

## THE FACTORS AFFECTING LIFE EXPECTANCY IN MONGOLIA

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### Abstract

*The life expectancy is essential indicator to identify the country's development, happy planet index, human development index, quality of life index etc. Studying on life expectancy is important for the policy makers to find the optimum way to increasing people's life expectancy. This research work is important for the experts to figure out the approach that increase the life expectancy. Although it is such important index and this kind of study is common in the worldwide, there is no research work in our country. Thus, we aim to identify factors that affect life expectancy in Mongolia using ordinary least squares regression analysis. Life expectancy is the dependent variable with, GDP per capita health expenditure per capita, and urbanization as the 2 main determinants. This is a time series study collecting annual data from World Open Source database 2000 to 2017. The result shows that health expenditure per capita and urbanization are influencing life expectancy positively.*

**Keyword:** GDP per capita, Health expenditure per capita, Urbanization, Air pollution, Education

## **1. INTRODUCTION**

The study of life expectancy is an essential topic of the medical and socioeconomic sector in any country. Life expectancy, often explained as life expectancy at birth, is a statistical measure of the average that is expected to live, based on the year of its birth, its current age and other demographic factors including gender. In the worldwide, life expectancy has been increasing steadily over the past few decades, due to technology, medication, and economy. In the case of Mongolia, life expectancy has increased by 3-4 years over the last decade. The life expectancy is still different between developed and developing countries. It is related with the reason that the increases in life expectancy depend on improvements in sanitation and access to pure water, access to health care, including vaccines and enormous increases in agricultural development. Therefore, life expectancy research often focuses on income inequality, economic growth, and health expenditure.

The average life expectancy of our population is 70.19, which is listed 131st place in the world. (United Nations, 2019) It means that life expectancy in Mongolia is lower than in other countries. Accordingly, our country needs to take measures to increase the life expectancy of the population. In order to do this, we need to identify the factors that increase and decrease life expectancy. So we considered that this research work is important for the experts to figure out the approach to increase the life expectancy.

Purpose of this study is to identify factors that affect life expectancy in Mongolia such as GDP per capita, health expenditure per capita and urbanization, using ordinary least squares regression analysis

## **2. LITERATURE REVIEW**

Life expectancy is one of the most vital issues in the social sector. Also there are many experts and researchers who examine the socio-economic indicators that affect life expectancy. These studies illustrate that developed countries focus on social sectors that include health, education, environmental management and other social welfare mostly. Furthermore, the findings noted that per capita income, poverty reduction in developing countries, high literacy rates for adults, improving hygiene, and improving food quality are influenced beneficially on life expectancy.

Navarro and his partners remarked that improving public health expenditures and increasing medical services have enhanced the quality of life for the population. (Elola, 1995)

According to the research work performed by Moser and Vajero, life expectancy is expected to grow over the long run but all countries are different, especially developing countries are outdated. (Moser, 2005)

Ahmad and his partners concluded that macro economic factors have a strong impact on life expectancy, as inflation increases and decreases in purchasing power of households have a negative trend in life expectancy. (Ahmad, 2014)

Forbes and MacGregor focused relationship between unemployment and mortality rates for Scotland. The result show that unemployment and mortality are positively correlated. It means unemployment is lowering life expectancy for both developed and developing countries. (Forbes, 1984)

### 3. METHODOLOGY

Data of the study used from the World Bank's open database for the years 2000-2017 related to the life expectancy of Mongolia. In order to expressing the determinants of life expectancy (LE), we selected the topical variables that used in this kind of paper. Ordinary least squares regression analysis were used to calculate effect of factors on life expectancy such as GDP per capita (GDPPC), Health expenditure per capita (HEPC), and Urbanization (URBAN). The general equation of the regression analysis is as follows:

$$Y = \beta_1 + \beta_2 X_2 + \beta_3 X_3 \dots + \beta_k X_k + u \quad (1)$$

Substituting the variables for this study into above equation:

$$LE = \beta_1 + \beta_2(HEPC)_{it} + \beta_3(URBAN)_{it} + \beta(PCGDP) + u_{it} \quad (2)$$

