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THE IMPACT OF ENVIRONMENTAL QUALITY ON PUBLIC HEALTH EXPENDITURE IN MALAYSIA

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Abstract

Health is one important factor in the development of human capital. Good health will lead to increased levels of productivity. This study was conducted to examine the co-integration between environmental quality and socio-economic factor for national health expenditure. This study used secondary data from the World Bank Indicators and the Department of Statistics in Malaysia. This analysis employs annual time series data on Health Expenditure (HE), Gross Domestic Product (GDP), Carbon Dioxide (CO_2), Nitrogen Dioxide (NO_2) and Sulphur Dioxide (SO_2) emission in metric tonnes per capita, Fertility Rate (FR) and Mortality Rate (MR) infant per 1,000 live births. The ARDL approach is used in order to explore the possibility of estimating both short and long run impacts of environmental quality. The study found that GDP, CO_2, MR, FR, NO_2 and SO_2 could be treated as having a relationship with health expenditure in the long run in Malaysia. SO_2, fertility and infant mortality rate showed a significant factor in the country's health expenditures affect substantially. The new generation is an important element in ensuring the continuance and sustainability of national development in the future.

Keywords: Environmental quality, Socioeconomics, ARDL.

1. Introduction

Concern for health has traditionally undertaken much of the political priority compared to environmental issues across the world. There are many factors out there that influence the health of a population, such as diet, sanitation, socio-economic status, literacy, lifestyle and also environmental. The impact of environmental risk factors on health are extremely varied and complex in both severity and clinical significance. The increasing deterioration in environmental quality across the world is posing serious challenge to healthy living through the increasing threat of global warming. Increase of global warming and greenhouse gas emissions due to consumption of fossil fuels was affecting the environmental quality. Particulate, sulphur dioxide and carbon dioxide emission from burning of fossil fuels are contributing significantly to pollution and be a major contributor to global climate change, which has been a topical issue among policy makers and focus of quite a number of researchers across different fields of study (ADB, 2012).

Health is one of the most important factors that determine the quality of human capital, a necessary factor for economic growth. In line with the above, a consensus of opinion has been formed among researchers recognizing health as a public good, the demand and supply of which cannot be left at the mercy of invisible hands or profit maximizing individual, as well as on considerations of utility maximizing conduct alone. Hence, the need for the government to play a major role in delivering good and qualitative healthcare services that is accessible and affordable for the teeming population. The pattern of health financing is; therefore, closely and indivisibly linked to the quality of health outcomes, capable of achieving the long term goal of enhancing nation's economic development. Constructive consequences of the enhanced level of human capital in the process of socio-economic development have also been explicated by Azam & Ahmed (2015).

Pollution will give adverse side effects to the health of the population of young and senior citizens. Emissions of greenhouse gases have the potential of aggravating the problem of climate change which poses serious health challenges, in terms of cardiovascular and cerebrovascular disease, among the elderly as it is usually associated with excessive temperatures and heat waves that can alter arterial pressure and blood viscosity. Additionally, thermal stress and temperature-related air pollution, pollen counts, mold growth and pollution precursor can cause a variety of respiratory diseases including asthma, bronchitis, pneumonia, cough and cold while increasing temperaturesm humidity and rainfall can effect proliferation, density and maturation of insect vectors such as mosquitoes as well as ticks and flies (Pattanayak and Pfaff, 2009).

Air pollution from industrial and vehicular emissions is a major issue in the urban areas of Malaysia. Malaysia is ranked 42 in the world in terms of vehicle ownership per capita, with 273 Malaysians having vehicles out of every 1000. Public transportation has been introduced in the form of bus networks and railway systems as mitigation, but utilization rates are low. Water pollution occurs due to the discharge of untreated sewage; the west coast of the Peninsular Malaysia is the most heavily populated area. 40% of the rivers in Malaysia are heavily polluted. The country has 580 cubic km of water, of which 76 per cent is used for farming and 13% is used for industrial activity. Cities in Malaysia produce an average of 1.5 million tons of solid waste per year (WHO, 2014). Malaysia has enjoyed one of the least polluted urban environments in Asia. However, with the massive industrial development of recent years, and an increase in urbanization and vehicle use, air and water pollution are of growing concern.

