Effect of Income Inequality on Health

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05/10/18

The paper used OLS and multilevel models to show the effect income inequality has on health captured by life expectancy of a country. The paper also considers the mediating effect that social capital has on the relationship through social trust. Social trust is measured through the percent a population reports helping another person. The paper also takes in account the effects of a population's education and GDP per capita.

Table of Contents

Introduction

Health has improved worldwide in the past 50 years. Ioana Andreea & Erik Wim Van (2013) found life expectancy at birth averages worldwide increased from an average of 66.3 years in 1987 to an average of 77.24 in 2008. Health outcomes have not been equal though average health has increased. It is not simply just the case of low income countries and high income countries having different life expectancy. Even when comparing low income to low income countries, middle income to middle income countries, and high income to high income countries, there are disparities. Chad has a life expectancy of 51.87 years and Haiti 63.07 years. Mexico has a life expectancy of around 76 and Cuba has an average life expectancy of 80. The United States has a life expectancy of 78.7years and Japan has a life expectancy of 83.84 (World Bank). Income inequality has been a subject that has gained more interest as a reason for this disparity.

Theory suggests that that wider income-inequality lower a population's overall health (Pickett and Wilkinson, 2015). Some authors suggest the reason for higher levels of income inequality decreasing health is that it affecting social capital by decreasing social trust and creating more stress with people taking more risks such as consuming alcohol and unhealthy eating habits. (Kragten and Rözer, 2017: Rözer and Volker, 2016). This study aims to analyze if income inequality affect health as a replication study of Kragten and Rözer's *The Income Inequality Hypothesis Revisited: Assessing the Hypothesis Using Four Methodological Approaches.* It expands on it by looking at the effect of how willing a population is willing to help someone as a way to measure social trust as the mediating factor to look at population health instead of reported individual health belief.

Literature Review

Having a higher income has been associated with longer life throughout the income distribution (Chetty et al (2016). That higher income has not been allocated equally throughout the income distribution equally in many countries. The extent of how inequal the distribution is differs with countries. Income inequality may be one explanation for why average population health is so different between nations. Several studies have looked at whether income inequality affects health. Using the Gini

coefficient for income inequality across countries, some studies have found that income inequality has a negative effect on health (Kragten & Rözer (2017); Safu-Adjaye (2004)). For example, there is evidence of a negative effect of income inequality on mortality rates (Kragten & Rözer (2017) and a significant effect on infant mortality (Safu-Adjaye (2004). Both genders health are affected by income inequality. In Chetty et al (2016) there is a 14.6 year difference between men at the top 1% and bottom 1% in the United States. For women, there is a 10.1 year difference between women at the top 1% and the bottom 1%. In the United States there are differences in the life expectancy between income strata and this would decrease the United States average life expectancy.

The degree income-inequality have in affecting health has been debated. In some studies, no link was found. For the United States, income was not found to have a causal effect on life expectancy and its correlation with longevity may be driven by omitted measures like health behaviors, or education (Chetty et al, 2016). Income inequality have not had the same degree of effect on countries with different income levels. Income inequality has had a larger significance in low income places than high income (Ioana & Erick Wim Van (2013) Kragten & Rözer (2017) Safu-Adjaye (2004). The effect of income inequality is more pronounced in lower income countries. Wealthier countries citizens do report higher health but the positive effect diminishes when countries become wealthier. (Rözer, & Volker (2016)

There is also the issue whether income inequality effects health immediately or if it takes time to show up. Chetty et al (2016) concluded that in the United States there was no time lag in the with the effect on a population's health. However in Rözer, & Volker (2016) and Safu-Adjaye (2004) do find that timing does affect the outcome income inequality has on health on a countries population health . Rözer, & Volker (2016) indicate that for exposure to higher income inequality in adolescence, in later life there were worse social trust and health. Safu-Adjuye (2014) also found that an increase in per capita GDP increased life expectancy in the next period.

The amount of human capital invested in a country may also affect how income inequality affects health. Higher level of education have positive effects on reported self-rated health (Kragten & Rözer (2017); Rözer, & Volker (2016). There is also the effect of social capital. The effect of social trust in a

population on income inequality and health has been analyzed by in some previous studies with varying results. Kragten & Rözer (2017) found that social trust is a mediator between income inequality and health and that social trust was associated with better health for all health measures. On the other hand the studies by Rözer, & Volker (2016) indicate that social trust does not significantly mediate the effect income inequality on health.

