

## **HEALTH AND DEVELOPMENT OF ASEAN COUNTRIES**

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### **Abstract**

In this paper, the effect of health on development of ASEAN Countries is studied by using health indicators and economic indicators. The secondary data published by World Bank Lending for Health Nutrition and Population Statistics are used in this study. Descriptive analysis is used to conduct the comparative analysis of health status of ASEAN countries. It is found that health status of Brunei, Singapore and Philippines are good and health status of Myanmar, Laos and Cambodia are not as good as these countries. Vector Autoregressive Regression (VAR) model is used to analyze the effect of health on development of ASEAN countries. To measure the health of the countries, life expectancy at birth and infant mortality rate are used. Gross domestic product is used as a proxy of development of the countries. According to VAR results, it is found that there is positive effect of life expectancy at birth on gross domestic product at lag one of ASEAN countries and there is negative effect of infant mortality rate on gross domestic product of some ASEAN countries.

**Keywords:** Life Expectancy at Birth, Infant Mortality Rate, Gross Domestic Product, Vector Autoregressive Model

### **1. Rationale of the Study**

To overcome the poverty of countries, health becomes an objective of development. According to the “basic needs” strategy of development, formally articulated in the ILO World Employment Conference of 1976, much of effort is needed to do to help poor nations meet minimum consumption requirements of families for adequate food, shelter, clothing and essential community services such as safe drinking water, sanitation, public transport, and health and educational facilities. If community health services are included as one of the objectives of development, health services contribute to better health of people and healthy people can produce more and more and, thus, there will be an increase of per capita income. Therefore health of people is one of the determinants of development of countries.

A number of studies showed that improved of health causes the development of the least developed countries. It would seem “obvious” that a

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healthier labor force will suffer less debility and disability and will work more effectively and more steadily resulting in increased productivity and rising per capita income.

The pressures placed on national healthcare systems by the recent demographic and epidemiological transitions are amplified by the growing demand of an increasingly educated and affluent population for high-quality healthcare. Countries in Southeast Asia and their health system reforms can be categorized according to the stages of development of their healthcare systems. Health indicators are commonly used to guide public health policy. Data on life expectancy, infant mortality and the causes of death used to be seen as a sufficient basis for assessing population health status and determining public health priorities. As mortality rates decline and life expectancy increases, however more and more questions arise about the quality of the years lived.

In a critical step for emergency preparedness across the WHO South-East Asia Region, member countries today agreed to establish a dedicated funding stream aimed at building preparedness for health emergencies in the Region, which is one of the most disaster-prone. Health indicators can be used to define public health problems at a particular point in time, to indicate change over time in the level of the health of a population, or individual, to define differences in the health status of populations, and to assess the extent to which the objectives of a program are being reached. Our country, Myanmar is the one of ASEAN member countries and trying to attain the sustainable development goals by collaborating with other ASEAN countries. According to these reasons, this study aims to analyze the effect of health on development of ASEAN countries.

## **2. Objectives of the Study**

The objectives of the study are:

- (1) to make the comparative analysis for the health status of ASEAN countries and
- (2) to analyze the effect of health status on development of ASEAN countries

### **3. Method of Study**

Descriptive Analysis and multivariate time series econometric analysis are used in this study because the time series data are used to study the health status of ASEAN countries and effect of health on development of ASEAN countries. The data used in this study are secondary data published by World Bank Lending for Health, Nutrition and Population Statistics.

### **4. Limitations of the Study**

Although there are many health indicators, namely infant mortality rate, crude death rate and life expectancy at birth from 1987 to 2015 are used to analyze the health status of ASEAN countries. Among the various methods, the descriptive analysis and multivariate time series econometric analysis are carried out to analyze the health status of ASEAN countries.

### **5. Health and Development**

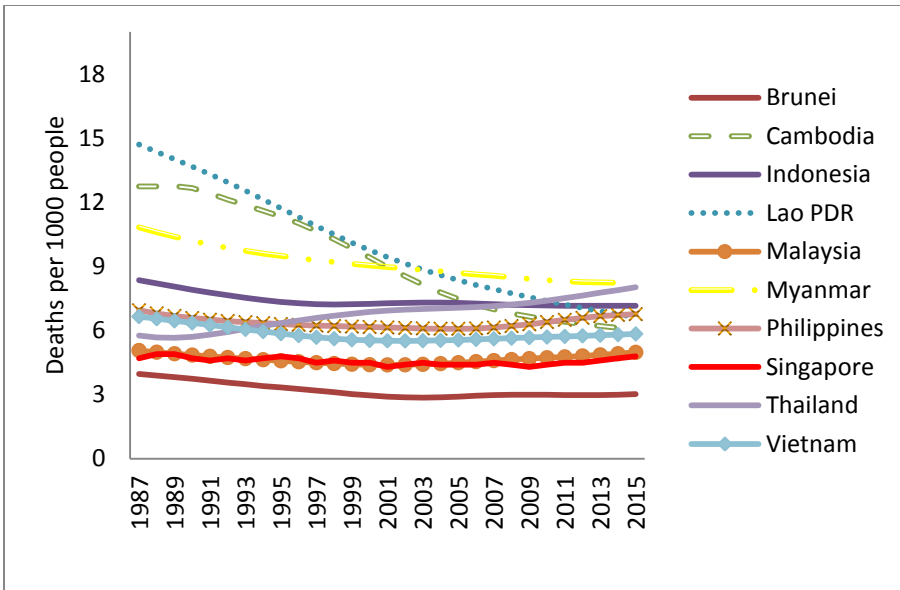
There are a large number of studies that the relationship between health and economic development. David, et al (2004) presented that the last 150 years has witnessed a global transformation in human health that has led people to live longer, healthier, more productive lives. While having profound consequences for population size and structure, better health has also boosted rates of economic growth worldwide. Economic historians and demographers still debate that the increasing point to rising income is the major cause of declines in 19<sup>th</sup> century mortality rate. This means that there is inverse relationship between mortality rate and income. Mortality rate is one of health indicators and income is the proxy of development.

