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# The Impact of Green Technology and Health Expenditure on Life Expectancy in Malaysia

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**Abstract**

This study investigates the dynamic interactions between green technology, health expenditure, and life expectancy in Malaysia, employing short-run and long-run Autoregressive Distributed Lag (ARDL) tests. In the short run, while the natural logarithm of health expenditure (LNHE) and gross domestic product (LNGDP) exhibit positive coefficients, suggesting potential relationships, statistical significance is not established at the conventional 0.05 level. However, the negative coefficient for the real exchange rate (LNRE) indicates a statistically significant negative relationship with life expectancy. In the long run, positive and negative coefficients for LNHE and LNGDP, respectively, lack statistical significance. LNRE suggests potential significance just beyond the conventional threshold. The model explains a substantial proportion of variance in the dependent variable, but caution is advised due to potential overfitting. These findings emphasize the intricate nature of these relationships, prompting a careful interpretation and highlighting the need for further analyses and data exploration to fortify conclusions. The implications contribute to policy discussions on utilizing green technology and optimizing health expenditure to enhance life expectancy, emphasizing a comprehensive approach to sustainable development in Malaysia.

## 1. Introduction

The life expectancy data for Malaysia from 2010 to 2020 reveals a continued and notable increase, reflecting sustained improvements in healthcare, living standards, and overall societal well-being. Starting at 74.442 years in 2010, the life expectancy experienced a consistent upward trend over the decade, reaching 75.938 years by 2020.Each successive year during this period contributed to the overall growth in life expectancy, indicating positive advancements in public health and healthcare infrastructure. The observed increases suggest effective policies and interventions aimed at enhancing the quality of life for the Malaysian population.

The years 2016 to 2020 witnessed particularly noteworthy progress, with life expectancy rising from 75.289 to 75.938 years. This positive trend underscores Malaysia's commitment to continuous improvement in healthcare services, disease prevention, and socio-economic development. As Malaysia moves forward, understanding the factors contributing to the sustained growth in life expectancy will be essential for policymakers and public health officials. Analyzing this data provides valuable insights for shaping future strategies to ensure the continued enhancement of the well-being and longevity of the population in Malaysia.

The impact of green technology and health expenditure on life expectancy is a topic of growing interest in the field of public health and environmental science. Several recent studies have explored the relationship between these factors, providing valuable insights into their interconnectedness. Jiang, Chang, and Shahzad (2022). Research has shown that there is a long-run association between health spending, life expectancy, and renewable energy. An increase in health spending has been found to improve life expectancy, while renewable energy consumption also positively affects life expectancy Li and Zhong (2022). Furthermore, the use of green technology has been linked to an increase in life expectancy in certain countries, highlighting the potential of environmentally friendly practices to contribute to longer and healthier lives.