This paper will test if increased income inequality will decrease life expectancy, and the role social capital has in that relationship.
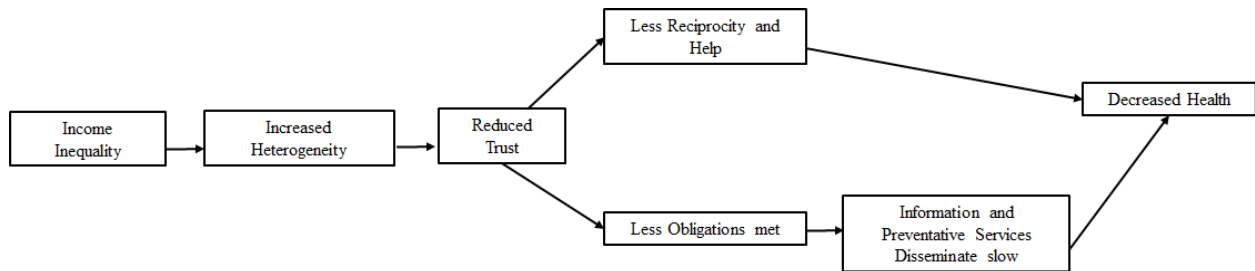
Theory

The income inequality hypothesis states that income inequality has a negative effect on the average health of a population (Chetty et al (2017) Ioana Andreea, & Erik Wim van, (2015); Kragton & Rozer, (2017); Safu-Adjaye (2004)). Safu-Adjaye (2004) describes this relationship as $H_p = f_p(Y_p, I_p)$ where health of a population (H) is a function of a population's income (Y) and a population's income inequality (I).

A psychosocial link has been commonly used as an explanation of this relationship (Kragton & Rozer, 2017; Safu-Adjaye (2004)). The psychosocial theory says that income inequality can impact health by first, causing stress in a population because of competition. Populations then try to cope with this stress by partaking in risky health behavior and addictions (Kragton & Rozer, 2017)). Secondly income inequality erodes social capital. It does this by decreasing social trust within the population.

There is an well documented association between higher social trust and health (Kragton & Rozer ,2017). Social trust makes a population more willing to partake in philanthropic behavior. (Kragton & Rozer, 2017). The "aversion to heterogeneity principle" states the less people are alike, the less they trust each other (Kragton & Rozer, 2017). Thus, more income inequality leads to less social trust. Reciprocity is encouraged by social trust which can lead to better health outcomes (Kragton & Rozer, 2017). The theory is summed in figure 1.

Figure 1 Theory

Data and Methodology

The theoretical model used is based on the model used in Kragton and Rozer's paper. The OLS

regression is used as the base model. This study plans on using OLS initially to test the hypothesis

whether an increase in income inequality will

decrease a population's health.

$$lnY_j = \beta_0 + \beta_1 lnGini_j + \beta_2 lnEducation_j + \beta_3 lnGDP_j + \beta_4 lnHelp_j + \varepsilon_j$$

For the multilevel model the following series of equations is used. Multilevel modeling is used to measure

the direct and indirect income effects of income inequality. Social capital or social trust is the latent

variable in structural equation modeling. The observable indicator Help-Score is used to measure social

trust.

$$lnHelp_J = \beta_0 + \beta_1 Gini + \varepsilon_1$$

$$lnLifeExpectancy = \beta_0 + \beta_1 lnGini_j + \beta_2 lnEducation_j + \beta_3 lnGDP_j + \beta_4 lnHelp_j + \varepsilon_j$$

To measure social trust, the Charity Aid Foundation World Giving Index indicator *Help* will be

used. The Charity Aid Foundation Word Giving Index uses data from Gallup World Poll. This variable

measure the percent of country population who reported to have helped a stranger. The willingness to help a stranger is used to measure how much you trust others in this paper. In the paper being replicated they measure social trust from the World Values Survey (WVS) and the European Values Study (EVS) using the question of how much they can people be trusted Kragton & Rozer (2016). *Help* in this paper is instead used as way to measure less reciprocity and less obligations met to measure social trust. Social capital is difficult to measure due to it being about the social relationships and networks people hold. Data from 2014 to 2017 is used. To measure income inequality, the Gini index will be used. The Gini index measures income distribution among a population. Many studies use the Gini index to measure income inequality (Ioana Andreea, & Erik Wim van, (2015); Kragton & Rozer, (2017); Safu-Adjaye, J. (2004)). Data from The Standardized World Income Inequality Database SWIID is used in this study for the Gini index. To measure population health, life expectancy at birth is used as a proxy. A country's tertiary gross enrollment ratio and per capita GDP, are used to for control variables.

