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Abstract

The sheer size of industrializing economies' echo rising health challenges, are we ignoring the darker side of economic development? Thus, this paper explores the impact of trade openness on life expectancy in Malaysia using time series data over the period of 1960-2014. We have applied structural break unit root and as well as cointegration tests to examine integrating properties of the variables and cointegration between the variables. The causal linkage between the variables is tested by applying the VECM Granger causality. The empirical evidence confirms the presence of cointegration amid the variables. Furthermore, economic growth increases life expectancy. Exports and imports have positive impact on life expectancy. The feedback effect exists between economic growth and life expectancy. Exports and imports cause life expectancy in Granger sense.

Keyword: exports, imports, life expectancy, Malaysia

I. Introduction

General Agreement on Tariffs and Trade (GATT) in 1947 is envisaged as the provenance of liberalized movement of goods, services and capital across the national borders. In 1995, the movement is matured in to comprehensive global organization with clearly defined regulatory framework of trade called World Trade Organization (WTO) (Andrianmananjara, 1993). As discussed in Baldwin et al. (2001), the current global economic order is passing through the low trade costs era, where global divergence converges and translates quick industrialization in small and developing states. Thence, the increasing role of trade openness in developing and emerging economies has deep socio-economic repercussions as well (Bloom et al. 2003; Ray, 2006; Würtenberger et al. 2006; Baldacci et al., 2008; Ncube et al. 2014). Recently, the development economics literature significantly focuses the impacts of globalization on various socio-economic indicators (Waterman, 2001; Glatzer, 2012; Cho, 2013). Besides supportive evidences, the existing literature also highlights the social costs of globalization especially in developing countries (Lim and Tsutsui, 2012; Holzmann and Werding, 2015). The trade openness policy assists both developed and developing nations to increase their national income, but it depresses welfare in developing countries in contrast to developed nations. Thus we follow the ongoing debate in scholarly community to further investigate this quest in regard to trade openness and its social cost.

Although large part of the literature formalizes trade openness as a key indicator of economic growth in developing countries, but it is not always the case in terms of social barometer (Stiglitz, 2000; Thirlwall, 2006; Olson, 2008). There are several channels of social change are discussed in past, and globalization has been the potential driver behind such change. The welfare economists argue that requisite country's economic growth is allied with the betterment of three main social indicators i.e. education, employment and public health (Jessop, 1998; Stiglitz et al. 2009)[1]. The plenty of the literature study the impact of economic development on education and employment but significantly ignored the health sector in developing countries (Tanner and Harpham, 2014). Recently, there is a growing consensus that trade openness has direct impact on population health in developing countries. For example; opening of trade increases the easy supply of life saving drugs to under-developed and developing countries. On the other hand, trade openness improves the institutional features of an economy which has endogenous impact on life style of masses. Trade openness urges the firms in developing countries to adopt environment friendly methods of production that plays the favorable role for improving the overall state of public health. However, the positive association between trade liberalization and improving public health is subject to the national policy to allocate sufficient resources during economic growth. Otherwise, economic growth does not ensure healthy society and in addition it may have detrimental impacts (Popkin et al. 2012). For example; if economic activities are related with international trade generate negative externalities, such as unfavorable working conditions, or unhealthy consumer goods or transfer of disease and practices across borders (Rodrik et al. 2002). Moreover, Sachs (2003) mentions

[1] Rehman et al. (2014) empirically examined a relation between human capital formation, self-employment, and economic growth in the case of Pakistan. They reported a profound relationship between these indicators.

that transmission of diseases is directly affected by the ecological conditions that directly relate to per capita income.