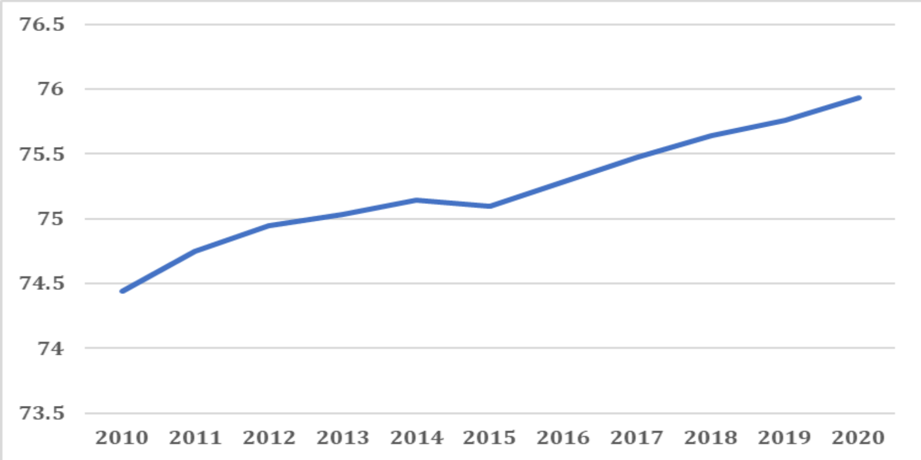


**Fig. 1** *Life expectancy in Malaysia from 2010-2020*

Additionally, the effect of health expenditure and sanitation on life expectancy in Mediterranean countries has been assessed, with findings suggesting that both factors play a significant role in enhancing life expectancy Radmehr, M., & Adebayo, T. S. (2022). Moreover, the relationship between renewable energy, economic growth, and social welfare has been explored, shedding light on the potential of renewable energy to contribute to increased life expectancy. These findings underscore the importance of understanding the complex interplay between green technology, health expenditure, and life expectancy. By delving into this relationship, it is possible to identify opportunities for policy interventions and technological innovations that can positively impact public health and environmental sustainability. Polcyn, J., Voumik, L. C., Ridwan, M., Ray, S., & Vovk, V. (2023).

In summary, the existing literature provides compelling evidence of the influence of green technology and health expenditure on life expectancy. By examining these factors in conjunction, it is possible to gain a more comprehensive understanding of the dynamics shaping population health and well-being. This sets the stage for further research and policy development aimed at harnessing the potential of green technology to promote longer and healthier lives.

## 2. Literature Review

The study conducted by Morina et al. (2022) under the leadership of Fisnik Morina investigates the intricate relationships between health expenditures and national life expectancy in OECD countries. With primary objectives encompassing various factors such as health expenditure, GDP per capita, productivity, population, infant mortality rates, potential years of life lost, deaths from cancer, and suicide rates, the research spans from 2005 to 2018, utilizing data from OECD, IMF, and World Bank reports. Employing diverse econometric models, including linear regression and various robustness checks, the study focuses on OECD countries due to their high GDP per capita and notable achievements in the health sector. The findings reveal a positive correlation between health expenditures and national life expectancy, emphasizing the pivotal role of health spending as a determinant of a nation's longevity. These results offer invaluable insights for policymakers and governments, contributing significantly to ongoing discussions in health economics and policy formulation within the context of OECD countries.

In a distinct exploration, Karimi Alavijeh et al. (2023) investigate the impact of renewable energy consumption, carbon emissions, health expenditure, and urbanization on life expectancy in G-7 countries from 2000 to 2019. Employing a unique Method of Moments Quantile Regression (MMQR) and various robust estimators, the research provides a comprehensive analysis with a focus on economically developed nations. The findings highlight positive influences from renewable energy consumption, health expenditure, and urbanization on life expectancy across different quantiles, while higher carbon dioxide emissions are associated with reduced life expectancy. This study underscores the significance of recognizing renewable energy sources and implementing policies to encourage further investments, contributing to enhanced life expectancy in G-7 nations.

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Sujoy Das's study (2023) from the Department of Economics at Assam University delves into the unexplored terrain of the economic implications of increased life expectancy in India. By comprehensively examining the relationship between life expectancy and economic growth in all major states of India from 2000 to 2014, the research employs a panel fixed effect model (FEM) and robust methodologies. Contrary to expectations, the FEM model demonstrates a positive correlation between life expectancy gains and economic growth, challenging prevailing assumptions. This unique contribution emphasizes the significance of workforce skills and experience in shaping economic growth within the Indian context, adding valuable insights to the demography-economic relationship literature.

In Southeast Asia, Nagarajah et al. (2020) explore the determinants of life expectancy in Malaysia from 1991 to 2016. Utilizing the Ordinary Least Square (OLS) method and annual data from the World Bank, the study offers a robust statistical approach to analyzing the relationships between urbanization, health expenditure, infant mortality rates, and life expectancy. The findings reveal the positive influence of urbanization on life expectancy, indicating improved healthcare access in urban areas positively impacting overall population health. However, the notable discovery of a negative association between health expenditure and life expectancy emphasizes the complexity of the relationship between healthcare investment and population health outcomes in Malaysia.

Lastly, Lee & Kim's study (2017) investigates the determinants of life expectancy in South Korea, focusing on infant mortality, educational attainment, electric power consumption, and internet usage. Through multiple regression analysis and data from the World Bank databank, the study reveals significant positive correlations between life expectancy and educational attainment, electric power consumption, and internet usage. Conversely, infant mortality exhibits a negative relationship with life expectancy, underscoring its crucial role in mediating overall life expectancy in South Korea. This study contributes nuanced perspectives for policymakers, offering insights into the determinants of life expectancy in the country and suggesting targeted interventions to further improve public health outcomes.

