Income Distribution and Health: A Worldwide Analysis

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I. INTRODUCTION

Despite having had nearly a decade of economic growth, the United States is among many developed countries that lag behind under developed countries on various health indicators such as life expectancy. Although access to universal health care is also a major contributor to the level of health of a nation, growing evidence suggests that broader economic forces may be playing a larger role in determining a nation's health status.

In a book written by British economist Richard G. Wilkinson, it is argued that the widening gap between the rich and the poor affects the health gains in advanced nations. Wilkinson states that levels of income inequality affect health more so than absolute living standards. His research indicates that life expectancy in certain nations is unrelated to average income but tends to be higher in countries with less inequality. He also showed that longevity has risen faster in those nations with narrowing income gaps than in those with widening gaps (Koretz, 1997).

A few of the first individuals to work on this subject, Kennedy and Kawachi (1999), stated that the extent of income inequality in a society determines its average health status. Their relative income hypothesis states that the greater the level of income inequality present in a society, the lower the average health of that particular society.

The main goal of this paper will be to test the relative income hypothesis by applying it to other developed and less developed countries. This paper will take a section by section approach to evaluate the relationship between income inequality and health. Section II evaluates the existing literature about income inequality and health. Section III introduces the theoretical foundation for this topic. Section IV lays out the hypothesis and explains the empirical model and data. Section V discusses the results of the model, and section VI draws conclusions from the results and suggests policy implications.

II. EXISTING LITERATURE

One of the more important studies that corroborated Wilkinson's findings was done by Kaplan and Daly et al. (1998). Their study examined the income inequality hypothesis within the Panel Study for Income Dynamics from 1978-1992 and 1988-1992. In Kaplan and Daly's study, state-level income inequality data was related to the mortality risk of individuals aged 25 years and older. When the individual mortality risk was regressed on state-level income inequality, greater inequality was consistently associated with increased mortality. However, the effects were small and not statistically significant. The author then examined the effects of income inequality across different population subgroups. He found that inequality had statistically significant detrimental effects on mortality risk in the non-elderly and middle-income individuals (Kaplan and Daly, 1998).

Fiscella and Franks (1997) examined the association between income inequality and health. They used the National Health and Nutrition Examination Survey to find the relationship between income inequality and individual risk of mortality. The study examined a sample of 14, 407 subjects from 1975-1987 in the United States. Fiscella and Franks found that income inequality at the county levels was correlated with population rates of mortality ($r = -0.34$, $p = .004$). However, when the community income inequality was examined simultaneously with family income, the relationship of income inequality to individual risk of death disappeared (Franks, 1997). These findings were problematic because they suggest that the average level of income is a better indicator of health status rather than income inequality.

Kennedy et al. (1998) examined the relation-

ship between state-level income inequality and individual self-rated health within the 1993 and 1994 Behavioral Risk Factor Surveillance System (BRFSS) surveys. The BRFSS is a random, digital telephone survey of U.S. residents. The study has the advantages of a large sample size of about 205,245 and a wealth of information that included race, gender, and household income. The results indicated a statistically significant effect on income inequality on self-rated health. Strong associations were also found between low household income and self-rated health (Kennedy, 1998).

The final paper examined was written by Peter Lobmayer et al. (2000). Their study involved the Luxembourg Income Study data which is widely regarded as providing the most internationally comparable data on income distribution. They analyzed income and mortality data for economically advanced and culturally similar OECD (Organization for Economic Cooperation and Development) countries. In their study they noticed a disappearance of the relationship between income inequality and mortality in the 14 countries that were members of the OECD. Their data shows that the strong positive correlation between income inequality and median income among the countries in this analysis means the effects of income inequality may be partly confounded by higher median income (Lobmayer, 2000). These findings contradict the conclusions of what a majority of the literature has been telling us about the relationship of income inequality and the level of public health in a society.

