

# Malaysia's Healthcare Expenditure: ARDL Bound Test

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## Abstract

This study aims to analyse the relationships between income level, education expenditure, inflation, and ageing population towards health expenditure in Malaysia over the period of 1997 until 2017. This study employs Autoregressive Distributed-Lag (ARDL) Bound test in determining the long-run empirical relationships between all independent variables and healthcare expenditures in Malaysia. The findings show the existence of long run cointegration between healthcare expenditure inflation, income level, and the government's education expenditure. The results confirmed that all independent variables have positive long run relationships, except the ageing population that displays a negative relationship in influencing healthcare expenditure in Malaysia. The regression result of GDPP shows income elasticity value of 0.690, reflecting the necessity of healthcare expenditure. The outcome of the paper hopes to provide insights on the importance of healthcare expenditure for the development of this country, especially on its economic fronts.

**Keywords:** Auto-Regressive Distributed-Lag Model, diagnostic test, education expenditure, healthcare expenditure, income level.

## 1. Introduction

Health is life's essential, and its importance is signified by a quote saying "health is the best wealth". Consequently, healthcare is an essential, dynamic, and opportunity-rich industry, with the global medical trend showing a relatively stable increase around the globe. A report by Aon Plc (NYSE:AON) revealed that in 2019, the global average medical trend rate was 8%, outpacing the average general inflation rate of 3.1%. A report of the 2020 Global Medical Trend Survey by Willis Towers Watsons stated that 41% of the insurers predicted a hike in healthcare cost for the next three years to come. For Malaysia, the report has outlined five causes of increase in its medical or healthcare spending. Those factors are: i) increase of demand as a result of new treatment and advanced technology, ii) continuous rise in

noncommunicable and infectious diseases, iii) increase in consultation fees and treatment costs, iv) growth of corporation-wellness initiatives, and v) greater awareness on additional medical coverage from the working population.

The most recent report by the Ministry of Health named MNHA Health Expenditure Report 2001-2017 defined health expenditures as all health-related expenses of medical care, rehabilitation, promotion, prevention, health administration and capital formation to improve health from both public and private sectors. The percentage of both public and private healthcare expenditures over Malaysian GDP are 4.24 in 2017, 4.23 in 2016, and 4.33 in 2015. The healthcare spending trend over Malaysian GDP has shown a gradual increase, but it is still considered as low for an upper middle-income country like Malaysia. Even though Malaysia has recorded RM57,361 million (equals to 4.24% of GDP) and RM1,790 per capita expenditure on healthcare in nominal value, it is reported that Malaysia is among the best healthcare providers among ASEAN countries.

According to the International Living website, Malaysia was ranked first in the World's Best Healthcare in 2019 with a score of 95 out of 100. Currently, Malaysia has also won the "Health and Medical Tourism: Destination of the Year 2020 Award" for the fourth time in an award ceremony organized by IMTJ Medical Travel Awards 2020. Among other factors that contributed to the score include good infrastructures, less communication barrier (most Malaysian doctors are fluent in English), affordable treatment, less bureaucracy, and genuine and friendly hospital staff. In 2017, the Malaysian public expenditures were 51% (RM29,338 million), with the remaining 49% (28.023 million) being taken up by the private sector. As outlined by the MNHA Health Expenditure Report 1997-2017, the public sector refers to the federal government, state government, local authority, and social security funds. The private sector consists of private insurance, out-of-pocket households, non-profit organizations, etc. Among the various sources of financing, the highest expenditure comes from the Ministry of Health (MOH) with 43.09% expense (RM24.715 million), followed by private household out-of-pocket spending of 37.61% (RM21.573), and private insurance with 7% expense (RM4.085 million). Both public and private healthcare expenditures showed an increasing trend throughout the 20 years of observation by which the public held the share's majority.

There are various reasons behind the rising trend of healthcare spending by both public and private sectors in Malaysia. For example, Geetha et al. (2013) proved that the relationship between healthcare expenditure and national income was positive, and their finding was consistent with previous literatures. The authors also found that the population aged below 15 was the only positive and significant variable in influencing healthcare expenditure per capita. Surprisingly, the study showed that healthcare in Malaysia was considered as a luxury good in the long run, but it was assumed to be inferior in the short run. By applying the ARDL Bound Test, Khan, Razali and Shafie (2016) also confirmed the presence of a long run cointegration between healthcare expenditure and GDP per capita. Other than income, the paper also indicated that technology advancement and life expectancy are significant and have a positive influence on healthcare expenditure in Malaysia.