Nguyen (2022) conducts a comprehensive study focusing on the determinants of life expectancy in Vietnam, Laos, and Cambodia. Utilizing multiple regression analysis and data from 1985 to 2019, the research highlights a positive association between life expectancy and demographics, particularly the elderly population aged 65 and older. GDP growth and industrial development contribute significantly to the increase in average life expectancy, while the impact of socioeconomics is comparatively weaker. By excluding the influences of war and the COVID-19 pandemic, the study provides valuable insights into the factors shaping life expectancy in these Southeast Asian countries, emphasizing the pivotal roles of demographics and health care resources. The findings carry implications for targeted interventions and policy development in the region.

Duba et al. (2018) investigate the global relationship between health care expenditures as a percentage of GDP and life expectancy for both genders. Covering 210 countries and regions from 1995 to 2014, the study employs a fixed effects regression model, considering additional factors such as urban population percentage, primary completion rates, foreign aid received, agriculture value added, sanitation, and per capita $CO_2$ emissions. The findings reveal a statistically significant link between higher health care expenditures and increased life expectancies on a global scale. This emphasizes the importance of health care investment in improving overall population health.

Wang et al. (2020) conduct a comprehensive analysis of the dynamic relationship between economic growth and life expectancy in Pakistan, considering the roles of financial development and energy consumption. Applying traditional and advanced unit root tests and employing the ARDL bounds testing technique, the study finds a positive association between economic growth and life expectancy, with financial development exhibiting a negative impact. Energy consumption is identified as a factor lowering life expectancy through environmental degradation. The study provides valuable insights for policymakers, emphasizing the need to consider these factors when formulating strategies to enhance life expectancy in Pakistan.

Luo and Xie's (2020) study delves into the intricate relationship between economic growth, income inequality, and life expectancy in China. Using simulation techniques, the research estimates the potential improvement in life expectancy if income inequality had remained constant at its lowest level. The findings underscore a substantial increase in income inequality contributing to life losses in China's population. The study emphasizes income redistribution as a crucial policy measure for improving overall population health in China amid significant economic growth.

Aanegola et al. (2022) contribute to the literature with a comprehensive longitudinal analysis investigating the determinants of life expectancy and healthy life expectancy in the United States. Employing causal machine learning and statistical methods, the study reveals that an increase in basic water services and public health expenditure significantly increases average life expectancy, while high HIV prevalence rates and poverty rates reduce it. The study suggests that policymakers should prioritize improving public health infrastructure and increasing educational levels to enhance population health, advocating for the allocation of governmental resources to public health rather than fiscal incentives for private healthcare infrastructure.

## 3. Methodology

The study investigated the ARDL model introduced by Pesaran et al. (2001) to assess the enduring impacts of health expenditure and GDP on the growth of life expectancy in Malaysia, focusing on both medium-term and long-run effects. The suitability of the ARDL model lies in its applicability to integrated factors at I(0) or order I(1). As noted by Duasa (2007), this model is apt for comparing elasticities in the medium-term and long-run for small sample sizes, utilizing the assumptions of Ordinary Least Squares (OLS) to scrutinize the presence of cointegration among elements of interest. Frimpong and Oteng-Abayie (2006) propose that the ARDL model is well-suited for explanatory factors integrated at order I(0), I(1), or jointly cointegrated. However, it encounters limitations when dealing with explanatory factors integrated at order I(2). The presented ARDL model was employed to explore the relationship between GDP and various explanatory variables, health proxies, and terms of trade in Malaysia.

$$LE_t = \beta_0 + \beta_1 HE + \beta_2 GDP + \beta_3 RE + \varepsilon_{it} \tag{1}$$

