International Journal of Business and Society, Vol. 23 No. 3, 2022, 1499-1515

DEADLY INCOME INEQUALITY? A PANEL DATA ANALYSIS ON THE IMPACT OF INCOME INEQUALITY ON MENTAL DISORDER MORTALITY

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ABSTRACT

This study investigated the impact of income inequality on mental disorder mortality. The present study also sought to discover the role of institutional quality in moderating the income inequality-mental disorder mortality nexus. The analysis used panel system generalized method of moments (GMM) estimations on data from developed and developing countries from 1989 to 2018. The analysis findings indicated that income inequality positively impacted mental disorder mortality in the total sample and developed countries but was insignificant for developing countries. In addition, the income-inequality-mental disorder mortality nexus was contingent on institutional quality, indicating that better institutional quality could alleviate the effect of income inequality on mental health, especially in developed countries.

***Keywords**:* Income inequality, Mental Health, System GMM.

Received: 31 January 2020.
Accepted: 21 September 2022
https://doi.org/10.33736/ijbs.5178.2022

1. INTRODUCTION

The World Health Organisation (WHO) stated, "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity," indicating that mental health is an integral part of general health. Mental health is the basic fundamental that allows individuals to interact with each other, think, and, most importantly, live and enjoy life. On the other hand, Mental illness refers to suffering or morbidity due to; mental, neurological and substance use disorders. It is, however, not uncommon as it affects all levels of society and age groups. The WHO (2010, 2018[a], 2019) indicated that mental disorders were prevalent worldwide; statistically, one in every four people globally would be affected by mental or neurological disorders at some point in

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their lives, and around 450 million people currently suffer from such conditions. In addition, approximately 10% of the adult population worldwide are diagnosed with mental illness or behavioural disorder at any point in time, WHO (2018[b]). Thus, placing mental disorders among the leading causes of ill-health and disability worldwide.

On the other hand, the economic implications of increasing mental illness are significant, where lost productivity resulting from poor mental health was estimated to cost the world economy approximately US$2.5 trillion per year and was projected to rise to US$6 trillion by 2030, (The Lancet Global Health, 2020). Additionally, mental health disorders were reported to cost approximately Canadian dollars 50 billion a year in Canada (representing 2.8 per cent of the Canadian GDP), and in Spain, the total costs of mental illness were estimated at 7 million Euros in 2002 and were over 565 million Euros in 2013, (Olivia-Moreno et al., 2009; Pickett & Wilkinson, 2010). The World Economic Forum (Bloom et al., 2011) reported that the global cost of mental health conditions in 2010 was around US$2.5 trillion and was projected to surge to US$6.0 trillion by 2030. In addition, it was reported that over the period 2011 to 2030, the total loss of output due to mental health conditions is projected to be approximately US$47 trillion, which is US$2.35 trillion per year for the next 20 years. This outcome is equivalent to about 5 per cent of global GDP in 2010 (Jha et al., 2012).

Various perceptions and theories have sought to explain the causes of mental illness. During the early 20th century, some argued that mental illness was linked to family violence or problematic relationships between parents and their children (Huntsman, 2008). However, the perception has changed over time as more research has been conducted in this area. Today the most common view is that mental illness is caused by; biological factors, psychological factors or environmental stressors rather than by problematic relationships between family members solely (WHO, 2018[b]). Unlike biological and psychological factors, environmental factors are external stressors individuals deal with daily[a]. Hence, income inequality, which addresses the gap between the rich and the poor's income differences, has been correlated with a higher rate of health and social problems and may also be correlated with mental illness in this case (Pickett & Wilkinson. 2010).

This study examined the effect of income inequality on mental disorder mortality in 57 developed and developing countries. The present study also sought to discover the role of institutional quality in moderating the income inequality-mental disorder mortality nexus.[b] Since North (1991) introduced the concept of institutional quality, it has received great attention in the existing literature. According to North, institutional quality can be defined as the humanly devised constraints that provide structure for political, economic and social interactions. Institutional quality is important because it provides the incentive structure for an economy and shapes the direction of economic changes toward; growth, stagnation or decline. In addition, better institutional quality has been shown to promote job satisfaction. Specifically it demonstrated a positive effect on the attitude of health workers and increased the efficiency of health workers, which was beneficial to patients (Amporfu et al., 2013). This situation implies that institutional quality could be important in explaining mental health levels across countries. Thus, it is widely

[a] Environmental factors include; poor relationships with others, poverty, social expectations not being met, low self-esteem and substance abuse, (WHO, 2018).

[b]Taking bureaucratic quality as an example, lower bureaucratic quality enables bureaucrats to more effectively pursue personal agendas, thus, leading to the failure of policy implementation and resulting in higher levels of inequality, (Urbanos-Garrido & Lopez-Valcarcel, 2015).

believed that poor institutional quality is detrimental to the income inequality-mental disorder mortality nexus.