III. THEORY

A. Erosion of Social Capital

There is a growing amount of evidence suggesting that the level of public health depends on social capital. Social capital is defined by Kennedy and Kawachi (1997) as "those features of social organization – such as the extent of interpersonal trust between citizens, norms of reciprocity, and vibrancy of civic association – that facilitate cooperation for mutual benefit." (Kawachi and Kennedy, 1997) It has also been claimed by many sources that social capital is important for the enhancement of government performance and the functioning of democracy, the prevention of crime, and the maintenance of public health. Kawachi and Kennedy (1997) found that there are strong correlations between social capital and mortality rates. Using U.S. data aggregated at the state level, social capital was measured by responses to the general surveys about the degree of mistrust, levels of perceived reciprocity, and membership of involuntary association of all kinds. It was shown that each indicator of social capital was correlated with lower mortality rates ($r = 0.79$, 0.71, and –0.49 respectively) even after adjustment for state median income and poverty rates (Kennedy and Kawachi, 1997).

We now need to examine how income inequality leads to an erosion of social capital. In the same study written by Kennedy and Kawachi (1997), income inequality was measured by the Robin Hood index, which equals the proportion of aggregate income that would have to be redistributed from households with disproportionate earnings to those earning less, if income were to be level. The higher the Robin Hood index, the larger the income gap (Kawachi, 1996). Using the General Social Surveys, Kennedy and Kawachi's study found that the larger the income gap within a society, the lower is citizens' trust in each other. Identical results were also obtained when they plotted income disparity against per capita participation in voluntary associations (Kennedy and Kawachi, 1997).

One of the mechanisms where the erosion of social capital affects health is through certain patterns of political participation and the passage of social policies that are detrimental to the poor. Those who find themselves at the bottom end of the income inequality feel negative emotions. These negative emotions such as shame and distrust translate into health damaging behaviors at the individual level through certain mechanisms. At the same time, perceptions of relative social positions and the negative emotions that accompany it translate into anti-social behavior, reduced civic participation, and less social cohesion within the community (Lynch, 2000). Low levels of civic participation by the poor will ultimately lead to a decrease in governmental representation for the lower class. If there is no one to represent the poor in the government, then there will be a higher probability that a reduction of public health laws and reduced premiums for health care for the financially disadvan-

taged will result.

B. Disinvestments of Human Capital

A study done by Kaplan et al. (1996) found a very strong correlation between the degree of income inequality at the state level and indicators of human capital investments. Those states with high levels of income inequality spent a smaller proportion of the state budget on education and showed poorer educational outcomes. One reason why income inequality may translate into lower social spending is that in societies with rising inequalities, the interests of the rich start to diverge from those of a typical family. For example, a family in the upper 95th percentile pays much more in taxes than a family in the lower 50th percentile, but does not receive a higher benefit from public services like education or health care policies. This translates into lower taxes and reduced public services through the higher influence on political figures by the rich. Some of this reduced social spending translates into diminished life opportunities for the poor to improve their material circumstances (Kaplan, 1996). Reduced spending on policies that enable the poor to afford health insurance will keep those with health problems from going to the hospital for adequate treatment. Illnesses that are contagious will then affect all those around that particular individual. A lack of affordable health care by the poor will eventually lead to the erosion of health in those societies where there exists a large income gap between the rich and the poor.

Both of these theories suggest that an increase in income inequality should, ceterus paribus, cause a decline in the quality of public health of a society. The goal of this research will be to evaluate this hypothesis and show that public health does depend on the distribution of income within a society.