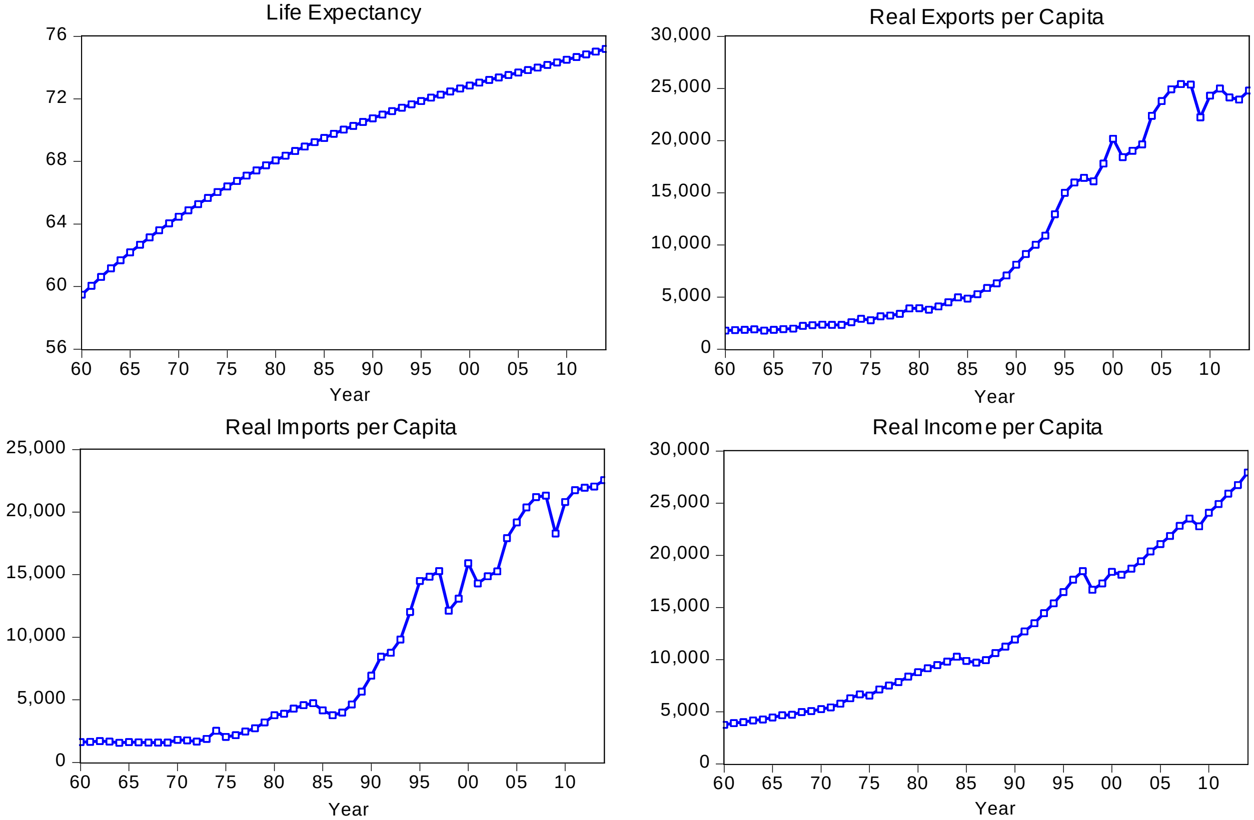
The economic activities and health status has been remained a topic of discussion for policy makers and economists both at micro and macro levels. Waldmann, (1992) mentioned that income distribution has positive and significant impact on infant mortality. Their empirical evidence reveals that in case of developing countries both income inequality and mortality rate is showing a rising trend. Pritchett and Summers, (1996) found that wealthier and rich economies have lower infant mortality rate and higher life expectancy with more open boundaries. Bhargava et al. (2001) proved that nations with better health outcomes grow faster. While studying the household level data, Smith (1998) and McClellan (1998) conclude that serious health events lead to large declines in household wealth. Meara, (1998) links socio-economic status with infant mortality (Meara, 1998) and (Marmot et al. (1984) with behavioral patterns such as smoking and drinking which is strongly related to trade pattern of the nations.

Trade openness may impact life expectancy by number of ways. Trade openness directly influences the institutional quality which further impacts environmental policy of an open economy that may have detrimental impact on the health of people. Dollar and Kraay, (2002) provide a theoretical framework and argue that both trade and institutions are important for economic growth in case of long run, but trade has relative strong impact on economic growth in short run. Wood (1994), Borjas and Ramey (1994) and Karoly and Klerman (1994) mention that trade openness worsens the poor population. Acemoglu (2007) provides a theoretical relationship and reports that trade and income inequality has adverse impact on the welfare of poor population. His findings are consistent with Wood (1994), Borjas and Ramey (1994), Karoly and Klerman (1994) who indicated that trade openness worsens the health of people.

Trade openness is associated with spillovers impact of knowledge, especially technological changes that has been developed by the world with continuous learning while spillover of knowledge is helpful for maintaining and improving health status. Romer, (1990) explained that trade openness provides access to domestic producer’s to wider variety of capital goods, effectively enlarging the base of productive knowledge which further enhances productivity and economic growth. Specifically, trade openness facilitates the interactions among the nations which increases the general flow of knowledge about suitable treatments for diseases, good and better health practices, or information that might aid the design and administration of public health programs. Jamison et al. (2003) claim that advancement and technical progress causes and brings the revolutionary improvements in infant mortality differences significantly across countries.

Owen and Wu (2007), using panel data based on 5-year intervals for the period 1960-1995, find that increased trade openness is associated with lower infant mortality rate and higher life expectancy, especially in developing countries. Stevens et al. (2013) confirm this finding based on 5-year data for the period 1970-2005. Recently, Herzer (2014) investigated the relationship between trade openness and population health using data of 74 developing economies. Using panel data approach, he mentioned that trade openness increases population health measures by life expectancy and infant mortality rate. The causality analysis reported the feedback effect between trade openness and life expectancy. Using time series data for US, Herzer (2015) reported that trade openness improves population health measures by life expectancy. Moreover, empirical evidence exposes that population health is cause of trade openness[2]. Recently, Alam et al. (2015) investigated the impact of foreign direct investment and trade openness on life expectancy using Pakistani time series data over the period of 1960-2014. They results indicated that foreign direct investment and trade openness are major contributors to life expectancy and causality is running from trade and foreign direct investment to life expectancy.

Figure-1: Trends in Life Expectancy, Exports, Imports and Income in Malaysia



This study investigates the impact of trade openness on life expectancy in case of Malaysia. This type of exercise is hardly conducted in case of Malaysia. Therefore, this study significantly contributes to existing literature. We employ life expectancy as single measure of population health in case of Malaysia over the period of 1960-2014. The reason to focus Malaysia as the case study is its trade profile which grew from 88% of GDP to 154% of GDP over the period of 1960-2014 and life expectancy rose from almost 59 years to 74 years for the same period (WDI, 2015) which is equalent to 25% growth in life expectancy. Infant-child and under-five mortality rate has declined from 18/1000 to 6/1000 and 16/1000 to 6/1000 between 1990 and 2009, respectively. Developing countries observed substantial decline in mortality rate between 1960 and 2000, and it is mainly associated with the rise in income during the same period (Soares, 2007). The improvement of child health and reduction of child mortality have been national development goals ever since the First Malaysia Plan. Most of the health sector