This equation describes how explanatory variables such as GDP per capita (GDPPC), Health expenditure per capita (HEPC), and Urbanization (URBAN) affect life expectancy(LE) that is a dependent variable. We hypothesized that these three variables will have a positive effect on life expectancy. (Table 1)

Table 1. Variables used in the model (Researcher's estimation)

Variables	Proxy	Expected probability	Unit
Life expectancy	Life expectancy at birth indicates the number of years a newborn infant would live		Year
GDP per capita (GDPPC)	GDP/ Total population	+	\$
Health expenditure per capita (HEPC)	$\sum HE$ / Total population	+	\$
Urbanization (URBAN)	Population in urban agglomerations of more than 1 million (% of total population)	+	%

*Source: Researcher's estimation*

#### 4. LIFE EXPECTANCY AND THE FACTORS AFFECTING LIFE EXPECTANCY

Life expectancy, often explained to Life expectancy at birth is a statistical measure of the average that expected to live, based on the year of its birth, its current age and other demographic factors including gender. (NSO, 2018)

Mongolia has been calculating life expectancy since 1992. Life expectancy was initially 62.77 in 1992, but has increased by 7.4 years in the 26 years to 2018. Elsewhere in the world, life expectancy is highest in Japan at 84.2 and lowest in Lesotho at 52.9.

As you can see, belowing graph explains about changes in Mongolian’s Life expectancy from 1992 to 2018 by gender and total. The life expectancy of women is 75.78, the men's 66.11. Generally, both women’s and men’s life expectancy is growing steadily. The average life expectancy of our population is 70.19, which is listed 131th place in the world. (United Nations, 2019) Comparing with last year, the life expectancy is increased by 1.73 percent. So we aimed to determine the influencing factors of the increases of life expectancy.

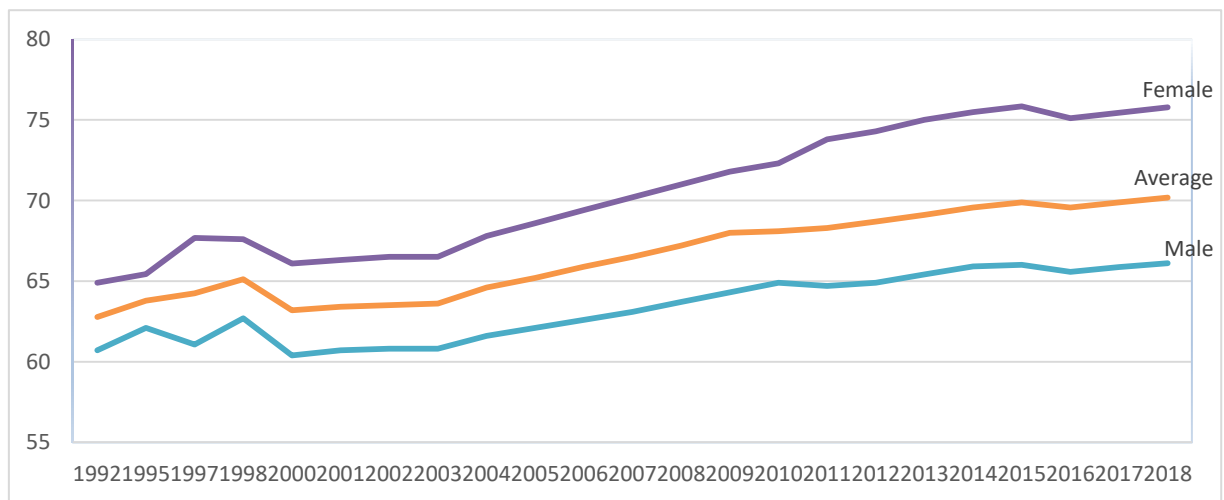


Figure 1. Trend of Mongolian’s life expectancy (NSO)