IV. RESEARCH DESIGN

This paper will use OLS regression in order to evaluate the relative income hypothesis set forth by Kennedy and Kawachi (1997). The data for this study comes from the World Bank Database, the United States Census Website, and the World Income Inequality Database. The World Bank database provides economic, political, and social statistics on many subjects for every country. The database contains a section on health that is especially useful for this type of study (World Bank Database, 1994). The U.S. Census website provides infant mortality data that was not present in the World Bank database (U.S. Census Database, 2000). The World Income Inequality Database provides valuable information on the level of income inequality for every nation in the world (World Income Inequality Database 2000). A random sample of 19 less developed and developed countries was used to see if average income affected the health status of a nation. The dependent variables that were used in this study were infant mortality and life expectancy. Infant mortality is defined as the number of infant deaths per one thousand births (World Bank Database, 1994). Life expectancy is defined simply as the average age of death. I chose to use both of these dependent variables in two separate OLS regressions to see if both measures of health would respond to changes in income inequality. I feel that since better health care should have an increased level of life expectancy and a decreased level of infant mortality, both should respond equally to the change in income inequality. The variable for infant mortality will be known as **INFM** and the variable for life expectancy will be known as **LIFEXPTY**.

One of the main independent variables used in this study is the Gini index. The Gini index is an important measure of income inequality that is similar to the Robin Hood index used in the Kennedy and Kawachi study (1997). According to the World Income Inequality Database (WIID), the Gini index "incorporates the more detailed shares data into a single statistic which summarizes the dispersion of the income shares across the whole income distribution. The Gini coefficient may be expressed as a proportion or as a percentage." The Gini coefficient will be equal to 0 when there is completely equal income distribution. If the society's total income mounts up to only one person/household unit, leaving the rest with no income at all, the Gini coefficient will be equal to 1, or 100% (World Income Inequality Database, 2000). The average Gini index values for the countries used in this study were approximately 36.9. The Gini indices for the entire world range from approximately 20-60. This variable will be known as **GINI** in the regression.

A third variable, GDP per capita (**GDP**) was

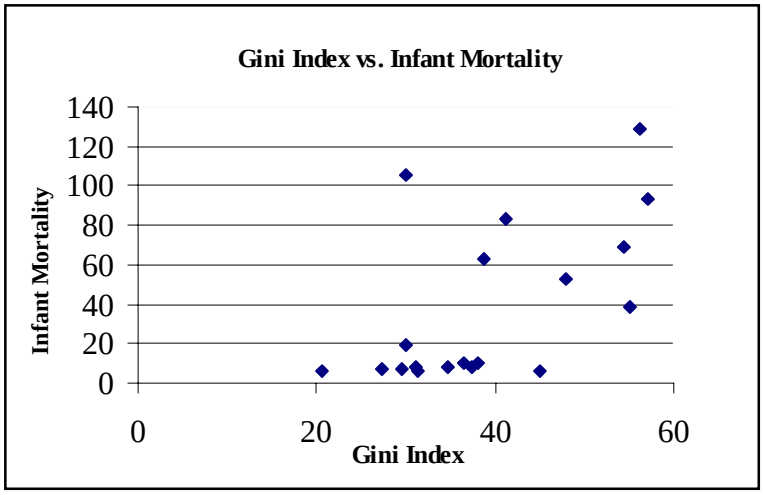
used as a control in this study. I chose to control for GDP per capita because I did not want the wealth of a nation to affect the data set. There is a great amount of evidence available stating that wealthy countries tend to be healthier than less wealthy countries especially when the difference is significant. The goal of this study was to look at income inequality alone while leaving the wealth of the nations constant. This eliminates any type of bias that may exist for the wealthier countries like the United States or Canada.

The data set consisted of 19 randomly selected countries that vary by the amount of GDP per capita, size, and population. At first, I attempted to build the data set with both developed and less developed countries. However, this proved to be difficult because the Gini index for less developed countries was not present in the World Income Inequality Database or in the World Bank Indicators. This is why most of the countries used in this study are mostly middle-income to high-income countries. The countries that will be used in this study are: Algeria, Australia, Canada, Finland, Guinea Bissau, Hong Kong, Kenya, Mexico, Netherlands, Nigeria, South Africa, Sri Lanka, Tanzania, United Kingdom, United States, Sweden, New Zealand, Nepal, and Ireland. The countries and their respective life expectancy values, infant mortality rates, Gini coefficients, and GDP per capita are shown in Table 1. Since the main purpose of this paper is to show that income distribution is a major indicator of the health of a nation, one of the main hypotheses of this paper is that the Gini index is directly proportional to infant mortality. Hence, the

