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Impact of Unemployment and Income Inequality on Life Expectancies of Male and Female in Selected Asian Countries

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ABSTRACT

Unemployment and income inequality are the significant determinants of life expectancy. Unemployment and income inequality are preventable occurrences to address the health consequences. This study evaluates the influence of unemployment and income inequality on male and female life expectancies in case of seven selected Asian countries. For analysis, annual panel data is obtained from the World Development Indicators (WDI) and Standardized World Income Inequality Database (SWIID) for the period from 2001to 2020. On the basis of Hausman test, the random effect model is utilized for estimation. The results show that unemployment and income inequality have significant negative effect on the life expectancies of male and female in these countries. Based on the findings of the study, policymakers should prioritize combating unemployment and income inequality to mitigate harmful impact on health outcomes (life expectancy) in these selected Asian countries. Policymakers can recommend reducing unemployment and income inequality to improve the health outcomes (life expectancy) in Asian countries.

Keywords: Unemployment, Income inequality, Life expectancy, Random effect model, Asian countries.

1 Introduction

The Sustainable Development Goals (SDGs) prioritize the achievement of a healthy life for all, with a special focus on health as a goal three. It aims to promote the well-being of people of all ages and ensure they lead healthy lives. The SDGs inspire us to strive towards achieving our health goals and work towards creating a healthier world for all. (United Nations, 2022). Health is a fundamental component of a country's economic growth (Ahmad et al., 2023). Keeping in view the importance of health, governments across the globe are committed to providing improved health and health care related services to its citizens.

The foundational and crucial elements of economic growth in every nation are housing, income, health, and education. Since the Human Development Index (HDI) is an extent of human progress, every nation aspires to raise it. There are three indexes in it: income, health, and education. Every nation strives to advance and raise its level of living. The Human Development Report (2024) of the United Nations Development Programme (UNDP) explains global challenges including climate change, inequality and technological disruption. It stresses the need for inclusive policies to state the wide disparities in education, healthcare, and digital access. The report urges governments to prioritize the social protection, green transitions, and fair opportunities for all individuals.

Experiencing unemployment can lead to adverse health outcomes. People who are unemployed often report feeling depressed, anxious, and demoralized, along with having low self-esteem and worries. They may also experience physical pain. Unemployed individuals are more likely to suffer from stress-related illnesses like heart outbreak, heart infection, high blood pressure and arthritis. Furthermore, events such as downsizing or workplace closure, perceived job insecurity, and underemployment can also have an influence on health (Avendano & Berkman, 2014). Unemployment can negatively impact health not merely at the time of employment loss but also over an extended period. Previous studies have shown this relationship for various phases of self-reported mental and corporeal health, along with miserable symptoms (Norstrom et al., 2019).

The innovative incomes are linked with the better state of health. Numerous studies have demonstrated this relationship (Deaton & Case, 2021; Braveman et al., 2022). These studies indicate that individuals with high income levels incline to have enhanced access to healthcare, healthier lifestyles, and longer life expectancies. This association is generally causal, as better health is caused by higher wealth. The amount and distribution of income and poverty, are well-recognized causes of health inequalities among communities. The products and services that individuals purchase directly bearing on their health since they may either expand or worsen it. In addition, it disturbs an extensive range of elements, such as social standing and one's talent to control unplanned conditions that ultimately affect health.

Income inequality, as well as other associated societal inequities, may be directly harmful to individual health (Deaton, 2003). Health is one and only of the most major aspects of well-being, and feels that health disparities are one of the world's biggest injustices today (Deaton, 2003). Redistribution of income from wealthy people to the deprived, within or across countries, will increase the wellbeing of the population (Preston, 1975).

The unequal distribution of income has an effect on the wellbeing of people in advanced as well as developing nations (Wilkinson, 1992). Preston (1975) observed that an upswing in per capita income and economic equality is significantly correlated to an increase in life expectancy among deprived nations; though, the association flattens off and is less or even not present between most prosperous countries. This association is denoted as the Preston curve, which claims that republics with more equal income distributions have a greater ordinary lifetime. Deaton (2003) investigated a connection between inequality in income and mortality rate in developed countries and discovered no link. For urban Canada and the United States, Ross et al. (2000) find an encouraging and substantial association among income inequality and death.

