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The impact of Income Inequality on Population Health: Empirical Evidence from Middle and Low Income Countries

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ABSTRACT

This research work aims to empirically verify the nature of the relationship between income inequality measured by the GINI index and population health measured by life expectancy at birth in a sample of 16 middle and low income countries during the period (2002-2018) using the static panel data models estimations. The results of estimating the fixed-effect model (FEM) as the most suitable model for the data of this study showed that income inequality has a significant negative impact on the population health.

1. Introduction

According to the World Health Organization, health is defined as a state of complete physical, mental and social well-being of an individual. Accordingly, health has physical, mental and social dimensions which are affected by social, economic and biological environment (Hajebi & Javad Razmi, 2014, p. 134).

Health is a fundamental human right and a basic need for every individual in the world today, so any society is judged by the quality of public health and the amount of healthcare distribution by social classes.

Health issues have been one of the most heated debates over the past decades. It is a major economic concern for many countries of the world because it plays a crucial role in economic development being an element of investment in human capital, so it is important to know the social and economic determinants of health in each society in order to take appropriate economic policies.

Income has a clear impact on health, as it is a means of obtaining basic requirements of community members such as food, shelter, warmth and the ability to participate actively in society. So that income levels affect how parents care for their family's health, as well as where they live. Therefore, living on a low income makes it difficult to exercise control over the family health.

Income is not the only determinant of health. With the steadily increase in unequal income distribution around the world over the past decades, strong evidence has emerged that large income inequalities have negative consequences for health and society. Accordingly in 1992, Richard Wilkinson published a widely cited article in The British Medical Journal, where he argued that higher levels of income inequality in rich countries lead to decreased life expectancy (Wilkinson, 1992).

World leaders, including the President of the United States of America, the Prime Minister of the United Kingdom, the leaders of the International Monetary Fund, the United Nations and the World Bank ... have described income inequalities that refers to the differences between the richest and poorest members of society as one of the most important

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problems of our times, as they have pointed out on its social, political and economic costs, especially those related to the aspect sanitary. British Prime Minister Tony Blair once told in the Parliament shortly after his election: There is no doubt that published statistics show a link between income inequality and poor health (Liu, 2017, p. 5).

In theory, four mechanisms by which income inequality can directly affect population health have been highlighted:

The first mechanism: The absolute income hypothesis, where the latter states that the income of individuals can affect their health, as they enable them to obtain good nutrition and better health facilities. According to the absolute income hypothesis, the population health is not affected by the income distribution (Anwar, Hashmi, & Nasreen, 2017, p. 180).

The second mechanism: The relative income hypothesis, as this hypothesis states that the health of an individual is affected by his economic status in relation to others in a particular reference group rather than the absolute income of the individual (Mullahy, Robert, & Wolfe, 2002).

Therefore, if the incomes of all individuals in a group except one individual increase, the health of that individual is expected to decline. Thus, poorer individuals experience stress, loss of respect, distrust and shame when comparing themselves to their richer peers. These perceptions can translate into physical pain through biochemical responses to stress and anxiety or to unhealthy behavior such as smoking (Bergh & Nilsson, 2012).

The third mechanism: The psychosocial hypothesis, according to this hypothesis, income inequality can affect health through social comparisons that reduce social capital, since the low ranking of individuals in the hierarchy and social status creates stress and causes negative feelings such as shyness and mistrust, which lead to deterioration of health through neuroendocrine mechanisms and stress induced behaviors such as smoking, excessive alcohol consumption,… (Drabo, 2010).

Thus, when the income inequality is smaller, people are more trusting of each other and more likely to participate in community activities, and this social cohesion is associated with lower overall mortality and improved health (Shi, Macinko, Starfield, Xu, & Politzer, 2003).

The fourth mechanism: The neo materialism hypothesis. Proponents of this hypothesis claim that income inequality can affect health through its effect on the level and distribution of social resources (Liu, 2017, p. 12). Thus, poor health is the result of increasing income inequality which leads to lower public expenditure on provision of adequate health services to the poor (Anwar, Hashmi, & Nasreen, 2017, p. 181).

Keeping the above considerations in mind, the following research question can be formulated:

Does income inequality affect the people's health in middle and low income countries?

In general, this study was organized as follows: The first section dealt with an introduction and the second section discussed the most important previous studies that clarify the relationship between income inequality and health, in the third section the methodology used in this study was addressed, while the fourth and fifth sections dealt with the empirical results that obtained and interpretations of those results. Finally, we end with a conclusion.

