86**	1.42**
	GDP per capita β -coef.	-2.48	2.99	-2.36***
	Health expenditures β -coef.	1.16 ***	-5.07	0.84
	Former Soviet bloc β -coef.	n/a	177.30**	45.30
	Model R square	0.0707	0.6217	0.3170
	Modified Wald test	1.8e+05***		
	Wooldridge test		3093.57***	
External-cause mortality females	Gini index β -coef.	-0.05	2.51**	-0.02
	GDP per capita β -coef.	-0.68 ***	0.75	-0.65***
	Health expenditures β -coef.	-0.08	-0.40	-0.12
	Former Soviet bloc β -coef.	n/a	43.05**	5.74
	Model R square	0.1023	0.5837	0.2206
	Modified Wald test	64417.76***		
	Wooldridge test		280.10***	

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

After including the control variables positive association between income inequality and mortality in between effects models increased and gained significance (0.05 level for males' all-cause mortality and external-cause mortality, 0.10 for females' all- cause mortality) which was opposite to what was stated in the hypotheses.

In fixed effects model and the random effects model the results are more like hypothesized in the beginning after including the control variables but still have no single direction. The negative

insignificant association with males' all-cause mortality became positive and significant at 0.01 level. The negative association with females' all-cause mortality decreased but remained significant (albeit only at 0.05 level). The positive relationship between economic inequality and males' external-cause mortality increased and became significant (at 0.1 and 0.05 level in fixed and random effects models respectively) while the negative association with females' all-cause mortality decreased (in both cases insignificant).

GDP almost always was associated with mortality significantly negatively (except in between effects model). A bit surprising is that in between effects models if it is also controlled for countries formerly belonging to the Soviet bloc the effects of GDP per capita are positive (albeit insignificant). That is, up to some level more absolute wealth is not necessarily linked with better health for the population (that is in line with the suggestion of Wilkinson & Pickett (2009) that for the developed countries the absolute level of wealth does not matter and its distribution becomes more important). Total health expenditures were negatively associated with mortality; country formerly belonging to the Soviet bloc had relatively high and significant negative effects in between effects models.

The model fit (R^2) is higher for males than for females and higher for all-cause mortality than external-cause mortality in between and random effects models (those comparisons are inconsistent in the fixed effects model). The model fit was better for external-cause mortality in the model without control variables showing that added control variables explain more variation in all-cause mortality than in external-cause mortality. In general, adding the control variables has considerably increased the model fit even to as high as 85% (for all-cause males' mortality).

The results of between, fixed and random effects models are quite different. The positive effects of between effects model are in line with much of the cross-sectional research that showed adverse influence of inequality (e.g. Wilkinson & Pickett, 2009). The mixed results in fixed effects model show that growing inequality in time in an individual country does not necessarily lead to a better public health (at least not for both genders and all causes of death). We can guess that probably both inequality and public health are determined by other underlying factors.

To conclude, the results of the regression between income inequality and mortality mostly positive when the developments in time are not considered. When it is the results are mixed. Living in an equal country is associated with lower mortality (especially for males and external-cause mortality as compared to all-cause mortality). In an individual country increasing equality would be associated with lower males' mortality but higher that of females. The same also holds for random effects. Adding the control variables strengthens the association and increases greatly the model fit but the results still point into different directions.

4.4. Income inequality perceptions as the mediating factor in the association between economic inequality and mortality

In this analysis there is checked if inequality perceptions are a mediating factor in the association between inequality and mortality. First it is checked if the perceptions are significantly associated with the dependant and independent variables (table 4).

Table 4 Correlation coefficients between the mediating variables and dependent variables, Gini index.

		Inequality perceptions			
		Differences in income are too large	The conflicts between the poor and the rich	Perceived earnings gap	Discrepancy between the perceived actual income inequality and the perceived just income inequality
All- cause mortality	males	0.48***	0.56***	0.09	0.16
All- cause mortality	females	0.41***	0.54***	0.02	0.05
External- cause mortality	males	0.30**	0.30***	0.21	0.27*
External- cause mortality	females	0.20	0.42***	0.16	0.22
Gini index		0.08	0.47***	0.50***	0.15

Note: *p< 0.10, **p< 0.05, ***p<0.01.