Researchers were investigated that **GDP per capita** influence the Life expectancy. Kimberly and Amadeo were noted that GDP e The researchers were investigated that GDP per capita influence the Life expectancy xpresses the total value of all goods and services produced in an economy. “GDP per capita is a measure of a country's economic output that accounts for its number of people. It divides the country's gross domestic product by its total population.” (Kimberly, n.d.) The first determinant proved to be income in most of the available literature. It has been investigated that there is a powerful relationship between absolute level of income, explained by GDP per capita, and life expectancy in the poor countries the lower GDP per capita, the lower life expectancy (World bank, 1993). On the other side Wilkinson pointed that if countries reach the threshold, the relationship between life expectancy and standard of living vanishes; further increases in GDP per capita no longer appear to be associated with life expectancy gains. (Wilkinson, The Afflictions of Inequality, 1996) And, Anand and Ravallion found a significant optimistic association between GDP per capita and life expectancy, which worked mainly through impact of national income on the poor’s income and public expenditure specifically on health in a cross country comparison. But when they considered poverty and

government expenditure on health as explanatory variables, the relationship between life expectancy and GDP per capita disappeared. (Anand, 1993)

**Health care spending** is thought to have a significant impact on life expectancy because they directly help reduce life expectancy and morbidity. A study in Canada found that lower health care costs were associated with higher infant mortality rates and lower life expectancy.. (Veugelers, AM, & Kephart, 2001) “The relationship was found to be independent of various economic, socio-demographic nutritional and lifestyle factors, as well as provincial specificity of time trend.” (Crémieux, 1999).

**Urbanization** plays an important role in determining life expectancy. What is urbanization? Residents of cities in the developing world enjoy health care, living conditions, education and other improved social and economic facilities that have a positive impact on health improvement.. (Mahfuz Kabir, 2008) Kalediene and Petruskiene studied the life expectancy situation in the Lithuanian region and found a positive correlation between the urban level and life expectancy. However, urbanization and housing are closely linked to the health and well-being of the country's population (Kalediene, 2000) Szwarcwald discovered the worst health position in the cluster composed of the port area and northern vicinity, precisely in the sector where the highest concentration of slum residents were present in a study on Rio de Janeiro. Life expectancy in this part of the city is seven times lower than in other parts. (Szwarcwald, 2000) In a study of life expectancy in 95 developing countries, Rogers and Wofford found that urbanization had a lower-than-expected impact on life expectancy due to poor health and sanitation in densely populated cities in developing countries.. (Rogers, 1989)

First of all, we assumed that if the output of country is high, the life expectancy will increase. There may also have relationship between per capita income and health expenditure, because higher per capita income may manage to higher health expenditure per capita. Also, higher per capita income increases a nation’s ability to purchase the necessary goods and services that support the health. Lastly, based on the assumption that population of the country with high urbanization are easy to get health service, we assumed that urbanization may affect the life expectancy.

## 5. EMPIRICAL RESULTS

In this chapter, we aim to identify the effects of independent variables using econometric analysis. A number of explanatory variables commonly used in this kind of study have been selected for the analysis of factors affecting life expectancy.

Table 2. Variables statistical analysis

	LE	CO2	GDPPC	HEPC	URBAN
Mean	66.86376	0.714786	145.3302	305.8680	40.59957
Median	66.92000	0.666460	150.0422	278.4586	40.98368
Maximum	69.84700	1.259968	403.2586	471.8075	47.68392
Minimum	63.77700	0.560452	-71.75318	179.5906	32.89796

Std. Dev.	2.044373	0.172941	124.2887	108.2508	4.645764
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Source: Researcher's estimation

Table 2 shows the statistical analysis of the variables used in the study estimated by eviews programm. For example, in a first line, the mean of life expectancy is 66.86. And median explains that in the 9 years, (half) the life expectancy was 66.92 years and 66.92 years in the last 9 years between 2000 and 2017. In addition, life expectancy was the highest in 2014, reaching 69,847, while in 2000 it had the lowest value of 63.7 years. And life expectancy standard deviation is 2.04, which is relatively low in comparison with other indicators in the current period, which is approximately 2.04 years deviating from an average of 66.92 years.