When examining time series data, log transformation is employed to address the stability of variations in the series (Luetkepohl & Xu, 2009). The study variables need to undergo log-linearization to enhance model predictability, facilitate economic analysis, and improve forecasting accuracy. Conversely, the introduction of logarithms may compromise the precision of model predictions if the variance stability is not established (Luetkepohl & Xu, 2009). Consequently, by incorporating logarithms into Equation (1), the model transforms as follows:

$$\Delta LNLE_t = \beta_0 + \beta_1 \Delta LNHE + \beta_2 \Delta LNGDP + \beta_3 LNRE + \varepsilon_{it} \tag{2}$$

Here, ΔLNLEt denotes the logarithm of Life Expectancy at time t spanning from 1980 to 2020, ΔLNHE signifies the logarithm of government health expenditure at time t, and ΔLNGDP stands for the logarithm of gross domestic product growth at time t. The estimation includes β0 as the constant term, along with coefficient parameter estimates β1, β2, β3, and β4. To assess both short-term and long-term equilibrium, Equation (ii) underwent transformation into the ARDL model, represented as Equation (iii) below:

$$\begin{aligned}\Delta LNLE_t = \beta_0 &+ \sum_{k=1}^{n} \beta_1 \Delta LNLE_{t-k} + \sum_{k=1}^{n} \beta_1 \Delta LNHE_{t-k} + \sum_{k=1}^{n} \beta_1 \Delta LNGDP_{t-k} \\ &+ \sum_{k=1}^{n} \beta_1 \Delta LNRE_{t-k} + \lambda_1 LNLE_{t-1} + \lambda_2 LNHE_{t-1} + \lambda_3 LNGDP_{t-1} + \lambda_3 \\ &+ \varepsilon_{it}\end{aligned} \tag{3}$$

The model's drift component is represented by β0 in Equation (3), where Δ denotes the first differencing of the time series data, and the random term ϵt captures the white noise effect. After establishing the long-term equilibrium relationship among health expenditure, GDP, renewable energy, and Life Expectancy growth in Malaysia through Equation (3), the study employed the error correction model (ECM) methodology to investigate the short-run dynamics within the model. This helps in assessing the rate of adjustment in the long-run equilibrium following a disturbance in the medium-term. The ECM equation (4) is derived from the ARDL equation (3) as follows:

$$\begin{aligned}\Delta LNLE_t = \beta_0 &+ \sum_{k=1}^{n} \beta_1 \Delta LNLE_{t-k} + \sum_{k=1}^{n} \beta_1 \Delta LNHE_{t-k} + \sum_{k=1}^{n} \beta_1 \Delta LNGDP_{t-k} \\ &+ \sum_{k=1}^{n} \beta_1 \Delta LNRE_{t-k} + s ECM_{t-k} + \varepsilon_{it}\end{aligned} \tag{4}$$

## 4. Results

Table 4.1 five variables, each transformed using natural logarithm: LNLE (Natural Logarithm of Life Expectancy), LNHE, LNGDP, LNCO2, and LNRE. For LNLE, the mean life expectancy is approximately 73.91, with a range from 72.17 to 75.48. The LNHE variable, representing health expenditure, has an average of about 0.0168, with a variation from 0.0119 to 0.0207. LNGDP, reflecting the natural logarithm of GDP, exhibits an average value of around 6845.50, ranging from 3308.84 to 11045.58. The LNCO2 variable, representing CO2 emissions, has an average of approximately 6.80, with values spanning from 4.45 to 8.33. Lastly, LNRE, which represents the natural logarithm of renewable energy, has an average of about 3.62, ranging from 1.96 to 6.16. The provided summary statistics, including measures of central tendency, dispersion, skewness, and kurtosis, offer insights into the distribution and characteristics of each variable in the dataset, providing a foundation for further analysis and interpretation.