The objective of the study is to estimate the impact of unemployment and income inequality on life expectancies of male and female in the selected Asian countries. Many studies explore the determinants of life expectancy in different regions of the globe. However, this study is unique to find determinants of life expectancies of male and female separately in selected Asian countries. Further, this suggests an effective economic policy to overcome the problem of unemployment and income inequality in Asian region to improving the life expectancies of male and female.

2 Literature Review

Norstrom et al. (2019) explored how joblessness affects the health related quality of life of Swedish individuals and how these possessions vary by educational attainment, married status, prior health, and sexual category in the population. A survey was given to 2500 randomly chosen people in Sweden, ages 20 to 64, as a component of a cross sectional study conducted in 2016. 967 people (39%) responded to the survey. 724 of the respondents had jobs, compared to 113 who did not. The score for those who were jobless compared to those who were working was lower, which is statistically significant. Additionally, there were statistically significant increases in issues related to anxiety/depression and unemployment more. Grouped analyses revealed that being jobless had a worse fitness impact on males, wedded people, and young people. The analysis demonstrated that the health penalties of unemployment are expected to be significant, with our estimated effect indicating a nearly 10% decline in health as equated to work. It highlights the need to identify those for whom unemployment has the most detrimental impacts, thereby identifying populations that require labor market interventions the most.

Masters et al. (2024) analysed the changes in life expectancy in the United States (US) from 2019 to 2021. The study comprised upon the all inhabitants with five racial/traditional groups of USA, along with more 20 extraordinary income countries to compare with USA. In the case of the US residents, they also examined changes in life span and the number of Coronavirus Disease 2019 (COVID-19) death. Life expectancy declines in the US in 2020 and 2021 were more significant than the nasty variations in peer countries, which saw a reduction of 0.39

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years and an increase of 0.23 years, respectively. In contrast, the losses in 2021 were the largest for the Silver population, while life expectancy in the American and Black populations stayed much inferior. The disease had a supplementary severe impact on the US population than on its noble countries and unreasonably affected grownups. The penalties on mortality excavated the US's shortcoming in longevity, which was already rising for decades, and worsened existing racial disparities in US death.

Tarkiainen et al. (2024) conducted a study using individual-level total population registers to determine the impact of smoking on humanity. They analyzed changes in allotted span and lifespan difference by income quintile from 1997-2020 and identified the reason of death groups responsible for these changes. The study found that between 2015 and 2020, there was arise in the disparity of life expectancy and lifespan difference by income, mainly due to inactivity of these measures. In 2018-2020, alcohol and smoking contributed to approximately 40% of the life expectancy gap. After a period of progress in reducing disparities in life expectancy and lifespan variations, the disparities in income groups are unfortunately rising once again. The widening gap in life expectancy and stagnation in death on the lowermost earning levels are not simply due to deaths related to liquor and smoking, but are broad and originate from most foundation of death groups.

Polcyn et al. (2023) analyzed the impact of health spending, energy ingesting, CO2 emissions, size of population, and income on the health outcomes of 46 Asian homelands from 1997 to 2019. In order to account for the close ties between these countries due to trade, tourism, faith, and international contracts, the study employed Cross-Sectionally Augmented Autoregressive Distributive Lag (CS-ARDL) model, was used. The results revealed that greater energy use and expenditure on health levels enhance health outcomes. The study found that CO2 emissions are harmful to human health. The CS-ARDL methods showed that the influence of population size harms health outcomes. The study concluded that healthcare spending is the key factor influencing life span in Asian countries.

Life expectancy (LE) is the most important factor to consider when examining population health in the modern world. Nandi et al. (2023) examined the effect of socioeconomic aspects on life expectancy in Bangladesh. The predictor variables used in this study include the unemployment rate, population growth rate, gross national income (GNI), age dependency ratio, and level of employment. Although bivariate investigation indicated that employment rate, GNI, and age dependency ratio are strongly associated with life expectancy, univariate investigation revealed that all factors are connected to LE. Additionally, the age dependence ratio peaked in 1991 at 81.52%, while the dependent variable LE peaked in 2019 at 72.59 years. The rates of employment, GNI, and LE have all been seen to increase together throughout time. There is an adverse correlation between the age dependence ratio and LE as compared to other highly advanced countries. To increase life expectancy, Bangladesh's GNI must expand more quickly than other important elements. For the SDGs, particularly the third target, we have projected factors that are strongly associated with LE through 2030.