[2] Shahbaz et al. (2015a) found that economic misery plays its significant role in determining life expectancy in Pakistan.

programmes in Malaysia have integrated with other sectoral programmes, in particular, water and sanitation, rural development, infrastructure and housing and agriculture. Based on the Millennium Development Goals (MDG), Malaysia is likely to reduce the under-five mortality rate by two third between 1990 and 2015. There are a number of factors contributed in the reduction of child mortality in Malaysia. Those factors, including, high proportion of deliveries attended almost all skilled birth attendants, a wellness assessment that includes regular monitoring of growth and development, introduction to specialist services by the Family Medicine Specialist at the primary healthcare level; and greater access to the basic healthcare services through community clinics with integrated maternal and child health programmes. Declines in the infant mortality rate are due not only to health sector interventions, but also to socioeconomic development, including improved education system and the empowerment of women through the provision of reproductive health services. It can be concluded that, there is two main groups of factors tend to have a large impact on infant mortality in Malaysia. These are, first, general development and growth factors, and second, health intervention programmes. Although Malaysia is not an exception, yet there are more lessons to learn from the experience. The growth in total trade as share of GDP is 75% and growth in life expectancy is almost 12% (see Figure-1). This paper may be an interesting case study for other regional countries to formulate their policies for sustainable growth in life expectancy using trade openness as an economic tool. Malaysia is playing her significant role in ASEAN region.

Recent years, Malaysia's trade balance is keep on stabilize with high volume of export compare to last 2 decades. This caused by the full labor mobilize in manufacturing and services sectors where domestic labor markets labor use increased after the government reform the retirement age from 56 to 60 years of age. In the recent past, even developing countries have started to explore the effects of exports and life expectancy (Croix and Licandro, 1999; Ngangue and Manfred, 2015). Consequently, reformation of retirement age has improved the labor market and dramatically changed the overall demographic structure with more ageing population in the labor market for Malaysia (World Development Indicators, 2015). When this situation appears, the economic progress in a positive condition and the volume of output created increased dramatically and will lead to exports increases. Besides exports, import determinant also affects life expectancy in Malaysia in various ways. Generally, Malaysia is a developing nation with average range standard of medical facilities in the last 3 decades and most of the basic health care treatment for newborn babies and ageing population in East Coast of Peninsular Malaysia (Kelantan, Terengganu and Pahang); and East Malaysia states (Sabah and Sarawak) are imported from developed countries. For example, in recent budgetary session the government always looks forward increasing allocation for healthcare sector, especially to increase the volume of important healthcare for new established rural clinic and hospitals for almost 30 percent of overall Malaysia population. Historically, on average the government allocates 15-20 percentage of national budgetary was for healthcare behind the education development allocation for the last 2 decades (Department of Statistics, 2015). Incorporated with imported medical facilities, numbers of choric diseases in rural areas has been controlled, besides good nutrients programmes; and this has contributed for the overall Malaysia's life expectancy in recent decades. In the line of importing healthcare tools and accessories, there are also huge numbers of imported healthcare services established in Malaysia, mostly concentrating on private medical centers and this has improved the standard of Malaysia medical industry.

This study has significant and practical implications by investigating either trade has positive or negative impact on life expectancy. Our findings validate the existence of long run equilibrium path relationship between trade openness and life expectancy. Moreover, we note that economic growth stimulates life expectancy. Exports spur life expectancy. Imports add in life expectancy. The unidirectional causality exists running from exports and imports to life expectancy. Economic growth and life expectancy are interdependent i.e. feedback effect.

The rest of paper is organized as following: section-II describes model construction and methodological framework. Empirical results are interpreted in Section-III and section-IV reports concluding remarks and suggests policy implications.

II. Model Construction and Estimation Strategy

The main aim of present study is to determine the contribution of trade openness in improving population health i.e. life expectancy. Trade openness may affect life expectancy via income effect, health adjusted imports effect and environmental effect. Following Pritchett and Summers (1996), Owen and Wu (2007), Stevens et al. (2013), Herzer (2015); we construct general form of life expectancy function as following:

$$E_t = f(Y_t, EX_t, IM_t) \qquad (1)$$

The findings of Herzer, (2015) ignored the role economic growth while investigating the relationship between trade openness and population health. His findings may be ambiguous. It is argued by and Summers, (1996) that income growth affects population health by increasing access to wealthy buys such as basic nutrition to improve health, healthier and hygienic accommodation etc. We have incorporated economic growth by considering additional determinant of trade openness as well as population health. The empirical model is given as following:

$$\ln E_t = \beta_1 + \beta_2 \ln Y_t + \beta_3 \ln FX_t + \beta_4 IM_t + \mu_i \qquad (2)$$

where, $\ln E_t$ is natural log of life expectancy, $\ln Y_t$ is natural log of economic growth measures by real GDP per capita, $\ln EX_t$ is natural log of real exports per capita, $\ln IM_t$ is natural log of real imports per capita and μ_i is white noised error term.

The data on life expectancy (total years at birth), real GDP (local currency), real imports (local currency) and real exports (local currency) is obtained from world development indicators (CD-ROM, 2015). We have used total population series to transform real GDP, real imports and real exports into per capita units. The study covers the period of 1960-2014.