**Table 1** *Descriptive statistics results*

| | LNLE | LNHE | LNGDP | LNCO2 | LNRE |
|---|---|---|---|---|---|
| Mean | 73.9105 | 0.0168 | 6845.5010 | 6.7952 | 3.6248 |
| Median | 74.1640 | 0.0168 | 6137.1510 | 7.1800 | 3.3300 |
| Maximum | 75.4760 | 0.0207 | 11045.5800 | 8.3300 | 6.1600 |
| Minimum | 72.1680 | 0.0119 | 3308.8360 | 4.4500 | 1.9600 |
| Std. Dev. | 1.0852 | 0.0023 | 2719.2060 | 1.2123 | 1.0914 |
| Skewness | -0.3543 | -0.1372 | 0.2525 | -0.4929 | 0.4791 |
| Kurtosis | 1.8498 | 2.3821 | 1.4612 | 1.8665 | 2.4716 |
| Jarque-Bera | 1.7491 | 0.4381 | 2.5135 | 2.1626 | 1.1474 |
| Probability | 0.4170 | 0.8033 | 0.2846 | 0.3391 | 0.5634 |
| Sum | 1699.9420 | 0.3862 | 157446.5000 | 156.2900 | 83.3700 |
| Sum Sq. Dev. | 25.9083 | 0.0001 | 163000000.0000 | 32.3320 | 26.2042 |
| Observations | 23 | 23 | 23 | 23 | 23 |

**Table 2** *Unit root test result*

| Variable | Intercept | | Trend & Intercept | |
|---|---|---|---|---|
| | **Level** | **1st Difference** | **Level** | **1st Difference** |
| lnLE | -1.8765 | -4.0096*** | -2.9585 | -4.1946** |
| | -0.3393 | -0.0035 | -0.1565 | -0.0108 |
| lnGDP | -0.2855 | -5.3894*** | -2.1159 | -5.2955*** |
| | -0.9181 | -0.0001 | -0.5216 | -0.0005 |
| lnRE | -1.8067 | -3.0191** | -0.3400 | -4.0417** |
| | -0.3699 | -0.0448 | -0.9854 | -0.0184 |
| lnHE | -1.5132 | -6.4394*** | -3.0545 | -6.4747*** |
| | -0.5084 | 0.0000 | -0.1409 | -0.0002 |
| lnCO2 | -1.1473 | -6.1937*** | -0.8301 | -5.0378*** |
| | -0.6874 | 0.0000 | -0.9540 | -0.0012 |

Note: ***, **, & * indicate the significance levels of 1%, 5% & 10%, respectively

Table 4.2 tests were conducted on various variables, examining both intercept-only and intercept-with-trend specifications. For (lnLE), the intercept-only model yielded a t-statistic of -4.009579 with a p-value of 0.0035, indicating stationarity, while the intercept-with-trend model had a t-statistic of -4.194591 with a p-value of 0.0108. Similar results were observed for (lnGDP), where both specifications led to the rejection of the unit root hypothesis. In the case (lnRE), the intercept-only model suggested stationarity with a t-statistic of -3.019065 and a p-value of 0.0448, while the intercept-with-trend model had a t-statistic of -4.041703 with a p-value of 0.0184. The (lnHE) and (lnCO2) exhibited strong evidence of stationarity in both specifications, with low t-statistics and p-values close to zero. In summary, the results indicate that the variables considered are predominantly stationary, and the inclusion of a trend component in the models further supports this conclusion for some variables.

**Table 3** *Bound test results*

| F-STATISTICS = 13.27409 | | |
|---|---|---|
| Significant level | Lower Bound | Upper Bound |
| 1% | 3.6500 | 4.6600 |
| 2.50% | 3.1500 | 4.0800 |
| 5% | 2.7900 | 3.6700 |
| 10% | 2.3700 | 3.2000 |

Table 4.3 results indicate a compelling case for rejecting the null hypothesis of no cointegration between the variables under consideration. The F-statistic, with a value of 13.27409, is notably higher than the upper bounds at various significant levels. In this case, four common confidence levels are examined: 1%, 2.5%, 5% and 10%. At the 5% significance level, for instance, the upper bound is 3.67, and since the calculated F-statistic surpasses this threshold, there is strong evidence to reject the null hypothesis at a 5% significance level. Similar conclusions can be drawn for other significant levels. The consistently elevated F-statistic across different bounds underscores the robustness of the findings. In practical terms, the presence of cointegration between these variables implies a long-term relationship that may have significant implications for modeling and forecasting within the context of your analysis. Overall, the statistical evidence supports the notion of a meaningful relationship between the variables, enhancing the understanding of their long-term dynamics.