However, population growth and population structure have a significant negative impact on Malaysian healthcare spending. A study by Ahmad and Hasan (2016) also revealed another interesting finding, where the authors also utilised ARDL approach to analyse data from 1984 to 2009, identifying that both public health expenditure and corruption are statistically significant in affecting health status in Malaysia. Considering this, it is crucial to investigate the determinants of healthcare expenditure because a good healthcare system is of utmost importance to every Malaysian citizen.

Therefore, the purpose of this study is to evaluate factors influencing healthcare spending in Malaysia by using the ARDL approach over a study period of 21 years (1997 – 2017). Specifically, the objective is to analyse the relationships between healthcare

expenditure, GDP, ageing population, inflation, and education expenditure in Malaysia. The second objective is to find the causality linkages between the above-mentioned factors. The remainders of this paper are organized as follows: Section 2's review of previous literature is explained, Section 3 briefs on the data and methodology used, Section 4's result and discussion of the findings are given, and the last section presents the conclusion and suggestions for further research.

## **2. Literature Review**

Nowadays, healthcare expenditure is trending as the most vital issue for households and governments in every country since they are overwhelmed by the covid-19 pandemic cases around the world. The higher health awareness among people makes them willing to spend more on healthcare. Here, many past researchers have revealed their evidence related to the determinants of healthcare expenditures like the Gross Domestic Product (GDP), age-65 population, inflation, and education expenditure.

Income level or GDP per capita is claimed as the vital determinant that influences healthcare expenditure as investigated by numerous studies. According to Khan et al. (2016); Kraipornsak (2017); and Zhou et al. (2020); income is one of the significant determinants that has positive relationships in explaining healthcare expenditure (HCE) in Malaysia. In addition, Khan et al. (2016) stated that income elasticity for HCE was  $0.99 < 1$ , confirming that healthcare was a necessity. Khan et al. (2015) and Baltagi and Moscone (2010) examined that HCE was still treated as a necessity when the value of income elasticity was less than one. However, Wahab, et al. (2019); Liu et al. (2011); Mehrara et al. (2010); Moscone and Tosetti (2010) found that income elasticity was more than one – showing that healthcare expenditure is a luxury good. Another study conducted by Baltagi and Moscone (2010) about reconsidering the long-run relationships between healthcare expenditure and GDP using a panel of 20 OECD countries observed over the period 1971-2004 indicated that healthcare expenditure and most of its determinants are non-stationary, and that they are linked in the long run. Furthermore, a long run cointegration between HCE and GDP per capita found to exist when the ARDL Bound test was used (Khan et al., 2016). Thereby, it reveals that a country is exposed as a developed nation because it received a high income or GDP, that increases the healthcare expenses too. Otherwise, poor nations with lower income or GDP will see a reduction of healthcare spending.

The incredible rise of the ageing population needs a rigorous healthcare that causes them to be more careful about their health. Some past researchers who studied healthcare expenditure did several research about the aging population. There is evidence by Zhou et al. (2020) who employed cross-section dependence and homogeneity tests for twenty-two (22) emerging countries, conducted from year 2000 until 2018 which revealed that an increase of ageing population (those aged 65 and above) leading to the rise of private and public healthcare expenditures. Moreover, there are also parallel findings about the explanatory variable which makes it clear that the upturn in public healthcare spending is due to the significant determinant of elderly population (those aged 65 and above) (Byaro et al., 2018). Despite that, research by Li et al. (2020) using fixed effect model and parameter estimation method from year 2008 until 2014 in China supported that the highest contributor of healthcare cost comes from the ageing population (age 65 and above), compared to the population with age 60 to 64 and 25 to 59. Therefore, it shows a positive relationship between healthcare expenditure and ageing population variables. The main reason is that the elderly is vulnerable to critical diseases like cancer and heart and lung problems due to declining antibodies as they grow older. Thus, they need to spend more on healthcare services and consume more medical resources.

Nevertheless, there is an argument by a few studies that stated a negative relationship between these variables. Evidence by Khan et al. (2016) indicated a short run healthcare expenditure in Malaysia that will diminish when the population aged 65 and above gets closer to death upsurge. The result is also similar with Erdil and Yetkiner (2009); Ogura and Jakovljevic (2014); and Khan et al. (2015). Thus, it is also a realistic result, since the elderly population’s life period is getting shorter, with more exposure to critical illness. In addition, the ageing population is not actively contributing to economic development since their earning becomes lesser due to healthcare expenses.