Before applying any standard cointegration test, it is necessary to test the unit root properties of the variables. We have noticed the implementation of economic policies by Malaysian government to improve the performance of health and economic indicators that may be cause of structural breaks in the series. These structural breaks in the series may create unit root problem and provide ambiguous empirical evidence. To overcome this issue, we have applied the unit root tests without structural break (augmented Dickey-Fuller, 1979; Philips and Perron, 1988) and with structural breaks (Zivot and Andrews, 1992). Furthermore, the bounds testing approach to cointegration developed by Peseran et al. (2001) is useless if any series is found stationary at 2nd difference (Ali et al. 2015). The ARDL or bounds testing approach has numerous advantages over traditional cointegration tests. The bounds testing approach is suitable if the variables have mixed order of integration i.e. I(1) or I(0) or I(1)/I(0). Pesaran and Shin, (1999) argued that bounds test of cointegration provides efficient empirical evidence for small sample. The dynamic unrestricted error correction model (UECM) can be derived from the ARDL bounds testing through a simple linear transformation. This test combines the short-run and long-run equilibrium having information about long-run relationship. The empirical form of the ARDL bounds testing is modeled as following:

$$\begin{aligned}\Delta \ln E_t &= \alpha_1 + \alpha_{DUM} DUM + \alpha_E \ln E_{t-1} + \alpha_Y \ln Y_{t-1} + \alpha_{EX} \ln EX_{t-1} + \alpha_{IM} IM_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta \ln E_{t-i} \\ &+ \sum_{j=0}^{q} \alpha_j \Delta \ln Y_{t-j} + \sum_{k=0}^{r} \alpha_k \Delta \ln EX_{t-k} + \sum_{l=0}^{s} \alpha_l \Delta IM_{t-l} + \mu_t \end{aligned} \quad (3)$$

where DUM is dummy for structural break based on ZA unit root test and μ_t is residual term having normal distribution. The next step is to compare the computed F-statistic with critical bounds developed by Pesaran et al. (2001). These bounds are called upper critical bound (UCB) and lower critical bound (LCB). The null hypothesis $H_0 : \alpha_E = \alpha_Y = \alpha_{EX} = \alpha_{IM} = 0$ of no cointegration is tested against the alternate $H_a : \alpha_E \neq \alpha_Y \neq \alpha_{EX} \neq \alpha_{IM} \neq 0$ of cointegration[3]. The series are cointegrated if the computed F-statistic exceeds the UCB and not cointegrated if the computed F-statistic is less than LCB. If computed F-statistic falls between the UCB and LCB, the test is uncertain. In our case, we have 38 observations and the critical bounds by Narayan (2005) are suitable for our sample, compared to Pesaran et al. (2001). We have applied the CUSUM and CUSUMSQ tests to examine the stability of long-run and short-run estimates suggested by Brown et al. (1975). The existence of the long run relationship among the variables leads us to determine the direction of causal relationship by using the vector error correction method:

[3] Pesaran et al. (2001) have computed two asymptotic critical values - one when the variables are assumed to be *I(0)* and the other when the variables are assumed to be *I(1)*.

$$
(1-L)\begin{bmatrix} \ln E_t \\ \ln Y_t \\ \ln EX_t \\ \ln IM_t \end{bmatrix} = \begin{bmatrix} \beta_1 \\ \beta_2 \\ \beta_3 \\ \beta_4 \end{bmatrix} + \begin{bmatrix} B_{11,1} B_{12,1} B_{13,1} B_{14,1} \\ B_{21,1} B_{22,1} B_{23,1} B_{24,1} \\ B_{31,1} B_{32,1} B_{33,1} B_{34,1} \\ B_{41,1} B_{42,1} B_{43,1} B_{44,1} \end{bmatrix} \times \begin{bmatrix} \ln E_{t-1} \\ \ln Y_{t-1} \\ \ln EX_{t-1} \\ \ln IM_{t-1} \end{bmatrix} + \ldots\ldots + \begin{bmatrix} B_{11i} B_{12i} B_{13i} B_{14i} \\ B_{21i} B_{22i} B_{23i} B_{24i} \\ B_{31i} B_{32i} B_{33i} B_{34i} \\ B_{41i} B_{42i} B_{43i} B_{44i} \end{bmatrix} \times \begin{bmatrix} \ln E_{t-1} \\ \ln Y_{t-1} \\ \ln EX_{t-1} \\ \ln IM_{t-1} \end{bmatrix}
$$

$$
+ \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \\ \alpha_4 \end{bmatrix} ECT_{t-1} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \end{bmatrix} \tag{4}
$$

where, the lag operator is indicated by $(1-L)$ and ECT_{t-1} is the lagged error correction term. The $\varepsilon_{1t}, \varepsilon_{2t}, \varepsilon_{3t}$ and ε_{4t} are error terms assumed to be N$(0, \sigma,)$. The long run causality exists if t-statistic on the coefficient of ECT_{t-1} is statistically significant. In case of short run causality, F-statistic on the first differences of the series should be statistically significant. The joint long-and-short runs causal relationship can be estimated by the joint significance of both ECT_{t-1} and the estimate of lagged independent variables. For instance, $B_{13,14,i} \neq 0 \forall_i$ shows that trade openness causes life expectancy while life expectancy causes trade openness in Granger sense is shown by $B_{32,42,i} \neq 0 \forall_i$.