Bhargava (University of Houston) and colleagues found that better health matters more for wages in low-income countries than in high-income ones. Studies also show that better health matters more for countries with good economic policies, such as openness to trade and good governance. Work undertaken by Bloom, Canning, and Malaney (Harvard University) concluded that the East Asian growth miracle was actually no miracle at all: rather, it represents compelling evidence for a process in which health improvements played a leading role in the context of generally favorable economic policies.

Babatund (2012) studied the relationship between health and economic growth in Nigeria. In this study, the effect of health measured by life expectancy is positive and significant on economic growth even after controlling for initial income levels. There is evidence of a significant negative effect of death rate on the growth of per capita income. Average number years of schooling and school enrollment positively affect on economic growth. The ratio of the working age of the population was a significant determinant of economic growth in Nigeria. In addition, the growth in the share of working age over total population is positive and statistically significant. The effects on health expenditure as a ratio of total government expenditure, infant mortality rate and the growth rate of the ratio of working age to total population is not significant on economic growth.

## **6. Comparative Analysis for Health of ASEAN Countries**

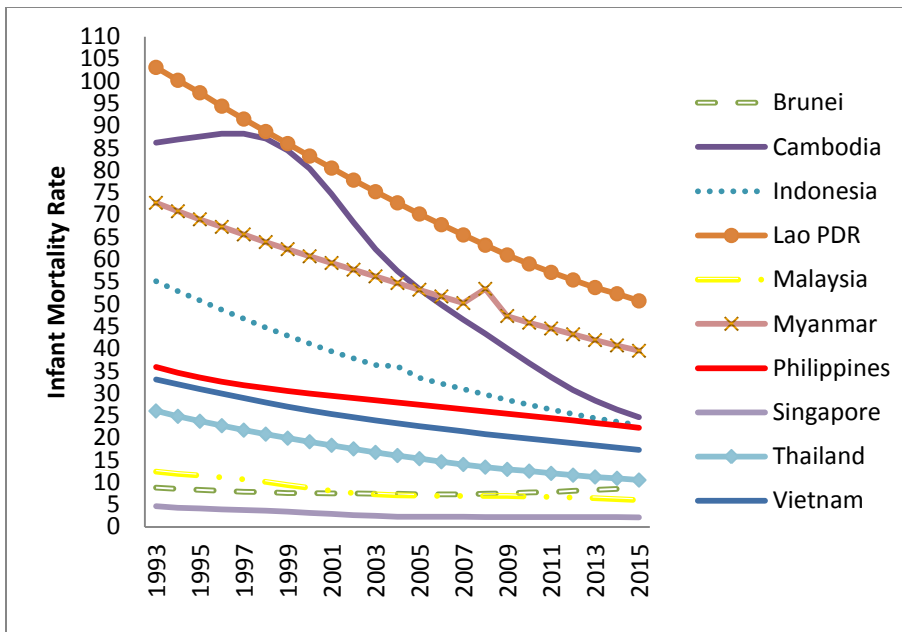
The ASEAN is an organization with most member countries still far from being considered as advanced or first class countries.” Poverty is still a problem in the region, and is reflected in the region’s health situation. The economic, political, and social diversity of ASEAN societies also contribute to health issues. Data compiled from the World Health Organization, the United Nations Population Fund, and the World Bank reveal a great disparity in health conditions. Richer countries like Singapore and Brunei tend to have healthier citizens while the less wealthy ones like Cambodia, Laos, and Vietnam suffer from lower access to health care and are less prepared in handling emergency health issues and threats. In this section comparative analysis of health of ASEAN countries is carried out by using the health indicators of these countries from 1987 to 2015. Among various health indicators, crude death rate, infant mortality rate and life expectancy at birth are analyzed. Crude death rate is a key indicator to measure the health status of people because healthier countries have lower death rate. Crude death rate is the number of deaths per 1,000 people. The observed data of crude death rate of 10 ASEAN countries are presented in the following Figure (1).