Inflation rate is another determinant that could influence healthcare spending, yet only a few studies used this variable in their research. A study by Turgut et al. (2017) analysed the relationships between healthcare expenditure and inflation in Turkey using Pearson Correlation analysis and regression analysis from year 2003 until 2016, and they found a significant and positive relationship between inflation and healthcare spending. Besides, Wahab et al. (2019) also claimed about the dynamic drivers of healthcare expenditure in Organization of Islamic Cooperation (OIC) countries from 1990 to 2015 using Generalized Method of Moments (GMM) technique, where a significant and negative relationship between the consumer price index (inflation) and healthcare expenditure was found. The findings revealed the rise of consumer demands for healthcare services due to the reduction of inflation rate in the OIC region. According to Boachie et al. (2014), inflation has no significant long run effect on public healthcare expenditure in Ghana, but they proposed that a positive sign of inflation is a vital determinant to look out in the future.

In general, educational investment improves a human being and promotes the betterment of one’s life in all aspects. A study by Antosova et al. (2019) found that education quality has a significant and positive relationship on healthcare expenditure. Conversely, education quantity has no significant effect on healthcare spending. Gukat & Ogboro (2016), verified that government expenditure on the education and healthcare sectors may influence economic growth in the long run only. Rahman (2011), ascertained that health expenditure and education expenditure have a significant positive effect on economic growth. At the same time, the study proved that the investment in health and education improve each other in the event of Bangladesh by applying causal study.

### 3. Research Methodology

This research uses annual data covering 1997 until 2017. Table 1 summarizes the measurements and sources of the variables used in this research.

Table 1: Measurements and sources of variables

Variable	Measurement	Source
Healthcare Expenditure	Healthcare Expenditure Per capita	Ministry of Health Malaysia
Income level	Gross Domestic Per capita	Department of Statistics Malaysia
Education	Federal Government Expenditure on Education	Ministry of Finance Malaysia
Inflation	Consumer Price Index	Department of Statistics Malaysia
Ageing population	Number of populations aged 65 and above	World Bank

To assess the long run relationship between all independent variables and healthcare expenditure in Malaysia, this research employed the Autoregressive Distributed-Lag (ARDL) bound testing approach, proposed by Pesaran et al. (2001). There are several advantages of using the ARDL method - one of them is providing a suitable and rigorous result for a small sample (Haug, 2002). In addition, the ARDL approach is relevant to be used as an alternative when the data stationarity in the research is a mixture of level and first difference. Most

traditional approaches deny this ambiguous order of integration (Alimi, 2014). This research carried out the Augmented Dickey-Fuller (ADF) along with Phillips-Perron (PP) test to examine the stationarity of data.

The basic ARDL models used in this research are as follows:

$$HEP_t = \beta_0 + \beta_1 AP_t + \beta_2 CPI_t + \beta_3 GDPP_t + \beta_4 EDU_t + \varepsilon_t \quad (1)$$

HEP is healthcare expenditure per capita measured in RM, AP is ageing population measured by number of populations aged 65 and above, CPI refers to Consumer Price Index, GDPP represents Gross Domestic Per capita, EDU is Federal Government Expenditure on Education in RM,  $\varepsilon$  is error term and lastly  $t$  refers to time.

All variables in this research were converted into natural logarithms (LN) to obtain more consistent and efficient results. The log-linear model (LN) are as follows:

$$LNHEP_t = \beta_0 + \beta_1 LNAP_t + \beta_2 LNCPI_t + \beta_3 LNGDPP_t + \beta_4 LNEDU_t + \varepsilon_t \quad (2)$$

Finally, the model was transformed into Unrestricted Error Correction Model (UECM) equation:

$$\begin{aligned} LNHEP_t = & \alpha_0 + \sum_{j=1}^{k1} \gamma_j \Delta LNHEP_{t-j} + \sum_{j=0}^{k2} \delta_j \Delta LNAP_{t-j} + \sum_{j=0}^{k3} \varepsilon_j \\ & \Delta \ln CPI_{t-j} \\ + \sum_{j=0}^{k4} \xi_j \Delta LNGDPP_{t-j} + & \sum_{j=0}^{k5} \theta_j \Delta LNEDU_{t-j} + \lambda_1 LNHEP_{t-1} + \lambda_2 LNAP_{t-1} + \\ & \lambda_3 LNCPI_{t-1} \\ & + \lambda_4 LNGDPP_{t-1} + \lambda_5 LNEDU_{t-1} + \varepsilon_t \quad (3) \end{aligned}$$

where  $\Delta$  refers to the first difference operator, while  $\varepsilon_t$  is a white-noise disturbance term.