III. Results Interpretations

For examining integrating properties of the variables, we have applied the ADF and PP unit root tests. We note that life expectancy, economic growth, exports and imports are non-stationary at level with intercept and trend. All the variables are found to be stationary after first differencing. It indicates that the variables have unique order of integration i.e. I(1). These unit root tests may provide indistinct empirical findings due to their low explanatory power as well as these tests do not consider the information about structural break in the series. This issue is handled by applying the ZA unit root test. The ZA unit root test results are shown in Table-2. The results show non-stationarity at level in series of life expectancy, economic growth, exports and imports having structural breaks for the period of 2000, 1991, 2003 and 1988 respectively. Over the selected period of time Malaysian government implemented numerous health reforms to improve the health indicators such as life expectancy. The Malaysian government implemented health policy for direct provision of primary health care in 77th five-year plan (1996-2000). These primary health care including for diabetes management, asthma management, appropriate hospitalization, client-friendly clinic, pathology services, radiology services, and pharmacy services. In addition, primary immunization coverage has exceeded 90 percentage of the overall population in Malaysia. Besides that, government has played an important role with a well-developed primary health care system, capable of bringing medical advances to the poor people in the rural areas. An initiative to ensure the provision of quality healthcare in health clinics is the improvement of the work process by developing practice standards and guides for credentialing and privileging of clinical staff, standard operating procedures, and comprehensive guidebooks to guide the clinic staff on managing and coordinating the activities of the clinic, ranging from clinic administration, environmental sanitation to patient care. The Country Health Plan has been detail out through the Tenth Malaysia Plan (2011-2015), where much effort had been put into consideration. In 10^{th} Malaysia Plan strategies, three Key Result Area (KRA) for the health sector has been identified. First, the health sector transformation towards a more efficient and effective health system in ensuring universal access to health care. Secondly, empowerment of individual and community to be responsible for their health and thirdly, health awareness and health lifestyle. All those plans work together towards improving Malaysia's health care system based on the concept of '1 Care for 1 Malaysia'. The aim of the 1 Care 1 Malaysia concept is to create an effective, efficient, fair and high-tech system of health care as well as responsive and can further improve access to various levels of appropriate health care to all Malaysians. Furthermore, Malaysian government adopted economic and trade reforms in 1991, adoption of exports oriented and imports substitution policies in 1990s. This improved the performance of health indicators as well as economic indicators. At first difference, all the series are stationary. It indicates that the ZA unit root test corroborates the ADF and PP tests' findings.

Table-1: Unit Root Analysis

Variables	ADF unit root test		P-P unit root test	
	T-statistic	Prob. value	T-statistic	Prob. value
$\ln E_t$	0.1633 (1)	0.9971	-1.5378 (3)	0.8023
$\Delta \ln E_t$	-6.3454 (2)*	0.0000	-6.3454 (3)*	0.0000
$\ln Y_t$	-2.0995 (2)	0.5414	-2.0383 (3)	0.5674
$\Delta \ln Y_t$	-5.3022 (2)*	0.0003	-6.4621 (3)*	0.0000
$\ln EX_t$	-1.3148 (1)	0.8734	-1.4387 (3)	0.8380
$\Delta \ln EX_t$	-4.6782 (3)*	0.0022	-6.3137 (3)*	0.0000
$\ln IM_t$	-2.4383 (2)	0.3565	-2.3117 (3)	0.4205
$\Delta \ln IM_t$	-5.0456 (3)*	0.0007	-6.242 (3)*	0.0000
Note: * shows the significance at 1% level.				

Table-2: ZA Unit Root Test Analysis

Variable	*At level*		*At first difference*	
	T-statistics	*Time break*	*T-statistics*	*Time break*
$\ln E_t$	-5.106 (3)	2001	-5.914 (3)*	2006
$\ln Y_t$	-3.303 (2)	1992	-7.359 (3)*	1998
$\ln EX_t$	-2.709 (3)	2004	-8.329 (4)*	1996
$\ln IM_t$	-3.569 (2)	1989	-7.125 (3)*	1996
Note. Lag length of variables is shown in small parentheses. * indicates significance at 1% level.				

The unique order of the variables leads us to apply the ARDL bounds testing to examine cointegration between the variables. The ARDL bounds approach requires appropriate lag length for model specification. The results are reported in Table-3 by various lag length criteria. We followed Akaike information criteria to select an appropriate lag length. Lütkepohl, (2006) argued that AIC has superior power properties for small sample data compared than other lag length criteria. Akaike information criterion provides efficient and consistent results as compared to final prediction error (FPE), Schwarz information criterion (SBC) and Hannan-Quinn information criterion (HQ). Based on empirical evidence provided by AIC, we find that the optimum lag reported in Table-3 (column-II). The next step is to compute ARDL F-statistic in order to test either cointegration is present or not among the variables. Our results reported in Table-3 disclose that our computed F-statistic surpasses upper bound at 1% level of significance once we treated life expectancy and economic growth as dependent variables. This confirms the presence of two cointegrating vectors that indicates the cointegration between the variables over the period of 1960-2014.