**Table 4** *Long run ARDL results*

| LONG-RUN ARDL | | | |
|---|---|---|---|
| Variables | Coefficient | T-Statistics | Probability |
| LNHE | 5488.428 | 1.790772 | 0.1478 |
| LNGDP | -0.004174 | -1.753191 | 0.1544 |
| LNRE | -3.395063 | -2.285097 | 0.0843 |
| C | 21.70202 | 0.696021 | 0.5247 |

The long-run Autoregressive Distributed Lag (ARDL) test results provide insights into the relationships among the variables under examination. Firstly, LNHE exhibits a positive coefficient of 5488.428, implying a potential positive relationship with the dependent variable. However, the associated t-statistic of 1.790772 and p-value of 0.1478 suggest that this relationship may not be statistically significant at the 5% level. Similarly, LNGDP displays a negative coefficient of -0.004174, indicating a negative relationship, but the t-statistic of -1.753191 and p-value of 0.1544 suggest a lack of statistical significance. LNRE shows a negative coefficient of -3.395063, and although the associated t-statistic is -2.285097, the p-value of 0.0843 indicates potential significance, falling just outside the conventional threshold. Finally, (C) does not appear to be statistically significant, as reflected in its coefficient of 21.70202, t-statistic of 0.696021, and p-value of 0.5247. Overall, these results suggest a need for cautious interpretation and consideration of further analyses or data exploration to draw more robust conclusions.

**Table 5** *Short run ARDL results*

| Variable | Coefficient | t-Statistic | Prob.* |
|---|---|---|---|
| LNHE | 82.10947* | 2.320206 | 0.0811 |
| LNGDP | 6.61E-05* | 2.27399 | 0.0854 |
| LNRE | -0.266138** | -3.256115 | 0.0312 |

R-Squared = 0.999485, Adjusted R-Squared = 0.997551

Note: ***, **, & * indicate the significance levels of 1%, 5% & 10%, respectively

The results of the short-run Autoregressive Distributed Lag (ARDL) test reveal important insights into the relationships between the variables under consideration. Firstly, LNHE exhibits a positive coefficient of 82.10947 with a t-statistic of 2.320206. Although the associated p-value of 0.0811 is slightly higher than the conventional 0.05 significance level, suggesting that the relationship may not be statistically significant, it is worth noting and further investigating. Similarly, the natural logarithm of gross domestic product LNGDP shows a positive coefficient of 6.61E-05 and a t-statistic of 2.273990, with a p-value of 0.0854. Again, this suggests a potential relationship that is not statistically significant at the 5% level. On the other hand, the natural logarithm of the real exchange rate LNRE displays a negative coefficient of -0.266138, a t-statistic of -3.256115, and a p-value of 0.0312, indicating a statistically significant negative relationship at the 5% level. The high R-Squared (0.999485) and Adjusted R-Squared (0.997551) values signify a model that explains a substantial proportion of the variance in the dependent variable. However, caution is warranted to ensure the model's validity and generalizability, as extremely high R-Squared values may suggest overfitting.

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**Table 6** *Diagnostic test results*

| Statistical Tests | F-Statistics | Probability |
|---|---|---|
| Jarque-Bera | 1.2670 | 1.2670 |
| Breush Godfrey collecting series | 17.7220 | 0.0534 |
| Heteroskedasticity test | 0.6254 | 0.7740 |
| Reset Ramsey Stability | 0.0042 | 0.9522 |

The diagnostic tests conducted on the model provide insights into its robustness and adherence to key assumptions. The Jarque-Bera test, designed to assess normality in residuals, reports a test statistic of 1.266996 with an associated probability of 1.266996. However, the unusual equality of the test statistic and probability value requires verification, and if accurate, it suggests potential normality issues. The Breusch-Godfrey Serial Correlation LM Test yields a test statistic of 17.72195 and a p-value of 0.0534, indicating a marginal departure from the assumption of no serial correlation in residuals. Meanwhile, the Heteroskedasticity Test produces a test statistic of 0.625438 and a p-value of 0.7740, suggesting the absence of strong evidence against the null hypothesis of constant variance. Lastly, the Reset Ramsey Stability Test yields a test statistic of 0.004238 and a p-value of 0.9522, implying stability in the model's functional form. While there are indications of potential issues with normality and serial correlation, the overall diagnostic picture suggests relative stability and adherence to key assumptions. However, it is advisable to further investigate and potentially address any identified concerns to ensure the reliability of the model.