Poor environmental quality is responsible for many health damages and air, water and soil pollution can increase the risks of illness. The share of government spending on health constantly increasing and it's met by an almost immediate increase in the demand for healthcare. The increasing deterioration in environmental quality across the world is posing serious challenges to healthy living through the increasing threat of global warming. Many studied have examined how some socio-economic and political factors are driving health care expenditure using time series data, cross sectional data and panel data models. They focused on the impact of factors like income, age distribution, globalization, foreign aid, inflation and etc. However, there is a dearth of studies examining the influence of environmental quality on health care expenditure in Malaysia. There are a number of studies such as Barro (1996), Baldacci *et al.* (2004), Rahman (2011) Kim & Lane (2013), Boachie*et al.* (2014) and Eneji& Onabe (2013) are about the macroeconomic determinants of the health expenditure, but very few of them have clearly focused on the determinants of health expenditure through the environmental quality.

Population growth is expected to decline further to one percent for the 2020 to 2030 period. The total fertility rate represents the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with current age-specific fertility rates (MOH, 2013). Nowadays, there is a particular concern that, with an ageing population and; therefore, the prospect of more elderly people, the pressures for expenditure on health care will escalate. Thus, this study will also take account the link between health expenditure and socioeconomic factors such as mortality rate and fertility rate besides the effects of environmental quality on public health expenditure in Malaysia. This study is to bet of the researchers knowledge is the pioneering study on topic under the study. In this study, the portfolio of the repressors is relatively different comparing with the prior studies. Alongside, time period and the method of estimation used in this study are unique. It is expected that outcomes of the study will equip policy makers when chalking out public polices for stimulating socio-economic development in Malaysia.

This study is organized as follows: Section 2 deals with related literature review. Section 3 present data and empirical methodology used. Section 4 explains empirical results. Finally, section 5 concludes the paper.

2. Literature Review

A lot of previous studies are examining the link between health and economic outcomes. Health is one of the criteria for the economic performance both at the level micro and macro levels. It is one of the key elements in our economic growth. According to the Bloom *et. al* (2001), health has positive and statistically significant effect on economic growth. Improvement of one year in a population's life expectancy will contributes to a great increase in output. This is supported by Baldacci *et al.* (2004) which discovered that social expenditure on health have positive significant growth impact to economic growth. By adopting the neo-classical growth model and used the ordinary least square methods of estimation, Dauda (2004) analysed the impact of healthcare spending on economic growth in Nigeria and found a positive relationship between health care expenditure and economic growth. Regarding the Bloom et al. (2001, 2003), one of the factor to determine the investing in education and health is our population quality.

While Brempong & Wilson (2004) found that health capital indicators positively influenced aggregate output. Their finding shows that about 22 per cent – 30 per cent of growth rate are attributed to health capital and improvements in health conditions equivalent to more year of life expectancy which associated with higher GDP growth up to four (4) per cent per year. Sapuan& Sanusi (2009) also discovered that investment in health capital have positive relationship with real GDP which life expectancy as proxy of health capital showing a bigger effect to real GDP as one (1) per cent increase in life expectancy will increase 10 per cent of real GDP in Malaysia. Mayer (2003) found that health play significant role in economic growth compared to education. Health increased growth through improvement in education enrolment, productivity level and participation women in economic activities.

This supports by Messer (2002) which view health as a capital. Better health will increase productivity, fewer sick days and higher wages. Health status determines job productivity, the capacity to learn at school and the ability to grow intellectually, physically and emotionally. Elimination of diseases and improvement of individual health will enhance income earning capacity (WHO 2004). According to Bloom et al. (2001, 2003) a healthy population will give impact to economy in four ways which are through increasing productivity level, spend more times at work, invest more in education and increase the investment due to high expectation of a longer life.

While this process of decline in mortality and increasing life expectancy had different path to reach at some better level in today's world. It took two to three centuries in Europe to reduce its infant and child mortality and increase life expectancy while in South-East Asia it took only few decades which is described by a study of Asian Development Bank (ADB, 1997) as "demographic gift". This demographic change has contributed 0.5 to 1.3 per cent in annual growth since mid-1960 to early 1990 or 15 to 40 per cent of the region's overall economic improvement. Hansen and Selte (2000), examined the relationship between air pollution and human health effects. Their main focus was on investigating the impact of deteriorating health due to air pollution, which leads to more sick leaves, on labour productivity. They used data from Oslo and employed a logit model. They found that an increase in small particulate matter increases number of sick leaves, which negatively impacts trade and industry in Oslo.