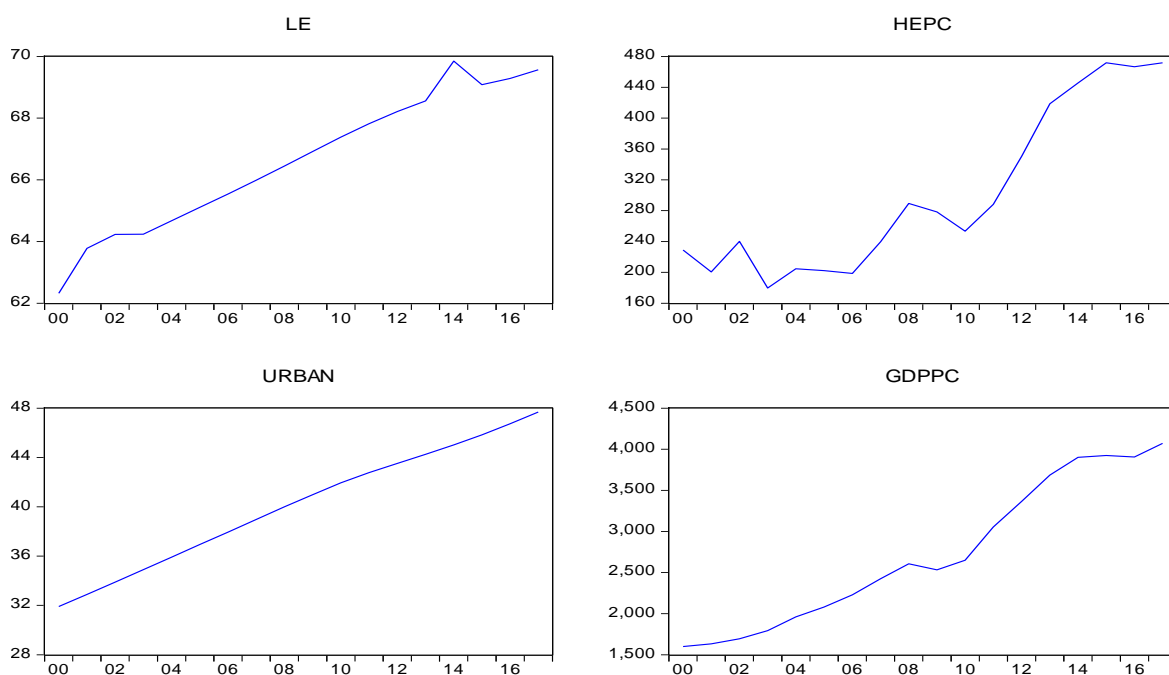


Figure 2. Trend of the variables (World Bank)

From the graph of the variables, it can be seen that life expectancy, urbanization, GDP per capita are constantly growing or trending during the period. On the contrary, health expenditure per capita is not fixed and is not trending. The unit root test is then evaluated because more realistic calculations are needed to verify the stability of the variables.

Table 3. Unit root test

Variables	Models	Probability calculated ADF		integrated ratio
		In level	In first difference	
<i>LE</i>	Trend and intercept	0.0574***		I(0)
<i>HEPC</i>	Intercept	0.9639	0.0114**	I(1)
<i>GDPPC</i>	Trend and intercept	0.1820	0.0337**	I(1)
<i>URBAN</i>	Trend and intercept	0.0030*		I(0)

Note:(\*), (\*\*) and (\*\*\*) indicates rejection of the null hypothesis variables are non-stationary at 1%, 5% and 10% level of significance. I (0) indicates that it is stable at a given level, and I (1) indicates that it is stabilized by a first difference.

Table 3 shows that life expectancy and urbanization were stationary at the level. But health expenditure per capita, GDP per capita were stationary at first difference. Therefore based on this result, the null hypothesis of unit root is rejected and it is safe to conclude that, these variables become stationary at first difference and they are integrated of order one I(1).

Table 4. Correlation analysis (Researcher's estimation)

	LE	HEPC	GDPPC	URBAN
LE	1.000000	0.923816	0.236420	0.987428
HEPC	0.923816	1.000000	0.073455	0.906837
GDPPC	0.236420	0.073455	1.000000	0.210641
URBAN	0.987428	0.906837	0.210641	1.000000

Source: Researcher's estimation

Table 4 expresses correlation between the variables. There are strong relationship between life expectancy and health expenditure per capita which can explained as 92.38%. And life expectancy has powerful relation with urbanization. On the other hand, GDP per capita hasn't any relation with life expectancy. As a result we met the situation that we have to exclude this unrelated variables from the equation in order to make effective and objective calculation.