This study has contributed to the existing literature in two important aspects. First, this study used data from developed and developing countries, allowing policymakers to evaluate the impact of income inequality on mental disorder mortality across different economic groups. Second, this study incorporated the institutional quality variable as an interactive term in the multiplicative model to highlight the role of institutional quality in the income inequality-mental health nexus. The remainder of this paper is structured as follows: Section 2 reviews the existing literature concerning income inequality and mental health. Section 3 presents the empirical model used in the analysis and explains the estimation techniques. Section 4 discusses the empirical results and robustness checks. Section 5 provides the summary and conclusions.

2. LITERATURE REVIEW

Kahn et al. (2000) examined the association between income inequality and individual income by states on the mental and physical health of women with young children in the USA. The results suggested that high-income inequality led to an increased risk of poor mental and physical health and was most pronounced among those women with low incomes.[c] In addition, their analysis also indicated that high income inequality in states was associated with a 60% greater risk of depression symptoms and an 80% greater risk of fair or poor health among women with low household incomes. The empirical finding suggested that income inequality significantly worsened mental health. In contrast, based on the Kawachi and Kennedy (1997, 1999) conceptual model, Zimmerman and Bell (2006) concluded that the unemployment rate of a country was significantly correlated with depression, and although income inequality was a significant risk factor for reporting general health, it was, however, not associated with depression.[d]

Pickett et al. (2006) used the Pearson correlation analysis and found a strong positive linear association between income inequality and mental illness. In addition, they also suggested that socioeconomic disadvantages, such as; low education, unemployment and deprivation, also contributed to an increase in mental illness cases.[e] In contrast, the empirical finding of Huisman and Oldehinkel (2008) indicated that income inequality was negatively and significantly correlated with the self-inflicted injury mortality rate of all European countries, except for the ex-Soviet Union countries. As for the ex-Soviet Union countries in Europe (e.g. Hungary, Romania), a positive correlation was observed, where higher income inequality was associated with a higher self-inflicted injury mortality rate.[f]

In Wales and the United Kingdom, Fone et al. (2007) demonstrated that poor mental health was significantly associated with a high level of income deprivation and low social cohesion.[g] In

[c]Individual level data of year 1991 (1988 National maternal infant health survey) and state level income inequality from the 1990 US census.
[d]Data obtained from the year 2000 wave of national longitudinal survey of youth.
[e]Data obtained from the world mental health survey and the Gini coefficient from the World Bank Indicators.
[f]Data from 30 European countries obtain from the Wold Values Survey 2000.
[g]Multilevel analysis of population survey data on 10,653 adults aged 18-74 years nested within the 325 census enumeration districts in Caerphilly County Borough, Wales, UK.

addition, their empirical finding also suggested that income deprivation and social cohesion measured at the community level were potentially joint determinants of mental health. High social cohesion significantly modified the association between income deprivation and mental health. In Japan, the empirical finding of Inagaki (2010) suggested that the suicide rate and income inequality (Gini coefficients) were cointegrated at the order of one.[h] Their result, based on the dynamic ordinary least squares (OLS) and fully modified ordinary least squares (FMOLS) models, revealed that income inequality and the unemployment rate were positively and significantly correlated with the suicide rate in Japan over the period 1951-2007.

Layte (2012) utilised multilevel modelling and data from the European Quality of Life survey covering 30 countries. The study examined the relationship between mental and physical health and income distribution. The author claimed that the mechanisms through which income inequality influenced mental well-being varied depending on a country's wealth. The impact of income inequality has become more important in influencing mental well-being at higher levels of country wealth. Thus, the empirical evidence of Layte's research indicated that income inequality had a direct effect on individual health and mental well-being and an indirect effect through its destructive effects on social relationships and social capital. Since social capital was defined as a form of an institution by North (1991), thus, it was crucial to evaluate the role of formal institutions in the mental health-income inequality nexus.

3. METHODOLOGY

3.1. Empirical model

The empirical specification investigated the effect of income inequality on mental disorder mortality and examined the role of institutional quality in moderating the income inequality-mental disorder mortality nexus. Thus, the empirical model employed in the analysis was as follows:

$$MD_{it} = \alpha_0 + \beta_{1i} lnMD_{it-1} + \beta_{2i} lnIE_{it} + \beta_{3i} lnINST_{it} + \beta_{4i} lnRGDPC_{it} + \beta_{5i} lnUem_{it} + \beta_{6i} lnUb_{it} + \beta_{7i} lnINF_{it} + \mu_i + \eta_t + \varepsilon_{it} \quad (1)$$