2. Literature review

In recent years, and especially since the mid-1990s, a number of studies and commentaries have emerged that explore the relationship between general measures of income inequality and indicators of population health, among which we mention the following:

(Hajebi & Javad Razmi, 2014) presented a study entitled "Effect of Income Inequality on Health Status in a Selection of Middle and Low Income Countries" that aimed to highlight the relationship between income inequality and health in a sample of 65 low and middle income countries during the period (2000-2011), by estimating the fixed effects model. The results of the study revealed a negative relationship between income inequality and public health status.

By examining the impact of income distribution on population health with and without environmental indicators in 90 developing and developed countries during the period (1970-2000), (Drabo, 2010) showed that income inequality negatively affects health and that environmental quality is an important channel through which the income inequality affects population health.

(Odusanya & Akinlo, 2021) studied the interaction between income inequality and health using the System GMM estimators and concluded that income inequality is an important indicator of poor health conditions for 31 sub-Saharan African countries from 1995 to 2015.

In a survey of 91 developed and developing countries during the period (1975-2000), (Drabo, 2010) showed by using the system GMM estimator that income inequality negatively affects the population health, especially in developing countries and that this negative effect is mitigated through good institutions.

And in an article titled "Does rising income inequality affect mortality rates in advanced economies?" For researchers (Robeira, Grootendorst, Coyte, & Aguirregabiria, 2017), the results of estimating the relationship between income inequality and health indicators using the DOLS model showed that for every unit increase in income inequality, female mortality rates decreased by 0.032 units, while male mortality rates decreased by 0.067 units in a sample From 10 OECD countries during the period (1950-2008).

On the other hand, (Anwar, Hashmi, & Nasreen, 2017) presented another article that aims to analyze the consequences of environmental degradation and income inequality on the health status in 05 South Asian countries during the period (1980-2014). The results revealed the existence of cointegration relationship between the study variables through the use of the Pedroni cointegration technique and Johansen Fisher technique. Also, through the use of FMOLS methodology, it was found that environmental degradation and income inequality are detrimental to health in the long run.

(Szczepaniak & Geise, 2021) studied the relationship between different dimensions of well-being (material dimension, health dimension, educational dimension and environmental dimension) and income inequalities in a group of 08 Eastern European countries after joining the European Union during the period (2004-2018). By estimating the Panel ARDL model, it was shown that there is a one-way, short-run relationship that extends from income inequality to the health dimension.

(Blázquez-Fernández, Cantarero-Prieto, & Pascual, 2018) also studied the relationship between life expectancy at birth as an indicator of health and income inequality in 26 European countries over the period (1995-2014). The results of the study using standard panel data showed that income inequality does not significantly reduce health in developed societies such as European societies.

In another article entitled "Income inequality and population health: a panel data analysis on 21 developed countries", (Torre & Myrskylä, 2011) interpreted the impact of income inequality on mortality rates by sex and by age in 21 developed countries during the period (1975-2006) by estimating the fixed effect model. The results showed that an increase in income inequality increases mortality rates until the age of 15 years for both sexes, while that positive correlation disappears at the age of more than 15 years for women and continues until the age of 50 years for men.

Through the previous studies that we discussed, we note that the results have agreed in their entirety on the negative impact of income inequality on the population health despite the difference in the sample selected in each study, the difference in the method and techniques of estimation and the difference in the variables used, in addition to the data sources. What distinguished our study from the studies mentioned above is its focus on middle and low-income countries and its use of recent data from 2002 to 2018.

3. Estimation methodology, data and variables

3.1. Research methodology

In order to study the impact of income inequality on population health in a sample of middle and low income countries, static panel data analysis was used in this study. The uses of panel data were first introduced by F. Lazarsfeld in the 1940s in an analysis of public opinion using market research collected over time and the latter has been known to have extensive uses in social science research, life science research, economic research ,... (Andreß, 2017, p. 2).

Panel data can be defined as a set of repeated observations on the same set of cross-section over time, such that these units are individuals, companies, or any group of units that can be tracked over time (Wooldridge, 2009).

The use of panel data has many advantages over using only time series or cross-section data, which can be summarized as follows:

Panel data can control for individual heterogeneity which is necessary as it causes biased estimates (Fitrianto & Musakka, 2016).

Panel data provides much more data, which results in more efficient estimation (Aali-Bujari & Venegas-Martínez, 2016, p. 83), the latter also provides more variability and less collinearity among variables compared to the cross-section model or time-series data alone (Fitrianto & Musakka, 2016).