Barbalat and Franck (2020) considered how various social determinants affect mental health differently or in the same way and whether their impacts on mental health are connected to one another or not. Organization for Economic Cooperation and Development (OECD) country-level analysis Databases from the OECD and UNDP were used to gather information on social indicators. Examined the relative effects of social inequality, unemployment rate, and HDI on the occurrence of 10 mental health illnesses. The impacts of socioeconomic determinants on mental health were then compared using a Pearson's correlation test and principal component analysis. Each socioeconomic component had a high overall effect on mental health issues. Though, the effect of social influences on cerebral health varied depending on the mental illness. Second, the impacts of socioeconomic determinants on mental health were found to be highly interdependent.

Urbanization, income disparity, and health payments are crucial aspects that impact life expectancy. Ahmad et al. (2023) evaluated the influence of urbanization and income inequality on the life expectancy of both males and females in six selected South Asian countries, with panel data from 1997 to 2021. The random effect model was used for estimation. The study used life expectancy for males and females as the response variables, urbanization and income disparity as explanatory variables, and health spending as a control variable. The outcomes indicated that urbanization, income disparity, and spending on health significantly affect life expectancy.

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Urbanization and income disparity in both situations reduces life expectancy, although health expenditures increases it. The results of the study are robust, and policymakers can use them to suggest solutions for problems related to urbanization.

McFarland et al. (2023) investigated the relationship between income difference and life expectancy over time in U.S. from 2000-2014. States with liberal policy tend to control the economy, reallocate income, and protect susceptible groups, while penalizing deviant social behavior less. According to results, policy liberalism and life expectancy are negatively linked to income inequality. This outcome demonstrates that states like California and New York, which have liberal policy contexts, can have high life expectancies and high income differences.

He et al. (2021) found that income inequality is the most visible manifestations of the world economy's imbalanced development and has negative impact on health. For the purpose of empirical data analysis, the 2018 China Domestic Panel Database was used. Income inequality was measured by Kakwani index, and societal capital was divided into cognitive and structural forms. Results demonstrated that income inequality negatively affects health, as well as indirectly through social capital. There are also geographic, urban rural, and gender inequalities in the penalties of income inequality. Therefore, poor countryside areas and female groups need extraordinary consideration when developing special policies.

De Cao et al. (2022) investigated the influence of in-utero economic variations on natal outcomes by taking advantage of the geographical disparity in the joblessness rate across residential regions in England and associating siblings born to the similar mother from 2003 to 2012. We investigated the influence of idleness on birth outcomes, including birth weight, fetal growth, and stillbirth. We discover that health is often highly pro-cyclical, with downturns increasing the likelihood of having a stillbirth or unimportant for gestational age infant as well as a drop in birthweight and fetal development. But not all people experience the same effects: newborns born in places with average to low socioeconomic status suffer the most from unemployment, whereas the converse is true for babies born in areas with the highest socioeconomic status. The findings are driven by parental alcohol intake, and first pre-birth care examination, all of which are paired with family income loss. While various mothers hazardous behaviors may explain the disparities in outcomes.

3 Data and Methodology

This study rigorously analyzed balanced panel data to determine the effects of unemployment and income inequality on life expectancies of male and female in the selected Asian countries. The dataset utilized in this study spans from 2001 to 2020, with yearly data collected over a span of 20 years. The study focuses on seven countries including Bangladesh, China, India, Indonesia, Japan, Pakistan, and Turkey, with a total of 140 observations. The data is derived from reliable and authoritative sources such as the World Development Indicators (WDI) and Standardized World Income Inequality Database (SWIID).