**Figure 1:** Crude Death Rate of ASEAN Countries

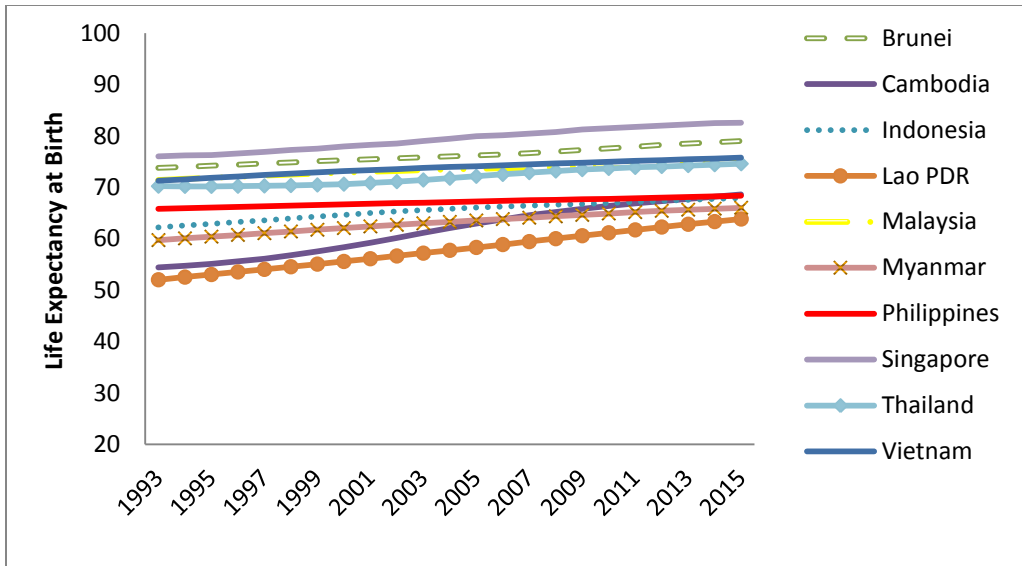
According to this figure, it was found that CDR of Lao PDR was the highest in 1987, that of Cambodia was the second highest and Myanmar attained the third highest CDR. In recent years, the highest CDR is found in Myanmar and the second highest is found in Thailand. Therefore, health status of Myanmar is at the lowest level in ASEAN today.

Infant mortality rate is also the important health indicator. Health policies are set up based on infant mortality rate. Infant mortality rate describes the infant deaths per 1000 live births. To attain the sustainable development, maternal and child health is essential. Child health is determined based on infant mortality rate and under five mortality rate. The infant mortality rates of ASEAN countries are presented in Figure (2).



**Figure 2:** Infant Mortality Rates of ASEAN Countries

According to Figure (2), the highest IMR is found in LaO PDR and the second highest IMR is found in Myanmar. IMR of Singapore is the lowest among ASEAN countries. Life expectancy at birth is an important factor of income of countries. According to empirical analysis, there is causal relationship between life expectancy and economic growth. Findings of a positive effect of life expectancy on income per capita based on cross-country regressions are reported by Bloom and Sachs (1998). The life expectancy at birth of ASEAN countries are presented in Figure (3).



**Figure 3:** Life Expectancy at Birth of ASEAN Countries

According to Figure (3), life expectancy at birth of Lao people is the shortest and that of Singaporean is the highest in the recent year.

### 7. The Effect of Health on Development of Countries

According to some empirical studies, it is found that there is causal relationship between development of countries and health of people of these countries. In this study, development of country is measured by log of gross domestic product, GDP (US dollars in 2010 constant price) and health status of people in the nations is measured by life expectancy at birth of people (LEB) and infant mortality rate (IMR) of these countries.

#### Effect of Health on Development of Brunei

Firstly the effect of health on development of Brunei is analyzed by using Vector Autoregressive Model because Log of GDP and Life expectancy at birth series of Brunei are not stationary. Stationary of these time series data are checked by using Augmented Dickey-Fuller unit root test. The estimated VAR models of Brunei are presented at the following:

Ln GDP <sub>t</sub>	=	7.43	+ 0.65 Ln GDP <sub>t-1</sub>	+ 0.01 LEB <sub>t-1</sub>	- 0.03 IMR <sub>t-1</sub>
S.E	=	(2.486)	(0.127)	(0.007)	(0.008)
Z	=	2.99***	5.10***	1.66*	-3.40***
LEB <sub>t</sub>	=	-3.96	+ 0.13 Ln GDP <sub>t-1</sub>	+ 1.01 LEB <sub>t-1</sub>	+ 0.04 IMR <sub>t-1</sub>
S.E	=	(5.147)	(0.264)	(0.015)	(0.017)
Z	=	-0.77	0.50	65.39***	2.20**
IMR <sub>t</sub>	=	-9.65	+ 0.16 Ln GDP <sub>t-1</sub>	+ 0.08 LEB <sub>t-1</sub>	+ 1.01 IMR <sub>t-1</sub>
S.E	=	(8.99)	(0.462)	(0.027)	(0.030)
Z	=	-1.07	0.35	2.85***	33.9***

According to the VAR results, there is significantly positive effect of life expectancy at birth at lag 1 and significantly negative effect of infant mortality rate at lag one on GDP of Brunei. There is no causal relationship between GDP and IMR. There is also no causal relationship between GDP and LEB of Brunei.