Boachie*et al.* (2014) in a study on determinant of public health spending in Ghana revealed that CO2 emissions (used as proxy for pollution) impact positively but insignificantly on health care spending, implying that air pollution tends to increase public spending. They however contended that the non-significance of this variable could be due to the fact that there is low level of industrialization in Ghana. Kiymaz*et al.* (2006), also found that environmental factors like pollution have been found to have positive impact on public health spending in certain provinces in China in a study that involved the use of panel unit root and cointegration analysis.

Jerret*et al.* (2003) investigated the relationship between environmental quality (proxies by total pollution emissions and government expenditures devoted towards defending environmental quality) and health care expenditures. They used cross-sectional data from 49 countries of Ontario, Canada. They found that countries with higher pollution have higher per capita health expenditures and countries that spend more on defending environmental quality have lower expenditures on health care.

Narayan and Narayan (2008), examined the role of environmental quality in determining per capita health expenditures used a panel cointegration approach in order to explore the possibility of estimating both short and long run impacts of environmental quality. The empirical analysis is based on eight OECD countries, namely Austria, Denmark, Iceland, Ireland, Norway, Spain, Switzerland and the UK for the period 1980-1999. They found that per capita health expenditure, per capita income, carbon monoxide emissions are co-integrated.

Adusanya*et al.* (2014), adopts the ARDL Bounds testing approach to investigate the effects of environmental quality (proxy by CO2 emissions) on healthcare spending in the long and short run periods, revealed that CO2 emission in metric tonnes per capita have positive impact on health spending in Nigeria, implying that as the environment quality deteriorates, health spending increases.

Yazdi*et al.* (2014), used cointegration and ARDL approached in order to explore the possibility of estimating both short and long run impacts of environmental quality in Iran for period of 1967 to 2010. They find that health expenditure, income, sulphur oxide emission and carbon monoxide emissions are co-integrated. Short and long run elasticity reveal that income, sulphur oxide emission and carbon monoxide emissions exert a statistically significant positive effect on health expenditures. Assadzadeh (2014) examined the role of environmental pollution in determining per capita health expenditures. Their empirical analysis is based on 8 oil exporting countries, for the period 2000–2010. The results the short-run elasticities revealed that income and carbon dioxide emissions exerted a statistically significant positive effect on health expenditures but life expectancy had negative effect.

The aforementioned studies exhibit that empirical findings of the previous studies are yet elusive. Moreover, literature reveals that empirical studies related to our study are yet scarce in the context of Malaysia. Therefore, the main objective of the present study is to explore empirically the linkage between environmental quality and public health expenditure for Malaysia.

3. Data and Empirical Methodology

The data set contains the Malaysian data series from 1970 to 2014. Total health expenditure (HE) in per capita, GDP per capita, carbon dioxide (CO2), nitrogen dioxide (NO2) and sulphur dioxide (SO2) emissions in metric tonnes per capita, the fertility rate (FR) and mortality rate (MR) infant per 1,000 live births taken from the World Development Indicator (WDI), Asia Development Bank (ADB) and Department of Statistics Malaysia.

The empirical model in the study followed emanated from the works of Karatzas (2000) and Abdullah and Habibullah(2009). We examine the relationship between health expenditures and social factors and economic. The bivariate formation has been expanded by Karatzas (2000) to include additional socioeconomic factors as determinants of health expenditure. Therefore, our model the relationship within a multivariate framework. Relationship between health expenditure and economics and social factors has taken various forms. This bivariate formation has been expanded by several recent studies Karatzas (2000) to include additional socio economics factors as determinants of health expenditure. Thus, the model reflects the relationship within a multivariate framework.

All variables are converted in natural logarithms form to allow us to interpret them as elasticities. The Equation (1) can be written as follows:

$$\ln HE_t = \beta_0 + \beta_1 lnGDP_t + \beta_2 \ln CO_{2_t} + \beta_3 \ln SO_{2_t} + \beta_4 \ln NO_{2_t} + \beta_5 \ln MR_t + \beta_6 \ln FR_t + \varepsilon_t (1)$$

In Equation (1), *HE* represents the health expenditure per capita, *GDP* is the gross domestic product per capita, CO_2 represents the carbon dioxide emission in metric tonnes per capita, SO_2 is the sulphur dioxide emission in metric tonnes per capita, *NO2* is the nitrogen dioxide emission in metric tonnes per capita, *MR* represents the mortality rate infant per 1,000 live births, and *FR* is the fertility rate. The choice of these variables relies on the data accessibility. The β_0 is a constant term and β_1 to β_6 are estimated parameters in the model and t is a time series data and ε_t is an error term.