The selection of the seven Asian countries Pakistan, China, India, Indonesia, Turkey, Bangladesh, and Japan was made to ensure a diverse representation of economic, social, and political conditions within Asia. These countries are chosen because they cover a wide spectrum of income inequality and life expectancy, which are central to the study. Pakistan, Bangladesh, and India, representing South Asia, are characterized by high levels of income inequality and have significant public health challenges. China and Indonesia, as rapidly developing economies, provide insight into the effects of transitioning from low to middle-income status, with dynamic labor markets and growing concerns about unemployment and health disparities. Japan, as an advanced economy with lower inequality serves as a contrasting case for comparison. Turkey, positioned at the crossroads of Europe and Asia, offers a unique economic profile that adds value to understanding the broader Asian context. Together, these countries offer a comprehensive sample to analyze the relationship between income inequality and life expectancy, reflecting the regional variations within Asia and offering insights that can be applicable to other parts of the continent.

3.1 Variables of the Study

Life expectancy is a fundamental indicator of the population health, reflecting the average lifespan an individual can anticipate given prevailing mortality rates. Life expectancies of male and female are the two

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dependent variables in two different econometric models in this study because it encapsulates the cumulative effects of various health determinants, including healthcare access, environmental factors, and lifestyle choices. It offers a measure of the public health status and helps to gauge the effectiveness of health policies. The life expectancies of male and female are the dependent variable in this study.

Life expectancy for males is the average lifespan a male newborn is expected to live under current death rates. This measure helps to identify specific health issues and risks that are prevalent among men, contributing to gender-specific health interventions. Life expectancy for female indicates the average number of years a female new born is expected to live based on existing mortality rates. This category highlights the health challenges and advantages unique to women, facilitating targeted health strategies to address their specific needs.

Unemployment is the state of being without a job while actively seeking employment. As per the standard definition, individuals who are unemployed are those who have been seeking job in the past, are presently available for work, and do not have a job. This includes individuals who have either been laid off or resigned voluntarily. Furthermore, individuals who have not been actively searching for employment however has made arrangements for an upcoming job are also classified as unemployed. Nevertheless, some degree of unemployment is inescapable as employers search for the right employees while workers explore better job prospects, resulting in some workers being temporarily out of work. The data on health expenditures was taken from the World Development Indicators (WDI) database, a reputable and comprehensive resource that provides standardized data across countries. The health expenditures are measured in current US dollars, which reflects the total amount spent on health services. Estimates of present health expenditures comprise healthcare goods and services utilized during each year.

The explanatory (independent) variables of this study are: unemployment and income inequality; whereas the health expenditure is taken as the control variable. The more explanation about these variables is given here. Income inequality is quantified utilizing the Gini coefficient, a standard measure of inequality. Gini coefficient is used in several studies, such as Gronqvist et al. (2012). This measure is an indicator of income inequality and ranges from zero to one, with zero representing a completely equal income distribution, while one indicating a fully unequal distribution of income. Herzer and Nunnenkamp (2015) have utilized the Gini coefficient scale ranging from zero to 100 to measure income inequality. According to their study, a Gini coefficient of zero corresponds to an equal income distribution, while a coefficient of 100 represents a completely uneven allocation of income. The Gini coefficient is a crucial tool for assessing income distribution and can provide visions into the level of inequality within inhabitants. This study also employs the Gini coefficient scale ranging from zero to 100 to measure income inequality. The Gini coefficient is computed using the Lorenz curve, which graphs the cumulative income of population against the cumulative number of earners. Data for the Gini coefficient is sourced from the Standardized World Income Inequality Database (SWIID) ensuring a reliable and consistent measure.

Higher health expenditures often correlate with better access to healthcare services, advanced medical technologies, and higher quality of care, which can significantly improve health outcomes. Conversely, lower health expenditures might indicate limited access to necessary healthcare services, poorer quality of care, and insufficient health infrastructure, leading to poorer health outcomes. The explanation of these variables is provided below in table 1.

Table 1: Variables Description and Data Sources

Notation	Variables	Description	Data Sources
Lem	Life expectancy, male	Male life expectancy at birth in years	WDI
Lef	Life expectancy, female	Female life expectancy at birth in years	WDI
Gico	Income Inequality	Gini coefficient based on disposable income of households.	SWIID
Une	Unemployment	Unemployment % of total labor force	WDI
He	Health Expenditures	Current per capita health expenditure, measured in current US$.	WDI

Note. World Development Indicators (WDI), Standardize World Income Inequality Database (SWIID).