The residual diagnostic test is vital in validating the research model's robustness. To check the existence of serial correlation problem, Breusch Godfrey serial correlation LM test was used in this research. Next, Breusch-Pagan Godfrey Heteroskedasticity test was used to examine whether the residual error term has a constant variance (homoscedasticity) or not (heteroscedasticity). In addition, Jarque-Bera test was performed to test the normality of data while the Ramsey Regression Equation Specification Error Test (Ramsey RESET) test was used for functional form. Lastly, CUSUM and CUSUMQ tests were used to examine the stability of the research model's parameters.

#### **4. Research Findings and Discussion**

Table 2 shows the result of the unit root tests for all variables in this research. The Augmented Dickey-Fuller (ADF) unit root test confirmed that at 5 percent significance level, only LNEDU was stationary at level. The other variables including LNHEP, LNAP, LNCPI and LNGDPP were detected as non-stationary at level but became stationary at first difference. These findings fulfil the criteria of ARDL approach where the data in this research have mix stationarities at level and first difference (Pesaran, Shin & Smith, 2001). Therefore, we can continue to run the cointegration test.

Table 2: Testing ADF and PP Unit Root Test

Level I(0)	ADF Unit Root		PP Unit Root	
	Intercept	Intercept and Trend	Intercept	Intercept and Trend
LNHEP	-3.024 (2) *	0.018 (2)	-1.612 (2)	-1.939 (2)
LNAP	1.617 (2)	-0.211 (2)	-2.865 (0) *	-2.079 (1)
LNCPI	-0.408 (0)	-2.906 (0)	-0.409 (2)	-3.046 (2)
LNGDPP	0.319 (0)	-7.445 (0) ***	0.440 (2)	-6.658 (2) ***
LNEDU	-3.916 (1)***	-3.764**	-2.528 (1)	-2.344 (1)
First difference I(1)	ADF Unit Root		PP Unit Root	
	Intercept	Intercept and Trend	Intercept	Intercept and Trend
LNHEP	-5.429 (1) ***	-3.942 (2) ***	-6.425 (2) ***	-8.675 (2) ***
LNAP	-3.948 (1) ***	-4.346 (1) **	-2.667 (3) *	-2.643 (3)
LNCPI	-4.998 (0) ***	-4.886 (0) ***	-5.198 (2) ***	-5.201 (2) ***
LNGDPP	-8.922 (0) ***	-8.317 (0) ***	-9.962 (2)	-9.151 (2) ***
LNEDU	2.601 (0)	2.464 (0)	-2.664 (1)*	-2.549 (1)

Note: 1) \*\*\*, \*\* and \* are 1%, 5% and 10% of significant levels, respectively. 2) The optimal lag length is selected automatically using the Schwarz Info Criteria (SIC) for ADF test and the bandwidth was selected using the Newey–West method for PP unit root test.

Table 3 presents the result of the ARDL cointegration test that detects the existence of long run cointegration in the research model. The value of the F-statistics (4.864) is more than the upper value of critical values for F-statistics (4.01) at 5 percent significance level. This means, there is a cointegrating relationship among all the variables in this research. In addition, this result also suggests that in the long run, the level of healthcare expenditure is influenced by the ageing population, level of inflation (CPI), income (GDPP), as well as the government’s education expenditure.

Table 3: Detecting the presence of long run cointegration based on F stat.

Model	Max Lag	Lag order	F statistics
LNHEP = F(LNAP, LNCPI, LNGDPP, LNEDU)	(1,2)	(1,2,2,2,2)	4.864**
Critical Values for F stat		Lower I(0)	Upper (1)
10%		2.45	3.52
5%		2.86	4.01
1%		3.74	5.06

Note: 1) # The critical values are based on Pesaran et al. (2001), case III: unrestricted intercept and no trend. 2) k is the number of variables and is equivalent to 5. 3. \*, \*\*, and \*\*\* represent 10%, 5% and 1% level of significance, respectively.

Table 4: Diagnostic Tests

Model	(A)	(B)	(C)	(D)
	Serial Correlation [p-value]	Functional Form [p-value]	Normality [p-value]	Heteroscedasticity [p-value]
LNHEP = F(LNAP, LNCPI, LNGDPP, LNEDU)	1.096 [0.371]	1.950 [0.077]	0.605** [1.004]	0.512 [0.8084]

Note. 1) \*\* represents 5% significant levels. 2) The diagnostic test performed as follows: A. Lagrange multiplier test for residual serial correlation; B. Ramsey’s RESET test using the square of the fitted values; C. Based on a test of skewness kurtosis of residuals; D. Based on the regression of squared fitted values. 2.