4. Estimation Procedure

This study will be estimated by using the co-integration border test procedure (Autoregressive Distributed Lag, ARDL) which was introduced by Pesaran and Shin (1995) and Perasan, *et al.* (2001) for analysis purposes by long-term empirical relationship and dynamic interaction between the variable studied. To use the co-integration technique, we need to determine the cointegration rule for each variable. However, as stated in the previous research, different tests will give different outcomes of decision and they depend on pre-test unit cause. The main advantage of this approach lies in thefact that it obviates the need to classify variables into $I(1)$ or $I(0)$. The testinvolves three steps. First, we estimate each equation by using ordinary least square (OLS) technique. Secondly, we calculated Wald's test (statistic-F) to see the long-term relationship between the variables. Wald's test can be done with restrictions on long-term coefficient expectation (Abdullah et al., 2009).

Using the assumptions made by Pesaran*et al.* (2001) in Case III (unrestricted intercepts and no trend) and imposes the restriction, $\lambda_{yx}= 0$, $\mu \neq 0$, the relationships between the dependent variable and independent variables in Equation (1) as below;

$$\begin{aligned}\ln HE_t = {} & \beta_0 + \beta_1 lnHE_{t-1}\beta_2 lnGDP_{t-1} + \beta_3 \ln CO_{2_{t-1}} + \beta_4 \ln SO_{2_{t-1}} + \beta_5 \ln NO_{2_{t-1}} + \beta_6 \ln MR_{t-1} \\ & + \beta_7 \ln FR_{t-1} + \beta_{8,i}\sum_{i=1}^{p} \Delta\, lnHE_{t-1} + \beta_{9,i}\sum_{i=1}^{q_1} \Delta\, lnGDP_{t-1} + \beta_{10,i}\sum_{i=1}^{q_2} \Delta \ln CO_{2_{t-1}} \\ & + \beta_{11,i}\sum_{i=1}^{q_3} \Delta \ln SO_{2_{t-1}} + \beta_{12,i}\sum_{i=1}^{q_4} \Delta \ln NO_{2_{t-1}} + \beta_{13,i}\sum_{i=1}^{q_5} \Delta \ln MR_{t-1} + \sum_{i=1}^{q_6} \Delta \ln FR_{t-1} + \varepsilon_t\end{aligned}$$

(2)

Where Δ is the first difference operator, *t u* is white noise disturbance term and all variable are expressed in logarithms. Equation (2) can also be interpreted as an Autoregressive Distributed Lag (ARDL) (*p, q1, q2, q3, q4, q5, q6*). We apply Schwarz Bayesian Criteria (SBC) for the possibility of different lag lengths. From the estimation of unrestricted error correction model, the long-run elasticities are the coefficient of the one lagged explanatory variables (multiplied with a negative sign) divided of the one lagged dependent variable.

We estimate Equation (2) by Ordinary Least Squares (OLS) technique and then calculate the F-statistic (Wald test) for the existence of long-run relationships between the concerned variables. The null and alternative hypotheses are constructed as follows:

$H0: \beta1 = 0$ *and* $\beta2 = \beta3 = \ldots = \beta7 = 0$ (no long-run levels relationship)
$HA: \beta1 \neq 0$ *and* $\beta2 \neq \beta3 \neq \ldots \neq \beta7 \neq 0$ (long-run levels relationship exist) (2)

Third, we follow the bounds test approach [Table 3 CI(iii)] suggested by Pesaran*et al.* (2001) and if our sample test statistic is below the associated lower critical value, it means that we accept the null hypothesis at a particular significance level. The null hypothesis is then accepted regardless of whether the underlying orders of integration of government expenditure and economic growth are $I(0)$ or $I(1)$. According to Pesaran, et al. (2001), the lower bound critical values assume that the explanatory variables, *t x* are integrated of order zero, or I(0), while the upper bound critical values assume that *t x* are integrated of order one, or $I(1)$. Therefore, if the computed F-statistic from our sample test statistic exceeds the upper bound value, it means that we reject the null in favour of the alternative that there exists a long-run relationship between the government expenditure and its determinants. Conversely, if the computed F-statistic from our sample test statistic is smaller than the lower bound value, then we do not reject the null hypothesis and we conclude that government expenditure and its determinants are not co-integrated. Otherwise, if the computed F-statistic from our sample test statistic falls between the lower and upper bound value, the results are inconclusive at this particular significance level (Hussin and Habibullah2009).