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3.2 Model Specification

We specified and estimated the following two single equation econometric models.

$$Lemit = \beta_o it + \beta_1 Gicoit + \beta_2 Uneit + \beta_3 \, Heit + \mu it \quad (1)$$

$$Lefit = \beta_o it + \beta_1 Gicoit + \beta_2 Uneit + \beta_3 \, Heit + \mu it \quad (2)$$

Where subscript i refer cross sections and subscript t is time period. Let_{it} is life expectency total, Lemit is Life Expectency Male and Lefit Life Expectency Female, $Gico_{it}$ is Gini Coefficient, Une_{it} is the Unemployment; He_{it} is Health Expenditures and u_{it} is an error term.

Fixed effect (FE) and random effect (RE) models are two frequently employed models. The selection between them depends on the number of cross sections and time span present in dataset. When the cross sections and time periods are less than or equal to 25, then either FE or RE model can be employed. In our case, we have 7 cross-sections and 20 time periods, which justifies the use of either of these models. To understand the mathematical aspect of FE or RE models, let's consider the regression model as shown, $Yit = \alpha it + \beta Xit + \mu it$. Here, i represents the nations, and t represents the time span. Whereas, Yit represents Life Expectancy, αi is the individual intercept for each country, and β = coefficient for a given country. This coefficient indicates the change in life expectancy resulting from a unit change in the predictor variable.

If we transform the model into the log form it demonstrates the common effects across countries while accounting for heterogeneity. Xit represents the collection of explanatory variables. Now, let's assume that, $uit = \mu i + \lambda t + vit$ Here, μi represents Individual differences which is heterogeneity, λt represents unobserved time heterogeneity, and vit represents the stochastic error term. These help to clarify whether the components are assumed to be fixed or random. Based on this assumption, we decided to use fixed effects and random effects models. This type of technique was already used by (Tafran et al., 2020; Ahmad et al., 2023).

3.3 Panel Data Analysis

Panel data is a collection of data from multiple entities with continual measurements taken over different time intervals. This type of pooled data is unique as it captures the same entities over time. Longitudinal data may contain individual effects, temporal effects, or both. RE FE models are used to analyze these effects. Primary advantage of panel data is its ability to address issues related to heterogeneity and collinearity. In this study, we aim to investigate health outcomes in seven selected Asian countries including Bangladesh, China, India, Indonesia, Japan, Pakistan, and Turkey, over 20 year period (2001-2020), and therefore, used panel data analysis.

Panel data is often preferred due to several causes. Initially, it controls for heterogeneity, which is overlooked by cross section and time series data and can lead to biased outcomes. Also it provides more precise and efficient estimates due to the additional information, degrees of freedom, and sample variance it offers. Another advantage of panel data is the lower correlation between variables. Lastly, panel data allows for a better analysis of the adjustment of macroeconomic variables, such as unemployment and poverty dynamics, as it contains data of the same entity across different point of time.

Panel data sets offer more detailed information and degrees of freedom, allowing for more accurate implication and prediction of parameters. Additionally, it includes information on entity uniqueness and intertemporal dynamics, which helps address variable omission bias and unobserved effects that can lead to incorrect conclusions. Panel data analysis takes these effects into account, unlike cross-sectional data, which cannot recognize and quantify unobservable effects, and time series data, which also suffer from this limitation. Moreover, panel data addresses potential heteroskedasticity issues resulting from data variations between nations (Greene, 2008).

3.4 Fixed Effect Model

According to this model, a country's effect is considered to be constant and not influenced by explanatory variables. This model also takes into account the unique, time invariant characteristics of each country. As every country is distinct, their error term and constant are uncorrelated with those of the other. The two models utilized in this approach are the Least Squares Dummy Variable model and the Within-groups regression model. The least squares dummy variable method requires a plethora of dummy variables for the cross sections and time to accurately capture variance in slope and intercept. However, this technique is not ideal and results in a loss of

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degree of freedom. Instead, it is best to estimate FE model by not using dummy variables. To convert the equation into deviation form, we can use the Q transformation method (Baltagi, 2005). This involves subtracting the mean values from the equation. The fixed effect model is widely used in various studies, such as (Afzal et al., 2013; Ahmad et al., 2023). FE model approach can help mitigate the bias of omitted variables in measuring the impact of unobserved time and country.