When using panel data, the problem of omitted variables that change over time is overcome, as they can be removed by taking the differences (Aali-Bujari & Venegas-Martínez, 2016, p. 83).

Panel data does not require very long time series, so that a model can be built accurately without relying on long time series, as the available data across individuals compensates for short time series (Sheytanova, 2015, p. 6).

In general, static panel models are divided into three basic models:

3.1.1. *Pooled regression model*

This type of model is also called the constant coefficients model, in which all coefficients are constant (intercepts and slopes) (Yaffee, 2003, p. 3). The pooled regression model is shown by the following formula:

$$Y_{it} = \beta_0 + \sum_{i=1}^{K} \beta X_{it} + \alpha_i + \varepsilon_{it}. \quad (1)$$

i=1,2,…,N t=1,2,…,T

where:

i: denotes the cross-section dimension.

t: denotes the time series dimension.

Y_{it}: dependent variable.

X_{it}: vector of observations of explanatory variables.

β_0 and β : estimated coefficients.

α_i: denotes the unobservable individual-specific effect.

ε_{it}: denotes the remainder disturbance.

3.1.2. Fixed regression model

In these models, it is assumed that the unobserved specific individual effect α_i is related to the independent variables; therefore this term can be added to the constant β_0 (Nassour, Meftah, & Mirani, 2020, p. 6).

So the formula for the new constant can be written as follows:

$$\beta_i = \beta_0 + \alpha_i. \quad (2)$$

Which means there is a fixed part in the new constant for all countries and a part that changes for each country, therefore in the fixed effects model, the slops for all countries are the same, while the constant is different for each country (Nassour, Meftah, & Mirani, 2020, p. 6).

The fixed effects model can be written as:

$$Y_{it} = \beta_i + \sum_{i=1}^{K} \beta_j X_{j(it)} + \varepsilon_{it} \quad (3)$$

i=1,2,...,N t=1,2,...,T

3.1.3. Random Effect model

The random effects model, unlike the fixed effects model, assumes that the country-specific effect is not correlated with the independent variables, and the country-specific effect is also assumed to be distributed randomly, and thus is combined with the error term (Nassour, Meftah, & Mirani, 2020, p. 6).

Therefore the new error term becomes:

$$\varepsilon_{it} = \alpha_i + \varepsilon_{it}. \quad (4)$$

The random effects model can be written as:

$$Y_{it} = \beta_0 + \sum_{i=1}^{K} \beta_j X_{j(it)} + \varepsilon_{it}. \quad (5)$$

i=1,2,…,N t=1,2,…, T

3.2. Data and variables

In order to study the impact of income inequality on population health in low and middle income countries, we selected a sample of 16 low- and middle-income countries for this study: Argentina, Armenia, Bolivia, Brazil, Costa Rica, Honduras, Indonesia, Panama, Peru, Paraguay, El Salvador, Thailand, Uruguay, Ukraine, Moldova and Turkey. The study

period spanned from 2002 to 2018 and the only criterion for selecting each country and study period was the availability of data obtained from the World Bank database.

As for the study variables, they were selected from a number of previous studies in this field such as: (Hajebi & Javad Razmi, 2014), (Shmueli, 2004), (Herzer & Nunnenkamp, 2011) and (Leitner, 2014). These variables are shown in the following table:

Table 1: Study variables

Variables	Variables description	Unit of measurement
LE	Life expectancy at birth	Years
GINI	Gini index	(0-100) where: 0: perfect equality, 100: absolute inequality
GDP	GDP per capita	constant 2010 US$)

Source: *Prepared by the author.*

**: We converted all data into the logarithmic formula to standarize the mesure unites.*

4. RESULTS

4.1. Estimation results

As the first step, we have tried to estimate the model coefficients using the Eviews 09 program and using a variety of estimation techniques, which are: the pooled regression model, the fixed effects model and the random effects model, so that the following table shows the estimation results:

Table *2*: *Estimation results of static panel data models*

Dependent variable: Life expectancy LOG(LE)			
Period: (2002-2018) T=17 N=16 Number of observations : 17*16=272			
Variables	Pooled regression model	Fixed effects model	Random effects model
LOG(GINI)	0.0179 [2.14]**	-0.0601 [−5.29]***	-0.0576 [−5.48]***
LOG(GDP)	0.0520 [18.10]***	0.0792 [16.98]***	0.0774 [18.21]***
Constant	3.7843 [107.99]***	3.8455 [52.87]***	3.8515 [58.68]***
R-Squared	0.5788	0.9442	0.6935
Adjusted R-Squared	0.5757	0.9405	0.6912
F-statistic	184.82	253.03	304.29
Prob(F-statistic)	0.0000	0.0000	0.0000

Source: *The author's calculations based on Eviews program 2009.*

[.]*: t-statistic*

****: indicate significance at the level 1%.*

***: indicate significance at the level 5%.*

**: indicate significance at the level 10%.*

Table 3 shows the estimation results of the static panel data models. The second column presents the output of the pooled regression model estimates, where both the GINI index coefficient and the GDP per capita coefficient appeared with a positive sign. It is also important to note that R2 equals 0.5788.