Where *MD* represents mental disorder mortality, *IE* represents income inequality (Gini coefficient), *INST* is institutional quality, *RGDPC* is the real gross domestic product per capita, *Uem is* the unemployment rate, and *Ub* is urbanisation. In addition, the specification also contains an unobserved country-specific effect μ_i, time effect η_t and error term ε. The controlled variables included in the model were; unemployment, urbanisation and inflation. These variables were selected because high levels of urbanisation, inflation and the unemployment rate are associated with increased mental disorder mortality as the process of modernisation produces psychological stress for the poorer people in society (Modernization Theory).
This study included a dummy variable that interacted with developed and developing countries to differentiate the effect of income inequality on mental disorder mortality for different economic groups.

$$\ln MD_{it} = \alpha_0 + \beta_{1i} \ln MD_{it-1} + \beta_{2i} \ln IE_{it} + \beta_{3i} \ln INST_{it} + \beta_{4i} \ln RGDPC_{it} \quad (2)$$

[h]The cointegration test was based on the Durbin Hausman cointegration.

$$+\beta_{5i}\ln Uem_{it} + \beta_{6i}\ln Ub_{it} + \beta_{7i}lnINF_{it} + \beta_{8i}(lnIE_{it} * ED\ Dummy)_{it} + \mu_i + \eta_t + \varepsilon_{it}$$

ED is the dummy variable representing the economic group: developed and developing countries. Next, the institutional quality variable was included as an interactive term to observe its influence on the income inequality-mental disorder mortality nexus.

$$\ln MD_{it} = \alpha_0 + \beta_{1i}lnMD_{it-1} + \beta_{2i}lnIE_{it} + \beta_{3i}lnINST_{it} + \beta_{4i}(\ln IE_{it} * lnINST_{it}) + \beta_{5i}lnRGDPC_{it} + \beta_{6i}lnUem_{it} + \beta_{7i}lnUb_{it} + \beta_{8i}lnINF_{it} + \mu_i + \eta_t + \varepsilon_{it} \quad (3)$$

The dummy variable (ED Dummy) was included to highlight the economic group.

$$\ln MD_{it} = \alpha_0 + \beta_{1i}lnMD_{it-1} + \beta_{2i}lnIE_{it} + \beta_{3i}lnINST_{it} + \beta_{4i}(\ln IE_{it} * lnINST_{it}) + \beta_{5i}lnRGDPC_{it} + \beta_{6i}lnUem_{it} + \beta_{7i}lnUb_{it} + \beta_{8i}lnINF_{it} + \beta_{9i}(lnIE_{it} * ED\ Dummy)_{it} + \mu_i + + \eta_t + \varepsilon_{it} \quad (4)$$

Equations (1) and (2) provided the basis for the empirical models estimated in this study. Equations (3) and (4) highlighted the influence of the institutional quality variable on the income inequality-mental disorder mortality nexus. From Equations (3) and (4), the effect of institutional quality could be calculated by examining the partial derivatives of mental disorder mortality concerning income inequality:

$$\frac{\partial MD_{it}}{\partial IE_{it}} = \beta_2 + \beta_3 \ln (INST_{it}) \quad (5)$$

This study computed the standard error of the marginal effect as suggested by Brambor *et al.* (2006)[i] to assess whether the institutional quality variable had a significant effect on the income inequality-mental disorder mortality nexus,

3.2. Estimation method

The empirical approach used in this study was based on the dynamic panel GMM estimator suggested by Arellano and Bond (1991) and further developed by Arellano and Bover (1995)[j]. This estimator was selected because of the need to address country-specific effects and simultaneity bias. To explain its application concerning this study's data set, consider the baseline Equation (1). Arellano and Bond (1991) suggested transforming Equation (1) into a first-difference to remove the country-specific effect and using lagged levels of the regressors as instruments to eliminate simultaneity bias. However, several more recent papers have argued that this may lead to incorrect inferences if the explanatory variables are persistent (Arellano & Bover, 1995). Blundell and Bond

[i] For instance, in the case where the model is an interaction model as in Equation (3), the marginal effect is $\frac{\partial MD_{it}}{\partial IE_{it}} = \beta_1 + \beta_4 \ln (INST_{it})$. Using the covariance matrix, the standard error is computed as:

$$\hat{\sigma}_{\frac{\partial MD_{it}}{\partial IE_{it}}} = \sqrt{var(\widehat{\beta_2}) + INST^2 var(\widehat{\beta_3}) + 2INST cov(\widehat{\beta_2}\widehat{\beta_3})}$$

[j] Interested readers may refer to Azman-Saini *et al.*, [4] for a detailed explanation of the empirical application of the system GMM estimator.

(1998) proposed the system GMM estimator to overcome this problem, where the level and difference equations are combined. A level equation is achieved by utilising the lagged differences of the dependent variable as additional instruments. They illustrated that this modelling strategy could reduce the biases and imprecision linked to the difference estimator.