Table-3: The Results of ARDL Cointegration Test

Bounds Testing to Cointegration			Diagnostic tests				
Estimated Models	Optimal lag length	F-statistics	Break Year	χ^2_{NORMAL}	χ^2_{ARCH}	χ^2_{RESET}	χ^2_{SERIAL}
$F_E(E/Y, EX, IM)$	2, 1, 2, 2	12.2401*	*2001*	2.2865	2.2519	1.0609	2.3966
$F_Y(Y/E, EX, IM)$	2, 2, 1, 2	9.9061*	1992	1.3400	0.0830	0.0911	0.3540
$F_{EX}(EX/E, Y, IM)$	2, 2, 2, 2	4.0511	2004	1.3570	0.0666	3.2894	1.4441
$F_{IM}(IM/E, Y, EX)$	2, 1, 2, 2	3.6081	1989	0.4504	2.1951	3.2540	0.7961
Significant level	Critical values (T= 55)						
	Lower bounds $I(0)$	Upper bounds $I(1)$					
1 per cent level	7.227	8.340					
5 per cent level	5.190	6.223					
10 per cent level	4.370	5.303					

Note: The asterisks *, ** and *** denote the significant at 1, 5 and 10 per cent levels, respectively. The optimal lag length is determined by AIC. [ ] is the order of diagnostic tests. Critical values are collected from Narayan (2005)

The presence of cointegration among the variables leads us to examine the impact of economic growth, exports and imports on life expectancy. The results are shown in Table-4 and we found that economic growth is positively linked with life expectancy at 1% level. A 1% rise in economic growth enhances life expectancy by 0.1879%. This finding is consistent with Cervellati and Sunde, (2009) who reported that wealthier nations are healthier. The relationship between exports and life expectancy is positive and statistically significant at 5%. A 0.0221% increase in life expectancy is lead by 1% increase in exports. The impact of imports on life expectancy is positive and significant at 1%. A 1% increase in imports increases life expectancy by 0.0682%. We find that trade (exports + imports) has beneficial effect on life expectancy. This empirical evidence is consistent with Herzer (2015, 2014), Owen and Wu (2007) who reported that trade is positively linked with life expectancy. The impact of dummy variable (health care policy in 2000) is negative and significant on life expectancy. This shows that adoption of health care policy in 2001 could not improve the health of population and affected life expectancy negatively in Malaysia. This might be surprising indication and may cause by population aging and fertility changes, which has been discussed in some of the recent studies focusing with Malaysia by Subramaniam et al. (2015). The study found that, infant mortality rate has positive effect with fertility rate and for Malaysia the fertility rate is declining over year from 1980s. This is supported by the study done by Sanderson and Scherbov (2015) previous findings. Where, we can see that the faster increases in human life expectancy will tend lead to lower population aging. This is what happens in Malaysia, where the volume of aging population keep on increasing and thus indirectly may reflect on the life expectancy rate.

Table-4: Long Run Analysis

Dependent Variable = $\ln E_t$				
Variable	Coefficient	Std. Error	T-Statistic	Prob. value
Constant	2.8886*	0.0373	77.3189	0.0000
$\ln Y_t$	0.1879*	0.0092	20.2491	0.0000
$\ln EX_t$	0.0221**	0.0097	2.2840	0.0266
$\ln IM_t$	0.0682*	0.0088	-7.6906	0.0000
D_{2001}	-0.0164*	0.0030	-5.3635	0.0000
R^2	0.9504			
$Adj-R^2$	0.9497			
$F-Statistic$	13.0613*			
Note: * and ** indicate significance at 1% and 5% levels respectively.				

In short run, we find that the effect of economic growth on life expectancy is positive and significant. Exports are positive and significantly linked to life expectancy. This positive relationship is mainly caused by demographic changes and socioeconomic advantages which likely increase the life expectancy in Malaysia by various ways of health care resources. This has been confirmed by Chan and Devi (2012), where life expectancy and is getting in line with demographic, socioeconomic and health care resources in Malaysia during the period of 1980-2009. The economic growth causes positively with life expectancy. The positive effect of a longer life on growth could indeed be offset by an increase in the average age of the workers and this will harm the volume of exports for the nation in the long run (Croix and Licandro, 1999; Ngangue and Manfred, 2015). Indeed, the Malaysia labor market also has been reformed in recent years with the retirement age has been increased to 60 years (aging workers). Adoption of primary health care plan (dummy variable) has negative but insignificant impact on life expectancy. The significance of lagged error term i.e. ECM_{t-1} corroborates our long run relationship between life expectancy and trade openness. The estimate of lagged error term i.e. ECM_{t-1} is statistically significant at 1% significance level. This indicates that short run deviations are corrected by 16.37% in every year towards long run equilibrium path. The results of diagnostic test are also reported in lower segment of Table-5. We find the normality of residual term confirmed by Jarque-Bera test. There is no evidence of serial correlation and absence of ARCH is confirmed. The empirical evidence validates the absence of white heteroskedisticity and functional form of model is well organized.

Table-5: Short Run Analysis

Dependent Variable = $\Delta \ln E_t$				
Variable	Coefficient	Std. Error	T-Statistic	Prob. value
Constant	0.0050*	0.0003	14.383	0.0000
$\Delta \ln Y_t$	0.1019*	0.0155	6.5595	0.0000
$\Delta \ln EX_t$	0.0194**	0.0096	2.0061	0.0504
$\Delta \ln IM_t$	-0.0281*	0.0063	-4.4528	0.0000
D_{2001}	-0.0009	0.0008	-1.0695	0.2901
ECM_{t-1}	-0.1637*	0.0601	-2.7202	0.0090
R^2	0.6728			
$Adj-R^2$	0.6387			
$F-Statistic$	9.7414*			
Diagnostic Tests				
Test	F-statistic	Prob. value		
$\chi^2 NORMAL$	1.1312	0.5680		
$\chi^2 SERIAL$	0.1977	0.8233		
$\chi^2 ARCH$	0.7890	0.4161		
$\chi^2 HETERO$	1.8629	0.1185		
$\chi^2 REMSAY$	1.4163	0.2201		
Note. * and ** indicate significance at 1% and 5% levels respectively.				