The third column presents the output of the fixed effect model estimates, where the coefficient of the GINI index appeared negative and significant, while the coefficient of GDP per capita appeared positive and significant. For the R2, it is equal to 0.9442.

From the output of the random effect model estimates shown in the fourth column, the coefficient of the GINI index also appeared negative and significant, while the coefficient of GDP per capita appeared with a positive sign and significant. For the R2, it is equal to 0.6935.

4.2. *Choosing the appropriate panel data model for the study*

4.2.1. Choosing between fixed effect model and pooled effect model

To choose between the pooled OLS model and the fixed-effects model, the F-test was used. The latter tests the hypothesis given below:

H0: The pooled OLS model is the appropriate model.

H1: The fixed effect model is the appropriate model.

The F-statistic value takes the following formula:

$$F = \left(\frac{R^2_{FEM} - R^2_{PEM} \big/ (N-1)}{1 - R^2_{FEM} \big/ ((N*T) - N - K)} \right). \quad (6)$$

Where:

R^2: Correlation coefficient

Therefore:

$$F = \frac{(0.9442 - 0.5788)/(16-1)}{(1-0.9442)/((16*17) - 16 - 2)}. \quad (7)$$

F=110.88

Where we compare the F statistic value with the F critical value:

$$F = (\alpha, N-1, ((N*T) - N - K) = F(0.05,15,254) = 1.71. \quad (8)$$

Since the F-statistic value is greater than F critical value, we reject the null hypothesis and accept the alternative hypothesis which states that the fixed effects model is the appropriate one.

4.2.2. Choosing between fixed effect model and pooled effect model

To choose between the fixed-effects model and the random-effects model, the hausman test will be used as shown in the following table:

Table 3: Hausman test results

Type of test	Chi-SQ Statistic	Prob
Hausman test	10.9450	0.0049

Source: *The author's calculations based on Eviews program 2009.*

By applying the Hausman test and using the Eviews 09 program, it was found that (P-value = 0.0042), therefore the null hypothesis is rejected and the alternative hypothesis is accepted, indicating that the fixed effects model is the appropriate model.

Accordingly, both F- test and hausman test showed that the fixed effects model is the appropriate model for this study.

5. Results interpretation

The results of the fixed effect model estimates, as the appropriate model for this study, indicate that there is a significant negative effect of GINI index on life expectancy at birth, which was consistent with economic theory and a set of previous empirical studies such as: (Hajebi & Javad Razmi, 2014), (Leitner, 2014), so that an increase in this indicator by one unit leads to a decrease in life expectancy by 0.0601 units. As this can be explained by the fact that high income inequality in low- and middle-income countries may lead to lower equality in access to essential resources, lower infrastructure investments, less financial support for families, lower social cohesion, less trust, which negatively affects life expectancy.

Also, rising income inequality in these countries may push parents to struggle more to improve their position in the social hierarchy, and thus may force parents to spend more time working rather than raising their children, which may negatively affect their children's health.

On the other hand, the results of the estimation showed a significant positive relationship between GDP per capita and life expectancy, which is consistent with economic theory and a set of previous empirical studies, as economic growth allows for an increase in public spending on health services, and thus leads to an improvement in healthcare.

6. Conclusion

In the presented study, an attempt was made to investigate the nature of the relationship between health and income inequality in a sample of low- and middle-income countries during the period 2002-2018. We first discussed the most important mechanisms through which income inequality affects the population health, then we presented the methodology used in the study, which is the static panel data models and we identified the variables used to estimate the model of this study. At the end of the research we concluded that there is a negative impact of income inequality on the population health.

Based on the results obtained, a number of recommendations can be made as follows:

Adopting reform policies aimed at raising living standards.

Decision makers should focus on providing educational facilities and healthcare to the disadvantaged groups in order to reduce the gap between the rich and poor classes.

Governments must implement a range of policies to address income inequality, especially progressive taxation as the most important tools of fiscal policy, because it enables the financing of government policies and programs needed to achieve equality and transfer resources to the poorest.

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