There are two variants of the GMM estimator: the one-step and two-step estimators. Theoretically, the two-step estimator is more efficient because it uses optimal weighting matrices. However, according to (Windmeijer, 2005), applying GMM estimators to a sample with small cross-section dimensions may lead to; biased standard errors, biased estimated parameters and a weakened over-identification test (Bowsher, 2002). Therefore, this study proposed to reduce the dimensionality of the instrumental variable matrix by restricting the moment conditions to a maximum of two lags on the dependent variables.

This research applied the two-step GMM estimator to examine the impact of income inequality on mental disorder mortality and to highlight the role of institutional quality on the income inequality-mental disorder mortality nexus. To ensure consistency, the GMM estimator was subject to two specification tests, the Sargan test for over-identifying restrictions and a serial correlation test in disturbances (Arellano & Bond, 1991). The instruments would be deemed valid, and the model correctly specified if the analysis failed to reject the null of the Sargan test. Likewise, for the serial correlation test, one should reject the null of the absence of the first-order serial correlation-AR (1) and not reject the absence of the second-order serial correlation -AR (2).

3.3. The Data

This study averaged the datasets into five-year averages from 1989 to 2018 to validate the use of the GMM estimator. Table 1 presents the list of countries that were investigated. This study utilised data on the mortality rate due to mental and behavioural disorders to represent mental disorder mortality, and the data was obtained from the WHO Mortality Database. The trend in income distribution disparity was portrayed by utilising the Gini Coefficient, a measure based on the Lorenz curve (Gini, 1912). These data were sourced from the Standardized World Income Inequality Database.

This study measured institutional quality using the political risk rating technique pioneered by Knack and Keefer (1995). The 12 weighted variables of the political risk rating, which cover both political and social attributes, are (1) Government Stability, (2) Socioeconomic Conditions, (3) Investment Profile, (4) Internal Conflict, (5) External Conflict, (6) Corruption, (7) Military in Politics, (8) Religious Tensions, (9) Law and Order, (10) Ethnic Tensions, (11) Democratic Accountability, and (12) Bureaucracy Quality. The data were taken from the International Country Risk Guide (ICRG). In each case where the risk point total was high, the higher the risk, and vice-versa.

Modernisation is important in explaining the level of mental disorders across countries. The Modernization Theory highlighted that high levels of urbanisation, inflation, and the unemployment rate due to modernisation produce psychological stress on society's poor. Thus, urbanisation, inflation and unemployment could be important variables to explain the level of the mental health rate across countries. The urbanisation, unemployment and inflation data used here were taken from the World Development Indicators (WDI), World Bank.

Table 1: Summary of the data set

Variable	Source	Unit of Measurement	Mean	SD	Min	Max
Mental Disorder Mortality	WHO Mortality Database	Rate per 100,000	28.50	16.19	1.00	56.00
Income inequality	SWIID	Percentile 0 - 100	34.72	8.56	18.34	52.02
Real Gross Domestic Product	World Development Indicators (WDI)	US Dollars (US$ 2005 Constant Prices)	18,584.92	17,284.91	709.73	82,102.35
Institutional Quality	International Country Risk Guide (ICRG)	Index 0-12	4.70	1.74	0.06	7.53
Urbanisation	WDI	Percentage	70.41	17.93	8.82	100
Unemployment	WDI	Percentage	8.05	4.25	0.98	26.96
Inflation	WDI	Percentage	71.61	392.91	2.01	4,739.91

Notes: List of countries: Argentina, Armenia, Australia, Austria, Belarus, Belgium, Brazil, Bulgaria, Canada, Chile, Colombia, Costa Rica, Cyprus, Czech Republic, Denmark, Ecuador, Egypt, El Salvador, Finland, France, Germany, Greece, Guatemala, Hong Kong, Hungary, Ireland, Israel, Italy, Japan, South Korea, Latvia, Luxembourg, Mexico, Netherland, New Zealand, Norway, Panama, Paraguay, Philippines, Poland, Portugal, Romania, Russia, Singapore, Slovakia, Spain, Sri Lanka, Sweden, Switzerland, Thailand, Trinidad and Tobago, Ukraine, United Kingdom, United States, Uruguay, Venezuela.

4. EMPIRICAL RESULTS

Table 2 presents Equations (1) and (2) empirical results using the dynamic panel System GMM approach. Model 1 highlights the estimation result of the full sample of countries. Whereas in Models (2) and (3), the economic development dummy variable was included to differentiate the effect of income inequality on mental disorder mortality between developed and developing economies.