Only perceiving conflicts in one's country between the poor and the rich is significantly correlated with both the inequality and mortality suggesting that it does not matter much how people estimate the current income distribution and how much it differs from their ideal distribution (it might also be that the perceived ideal distribution gets adjusted according to the actual inequality (Castillo, 2011)). But what tends to be relevant (for both genders, all- cause and external- cause mortality) is the perceived level of the tension, the indication that the inequality is really having more tangible negative consequences. Therefore this perception only is examined further.

It is shown how adding perceiving conflicts between the poor and the rich in one's country (as it is significantly correlated with the independent variable and all the dependent variables) to the model changes the outcome (table 5) in the association between the income inequality and mortality when the aforementioned control variables are used.

Table 5 The comparison of Gini index β -coefficients in the association between income inequality and mortality controlling for GDP per capita, total health expenditures and country formerly belonging to the Soviet bloc in the models when perceiving the conflicts between rich and poor in the country is used and not used as a mediating variable

		Fixed effects	Between effects	Random effects	
All- cause mortality	males	Gini index β -coef. in the model without mediating variables	4.74***	24.87**	4.73***
		Gini index β -coef. in the model with mediating variables	-0.95	20.17**	3.65
All- cause mortality	females	Gini index β -coef. in the model without mediating variables	-1.66**	9.01*	-1.56**
		Gini index β -coef. in the model with mediating variables	-3.52	6.00	-0.23
External- cause mortality	males	Gini index β -coef. in the model without mediating variables	1.27*	11.86**	1.42**
		Gini index β -coef. in the model with mediating variables	-4.67*	10.70**	0.95

Table 6 continued The comparison of Gini index β -coefficients in the association between income inequality and mortality controlling for GDP per capita, total health expenditures and country formerly belonging to the Soviet bloc in the models when perceiving the conflicts between rich and poor in the country is used and not used as a mediating variable

External- cause mortality females	Gini index β -coef. in the model without mediating variables	-0.05	2.51**	-0.02
	Gini index β -coef. in the model with mediating variables	-1.34**	1.74*	-0.05

Note: *p< 0.10 level, **p< 0.05 level, ***p<0.01.

Including perceiving conflicts between the poor and the rich in has changed the outcome by 10 % in all cases which is the requirement for a mediating variable.

In the between effects model and random effects model for males including this perception has reduced the positive effects, that is the association between mortality and inequality was partially explained by this mediating variable.

In the fixed effects model for males including perceiving social tensions between the poor and the rich has also changed the sign of the coefficient of Gini index from plus to minus showing that the effects of perceiving those conflicts in one's country instead of only explaining the effects of Gini index precede them, violating the causality assumptions. For females both in fixed and random effects models including conflicts has strengthened the negative effects that already existed but the interpretation of perceived conflicts between the poor and the rich as a mediating variable is not meaningful in this case as even the relationship theoretically expected to be mediated does not exist.

4.5. Re-evaluating the hypotheses

Using the results of the analysis the previously formulated hypotheses are accepted or rejected:

- Economic inequality is associated positively with both all- cause and external- cause mortality.

When the association with the control variables is analyzed the results differ in the models focusing on time and space dimensions. When only spatial effects are concerned there is a positive association between economic inequality and mortality. When the time dimension is analyzed (on its own or in combination with the spatial dimension) the association is positive for males' all-cause mortality and external- cause mortality; for females this association is negative both for all-cause mortality and external- cause mortality (significance levels shown in table 3).

- The association is stronger for external- cause mortality.

In the model with control variables when the positive association exists between income inequality and mortality the absolute effects of Gini index are stronger pronounced for all- cause mortality. The relative change keeping in mind the differences in the magnitude between all- cause and external- cause mortality is bigger for external -cause mortality. When the negative association exists (for females, in fixed and random effects models) both the absolute and relative negative effects are greater for all- cause mortality. It must be however kept in mind that while the inequality effects on external- cause mortality are assumed to be instantaneous many other causes included under 'all causes' might also have a latent period and thus be stronger after a certain lag.