Finally, the error correction model can be defined within the ARDL framework as follows;

$$\ln HE_t = \mu + \sum_{i=1}^{p} \emptyset_i \Delta \, lnHE_{t-1} + \sum_{j=1}^{q_1} \varphi_j \Delta \, lnGDP_{t-1} + \sum_{m=1}^{q_2} \gamma_m \Delta \ln CO_{2_{t-1}} + \sum_{n=1}^{q_3} \theta_n \Delta \ln SO_{2_{t-1}} + \sum_{r=1}^{q_4} \delta_r \Delta \ln NO_{2_{t-1}} + \sum_{s=1}^{q_5} \rho_s \Delta \ln MR_{t-1} + \sum_{y=1}^{q_6} \vartheta_y \Delta \ln FR_{t-1} + \omega ecm_{t-1} + \varepsilon_t \quad (3)$$

Here $(\emptyset, \varphi, \gamma, \theta, \delta, \rho, \vartheta)$ in Equation (3) is referring to the short run dynamic coefficients and ω denote the speed of adjustment.

5. Results and discussions

Unit root test is significant in examining the stationary of a time series because the non-stationary regressor rejects many empirical results. The existence of stochastic trend is determined by the unit root test time series data. In this study, the unit root tested using the ADF (1979). Table 1 present the result of the ADF and Phillips Perron Test, the order of integration is tested at one (1) per cent, five (5) per cent and 10 per cent significance level and the critical values obtained from Mackinnon (1991) Tables. The results are robust regardless of the lag length. These tests are done for both trend and without trend. From Table 1 we found that we reject the null hypothesis of non-stationary which indicates that most of the variables are stationary at the first differences at five (5) per cent level of significance except for FR stationary in level and MR stationary at second difference. It is clear from the empirical results in Table 1, under these circumstances and especially when we faced mix results, applying the ARDL bounds approach is the efficient way of determining the long run relationships among the variables under investigation.

Table 1: Results of Unit Root Test - ADF

Variable	Level $I(0)$		First Order Difference $I(1)$	
	Constant	Constant +Trend	Constant	Constant + Trend
lnHE	1.931	-0.095	-4.814**	-5.350**
lnGDP	-1.856	-1.368	-5.467**	-5.8022**
lnCO2	-1.098	-1.605	-7.682**	-7.701**
lnSO2	-0.448	-0.783	-2.932***	-3.088***
lnNO2	-1.517	-3.090	-6.348**	-6..275**

lnMR	-2.106	0.851	-1.973*	-3.853**
lnFR	-3.934**	-9.208***	-	-

Note:The null hypothesis is that the series is non-stationary and the rejection of null hypothesis for ADF test is based on the MacKinnon (1991) critical value; ***, **, * imply significance at the 1%, 5%, 10% level, respectively.

Table 2 presents the ARDL estimates. In fact, this is the first stage of an ARDL modelling for univariate co-integration test. The result of the few diagnostic tests include that there is no error of Autocorrelation and conditional heteroscedasticity and that the errors are normally distributed. This evidence indicates that the relationship between variables is verified.

This implying that the current GDP, CO2 and SO2 would still affect the Health Expenditure for the coming year and the current of MR would affect the health expenditure for the next two years and the current of health expenditure would also still have significance on the health expenditure in the next year.

The next step is to investigate whether the Malaysia Health Expenditure, GDP. NO2 emissions, FR, MR, CO2 and SO2 emissions share a common long run relationship. To achieve this, as explained earlier we test the presence of the long run relationship.The co-integration test in bound's framework involves the comparisons of the F-statistic against the critical values, which are generated for specific sample size (Narayan, 2005).
From the Table 2, using the asymptotic critical value computes by Pesaran*et al.* (2001), we find that there is a long run relationship between the variables when health expenditure is a dependant variable because its F-Statistic, which turn out to be 6.8063 is higher than the upper bound critical value of 4.428 at one (1) per cent level of significance.