Table 1: Comparative Statistics

Country	Life Expectancy	Infant Mortality	GINI	GDP (billions of dollars)
Algeria	65.7	63.3	38.73	45
Australia	76.6	8	37.32	257.5
Canada	77.1	7.4	27.41	480.5
Finland	74.6	5.7	20.5	99
Guinea-Bassau	45	129	56.12	0.16
Hong Kong	78.9	6.5	45	60.7
Kenya	54.1	68.5	54.4	7.2
Mexico	68.3	38.6	54.98	186.8
Netherlands	76.8	6.8	29.6	208
Nigeria	52.2	82.9	41.15	30.7
South Africa	62	53	48	79.3
Sri Lanka	71	18.8	30.1	6.3
Tanzania	55.6	93.5	57	2.3
United Kingdom	75.5	7.7	31.2	722.9
USA	75.1	9.8	38.16	4818.9
Sweden	77.7	5.9	31.33	168.8
New Zealand	75.2	10.2	36.58	36.4
Nepal	49.1	105.6	30.06	2.9
Ireland	74.3	7.7	34.6	30.3

Figure1: Regression #1 Graph



GINI variable will have a positive sign in the first regression. The other hypothesis is that the **GINI** variable will be inversely proportional to life expectancy. Thus, the **GINI** variable will have a negative sign in the second regression. The **GDP** variable was placed in the study as a control in both regressions and should also have a positive coefficient in the first regression and a negative coefficient in the second regression. These hypotheses combined with all the variables stated above produces the following equations:

$$INFM = \alpha_1 + \alpha_2(GINI) + \alpha_3(GDP)$$
$$LIFEXPTY = \alpha_1 + \alpha_2(GINI) + \alpha_3(GDP)$$

V. RESULTS

The results of the first OLS regression using infant mortality as the dependent variable are summarized in Table 2. It was found that the **GINI** variable was significant to the .01 level. It was also found that the **GINI** variable was positively correlated with infant mortality which supports the hypotheses that Gini index is directly proportional to infant mortality. On average, when a country had high levels of income distribution, the level of infant mortality of the nation decreased. This can also be seen in the scatter plot in Figure 1. The general pattern of the graph is upward sloping which supports one of the hypotheses stated above. These results confirmed the findings of Daly and Kaplan et al (1998) when they used mortality rates instead of life expectancy as their dependent variable.

The results for the second regression using life expectancy as the dependant variable are **GINI** variable was also significant to the .01 level. It was also found that the **GINI** index is negatively correlated with life expectancy which supports the hypothesis that Gini index is inversely proportional to life expectancy. On average, when the income inequality of a nation increases, the average age of death within a nation decreases. This can be seen graphically in Figure 2. The general pattern of this graph is downward sloping which also supports the second hypothesis stated above. This confirms the findings done by Richard Wilkinson et al. when he related income inequality to life expectancy. The only difference between this study and Wilkinson's study is that he used the 50 states as his data sample instead of randomly selected countries as in this study.

Table 2: Regression #1 Coefficient Results

Variable & Expected Sign	Coefficient	Significance
GDP (-)	-7.5E03	.317
GINI (+)	2.144	.01

In both regressions it was found that the GINI variable was very significant in predicting the level of infant mortality and life expectancy.

Table 3: R Squared Results for Regression #1

R-squared	Adjusted R-squared	Degrees of Freedom
.389	.313	18

However, the adjusted R square value for the first regression (0.313) was slightly larger than the adjusted R square in the second regression (0.274). This tells us that the first regression which used infant mortality as the health indicator was slightly more accurate at predicting the level of health care than the second regression which used life expectancy as the health indicator.