Results

OLS Results

The education variable was significant in this model and had the largest effect on life expectancy. Increasing the ratio of amount of population in enrolled in university or college by one percent would increase life expectancy of that country by 0.07032%. The significance of population that is enrolled in college was the highest of all the variables.   *GDP* was significant at the 99% level. This says that improving a country's economy GDP per capita by one percent would increase the country life expectancy by 0.02548%. The Gini variable had the effect expected in the income inequality hypothesis. It was significant at the 95% level and had the second largest effect on life expectancy in the model. Increasing the gini coefficient by one percent (making the income inequality increase) will decrease the life expectancy of the country population by 0.04596%. For *Help*, increasing the percent of the population who help a stranger by one percent increases population health by 0.02374%. This means an increase in social trust increases average life expectancy of a country's population. Helping a stranger had the smallest effect on life expectancy but was still significant in the 95% level

OLS Model		Multilevel Model
Life Expectancy		
Intercept	3.97786***	3.97786***
	0.10122	0.10122
GINI	-0.04596**	-0.02858*
	0.02477	(0.02858)
Help	0.02374**	0.02374**
	0.01149	(0.01207)
Education	0.07032***	0.07032***
	0.00521	(0.00709)
GDP	0.02548***	0.02548***
	0.02477	(0.00589)
Indirect		0.009127
		(0.006919)
Direct		-0.0460*
		(0.0286)
Income Inequality		
Intercept		2.56291***
		(0.64862)
Help		0.38450*
		(0.2168)
R-Squared	0.91423	
No. Obs	90	
Standard errors in parentheses. *, **, *** indicates significance at 90%, 95%, and 99% level.		

Multilevel Model Results

Like the OLS *Gini* had the second largest effect on life expectancy. A one percent increase in a country's Gini coefficient has a corresponding 0.045% reduction in life expectancy. The significance decreased however in this model. But higher income inequality stills decreases population health. *Education* continued to be the most statistically and economically significant factor. An increase of 1 percent would have a increase life expectancy of that country by 0.07032. *Help* does act as a mediator for the effect *Gini* has on life expectancy. *Gini* had a total effect of -0.0467. -0.0583 was the direct effect and 0.0116 was the indirect effect. This implies that social trust does act as mediator in the relationship income inequality has with health.

Conclusion

Increased income-inequality decreases health of a population in the model tested. How much citizens of a country help other people also act as mediator to the degree income inequality decreases population health. This supports the income inequality hypothesis. But income inequality was the not the biggest factor in affecting life expectancy. Education was the largest factor in affecting life expectancy. Increasing a country's population graduating high school and applying for college would also increase life expectancy. One way to increase the world's health would to focus on decrease income inequality and improving education too. It needs to be kept in mind that there are extremes in the country data however.

Summary statistics show that the lowest life expectancy is 19 years. This is in Cambodia in the late 1970s, which is the later years of the Vietnam War. There are other factors that can affect a population's life expectancy such as war and disease. These were not accounted for in the model. There were also issues getting data from less developed countries, there was much more data points from more developed countries, and gaps in data with the more undeveloped countries. This lead the results to may be more skewed towards more developed countries. One next step is to add more years for the *Help* variable, there were only 4 years of data used and that limited the number of countries used by half. Another step would be to further look at how social capital affects and social trust affect countries when

they are low-income, medium-income, or high income and whether the effect diminishes as countries

have higher income.

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Appendix

Table 1. Variables

Variable	Definition	Source
Birth Life Expectancy	Average life expectancy by country measuring overall mortality of a country's population that year. Will be used as an indicator of health.	World Health Organization Global Health Observatory
Help	Percent of a country population who has helped a stranger. Uses survey data. From Gallup World Polls. Will be used as an indicator for social trust. Years 2014-2017 used.	Charity Aid Foundation World Giving Index
GINI	Measurement of income inequality within countries. Estimate of Gini index of inequality in equalized (square root scale) household income .Will be used as indicator of income inequality.	The Standardized World Income Inequality Database
Education	Gross enrolment ratio, tertiary, both sexes (%)	World Bank
GDP per Capita	GDP per Capita (Constant 2010 USD)	World Bank

Table 2. Descriptive Statistics

Variable	N	Mean	Std Dev	Minimum	Maximum
Year	6986	2001.29	13.3082249	1960	2017
Health	2495	69.78916	8.7021671	34.2118049	84.2780488
Education	1696	35.13926	25.901226	0.268000	119.77887
GDP per Capita	2671	12,850.17	18,174.18	172.9108663	14,4246.37
Gini	5091	37.98778	8.6336869	18.4000000	61.000000
Help	552	3.871117	0.2814537	2.7725887	4.3944492