### Effect of Health on Development of Cambodia

The effect of health on development of Cambodia is analyzed by using Vector Autoregressive Model because Log of GDP, Life expectancy at birth and infant mortality rate series of Cambodia are not stationary. Stationary of these time series data are checked by using Augmented Dickey-Fuller unit root test. The estimated VAR models of Cambodia are presented in the following:

Ln GDP <sub>t</sub>	=	8.35	+0.96Ln GDP <sub>t-1</sub>	-0.53Ln GDP <sub>t-2</sub>	+ 0.10LEB <sub>t-1</sub>	-0.03LEB <sub>t-2</sub>	+0.01IMR <sub>t-1</sub>	+0.004 IMR <sub>t-2</sub>
S.E	=	(3.08)	(0.21)	(0.22)	(0.06)	(0.06)	(0.01)	(0.01)
Z	=	2.71***	4.55***	-2.42**	1.69*	-0.45	1.04	-0.67
LEB <sub>t</sub>	=	-9.61	+0.52 Ln GDP <sub>t-1</sub>	-0.04 Ln GDP <sub>t-2</sub>	+ 1.65LEB <sub>t-1</sub>	-0.67LEB <sub>t-2</sub>	- 0.01IMR <sub>t-1</sub>	+0.02 IMR <sub>t-2</sub>
S.E	=	(3.24)	(0.22)	(0.23)	(0.06)	(0.06)	(0.01)	(0.01)
Z	=	2.96***	2.34**	-0.19	26.45***	-10.36***	-1.98**	3.51***



$$\begin{aligned}
 \text{IMR}_t &= 136.06 - 4.04\text{Ln GDP}_{t-1} + 1.61\text{Ln GDP}_{t-2} + 1.43\text{LEB}_{t-1} - 2.49\text{LEB}_{t-2} + 1.70\text{IMR}_{t-1} - 0.98\text{IMR}_{t-2} \\
 \text{S.E} &= (3.24) \quad (1.88) \quad (1.96) \quad (0.53) \quad (0.55) \quad (0.05) \quad (0.05) \\
 \text{Z} &= 27.44^{***} \quad -2.14^{**} \quad 0.82 \quad 2.71^{***} \quad -4.53^{***} \quad 31.09^{***} \quad -19.45^{***}
 \end{aligned}$$

According to the VAR results, there is significantly positive effect of life expectancy at birth at lag 1 and there is no significantly effect of infant mortality rate at lag one and lag two on GDP of Cambodia. There is significant negative effect of GDP on IMR. There is causal relationship between GDP and LEB. That is increasing in GDP lead to longer live and increase in LEB cause the higher GDP.

### **Effect of Health on Development of Indonesia**

The effect of health on development of Indonesia is analyzed by using Vector Autoregressive Model because Log of GDP is not stationary and life expectancy at birth and infant mortality rate series of Indonesia are stationary. Stationary of these time series data are checked by using Augmented Dickey-Fuller unit root test. The estimated VAR models of Indonesia are presented in the following:

$$\begin{aligned}
 \text{Ln GDP}_t &= 14.89 + 0.96\text{Ln GDP}_{t-1} - 0.25\text{Ln GDP}_{t-2} + 0.89\text{LEB}_{t-1} - 0.98\text{LEB}_{t-2} + 0.01\text{IMR}_{t-1} - 0.30\text{IMR}_{t-2} \\
 \text{S.E} &= (6.65) \quad (0.20) \quad (0.21) \quad (0.45) \quad (0.42) \quad (0.02) \quad (0.02) \\
 \text{Z} &= 2.24^{**} \quad 4.80^{***} \quad -1.17 \quad 1.96^{**} \quad -2.32^{***} \quad 0.29 \quad -1.52 \\
 \text{LEB}_t &= 6.30 + 0.10\text{Ln GDP}_{t-1} - 0.01\text{Ln GDP}_{t-2} + 1.77\text{LEB}_{t-1} - 0.89\text{LEB}_{t-2} - 0.003\text{IMR}_{t-1} - 0.01\text{IMR}_{t-2} \\
 \text{S.E} &= (1.31) \quad (0.04) \quad (0.04) \quad (0.09) \quad (0.08) \quad (0.004) \quad (0.004) \\
 \text{Z} &= 4.80^{***} \quad 2.49^{**} \quad -0.24 \quad 19.85^{***} \quad -10.64^{***} \quad -0.91 \quad -2.56^{***} \\
 \text{IMR}_t &= 55.95 + 1.55\text{Ln GDP}_{t-1} + 1.62\text{Ln GDP}_{t-2} - 6.95\text{LEB}_{t-1} + 4.94\text{LEB}_{t-2} + 0.39\text{IMR}_{t-1} + 0.38\text{IMR}_{t-2} \\
 \text{S.E} &= (54.81) \quad (1.65) \quad (1.76) \quad (3.71) \quad (3.48) \quad (0.18) \quad (0.16) \\
 \text{Z} &= 1.02 \quad 0.94 \quad 0.92 \quad -1.87^* \quad 1.42 \quad 2.22^{**} \quad 2.28^{**}
 \end{aligned}$$