As indicated in Table (2), the lagged dependent variable was statistically significant, which implied that the dynamic GMM was an appropriate estimator and that the empirical results could be relied upon for statistical inference. Additionally, the findings indicated that the income inequality indicator increased mental disorder mortality for the full sample of countries: Model (1) and developed countries: Model (2). Hence, the results obtained for Models (1) and (2) were in parallel with the World Health Organisation's (WHO, 2010) findings that environmental factors, which are the external stressors that individuals deal with in everyday life, were significantly correlated with mental disorder mortality. The insignificant results of income inequality in Model (3) were not surprising as previous studies have suggested that the impact of income inequality only becomes more important in influencing mental well-being at higher levels of country wealth (Layte, 2012).

In terms of other control variables, the empirical results demonstrated that the coefficients of the unemployment and inflation variables were positive and significant determinants of mental disorder mortality throughout all models. Hence, this finding paralleled the findings of Urbanos-

Garrido and Lopez-Valcarcel (2015) that mental health worsens with economic crises. On the other hand, the institutional quality variable was not a significant determinant of mental disorder mortality as the coefficient obtained failed to reject the null at a conventional significance level. In contrast, the real GDP per capita was not a significant determinant of mental disorder mortality for Models (1) and (2) but was statistically significant for Model (3). Lastly, the coefficient of the urbanisation variable was negative and a significant determinant of mental disorder mortality at conventional levels in Models (2) and (3). The negative and significant result of urbanisation in Models (2) and (3) was rather surprising as previous studies have suggested that a high level of urbanisation due to modernisation produces psychological stress on the poorer people in society. Overall, the estimated models in Table 2 were relatively well specified, with all three diagnostic statistics found to be satisfactory. The Sargan test did not reject the over-identification restrictions. In addition, the null hypothesis of the absence of first-order serial correlation-AR (1) was rejected, but the null hypothesis of the absence of second serial correlation-AR (2) was not.

Table 3 reports the estimated Equations (3) and (4), which examined the marginal effect of institutional quality on the income inequality-mental disorder mortality nexus. In the specification, a conditional hypothesis was introduced in the model. An interactive term for measuring the institutional quality factor on the income inequality-mental disorder mortality nexus was also included. The individual terms of income inequality and the institutional quality variable in the model were not interpreted as they do not capture the marginal effects of the institutional quality variable in the specification (Brambor et al., 2006). The empirical results indicated that the coefficient of inflation variable was positive and a statistically significant determinant of mental health throughout the three models: Models (4), (5) and (6).

In contrast, the coefficient of urbanisation was not a significant determinant of mental disorder mortality for Models (4) and (6) but was significantly associated with mental disorder mortality for Model (5). On the other hand, the coefficient of the real GDP per capita was not a significant determinant of mental disorder mortality throughout the three models. Lastly, the coefficient of unemployment was associated with higher mental disorder mortality for Models (4) and (6) but insignificant for Model (5). The finding suggested that the coefficient of unemployment variable obtained for Models (4) and (6) was in parallel with modernization theory: the unemployment rate due to modernisation produces psychological stress for poorer people.

The marginal effects in all models in Table 3 were evaluated at the institutional quality variable's, mean, medium and maximum values, based on the calculated standard errors (Brambor et al., 2006). As indicated in Table 3, the marginal effect of institutional quality was significantly associated with the income inequality-mental disorder mortality nexus. The empirical results indicated that income inequality's positive impact on mental disorder mortality was weakened at the mean and maximum levels of the institutional quality variable. Income inequality was associated with lower mental disorder mortality at a higher institutional quality level. This outcome was in line with Amporfu et al. (2013) findings that better institutional quality promoted job satisfaction and, hence, had a positive effect on the attitude of health workers and increased the efficiency of health workers, which was beneficial to patients.

Table 2: Results of the Dynamic Panel GMM Estimations

VARIABLES	Model (1) Full sample	Model (2) Developed countries	Model (3) Developing countries
Mental Disorder Mortality$_{it-1}$	1.068***	0.639***	0.568***
	(0.074)	(0.119)	(0.116)
Income Inequality$_{it}$	0.340*	-	-
	(0.188)		
Urbanisation$_{it}$	-0.101	-1.580***	-1.091*
	(0.895)	(0.587)	(0.640)
Unemployment$_{it}$	0.178*	0.222*	0.211*
	(0.107)	(0.121)	(0.113)
Inflation$_{it}$	0.085**	0.089***	0.082*
	(0.040)	(0.032)	(0.037)
Institutional Quality$_{it}$	-0.073	0.124	0.155
	(0.332)	(0.232)	(0.224)
Real GDP per Capita$_{it}$	0.289	-0.154	-0.259*
	(0.241)	(0.197)	(0.156)
Developed Countries		0.922***	
Dummy x Income Inequality		(0.218)	
Developing Countries			0.949
Dummy x Income Inequality			(0.516)
Constant	-4.246*	5.821**	8.082***
	(2.203)	(2.724)	(2.715)
Sargan test	9.781	7.164	7.479
	[0.281]	[0.519]	[0.486]
AR(1)	-2.433	-1.945	-1.836
	[0.015]**	[0.052]*	[0.066]*
AR(2)	0.892	1.241	1.478
	[0.373]	[0.215]	[0.139]
Observations	222	222	222
Number of Countries	56	56	56

Notes: Dependent Variable: Mental Disorder Mortality. All models were estimated using the Blundell and Bond (1998) dynamic panel system GMM estimations (Stata xtabond2 command). The standard errors are reported in parentheses, except for the Sargan test, AR(1) and AR(2), p-values. ***, ** and * indicate the significance at the 1%, 5% and 10% levels, respectively. Time dummies were included in the model specification, but the results have not been reported to save space.