3.5 Random Effect Model

The random effect model involves the individual influence of a country being a random variable that is not linked to independent variables in the model. This model assumes that the change of individual effects remains persistent. For the estimation of random effect model, one can use Generalized Least Squares (GLS) or Feasible Generalized Least Squares (FGLS), depending on the shape of the error. According to Judge et al. (1988), random effect estimators are more efficient when there is a large number of entities (N) and a small number of time periods (T), and when the assumptions of the random effect model hold true.

3.6 Hausman Test

The Hausman test is a statistical test commonly employed in empirical research to differentiate the most suitable model that best fits the data between Fixed Effects Model (FEM) and Random Effects Model (REM). The test is based on two hypotheses,
H_0: REM is more suitable
H_1: FEM is more suitable
A Hausman test result is straightforward to explain if the p-value below 0.05 it suggest rejecting the null hypothesis, otherwise do not reject H_0.

4 Results and Discussion

4.1 Descriptive Analysis

Table 2 presents the summary statistics, including the quantity of observations, average, standard deviation, smallest, and extreme values. There are 20 years of annual data available for seven nations, making a total of 140 observations.

Table 2: Summary Statistics

Variables	Obs	Mean	Std. Dev.	Min	Max
Lem	140	69.652	5.532	61.172	81.561
Lef	140	74.241	6.772	63.574	87.711
Gico	140	38.772	5.215	29.701	47.501
Une	140	5.5531	2.856	0.4001	13.671
He	140	648.030	1298.1	8.416	5235.3

Note. Author's Own Estimation

The table shows that the mean life expectancy of male is 69.65 years whereas the lifespan of female is 74.24 years with standard deviation 5.53, and 6.77 respectively. The extreme value of life expectancy for males is 81.56 years, and the smallest value is 61.17 years. For females, the maximum is 87.71 years, and the minimum is 63.57 years. In terms of statistical measures, income inequality has an average value of 38.77 along with standard deviation of 5.21. Unemployment, alternatively, has average value of 5.55. Lastly, per capita health expenditures have an average value of 648.03 dollars, but with a substantial standard deviation of 1298.1.

4.2 Correlation Matrix

The correlation of life expectancies of male and female with the independent variables is explained in table 3 and table 4.

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Table 3: Correlation Matrix for Life Expectancy Male

Variables	Lem	Gico	Une	He
Lem	1.000			
Gico	-0.298	1.000		
Une	0.090	0.465	1.000	
He	0.796	-0.527	-0.167	1.000

Note. Author's Own Estimation

Male life expectancy has a substantial positive correlation with unemploymen, and health expenditures, sh owing a high level of linkage among these factors. Life expectancy male shows a negative association with income in equality.

Table 4: Correlation Matrix for Life Expectancy Female

Variables	Lef	Gico	Une	He
Lef	1.000			
Gico	-0.305	1.000		
Une	0.112	0.465	1.000	
He	0.779	-0.527	-0.167	1.000

Note. Author's Own Estimation

Female life expectancy has a significant positive connection with unemployment, and health expenditures, indicating a strong association between these variables.

4.3 Cross Sectional Dependence

Table 5 reports on the outcomes of a Pesaran CD test conducted on a panel dataset. Results of two econometric models of life expectancy male and life expectancy female are presented here. For each model, the test statistic, critical value, and p-value are reported.

Table 5: Pesaran CD Test

Model	**Test Statistic**	**Critical Value**	**P Value**
Life Expectancy Male	1.063	0.251	0.288
Life Expectancy Female	1.168	0.210	0.242

Note. Author's Own Estimation

The p-value (0.2880) is greater than 0.05. Therefore, we are unable to roll out the null hypothesis of cross-sectional independence for the Life Expectancy Male at the 5% significance level. The p-value (0.2426) is larger than 0.05. Consequently, we accept the null hypothesis of cross-sectional independence for the Life Expectancy Female. In summary, there is no cross-sectional dependence among the observations.