The stability of long-and-short run is investigated by applying the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMsq) tests. The results of CUSUM and CUSUMsq are reported as Figure-1 and 2. Both graphs of CUSUM and CUSUMsq are lying between critical bounds at 5% level of significance. This ensures the stability of long run and short run coefficients.

Figure-1: CUSUM

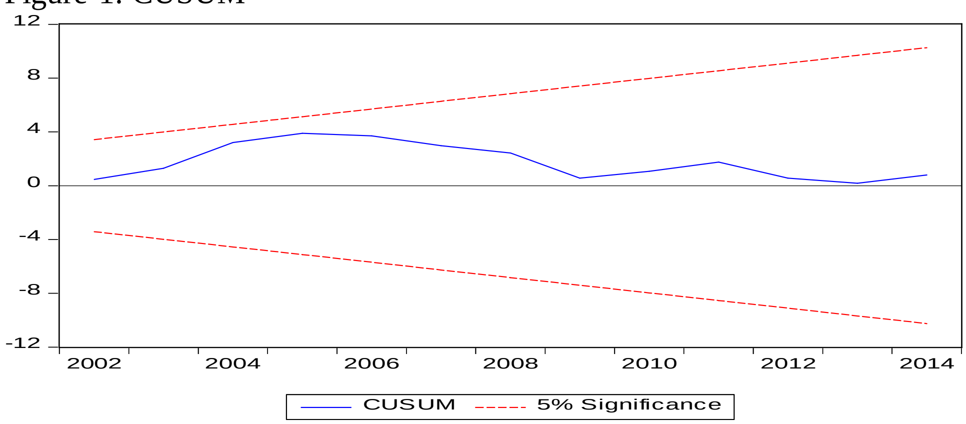
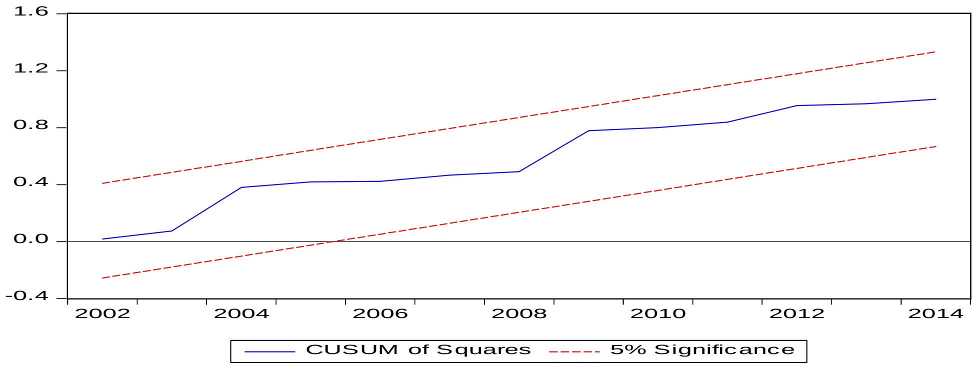


Figure-2: CUSUMsq



The results of the VECM Granger causality are noted in Table-6. We note that in long run, life expectancy cause economic growth (consistent with Pritchett and Summers, 1996) and economic growth causes life expectancy (consistent with Cervellati and Sunde, 2009) in Granger sense. The unidirectional causal relationship exists running from exports to economic growth. Exports Granger cause life expectancy but similar is not true from opposite side. Imports cause economic growth and life expectancy. It indicates that trade openness (exports + imports) causes life expectancy. This empirical evidence is consistent with Herzer (2014, 2015) and Stevens et al. (2013) who reported that trade openness is healthy for USA and developing economies. Later on, Alam et al. (2015) reported that unidirectional causality exists running from trade openness to life expectancy. Their findings exposed that trade openness leads infant mortality as well as life expectancy. In short run, economic growth causes life expectancy and life expectancy causes economic growth in Granger sense. Imports cause life expectancy. The feedback effect exists between imports and economic growth. The relationship between exports and imports is bidirectional. Exports are cause of life expectancy.

Table-6: The VECM Granger Causality Analysis

Dependent Variable	Type of Causality									
	Short Run					Long Run	Short-run and long-run joint causality			
	$\sum \Delta \ln E_{t-1}$	$\sum \Delta \ln Y_{t-1}$	$\sum \Delta \ln EX_{t-1}$	$\sum \Delta \ln IM_{t-1}$	Break Year	ECM_{t-1}	$\sum \Delta \ln E_{t-1}, ECM_{t-1}$	$\sum \Delta \ln Y_{t-1}, ECM_{t-1}$	$\sum \Delta \ln EX_{t-1}, ECM_{t-1}$	$\sum \Delta \ln Y_{t-1}, ECM_{t-1}$
$\Delta \ln E_t$	…	3.0049** [0.0600]	0.2714 [0.7636]	2.5161*** [0.0926]	*2001*	-0.2700** [-2.6930]	…	2.7917** [0.0292]	3.1105** [0.0361]	2.5169*** [0.0926]
$\Delta \ln Y_t$	2.8415*** [0.0871]	…	1.0387 [0.3626]	7.0818* [0.0022]	1992	-0.2359** [-2.2283]	4.3003** [0.0313]	…	3.5667** [0.0217]	4.8205* [0.0056]
$\Delta \ln EX_t$	2.3663*** [0.0831]	2.1327 [0.1303]	…	8.4843* [0.0008]	2004	…	…	…	…	…
$\Delta \ln IM_t$	0.1775 [0.8379]	12.0057* [0.0000]	8.3301* [0.0002]	…	1989	…	…	…	…	…
Note: *, ** and *** represent significance at 1%, 5% and 10% levels respectively.										