As noted before, to determining the impacts of the factors, we consider socio-economic factors. According to the equation, the ordinary least squares method (OLS) of linear regression is used.

$$LE = \beta_1 + \beta_2(HEPC(1))_{it} + \beta_3(URBAN)_{it} + u_{it} \quad (3)$$

In the equation of the model, LE describes the dependent variables, while independent variable are represented by health expenditure per capita (HEPC) in the previous period and urbanization (URBAN). The reason why we had chosen the previous period's indicator is the hypothesis that may health expenditure affect to life expectancy in the next year. And it can proved the analysis.

Table 5 Life expectancy and independent variables

	$LE = 49.3 + 0.002 (HEPC(1))_{it} + 0.4(URBAN)_{it}$		
S.E <sup>1</sup>	[1.26]	[0.001]	[0.045]
Prob <sup>2</sup>	[0.00]	[0.2897]	[0.00]
R <sup>3</sup>	=0.91		
DW <sup>4</sup>	=1.87		

<sup>1</sup> S.E- It indicates the standard error for each parameter, and the lower the value, the higher the significance level

<sup>2</sup> Prob- At the significance level of 1%, 5%, and 10%, p = 0, which refutes the assumption that the model was not affected

<sup>3</sup> R- Called the coefficient of determination, and shows how many percent of the change in the dependent variable in the regression model is explained by the variable. The closer you are to one, the higher your ability to interpret.

<sup>4</sup> DW- The Durbin Watson statistic is a test value that indicates whether the error expression over time is correlated. The closer to 2, the more irrelevant the error expression. It is also an indicator of how well the model is defined.

SER=0.35

*Note: (\*), (\*\*) and (\*\*\*) denotes rejection of the null hypothesis at 1%, 5% and 10% level of significance.*

*Source: Researcher's estimation*

This is the case when replacing the results from calculations to the main equations. Depending on the degree of significance of our equation, dependent variable or life expectancy is explained as 91% by health expenditure per capita and urbanization. The probability of coefficients approximately to 100% that means our equation can be objective and efficient. Life expectancy is 49.3 years, while other factors are stable, regardless of variable or health expenditure per capita and urbanization are zero.

For  $\beta_2$  of the equation is 0.002 years or about 17 hours which is consistent with our expected forecasts and if other factors constant and during previous year's health expenditure per capita rose by 1\$, average life expectancy will increasing by 17 hours.

For  $\beta_3$ , if other factors constant and urbanization grow up by 1%, average life expectancy will increasing by 0.4 year or 5 months.

Overall, both health expenditure per capita and urbanization are raise the life expectancy such way. The reason of health expenditure's impact is associated with it directly helps reduce mortality and morbidity. As aforementioned, inhabitants of the urban city generally enjoy improved medical care and means of life, better education, and other improved socio-economic facilities, which impact positively on health outcomes.

## 6. CONCLUSION

Factors that may affect human life expectancy were selected based on a theoretical basis. In order to estimate factor's influencing rate, we opted socio-economic indicators such as GDP per capita, health expenditure per capita, and urbanization. But according to the assessment, GDP per capita can't explain the life expectancy. So we excluded this variable. And continuing the estimation with two factors. In the results of the study, variable life expectancy is explained by 98 percent by health expenditure per capita, and urbanization. To summarize regression analysis results:

- Average life expectancy is 49.79 years, when the other factors are stable, regardless of variable or health expenditure per capita and urbanization.
- Increases in health expenditure per capita by one dollar during previous periods will increase your life expectancy by 0.002 years or 17 hours.
- Increase in urbanization by one percentage point over other factors, with average life expectancy increasing by 0.4 year or 5 months

All in all, the government should make a policy to raise life expectancy through increasing health expenditure and establish more development urban city. In case Mongolian's life expectancy can be increased. However health expenditure's growth affect positively to life



expectancy, if it can't reach the right sector that need health care it is gone into the negative impact.

In studying on this research, there was lack of data interval NSO's database. If the interval is expanded our estimation can be more faithful.

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