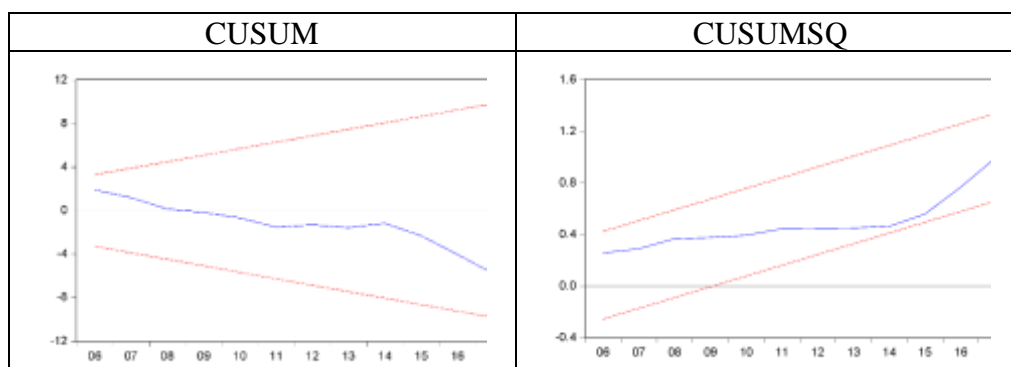


Figure 1: CUSUM and CUSUMSQ tests

The result of the diagnostic test in Table 4 validated that the research model is free from any econometrics issues. Therefore, the result generated from this model is reliable. The p-value of all the diagnostic tests is more than 5 percent significance level, indicating that there is no evidence of serial correlation’s presence, heteroscedasticity, incorrect functional form, and abnormal residuals for the model. In addition, cumulative sum of recursive residuals (CUSUM) and the cumulative sum of square of recursive residuals (CUSUMSQ) tests were applied to evaluate the model’s long run stability. The result in Figure 1 indicates the stability of the model’s structure as the cumulative sum and cumulative sum of squares are within the 5 percent significance lines.

Table 5: Long run elasticities

Variables	Coefficient	t-stat	Prob
Constant	-8.528	-1.967	0.072
LNAP	-0.036	-0.071	0.944
LNCPI	1.621	1.844	0.089*
LNGDPP	0.690	5.861	0.001***
LNEDU	0.112	5.890	0.001***

Note: 1) \*\*\*, \*\* and \* are 1%, 5% and 10% of significant levels, respectively.

To achieve the primary objective of this research, the long run elasticities based on the ARDL analysis was employed, and the results are presented in Table 5. GDPP and EDU are positively and significantly influencing the healthcare expenditure in Malaysia at 1 percent significance level. In details, these findings found that an increase of GDPP by 1 percent will increase the healthcare expenditure by 0.69 percent, while an increase of EDU by 1 percent will increase the healthcare expenditure by 0.112 percent. Furthermore, CPI shows a positive relationship and it significantly influences healthcare expenditure at 10 percent level. The result implies that as CPI increases by 1 percent, the healthcare expenditure in Malaysia increases by 1.621 percent. In contrast, ageing population displayed a negative relationship, but it was not significant in influencing healthcare expenditure at any level.

## 5. Conclusion and Recommendation

For decision and policy makers, the issue of healthcare expenditures that keep increasing over the year are a valid point to ponder and resolve. As this paper discovered from the utilization of the ARDL Bound test, GDPP that acts as an income level variable increases

healthcare expenditure by 0.69 per cent for every one percent increment of GDPP. This finding is in line with Khan et al. (2016), Kraipornsak (2017), and Zhou et al. (2020). Expenditure on education variables also positively influence healthcare expenditure by 0.112 per cent, which follows the study result of Antosova et al. (2019).

Interestingly, the regression result shows that GDPP has a positive and significant effect on healthcare expenditure with income elasticity for healthcare expenditure showing a value of 0.690, which is less than one. This result is similar to Khan's (2016) study, indicating that healthcare expenditure is a necessity. Also similar to Khan, the researchers believe that Malaysia is currently on a satisfactory road in growing its economy among the members of Association of Southeast Nation (ASEAN). However, with the unforeseen issues of the worldwide pandemic that Malaysia is currently facing, it would be an uphill battle for this country to enter the list of developed countries in the future.

Having said that, without discounting the concern of the global pandemic, the outcomes of the paper are hopefully able to provide insights for the decision and policy makers about the importance of healthcare expenditure for Malaysian development, especially on its economic fronts. Encouraging healthcare expenditure policies should be adopted as the main purpose of producing and maintaining a labour force that is highly skilled, productive, competent, and particularly healthy. It would be a reassurance if the Ministry of Health Malaysia (MOH) is able to look into the current healthcare education frameworks and healthcare facilities and set them at high priority for the enhancement and improvement of the general public in the future.

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