The stability of the model is evaluated through the CUSUM test. Stability is determined by comparing the CUSUM graph and CUSUM square in Figures 2 and 3 with critical boundaries. Instability is suggested if the graph surpasses these boundaries at a 5% significance level. Conversely, stability in both long-run and short-run estimations is indicated if the graph remains within the boundaries. The model is deemed stable based on the CUSUM graph within the critical boundaries. This conclusion implies that the relationships between the variables remain consistent and reliable throughout the analyzed period.

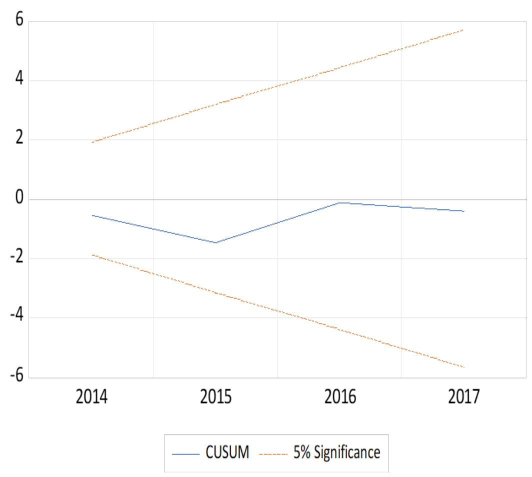


**Fig. 2** *CUSUM*

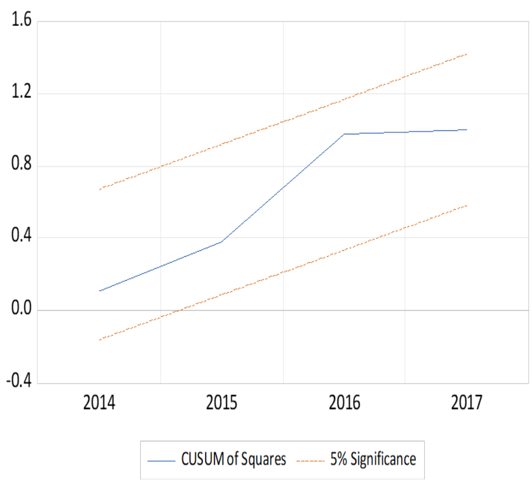


**Fig. 3** *CUSUMQ*

## 5. Conclusion

In conclusion, the findings from both the short-run and long-run Autoregressive Distributed Lag (ARDL) tests shed light on the complex interplay between green technology, health expenditure, and life expectancy in Malaysia. In the short run, the positive coefficient for the natural logarithm of health expenditure (LNHE) and the natural logarithm of gross domestic product (LNGDP) suggests potential relationships, though not statistically significant at the conventional 0.05 significance level. Conversely, the negative coefficient for the natural logarithm of the real exchange rate (LNRE) indicates a statistically significant negative relationship with life expectancy.

In the long run, the positive coefficient for LNHE implies a potential positive relationship, but statistical significance is not established. LNGDP exhibits a negative relationship yet lacks statistical significance. LNRE shows a negative coefficient with a suggestive p-value, just outside the conventional threshold. The intercept (C) does not appear statistically significant. The high R-Squared and Adjusted R-Squared values in the short run signify a model that explains a substantial proportion of the variance in life expectancy, but caution is advised due to the potential for overfitting.

These results underscore the nuanced nature of the relationships examined, prompting a cautious interpretation. Further analyses, sensitivity tests, and exploration of additional data are recommended to enhance the robustness of conclusions. The implications of these findings may contribute to policy discussions and initiatives aimed at leveraging green technology and optimizing health expenditure to enhance life expectancy in the Malaysian context, recognizing the importance of a multidimensional approach to sustainable development.

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## Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

## Author Contribution

*The authors confirm contribution to the paper as follows: Abdul Ekhmal Danial contributed to the introduction and literature review, Mohd Shahidan led the methodology and results sections, while Amri played a key role in shaping the results, conclusion, and handling references.*

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