- The association is stronger pronounced for men.

The association is considerably stronger pronounced for men in the between effects model. In the fixed and random effects models only for the males the association is positive, for females it goes the opposite direction.

- The association between inequality and mortality is mediated by the inequality perceptions.

Perceiving conflicts between the poor and the rich in one's country is the only perception that is correlated both with the dependent and the independent variable and changes the effects of Gini index by more than 10%. It seems to meet the requirements in the between effects model for both genders and in random effects model for males but not in fixed effects model for males (in fixed and random effects models the association to be explained does not exist for females and therefore checking for mediation is not meaningful).

- The association becomes weaker but remains after controlling for GDP per capita, total health expenditures and from the former Soviet Bloc countries in the between effects models but becomes stronger in fixed and random effects models.

Contrary to some previous research adding the control variables has strengthened the positive association or reduced it where it was negative in all of the models. The dummy variable for countries formerly belonging to the Soviet bloc had negative effects as well as the total health expenditures. The influence of GDP per capita was ambiguous, increasing GDP per capita is related to lower mortality but among the selected countries (ignoring the developments in time) and using the former Soviet bloc countries dummy it appeared that lower GDP was even associated with lower mortality.

5. Conclusions and discussion

The results and their implications are quite different when the differences between countries are concerned as compared to when the developments in time are of interest.

When the between- countries variation (between effects model) is examined income inequality is indeed associated with increased mortality for both genders both for all- cause and external- cause mortality. This relationship is mediated by perceiving conflicts between the poor and the rich. This is in line with the conclusive results of much of cross- sectional countries- level research based on the psychosocial interpretation (e.g. Wilkinson & Pickett, 2009).

When the variation in time or the combination of time and between- countries differences are examined (fixed and random effects models respectively) the results are much more ambiguous and inconsistent. While they show that inequality is associated with adverse effects on males' mortality it also is related to beneficiary effects for females. Inequality perceptions are also not mediators here. Inconsistent results have also previously been shown when the time dimension was incorporated (e.g. Kravdal, 2008) though most of the previous research has been cross- sectional.

It is quite difficult to explain why higher inequality is related to lower women's mortality. Based on theory it could be expected that the association between income inequality and mortality would be stronger for men but the opposite direction of the effects is quite surprising. It is likely that this happens because of gender and age interactions. Analysis by age was not conducted in this analysis but it has been previously suggested that the age effects are intertwined with gender effects. Also in the sexual selection theory the association between inequality and mortality is supposed to be the strongest for young adult males whose status is not yet fixed and they are still struggling for it, besides that is when mating and reproduction are the most important. The association weakens later for old males. The research has shown that inequality can even be associated with lower the mortality in the old age groups (e.g. by Kravdal, 2008, Dorling, 2007) which can overweight the young ages opposite effects for women. For males apparently the association is stronger in young ages so it cannot be outweighed by the opposite effects at older ages. It however still leaves the question open why inequality could have beneficiary effects for old people.

The results for mediation also differ in different models. Perceiving conflicts between the poor and the rich is a mediating variable in between effects model and in random effects model for males but not in fixed effects model for males (it is not applicable to females in fixed and random effects model due to the fact that the direction of the main association is the opposite to the one theorized).

To add to the discussion on relative versus absolute wealth, higher GDP per capita still is associated with lower mortality in the models incorporating the time dimension, even in developed countries. When only differences between countries (but not developments in time) are concerned GDP is shown to even have positive albeit insignificant effects (when also controlling for countries formerly belonging to Soviet bloc) suggesting that at least in a certain GDP per capita range wealthier does not mean healthier (as shown in table 3).

The juxtaposition of the results of different models suggests that when individual countries are considered higher inequality is linked with higher mortality but the effects of historical inequality developments have mixed effects, that is growing inequality is linked to increasing males' mortality but decreasing that of females. It might be speculated that probably there are some underlying country- fixed factors effecting both inequality and mortality. While it is strictly speaking not a proof of lack of causality (see Babones, 2008) it points the direction that some countries simply have what the others do not.