According to the VAR results, there is significantly positive effect of life expectancy at birth at lag 1 and there is no significantly effect of infant mortality rate at lag one and lag two on GDP of Indonesia. There is significant

negative effect of LEB at lag one on IMR. There is causal relationship between GDP and LEB. That is increasing in GDP lead to longer live and increase in LEB cause the higher GDP.

### **Effect of Health on Development of Lao PDR**

The effect of health on development of Lao is analyzed by using Vector Autoregressive Model because Log of GDP and life expectancy at birth are not stationary and infant mortality rate series is stationary. Stationary of these time series data are checked by using Augmented Dickey-Fuller unit root test. The estimated VAR models of Lao are presented in the following:

$$\begin{aligned}
 \text{Ln GDP}_t &= 1.44 + 0.62\text{Ln GDP}_{t-1} + 0.10\text{LEB}_{t-1} + 0.01\text{IMR}_{t-1} \\
 \text{S.E} &= (1.44) \quad (0.13) \quad (0.03) \quad (0.01) \\
 \text{Z} &= 1.00 \quad 4.93^{***} \quad 2.91^{***} \quad 2.39^{**} \\
 \text{LEB}_t &= 15.55 - 0.20\text{Ln GDP}_{t-1} + 0.87\text{LEB}_{t-1} - 0.03\text{IMR}_{t-1} \\
 \text{S.E} &= (0.66) \quad (0.06) \quad (0.02) \quad (0.002) \\
 \text{Z} &= 23.52^{***} \quad -3.48^{***} \quad 54.06^{***} \quad -14.88^{***} \\
 \text{IMR}_t &= -90.65 - 0.40\text{Ln GDP}_{t-1} + 1.29\text{LEB}_{t-1} + 1.25\text{IMR}_{t-1} \\
 \text{S.E} &= (10.31) \quad (0.90) \quad (0.25) \quad (0.03) \\
 \text{Z} &= -8.79^{***} \quad -0.44 \quad 5.17^{***} \quad 36.82^{***}
 \end{aligned}$$

According to the VAR results, there is significantly positive effect of life expectancy at birth and IMR at lag 1 on GDP of Lao. There is significant positive effect of LEB at lag one on IMR. There is causal relationship between GDP and LEB. That is increasing in GDP at lag one lead to decrease in LEB and increase in LEB cause the higher GDP. The contradict result occurs because of limited number of observations.

### **Effect of Health on Development of Malaysia**

The effect of health on development of Malaysia is analyzed by using Vector Autoregressive Model because Log of GDP and infant mortality rate are not stationary and life expectancy at birth is stationary. Stationary of these time series data are checked by using Augmented Dickey-Fuller unit root test. The estimated VAR models of Malaysia are presented in the following:

$\text{Ln GDP}_t$	=	-0.85	+0.70	$\text{Ln GDP}_{t-1}$	+ 0.12	$\text{LEB}_{t-1}$	+0.01	$\text{IMR}_{t-1}$
S.E	=	(1.97)	(0.14)		(0.06)		(0.01)	
Z	=	-0.43	5.06 <sup>***</sup>		1.94 <sup>*</sup>		1.13	
$\text{LEB}_t$	=	-1.17	+ 0.07	$\text{Ln GDP}_{t-1}$	+ 0.99	$\text{LEB}_{t-1}$	- 0.02	$\text{IMR}_{t-1}$
S.E	=	(0.94)	(0.07)		(0.03)		(0.01)	
Z	=	-1.25	1.02		34.42 <sup>***</sup>		3.56 <sup>***</sup>	
$\text{IMR}_t$	=	-0.35	+ 1.04	$\text{Ln GDP}_{t-1}$	- 0.36	$\text{LEB}_{t-1}$	+0.92	$\text{IMR}_{t-1}$
S.E	=	(8.28)	(0.58)		(0.25)		(0.05)	
Z	=	-0.04	1.78 <sup>*</sup>		-1.41		18.99 <sup>***</sup>	

According to the VAR results, there is significantly positive effect of life expectancy at birth at lag 1 on GDP of Malaysia. There is no causal relationship among GDP,IMR and LEB.