Table 3: Results of the Dynamic Panel GMM estimations with the interaction between institutions and income inequality

VARIABLES	Model (4) Full sample	Model (5) Developed countries	Model (6) Developing countries
Mental Disorder Mortality$_{it-1}$	1.077***	0.700***	0.665***
	(0.078)	(0.120)	(0.130)
Income Inequality$_{it}$	0.007	0.068	0.042
	(0.278)	(0.267)	(0.267)
Urbanisation$_{it}$	-0.513	-1.342*	-0.980
	(0.903)	(0.715)	(0.729)
Unemployment$_{it}$	0.221*	0.206	0.210*
	(0.132)	(0.127)	(0.119)
Inflation$_{it}$	0.078*	0.074**	0.080***
	(0.042)	(0.032)	(0.030)
Institutional Quality$_{it}$	2.242	1.101	1.002
	(1.564)	(1.570)	(1.532)
Real GDP per Capita$_{it}$	0.347	-0.044	-0.089
	(0.252)	(0.222)	(0.226)
Income Inequality$_{it}$ X Institutional Quality$_{it}$	-0.664	-	-
	(0.416)		
Income Inequality$_{it}$ X Institutional Quality$_{it}$ X Developed		0.799***	
		(0.229)	
Income Inequality$_{it}$ X Institutional Quality$_{it}$ X Developing			0.077***
			(0.224)
Constant	-2.017	4.275	6.117
	(3.153)	(3.755)	(4.284)
Sargan Test	9.873	6.405	6.465
	[0.274]	[0.602]	[0.595]
AR(1)	-2.404	-1.985	-1.913
	[0.016]**	[0.047]**	[0.056]*
AR(2)	0.903	1.202	1.253
	[0.367]	[0.229]	[0.210]
Observations	222	222	222
Number of Countries	56	56	56
Marginal Effect			
Min	3.007	0.448	1.328
	(1.925)	(0.385)	(1.819)
Mean	0.373*	0.140*	0.436*
	(0.217)	(0.078)	(0.253)
Max	-0.006	0.062	0.098
	(0.284)	(0.085)	(0.210)

Notes: Dependent Variable: Mental Disorder Mortality. All models were estimated using the Blundell and Bond (1998) dynamic panel system GMM estimations (Stata xtabond2 command). The standard errors are reported in parentheses, except for the Sargan test, AR(1) and AR(2), p-values. ***, ** and * indicate the significance at the 1%, 5% and 10% levels, respectively. Time dummies were included in the model specification, but the results have not been reported to save space.

4.1. Robustness Checks

Table 4 presents the empirical results with an alternative source of income inequality data (source: Estimated Household Income Inequality Data Set (EHII), University of Texas). The Sargan test for over-identification failed to reject the null (p-value > 0.05). This outcome demonstrated that the instrumental variables were valid and highly informative. In addition, the second-order autocorrelation test (2) suggested that there was no second-order autocorrelation. Lastly, the coefficients of the lagged dependent variables were significant at the 1 per cent level.

The findings indicated that the income inequality indicator led to an increase in mental disorder mortality throughout all three models: Models (7), (8) and (9). This outcome implied that income inequality increased mental disorder mortality in all datasets (full sample data, developed and developing countries). Regarding other control variables, the urbanisation and real GDP per capita variables were insignificant throughout all models. On the other hand, the inflation variable was statistically significant for all models: Models (7), (8) and (9). In contrast, the coefficient obtained for the unemployment variable was significant at the conventional level for Model (8) but insignificant for Models (7) and (9). Lastly, the coefficient of the institutional quality variable was negative and statistically significant at the conventional level for Model (9) but insignificant for Models (7) and (8).