It was also found in both regressions that although the predicted signs were correct, the coefficients for the GDP per capita were insignificant. This may have been due to a variety of reasons. I initially thought that GDP per capita might depend on the level of income distribution in a country or vice versa. However, I ran the regression between the two using each one as the dependent variable. I found that there was no significant relationship between the two variables. The discrepancy might be due to not controlling for enough variables in the study. It could also be due to the compositions of the data set. Since it was hard to find income distribution data on some of the less developed countries, I tended to use more developed countries in my analysis. The misrepresentation of countries with low annual GDP per capita values could have made the GDP variable insignificant.

VI. CONCLUSIONS AND POLICY IMPLICATIONS

The main goal of this paper was to show that income inequality was a major determinant of the level of health in a particular nation. By using OLS regression analysis for two separate dependant variables, it was shown on average that the higher the amount of income inequality that exists in a nation, the higher the level of infant mortality and the lower the life expectancy. For approximately every .21 unit increase in the Gini index, there will be .1 more infant deaths per one thousand births. For approximately every .56 unit increase in the Gini index, life expectancy will decrease by one year. High levels of income inequality have shown to decrease not only investments in human capital, but also social cohesion. These pathways were presented in studies done by Kaplan et al. (1996) and by Kennedy and Kawachi (1997). A decrease in social cohesion and a decrease in investments in human capital ultimately led to decreases in the level of health within a society.

Figure 2: Regression #2 Graph

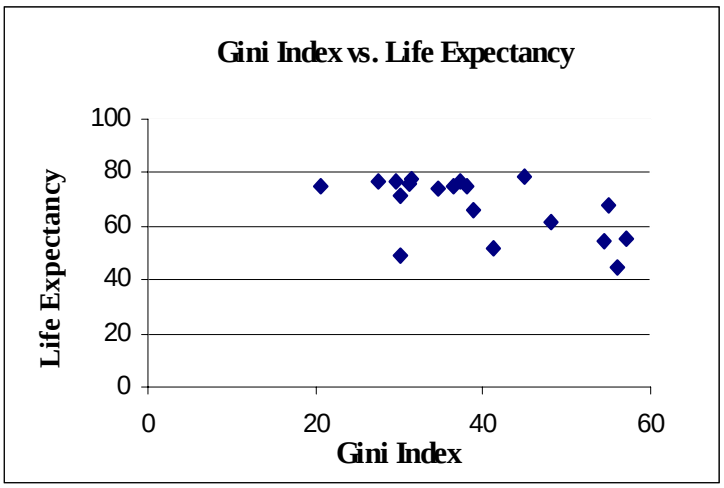


Table 4: Regression #2 Coefficient Results

Variable & Expected Sign	Coefficient	Significance
GINI (-)	-0.561	0.015
GDP (+)	2.00E-03	0.338

Table 5: R squared Results for Regression #2

R-squared	Adjusted R-squared	Degrees of Freedom
.355	.274	18

The GDP variable that was used as a control in this study was shown to have a negative coefficient with low significance. This goes against the hypothesis stated early in the paper that said that GDP should be directly proportional to life expectancy and inversely proportional to infant mortality. As stated earlier, the error could have been due to the exclusion of other variables that need to be controlled for. It could also be due to the fact that GDP per capita has nothing to do with the infant mortality level or life expectancy of a particular country. This is the conclusion of most authors who have had publications on this topic. Almost every article reviewed with the exception of Lobmeyer et al. (2000) concluded that in the end, income inequality is a more decisive measure of public health within a society. More research can still be done to measure the impact of both of these variables and to see which one affects public health the most.

In order to improve the overall health of a particular nation, policy makers need to increase access to effective and affordable health care. They also need to pay more attention to the broader economic forces in order to increase the health of a particular country. Policies that are aimed at reducing income inequality may need to be initiated. Policies such as raising minimum wage have been attempted but it seems to have negative macroeconomic consequences. In the end, the big challenge that will face policy makers will be to reduce income inequality without in

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