### **Effect of Health on Development of Myanmar**

The effect of health on development of Myanmar is analyzed by using Vector Autoregressive Model because Log of GDP and infant mortality rate are not stationary and life expectancy at birth is stationary. Stationary of these time series data are checked by using Augmented Dickey-Fuller unit root test. The estimated VAR models of Malaysia are presented in the following:

$\text{Ln GDP}_t$	=	-2.32	+0.79	$\text{Ln GDP}_{t-1}$	+ 0.11	$\text{LEB}_{t-1}$	+0.01	$\text{IMR}_{t-1}$
S.E	=	(2.08)	(0.03)		(0.03)		(0.01)	
Z	=	-1.12	26.01 <sup>***</sup>		3.73 <sup>***</sup>		1.44	
$\text{LEB}_t$	=	-0.20	- 0.06	$\text{Ln GDP}_{t-1}$	+ 1.02	$\text{LEB}_{t-1}$	- 0.01	$\text{IMR}_{t-1}$
S.E	=	(1.05)	(0.02)		(0.02)		(0.003)	
Z	=	-0.19	-3.71 <sup>***</sup>		66.84 <sup>***</sup>		1.86 <sup>*</sup>	
$\text{IMR}_t$	=	384.65	+ 0.49	$\text{Ln GDP}_{t-1}$	- 5.39	$\text{LEB}_{t-1}$	- 0.04	$\text{IMR}_{t-1}$
S.E	=	(71.68)	(1.04)		(1.04)		(0.19)	
Z	=	5.37 <sup>***</sup>	0.47		-5.17 <sup>***</sup>		-0.21	

According to the VAR results, there is significantly positive effect of life expectancy at birth lag 1 on GDP of Myanmar. There is significantly

negative effect of GDP at lag 1 on life expectancy at birth of Myanmar. There is causal relationship between GDP and LEB.

### **Effect of Health on Development of the Philippines**

The effect of health on development of the Philippines is analyzed by using Vector Autoregressive Model because Log of GDP is not stationary and life expectancy at birth and infant mortality rate are stationary. Stationary of these time series data are checked by using Augmented Dickey-Fuller unit root test. The estimated VAR models of the Philippines are presented in the following:

$$\text{Ln GDP}_t = -0.54 + 0.89\text{Ln GDP}_{t-1} - 0.25\text{Ln GDP}_{t-2} + 0.94\text{LEB}_{t-1} - 0.80\text{LEB}_{t-2} - 0.02\text{IMR}_{t-1} + 0.02\text{IMR}_{t-2}$$

$$\text{S.E} = (0.49) \quad (0.20) \quad (0.20) \quad (0.45) \quad (0.45) \quad (0.04) \quad (0.03)$$

$$\text{Z} = -0.12 \quad 4.43^{***} \quad -1.26 \quad 2.27^{**} \quad -1.76^* \quad -0.49 \quad 0.55$$

$$\text{LEB}_t = 3.99 - 0.002 \text{Ln GDP}_{t-1} + 0.02 \text{Ln GDP}_{t-2} + 2.11\text{LEB}_{t-1} - 1.18\text{LEB}_{t-2} - 0.02\text{IMR}_{t-1} + 0.01 \text{IMR}_{t-2}$$

$$\text{S.E} = (0.7) \quad (0.03) \quad (0.03) \quad (0.7) \quad (0.7) \quad (0.01) \quad (0.01)$$

$$\text{Z} = 5.70^{***} \quad -0.07 \quad 0.54 \quad 29.86^{***} \quad -16.60^{***} \quad -3.69^{***} \quad 2.14^{**}$$

$$\text{IMR}_t = 33.72 - 0.07\text{Ln GDP}_{t-1} - 0.16\text{Ln GDP}_{t-2} - 0.67\text{LEB}_{t-1} + 0.29\text{LEB}_{t-2} + 1.46\text{IMR}_{t-1} - 0.56 \text{IMR}_{t-2}$$

$$\text{S.E} = (10.90) \quad (0.49) \quad (0.48) \quad (1.10) \quad (1.10) \quad (0.10) \quad (0.08)$$

$$\text{Z} = 3.09^{***} \quad -0.14 \quad -0.33 \quad -0.61 \quad 0.26 \quad 14.75^{***} \quad -7.40^{***}$$

According to the VAR results, there is significantly positive effect of life expectancy at birth lag 1 on GDP of the Philippines. There is significantly negative effect of IMR at lag 1 on life expectancy at birth of the Philippines. There is no causal relationship among GDP, IMR and LEB.

### **Effect of Health on Development of Singapore**

The effect of health on development of Singapore is analyzed by using Vector Autoregressive Model because Log of GDP and life expectancy are not stationary and infant mortality rate is stationary. Stationary of these time series data are checked by using Augmented Dickey-Fuller unit root test. The estimated VAR models of Singapore are presented in the following:

$$\begin{aligned}
 \text{Ln GDP}_t &= 4.99 + 0.67\text{Ln GDP}_{t-1} + 0.05 \text{LEB}_{t-1} - 0.02\text{IMR}_{t-1} \\
 \text{S.E} &= (1.46) \quad (0.09) \quad (0.01) \quad (0.01) \\
 \text{Z} &= 3.41^{***} \quad 7.04^{***} \quad 3.35^{***} \quad -1.92^* \\
 \\
 \text{LEB}_t &= 7.08 - 0.29\text{Ln GDP}_{t-1} + 1.09 \text{LEB}_{t-1} - 0.08\text{MR}_{t-1} \\
 \text{S.E} &= (5.15) \quad (0.33) \quad (0.05) \quad (0.04) \\
 \text{Z} &= 1.38 \quad -0.88 \quad 20.40^{***} \quad -2.03^{**} \\
 \\
 \text{IMR}_t &= -4.67 + 0.25 \text{Ln GDP}_{t-1} - 0.02 \text{LEB}_{t-1} + 0.93 \text{IMR}_{t-1} \\
 \text{S.E} &= (4.22) \quad (0.27) \quad (0.04) \quad (0.03) \\
 \text{Z} &= -1.11 \quad 0.93 \quad -0.56 \quad 29.14^{***}
 \end{aligned}$$

According to the VAR results, there is significantly positive effect of life expectancy at birth lag 1 on GDP of Singapore. There is significantly negative effect of IMR at lag 1 on GDP of Singapore. There is no causal relationship among GDP, IMR and LEB.

### **Effect of Health on Development of Thailand**

The effect of health on development of Thailand is analyzed by using Vector Autoregressive Model because Log of GDP and infant mortality rate are stationary and life expectancy at birth is not stationary. Stationary of these time series data are checked by using Augmented Dickey-Fuller unit root test. The estimated VAR models of Thailand are presented in the following:

$$\begin{aligned}
 \text{Ln GDP}_t &= 4.99 + 0.67\text{Ln GDP}_{t-1} + 0.05 \text{LEB}_{t-1} - 0.02\text{IMR}_{t-1} \\
 \text{S.E} &= (1.46) \quad (0.09) \quad (0.01) \quad (0.01) \\
 \text{Z} &= 3.41^{***} \quad 7.04^{***} \quad 3.35^{***} \quad -1.92^*
 \end{aligned}$$

$$\begin{aligned} \text{LEB}_t &= 7.08 - 0.29\text{Ln GDP}_{t-1} + 1.09 \text{LEB}_{t-1} - 0.08\text{MR}_{t-1} \\ \text{S.E} &= (5.15) \quad (0.33) \quad (0.05) \quad (0.04) \\ \text{Z} &= 1.38 \quad -0.88 \quad 20.40^{***} \quad -2.03^{**} \end{aligned}$$

$$\begin{aligned} \text{IMR}_t &= -4.67 + 0.25 \text{Ln GDP}_{t-1} - 0.02 \text{LEB}_{t-1} + 0.93 \text{IMR}_{t-1} \\ \text{S.E} &= (4.22) \quad (0.27) \quad (0.04) \quad (0.03) \\ \text{Z} &= -1.11 \quad 0.93 \quad -0.56 \quad 29.14^{***} \end{aligned}$$

According to the VAR results, there is significantly positive effect of life expectancy at birth lag 1 on GDP of Thailand. There is significantly negative effect of IMR at lag 1 on GDP of Thailand. There is no causal relationship among GDP, IMR and LEB.

### **Effect of Health on Development of Vietnam**

The effect of health on development of Vietnam is analyzed by using Vector Autoregressive Model because Log of GDP is not stationary and life expectancy at birth and infant mortality rate are stationary. Stationary of these time series data are checked by using Augmented Dickey-Fuller unit root test. The estimated VAR models of Vietnam are presented in the following:

$$\text{LnGDP}_t = 8.66 + 0.40\text{Ln GDP}_{t-1} + 0.04\text{Ln GDP}_{t-2} - 0.03\text{LEB}_{t-1} + 0.11\text{LEB}_{t-2} + 0.12\text{IMR}_{t-1} - 0.15 \text{IMR}_{t-2}$$

$$\begin{aligned} \text{S.E} &= (1.75) \quad (0.18) \quad (0.15) \quad (0.05) \quad (0.06) \quad (0.06) \quad (0.06) \\ \text{Z} &= 4.94^{***} \quad 2.19^{**} \quad 0.27 \quad -0.68 \quad 1.89^* \quad 1.85^* \quad -2.41^{**} \end{aligned}$$

$$\text{LEB}_t = 0.68 + 0.004 \text{Ln GDP}_{t-1} + 0.08 \text{Ln GDP}_{t-2} + 1.27\text{LEB}_{t-1} - 0.30\text{LEB}_{t-2} - 0.18\text{IMR}_{t-1} + 0.14 \text{IMR}_{t-2}$$

$$\begin{aligned} \text{S.E} &= (6.88) \quad (0.72) \quad (0.57) \quad (0.21) \quad (0.23) \quad (0.25) \quad (0.24) \\ \text{Z} &= 0.10 \quad 0.01 \quad 0.13 \quad 6.02^{***} \quad -1.29 \quad -0.74 \quad 0.60 \end{aligned}$$

$$\text{IMR}_t = -2.64 + 0.70\text{Ln GDP}_{t-1} - 0.49\text{Ln GDP}_{t-2} - 0.13\text{LEB}_{t-1} + 0.10\text{LEB}_{t-2} + 0.92\text{IMR}_{t-1} - 0.04 \text{IMR}_{t-2}$$

$$\begin{aligned} \text{S.E} &= (4.92) \quad (0.52) \quad (0.41) \quad (0.15) \quad (0.16) \quad (0.18) \quad (0.17) \\ \text{Z} &= -0.54 \quad 1.35 \quad -1.20 \quad -0.86 \quad 0.60 \quad 5.22^{***} \quad -0.22 \end{aligned}$$