This is not that surprising though as the universal applicability of the psychosocial interpretation has been often called into question. It is not a new idea that the income inequality- mortality

association is not universal and there are a lot of debates going on about on which regions of the world the hypothesis is applicable and what are the determinants of countries being susceptible to the detrimental inequality effects (de Maio, 2012).

One of the most serious limitations of this research is also that the results are dependent on single country. Excluding Russia with an exceptional mortality, GDP per capita and total health expenditures patterns, changes the positive effects on external cause females' mortality in the between effects model to negative (not statistically significant) and changes the positive effects to negative (and statistically significant) on males' all-cause and external-cause mortality in fixed and random effects models. These effects are also not captured by the former Soviet bloc dummy variable, Russia is exceptional also among the former Soviet bloc countries.

Another limitation is that the research used quite a small number of countries. Including more countries would increase the statistical power and would probably generate more statistically significant results. It is likely that some geographical patterns would also emerge.

One more issue that could affect the results is the completeness of the data on health expenditures and economic inequality perceptions. For the health expenditures there were in some cases quite a lot of missing values in a row (especially for the time period of 1985-1994 for the former Soviet bloc countries) and many values had to be imputed.

The data for income inequality perceptions was limited too (4 waves, some countries only took part in 3 out of 4). It can be also argued how good indicators of the psychosocial responses the used perceptions are. According to the examples given by Wilkinson & Pickett (2009) on the psychosocial interpretation, the psychosocial factors can encourage people to commit all sorts of actions not necessarily directly related to competitive behaviour and without a direct reference to the role of inequality in it (e.g. higher teenagers' pregnancy rates in unequal societies). That is quite vague and difficult to check empirically. It is assumed in this paper that even if inequality worked in such ways the presence of it and the deleterious effects of it would still be recognised but the indicators capturing the complex psychosocial environment and responses still need to be improved.

While as it has been mentioned the economic inequality has proved to be able to cause social tension the evidence it has also been able to cause worse public health is still very debatable. Those positions have often been expressed simultaneously, for instance Mellor & Milyo (2001) also suggest that the detrimental influence on public health is dubious but economic inequality still remains one of the major social concerns. It is likely that economic inequality can cause direct psychosocial reactions (such as lack of cohesion, social trust) but the relationship seems to blur and go different ways looking for evidence that those psychosocial reactions can in turn cause worse public health. The new direction of the research on the association between income inequality and public health is then to become more specific and focus on separate causes of death, genders and age groups and look for what makes the countries susceptible to the deleterious effects of inequality. The societies seem to be too heterogeneous to universally respond in the same way to the inequality changes. While this research area offers answers to questions to how certain people act under a certain set of conditions it definitely does not provide with universal moral guidance on what our societies should be.

In this light there are few implications for the policymakers regarding the public health. The results are mixed for countries. The policymakers might be interested in the possible developments in the research striving to answer the question what makes the countries susceptible to the association between income inequality and public health and what it would be like in countries of their interest. The policymakers would definitely be not interested in implementing big- scale policies that would, for instance, benefit one gender but deprive the other or would have opposite effects on different age groups and causes of deaths. Therefore useful policy implications could only be possible to

provide with very specific context- sensitive research. It must also be not forgotten that while the possible solutions would be economic measures enabling greater income redistribution this problem is then quite unique in the sense of what the policymakers can do about it. Since the political parties often have a clear agenda on the income redistribution every voter during every election actually contributes to the policy interventions or the lack of them in this field, at least in the democratic regimes. Here an important role is also played by the media portrayal and also the fact that the discussion on the detrimental effects of income inequality has also attracted fairly much attention from the general public.

To sum up, this study has shown again there are no universal generalizations about the effects of inequality (which is also shown by the variety of different results in the research in this area, or mixed results for countries with different characteristics, genders, ages or causes of death in the studies that went to examine the pathways more specifically). A clear message is that the strong statements that equal societies are simply healthier is an oversimplification. While this hypothesis started off with a huge power offering a simple (to understand, not implement) an appealing to many solution as more research has been coming out it has been gradually losing its imperative power. Economic inequality creates a different set of conditions that can harm some groups while benefiting the others (genders, ages, those suffering from different diseases) and does not have unambiguous consequences.

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