4.4 Panel Unit Root Test

Firstly, two panel unit root tests, the Levin, Lin, and Chin (LLC) test, and the Im-Pesaran-Shin (IPS) test were conducted. Table 6 summarizes the findings of LLC and IPS tests.

Table 6: Unit Root Test

Variables	LLC		IPS	
	I(0)	I(1)	I(0)	I(1)
	Test stat.	Test stat.	Test stat.	Test stat.
Lem	-3.67***	-4.58***	0.72	-1.90*
Lef	-2.41*	-5.10***	1.09	-5.09***

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Gico	-2.35*	-3.60***	-0.74	-3.29***
Une	-1.44	-5.55***	0.71	-8.11*
He	-0.95	-5.51*	-1.87	-4.00

Note. Author's Own Estimation

Life expectancies male and female exhibits stationarity at the level according to both the LLC and IPS tests. Additionally, income inequality demonstrates stationarity at the level based on the LLC test. However, health expenditures do not display stationarity at the level, as their test statistics lack statistical significance. Moving to the first difference, life expectancy male and life expectancy female maintain stationarity according to the IPS test. Income inequality also show stationarity at the first difference based on the IPS test. Lastly, unemployment and health expenditures are stationary at the first difference. These findings suggest varying degrees of stationarity across the variables.

4.5 Hausman Test

To assess the significance of the coefficients estimated by both the RE and FE models for life expectancy male, Table 7 present the findings of Hausman test.

Table 7: Hausman Test for Life Expectency Male

Variables	Fixed (b)	Random (B)	Difference (b-B)	S.E
Gico	-0.198	-0.196	-0.0017	0.0065
Une	-0.302	-0.297	-0.0056	0.0054
He	0.001	0.001	-0.00002	0.000023

Note. Author's own estimation.

B = efficient under Ho; consistent under both Ho and Ha; B = inconsistent under Ha. Test: Ho: difference in coefficients not systematic. chi2 (5) = (b-B)'[(V_b-V_B)^(-1)](b-B)= 2.49 and Prob > chi2 = 0.646; Prob > chi2 = 0.646 is more than 0.05; the random effect model is suitable.

There coefficients predicted by FEM and REM do not differ significantly. This implies that both models provide similar estimations for the influence of the independent variables on male life expectancy with a p-value of 0.646 >0.05, so we cannot disprove the null hypothesis. Therefore, random effects model is suitable for analyzing the data on male life expectancy. In summary, the Hausman test supports the use of the random effects model for studying the factors influencing male life expectancy at birth, as it provides reliable and efficient estimates.

Table 8: Hausman Test for Life Expectency Female

Variables	Fixed (b)	Random (B)	Difference (b-B)	S.E
Gico	-0.086	-0.087	0.0019	0.0053
Une	-0.238	-0.237	-0.0028	0.0043
He	0.00068	0.0007	-0.0000278	0.000018

Note. Author's own estimation.

b = consistent under Ho and Ha; B = inconsistent under Ha, efficient under Ho. Test: Ho: difference in coefficients not systematic. chi2 (5) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 2.98 and Prob > chi2 = 0.5618; Prob > chi2 = 0.5618 >0.05; The random effect model is preferred.

Table 8 demonstrations the outcomes of the Hausman test for life expectancy female. Since the p-value is 0.5618 >0.05, we fail to reject the null hypothesis. There is no significant difference between the coefficients estimated by the FEM and the REM for life expectancy at birth among females. Therefore, based on the Hausman test, the random effects model is accepted as the appropriate model for analyzing life expectancy females. This recommends that the variation in female life expectancy across different countries (or clusters) can be efficiently captured by the random effects model, and no need to consider individual country-specific effects as fixed effects.

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4.6 Random Effect Model

Table 9 explains the impact of unemployment and income inequality on life expectancy male. The statistical analysis shows that income inequality, unemployment, and health expenditures are highly significant (p-value of 0.000). This implies that these factors have a considerable impact on life expectancy. Specifically, the study indicates that unemployment and income inequality have a negative effect on overall life expectancy, while per capita health expenditures and food production index have a positive impact on male lifespan.