According to the VAR results, there is significantly positive effect of life expectancy at birth at lag 2 on GDP of Vietnam. There is significantly negative effect of IMR at lag 2 on GDP of Vietnam. There is no causal relationship among GDP, IMR and LEB.

## Conclusion

Life longevity in Southeast Asia is expected to exceed other areas in Asia in the long term, challenging healthcare providers to equip themselves with skills and resources in caring for elderly people. As communicable diseases have successfully been placed under control and infant mortality ratio improves, focus in many ASEAN countries has shifted to treating chronic disease and injuries which are top death causes. Nowadays, efficient health policies are needed for development of countries. Health indicators play important roles, to develop the efficient health policies, it is essential to analyze the importance of health indicators for development of ASEAN countries. Therefore effect of health on development of ASEAN countries is studied. To measure the health of people, life expectancy at birth is used for to measure the health of all people and infant mortality rate is used to measure the health of children. Since the observed data are time series data, Augmented Dickey-Fuller unit test is applied to check stationary condition and it is found that all series are not stationary. Therefore, Vector Autoregressive Regression model is applied. According to VAR results, Life expectancy at birth at lag one and at lag two significantly and positively affect on GDP of all countries and infant mortality rate has negative effect on GDP of Brunei, Singapore, Thailand and Vietnam. Therefore health conditions play crucial role in development of ASEAN countries.

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## Appendix

### Augmented Dickey Fuller Unit Root Test

Nations	Series Name	Z(t)	1% Critical Value	5% Critical Value	Stationary
Brunei	LnGDP	-1.728	-3.730	-2.990	No
	LEB	2.089			No
	IMR	-4.149			Yes
Cambodia	LnGDP	-0.525	-3.750	-3.00	No
	LEB	-0.571			No
	IMR	0.961			No
Indonesia	LnGDP	-0.476	-3.730	-2.990	No
	LEB	-11.244			Yes
	IMR	-8.047			Yes
Lao	LnGDP	1.522	-3.730	-2.990	No
	LEB	-2.245			No
	IMR	-5.213			Yes
Malaysia	LnGDP	-2.506	-3.730	-2.990	No
	LEB	-10.881			Yes
	IMR	-7.993			Yes
Myanmar	LnGDP	2.132	-3.730	-2.990	No
	LEB	-14.44			Yes
	IMR	-0.980			No
Philippine	LnGDP	2.066	-3.730	-2.990	No
	LEB	-6.046			Yes
	IMR	-13.802			Yes
Singapore	LnGDP	-2.352	-3.730	-2.990	No
	LEB	0.278			No
	IMR	-11.220			Yes
Thailand	LnGDP	-3.571	-3.730	-2.990	Yes
	LEB	1.273			No
	IMR	-38.814			Yes
Vietnam	LnGDP	-1.689	-3.730	-2.990	No
	LEB	-22.853			Yes
	IMR	-17.954			Yes



**Test for Stability of VAR Result**

<b>Nations</b>	<b>Modulus of Eigen Value</b>	<b>Stability</b>
Brunei	1.05485 0.956941 0.656792	Not Satisfy
Cambodia	0.912 0.898 0.756	Satisfy
Indonesia	1.041 0.958 0.393	Not Satisfy
Lao	1.019 1.019 0.6998	Not Satisfy
Malaysia	1.023 0.938 0.652	Not Satisfy
Myanmar	0.977 0.808 0.014	Satisfy
Philippine	1.117 0.929 0.816	Not Satisfy
Singapoore	0.941 0.941 0.723	Satisfy
Thailand	0.947 0.879 0.879	Satisfy
Vietnam	1.005 0.943 0.943	Not Satisfy

**Test of Normality and Autocorrelation**

Nations	Largrange Multiplier Test (H <sub>0</sub> :No auto correlation)		Jarque- Bera Test (H <sub>0</sub> :Normally Distributed)	
	Chi-square Value	P-value	Chi-square Value	P-value
Brunei	62.25	0.000	1.304	0.971
Cambodia	15.35	0.082	10.804	0.092
Indonesia	Nil		316.591	0.000
Lao	18.306	0.03	42.862	0.000
Malaysia	Nil		23.962	0.005
Myanmar	12.185	0.203	357.513	0.000
Philippine	Nil		1.874	0.930
Singapoore	15.640	0.074	2.598	0.857
Thailand	Nil		20.150	0.003
Vietnam	Nil		2.349	0.885