Table 4: Robustness Check using Alternative Income Inequality Data

VARIABLES	Full Sample Countries Model (7)	Developed Countries Model (8)	Developing Countries Model (9)
Mental Disorder Mortality$_{it-1}$	0.695***	0.538***	0.622***
	(0.0786)	(0.035)	(0.116)
Income Inequality$_{it}$	0.723**	1.845***	0.506*
	(0.292)	(0.431)	(0.263)
Urbanisation$_{it}$	-0.226	-0.599	-1.215
	(0.894)	(0.524)	(0.879)
Unemployment$_{it}$	0.208	0189**	0.023
	(0.154)	(0095)	(0.195)
Inflation$_{it}$	0.081**	0.969***	0.135***
	(0.039)	(0.110)	(0.037)
Real GDP Per Capita$_{it}$	0.325	0.222	-0.122
	(0.252)	(0.247)	(0.185)
Institutional Quality$_{it}$	-0.123	-0.101	-0.055*
	(0.345)	(0.269)	(0.032)
Constant	-5.570*	-3.842	3.775
	(3.084)	(3.832)	(4.082)
Sargan Test	9.080	10.037	9.017
	[0.336]	[0.262]	[0.341]
AR(1)	-2.406	-2.019	-1.897
	[0.016]**	[0.044]**	[0.058]*
AR(2)	0.835	1.084	0.482
	[0.404]	[0.278]	[0.630]
Observations	222	107	115
Number of countries	56	27	29

Notes: All models were estimated using the Blundell and Bond (1998) dynamic panel system GMM estimations (Stata xtabond2 command). The standard errors are reported in parentheses, except for the Sargan test, AR(1) and AR(2), p-

values. ***, ** and * indicate the significance at the 1%, 5% and 10% levels, respectively. Time dummies were included in the model specification, but the results have not been reported to save space.

Table 5 presents the empirical results of the robustness checks using all 12 weighted institutional quality variables to investigate what type of institutions matter and that the results remain robust with these changes. The findings highlighted the estimations with alternative measures of institutional quality in Equation (2). As indicated in Columns (1), (3), (4), (7), (9), (11) and (12), the coefficients obtained for government stability (GS), investment profile (IP), internal conflict (IC), the military in politics (MIP), law and order (LOA), democratic accountability (DC) and bureaucracy quality (BQ) were significant at the conventional level, whereas the remaining variables failed to reject the null. The findings implied that a decrease in the risk factors of; government stability, investment profile, internal conflict, the military in politics, law and order, democratic accountability and bureaucracy quality was likely to improve the mental health of the full sample countries datasets. The notations included in Table 5 are as follows: Mental Disorder Mortality (MDO), Income Inequality (IE), Urbanisation (UB), Unemployment (UEM), Inflation (INF), Real GDP per Capita (RGDP), Government Stability(GS), Socioeconomic Conditions (SC), Investment Profile (IP), Internal Conflict (IC), External Conflict (EC), Corruption (CORR), Military in Politics (MIP), Religious Tensions (RT), Law and Order (LO), Ethnic Tensions (ET), Democratic Accountability (DA), and Bureaucracy Quality (BQ).

Table 5: Robustness Check – Full Sample Countries with Different Institution Measures

Variables	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)	Model (8)	Model (9)	Model (10)	Model (11)	Model (12)
$L.lMDO_{it-1}$	0.612***	0.554***	0.611***	0.537**	0.602***	0.591***	0.657***	0.567***	0.582**	0.687***	0.555***	0.569***
	(0.215)	(0.191)	(0.173)	(0.218)	(0.223)	(0.210)	(0.236)	(0.199)	(0.244)	(0.217)	(0.195)	(0.189)
lIE_{it}	0.283*	0.276*	0.169	0.323*	0.274	0.326**	0.278	0.262	0.346**	0.282*	0.334**	0.367**
	(0.164)	(0.166)	(0.155)	(0.171)	(0.176)	(0.154)	(0.171)	(0.164)	(0.170)	(0.171)	(0.167)	(0.181)
lUB_{it}	-1.102**	-1.176**	-1.318**	-1.229**	-1.142**	-1.215**	-0.759	-1.167*	-1.314**	-1.325***	-1.040**	-0.960*
	(0.503)	(0.511)	(0.545)	(0.500)	(0.506)	(0.517)	(0.589)	(0.638)	(0.517)	(0.493)	(0.437)	(0.572)
$lUEM_{it}$	0.0934	0.212**	0.177*	0.223**	0.212**	0.217**	0.289***	0.197*	0.221**	0.221**	0.300***	0.201*
	(0.124)	(0.108)	(0.101)	(0.104)	(0.106)	(0.105)	(0.107)	(0.106)	(0.106)	(0.105)	(0.101)	(0.105)
$lINF_{it}$	0.111***	0.135***	0.106***	0.128***	0.138***	0.145***	0.139***	0.135***	0.132***	0.122***	0.120***	0.130***
	(0.0342)	(0.0336)	(0.0363)	(0.0322)	(0.0345)	(0.0361)	(0.0313)	(0.0283)	(0.0327)	(0.0329)	(0.0329)	(0.0329)
$lRGDPC_{it}$	0.321**	0.272*	0.534***	0.319**	0.277**	0.251*	0.303**	0.258**	0.313**	0.271**	0.504***	0.373***
	(0.125)	(0.160)	(0.126)	(0.128)	(0.136)	(0.142)	(0.134)	(0.125)	(0.127)	(0.133)	(0.131)	(0.132)
lGS_{it}	-0.292*											
	(0.161)											
lSC_{it}		0.0208										
		(0.179)										
lIP_{it}			-0.294**									
			(0.130)									
IC_{it}				-0.207**								
				(0.105)								
lEC_{it}					0.0209							
					(0.385)							
$lCORR_{it}$						-0.147						
						(0.132)						
$lMIP_{it}$							-0.525***					
							(0.149)					
$lRIP_{it}$								0.0484				
								(0.339)				
$lLOA_{it}$									-0.311**			
									(0.145)			
lET_{it}										-0.152		
										(0.141)		
lDA_{it}											-0.738***	
											(0.205)	
lBQ_{it}												-0.316*
												(0.171)
Constant	0.718	0.633	0.0250	0.754	0.442	1.013	-0.781	0.778	0.978	1.536	-1.262	-1.079
	(2.384)	(2.407)	(2.512)	(2.368)	(2.404)	(2.488)	(2.446)	(3.028)	(2.446)	(2.306)	(2.116)	(2.611)
Sargan Test	10.588 [0.226]	13.057 [0.110]	10.238 [0.249]	12.609 [0.126]	12.817 [0.118]	10.925 [0.211]	10.975 [0.203]	12.259 [0.142]	11.591 [0.185]	13.204 [0.105]	8.975 [0.344]	12.222 [0.142]