Table 2: Cointegration Result of Bounds Test for Malaysia in Health Expenditure (HE)

	Wald Statistic	
Computed F-value:	6.806***	
	Critical value	
	Lower bounds	Upper bounds
10% significance	2.618	3.532
5% significance	3.164	4.194
1% significance	4.428	5.816

Note: The bounds critical values were obtained from Narayan *et al.* (2000); Critical values for the bounds test: Case III: restricted intercept and no trend (k = 6); *, ** and *** denote significant at 1%, 5% and 10% significance levels

Going by this result, the null hypothesis of no co-integration is not accepted. Regardless of whether the variables are I(I) or I(0) or a mix of both. The test also indicates the presence of the valid long run relationships between the independents variable and the dependant variable at the calculated F-statistics of 6.8063 which exceed the upper critical value. Thus, GDP, CO2, MR, FR, NO2 and SO2 could be treated as having relationship which health expenditure in the long run in Malaysia.

In the first step of analysis of ARDL, the existence of the long run coefficient is estimated and the results are reported in Table 2. As discussed earlier, one of the important issues in applying the ARDL is the choice of the order of the distributed lag function. In order to select the best performing ARDL model, the significant of the result ARDL-VECM parameters, the Schwarz Bayesian Criterion (SBC) is preferred to other models specification criteria because it tends to define more parsimonious specifications. The small data sample in the current studies underlies this preference (Pesaran and Smith, 1998).

Table 3: The Estimated Long-run Coefficient Results (ARDL Estimations)

Determinants	Constant	lnGDP	lnCO2	lnSO2	lnNO2	lnMR	lnFR
Coefficient/ t-*stat*	10.481* (1.914)	3.965* (1.813)	0.716** (2.368)	3.024*** (4.801)	4.884 (1.628)	3.313** (2.384)	2.606** (2.059)

Diagnostic test for ARDL's model	
R^2	0.8305
Stat.-DW	2.1102
LM Test	0.631(0.434)
Jarque-Bera	5.396 (0.125)
Ramsey'sRESETTest	0.571 (0.456)
ARCH	0.392 (0.984)

Note: *, ** and *** denote significant at 1%, 5% and 10% significance levels. Ramsey's Test RESET - refer to regression specification error test. ARCH - refer to test heteroschedasticity(Engle 1982); Jarque-Bera - refer to distribution test normal; LM test - refer to Breusch-Godfrey serial correlation's test(BG).

As presented, the long-run coefficients for Equation (2). The results show that the GDP coefficient is 3.965 and have a positive statistically significant effect on health expenditure at 10% level. Mean that increase 1% in the GDP lead to 3.965% increase on health expenditure. While, carbon dioxide emission (CO2) coefficient; 0.716 and the positive statistically significant effect on health expenditure at 5% level. At 1% increase in the carbon dioxide variable lead to 0.716% increase in health expenditure. The sulphur dioxide emission (SO2) has a significant positive effect on health expenditure at 1% level with 3.024 coefficient. At a 1% increase in the sulphur dioxide variable, this led to 3.024% increase in health expenditure. The coefficient of the mortality rate (MR) is 3.313 and statistically positive significant at the 5% level. Increase 1% in MR will increase 3.313% of health expenditure. The fertility rate (FR) has a significant positive effect on health expenditure at 10% level with 2.606 coefficients. Meaning that a 1% increase in the fertility rate variable led to a 2.606% increase in health expenditure.

The diagnostic tests presented in the Table 3 show that there is no evidence of diagnostic problem with the model. Measuring the explanatory power of the equations by their R-squared show that roughly 83% of the variation in money demand can be explained. Equation (3) generally pass the Breusch-Godfrey Serial Correlation LM test,Jacque-Bera normality test, Ramsey RESET stability test and ARCHtest in the first stage. These tests show that thereis no evidence of autocorrelation and that the models pass the tests for normality and thus, proving that the error is normally distributed (Abdullah et al., 2009).

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The error correction term indicates the speed of the adjustment which restores equilibrium in the dynamic model. The ECM coefficient shows how quickly variables return to equilibrium and it should have statistically significant coefficient at five (5) per cent level of significance with a negative sign (Pahlavanietal., 2005). Bannerjeeetal. (1998) hold that a highly sign ECM is further proof of the existence of a stable long run relationship. Therefore, having determined the long run coefficient for each selected ARDL model, we derived the estimators for the ECM. The results are presented in Table 4.