Table 9: Random Effect for Life Expectency Male

Variables	Coef.	Std.err.	z-value	p-value
Gico	-0.197	-0.042	-4.68	0.000
Une	-0.296	-0.050	-5.86	0.000
He	0.001	0.001	6.56	0.000
Cons	69.430	2.491	27.87	0.000
R^2	within = 0.857	between = 0.377	overall = 0.415	
Modified Wald test	6.921			0.064
Wooldridge test	4.642			0.054

Note. Author's own estimation

The R^2 values indicate that a significant proportion of the variability in life expectancy can be explained by the model, both within and between clusters (countries). These findings suggest that RE model is a suitable fit for the data, and the variables included in the model are meaningful predictors of life expectancy.

The Modified Wald test has a value of 6.921 and a p-value of 0.064, which is higher than 0.05. This means there's no clear evidence of heteroscedasticity (unequal variance of errors) in the model, but it's close to being significant. The Wooldridge test has a value of 4.642 and a p-value of 0.054, which is also just above 0.05. This suggests there's no strong evidence of autocorrelation (correlated residuals) in the data, but it's also near the threshold for significance.

In case of life expectancy female, table 10 explains significant impact of unemployment and income inequality on life expectancy female. All the coefficients (Coef.) have low p-values (0.000), indicating that they are statistically significant. The t-values indicate the coefficients' significance relative to their standard errors. For instance, Gico has a t-value of -2.01, indicating it is significant at 5% level. The R^2 values suggest that the model explains a high proportion of the variance in female life expectancy, both within and between clusters (likely countries).

Table 10: Random Effect for Life Expectency Female

Variables	Coef.	Std.err.	z-value	p-value
Gico	-0.087	0.044	-2.01	0.045
Une	-0.236	0.052	-4.52	0.000
He	0.001	0.0002	4.12	0.000
Cons	67.479	2.917	23.13	0.000
R^2	within = 0.890	between = 0.403	overall = 0.385	
Modified Wald test	3.902			0.073
Wooldridge test	4.168			0.087

Note. Author's own estimation.

The Modified Wald test shows a value of 3.902 with a p-value of 0.073, which is above the 0.05 significance level. This means there is no strong evidence of heteroscedasticity (unequal variance of errors) in the model, though the result is slightly above the threshold for significance. The Wooldridge test gives a value of 4.168 with a p-value of 0.087, which is also above 0.05. This suggests there is no strong evidence of autocorrelation (correlated residuals) in the data, but the result is slightly above the threshold for significance.

5 Conclusion and Policy Recommendations

This research study empirically investigates how unemployment and income disparity affect health outcomes of male and female in the selected Asian economies. Utilizing the random effect-GLS model, the analysis employs life expectancy (male and female) as a proxy for health, a common metric utilized in prior literature such as Ahmad et al. (2023), and Hu et al. (2015). Income inequality and unemployment are treated as explanatory variables, while health expenditure serves as the control variables.

The results explain that higher income disparity is linked with a decrease in life expectancy male and life expectancy female in the selected Asian economies. Furthermore, the analysis indicates that unemployment also adversely affects the life expectancy male and life expectancy female. The health expenditures positively influence life expectancy male and life expectancy female.

As regards implications, the ruling classes can expand the health of the residents by implementing targeted redistribution initiatives. These initiatives may include expanding access to education, healthcare, and social safety nets so as to mitigate the harmful effects of income disparity on health outcomes. Policymakers could also develop strategies to promote job creation, especially in sectors that contribute to better health outcomes. To increase access to better healthcare services, policymakers should consider expanding health insurance coverage, investing in healthcare infrastructure, and strengthening primary care systems.

The study did not consider the impact of the COVID-19 pandemic on life expectancy. Further research is required to examine the influence of income disparity and unemployment on health at the micro level. Such types of research will sustenance to determine how income inequality and unemployment affect the health outcomes and will enhance our understanding to implement health policies. As Asia is composed of 48 countries, future research should consider increasing sample sizes.

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