Table 5: continued

AR(1)	-2.442 [0.015]**	-2.428 [0.015]**	-2.355 [0.019]**	-2.522 [0.012]**	-2.386 [0.017]**	-2.444 [0.015]**	-2.463 [0.014]**	-2.424 [0.015]**	-2.568 [0.011]**	-2.513 [0.012]**	-2.235 [0.025]**	-2.443 [0.015]**
AR(2)	1.037 [0.300]	0.986 [0.324]	1.150 [0.250]	0.873 [0.383]	0.991 [0.322]	0.861 [0.390]	1.134 [0.257]	1.013 [0.311]	0.829 [0.407]	0.969 [0.332]	0.793 [0.428]	1.172 [0.241]

Notes: Standard errors are shown in parentheses ( ), Probability > z are shown in Parenthesis [ ]. ***, ** and * indicate the significance at the 1%, 5% and 10% levels, respectively.

5. CONCLUSION

This paper investigated the impact of income inequality on mental disorder mortality for the full sample and developed and developing countries datasets. The results have contributed to the unresolved question of the significance of income distribution disparities on mental health and provide new information on the impact of institutional quality on the income inequality-mental disorder mortality nexus. Based on the empirical evidence obtained from the system GMM estimator, the empirical results suggested that income inequality increased mental disorder mortality in the overall sample and developed countries but was insignificant for developing countries. Hence, the findings acknowledged that for all developed countries, the daily external stressors individuals deal with were significantly correlated with mental disorder mortality (WHO, 2010).

In addition, the inflation and unemployment variables were found to be positively and significantly associated with mental disorder mortality, thus, suggesting that an increase in the unemployment rate and inflation was likely to cause external stressors that lead to mental disorder mortality. Moreover, the developing countries' dataset's real GDP per capita was inversely correlated with mental disorder mortality. This situation suggested that, for developing countries, a higher real GDP per capita was associated with a lower level of mental disorder mortality. Surprisingly, the institutional quality variable was not a significant determinant of mental disorder mortality, thus, suggesting that institutional quality had no direct effect on mental disorder mortality.

Lastly, the results obtained from the marginal effect revealed that institutional quality had a curative effect on the income inequality-mental disorder mortality nexus when the institutional quality level had attained a higher level than the minimum level. The empirical results suggested that further improvement of institutional quality above the minimum level decreased the impact of the income inequality-mental disorder mortality nexus. Thus, indicating that the institutional quality variable was an effective tool to combat mental disorder mortality.

In summary, the empirical results indicated that an increase in income inequality was likely to produce psychological stress and deteriorating mental health. As a result, redistribution of income to reduce the income gaps between the poor and the rich would be desirable. Policymakers could consider options including; tax reductions, coupons for essential goods, housing subsidies, welfare, and unemployment benefits for the poor. Additionally, an incentive plan, such as quality performance bonuses, should be put forward by policymakers to stimulate higher institutional quality. Lastly, public service announcements, counselling units within the economic planning unit, and mental health warnings on conventional and social media should be promoted to reach out to those in need.

Funding: This publication is partially funded by the Faculty of Business and Economics, Universiti Malaya Special Publication Fund.

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