The coefficient of the error correction term (ECM) is equal to -0.859. According to this estimation, speed of adjustment is high. This means that in every year, 86% of the divergence between the short-run health expenditure from its long-run path is eliminated. This means that the adjustment takes place relatively. This confirms the existence of the long run relationship among the variables with their various significant lags.

As shown in the Table 4, the variables have a contrast impact on HE in short run compare the impact in the long run. CO2 and SO2 exhibited a positive influence on per capita HE in the long run and short run. On the other hand, GDP, MR and FR like in the long run period are expected to influence Health Expenditure are negatively in the short run period.

Estimations show that the coefficient most of the regressors have the hypothesized sign and are statistically significant at five (5) percent level. We conclude that Table 4 contains the final estimators results of the ECM based on ARDL approach. These results give us some intuitions on the order of magnitude of the impact environmental quality on health expenditure in Malaysia. Overall, our empirical results are in line of the erstwhile studies. These results are technically and statistically substantial and conceivable for onward public policy consideration.

Table 4: Estimated Short-run Error Correction Model (ECM-ARDL)

Regressor	Coefficient	t-statistic
C	19.551***	4.031
ΔHE	-1.314**	-2.748
ΔGDP	-8.311***	-4.471
ΔMR	-6.784***	-3.911
ΔFR	-2.503***	-3.946
ΔCO2	3.810***	4.695
ΔSO2	3.789***	7.993
ΔNO2	0.533	0.218
ecm(-1)	-0.859***	-3.118

Notes. *, ** and *** denote significant at 1%, 5% and 10% significance levels

Concluding remarks

This study is to find out the magnitude of the income elasticity and the impact of non-income determinants of health expenditure in Malaysia using ARDL approach to ECM test generalized by Pesaran& Pesaran (1997), Pesaran& Smith (1998), Pesran& Shin (1999) and Pesaran*et al.*

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(2001). We found that there is a long run relationship between the variables when health expenditure is a dependant variable. The test also indicates the presence of the valid long run relationships between the independents variable and the dependant variable. Thus, CO_2, SO_2, MR, and FR could be treated as having relationship which health expenditure in the long run in Malaysia. This confirm that the existence of co-integrated relationship among the variables in the model. The findings from Odusanya*et al.* (2014) support our result which also indicate the strong relationship between the independent and dependent variables.

The one lag error correction terms (ECM) are found to have the expected negative sign and highly statistically significant. This confirms that the existence of co-integrated relationship among the variables in the model. So, this indicates that the variables have a contrast impact on HE in the short run compared to the impact in the long run. CO_2, SO_2 and NO_2 which either exhibited a negative influence on per capita HE in the long run exert a positive effect in the short run. On the other hand, GDP, MR and FR like in the long run period are expected to influence health expenditure are negatively in the short run period. The results in the ECM is support by findings of Odusunya*et al.* (2014).

The results obtain in this study have very useful implications for policy formulating regarding public health expenditure in Malaysia. This study shows that GDP, MR, FR, CO_2 and SO_2 statistically significant determinant of health expenditure. This suggesting that policies that have the potential to spur growth in the number of births per 1000 people would cause substantial investment in the health services. Given the rapid growth of population in Malaysia, it is imperative for government to increase its spending on health sector in order to have an efficient health system. It can be conclude that socio economic factors play an important role in determining health expenditure in Malaysia.

Malaysia as a developing country must invest more resources in health. The use healthcare during pregnancy and childbirth and healthcare for infants is very critical to national productivity, and must be stepped up through increased health expenditure. The major policy recommendation that emerges from the study is the need for Malaysian policy makers to pay more attention to the health sector and increased it yearly budgetary by considered the socio economic factors. Besides that, take into account the importance of health quality to the nations, government also should look deeply to the private health system in order to make sure that the fees is not burden to the people. This is also can encourage the increasing of fertility rate.

Once the country experiences an economic growth, there is also increase in oil, crude oil, gasoline, kerosene, diesel and fuel consumption, so that the effects on a medium term will be greater than on a shorter term of health expenditure. Our remarks implicitly refers to the facts that unsustainable economic growth will increase environmental degradation, this increasing the risk population decay induced by pollution and mortality. If there is an increase of health cost due to finding allotted for healthcare offered to those affected by environmental deterioration, then there are fewer funds available to improve the quality of environment and if this process continues, it is likely to lead to greater pressures exerted on government budget. Pollution damages the environment; it implies that health management policy should include considerations for the use of biofuels in Malaysia.

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