The VECM analysis provides the information about direction of causal relationship between the series in long-run as well short-run. This approach is unable to provide any information if innovation or shock occurs into the system. In doing so, we employ the generalized variance decomposition approach which provides information if there is any innovation or shock into system from one series to rest of the variables. The decompositions are presented in Table-7 (see Appendix). We find that innovative shock occurs in economic growth, exports and imports explain life expectancy by 2.59%, 24.87% and 3.61%. A 68.90% of life expectancy is contributed by its innovative shocks. Life expectancy contributes to economic growth by 21.19%. The contribution of exports to economic growth is 10.88%. The innovative shock occurs in imports contributes to economic growth minimally i.e. 2.43%. Almost 65% of economic growth is contributed by its own innovative shocks.

The shock arises in life expectancy contributes to exports by 6.79% and economic growth donates to exports by 6.3%. The role of imports to exports is negligible i.e. 8.16%. The contribution of economic growth and exports to imports is 29.60% and 51.97% respectively. Life expectancy contributes to imports by 1.51%. The results show that unidirectional causality is found from exports to life expectancy. Life expectancy causes economic growth but similar is not true from opposite side. Economic growth and exports cause imports.

IV. Conclusion and Policy Implications

The impact of trade openness on economic growth via innovation and productivity is well debated in existing economic literature (Vivarelli, 2014) but less attention is paid to investigate its impact on human well-being (Hall and Lawson, 2014). Since most of South-East Asian countries follow export-led growth policy, thus trade has significant impact on the socio-economic well-being of the countries (Jalles, 2012). Consequently, this study aim to examine the impact of trade liberalization on the life expectancy in Malaysia for the period of 1976Q1-2013Q4. We have applied structural break unit root and cointegration tests to examine the long-run equilibrium relationship between the underlying variables. In addition, the Granger causality analysis in a VECM setting tests the causal properties of the variables.

The results of bounds test approach to cointegration confirm the long-run equilibrium relationship between life expectancy, economic growth and trade openness (exports + imports). The trade induced economic growth has long-run implication for life expectancy in Malaysia. Furthermore, the short-run negative elasticity between exports and life expectancy sounds the inward pressure of export promotion policies on life expectancy. The export led growth policies drive employment mainly in manufacturing sectors that detriment the environmental and human health directly, hence reduces the life expectancy. This effect can also be observed in shape of negative elasticity between economic growths on life expectancy as overall economic growth depends on country's exports. However, imports have positive and significant impact both in short- and long-run, which means imports offset the pressure induced by exports on the life expectancy. The positive elasticity of all variables in the long-run shows that trade policies have positive effect on country’s life expectancy in the long-run. The causality analysis indicates feedback effect between economic growth and life expectancy. Exports and Imports cause life expectancy in Granger sense. The causality results are consistent with regression analysis where, economic growth and trade increases life expectancy in the long-run path.

In doing so, we applied the bounds testing approach to examine the cointegration and found that the variables have long run relationship in the presence of structural breaks stemming in the series. Economic growth is positively linked with life expectancy confirming the hypothesis that wealthy nation is a healthy nation. Exports stimulate population health. Imports spur life expectancy. The implementation of primary health care program enhanced population health as well as life expectancy. The causality analysis shows the presence of bidirectional causal relationship between economic growth and life expectancy. Trade openness (exports, imports) causes life expectancy but reverse is not true. This study suggests that Malaysian government should use trade openness as economic tool not only to enhance domestic production but also to improve population health. In doing so, health adjusted imports should be more encouraged.

The overall findings conclude that prevailing trade opening policies have increased life expectancy in Malaysia. However, the study also suggests the revision of environmental and public health policies at micro-level to overcome the short-run negative impacts of exports and growth on life expectancy in Malaysia. The implementation of primary health program for industrial and agricultural related workers and their families sound viable option. Although UNICEF[4] reports drastic decline in child mortality rate in Malaysia, but points out spatial disparity. For example: the mortality rate in East Malaysia is higher than in West Malaysia. Thus, this study assists Malaysian government to reduce the spatial disparity gaps and other policy controls. Owen and Wu, (2007) study the 209 countries and their empirical results found positive impact of trade openness on the health conditions in the developing economies. However, Popkin et al. (2012) highlights number health concerns arise due to emerging trade agreements. Hence, this study open up further research opportunities by studying the impact of trade agreement on the life expectancy in Malaysia.

This study opens up new insights for future research. For example, the impact of trade openness on female and male life expectancy is attractive for further research. The net foreign direct investment growth rate is 22.2% in 2013-04. Foreign direct investment may affect population health via income effect, employment and heath effect. This shows that foreign direct investment is potential determinant while investigating the relationship between trade openness and life expectancy. Trade openness affects life expectancy via environmental degradation. Environmental degradation and income distribution should also be considered while examining the linkages between trade openness and population health.

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Appendix

Table-7: Variance Decomposition Analysis

Variance Decomposition of $\ln E_t$				
Period	$\ln E_t$	$\ln Y_t$	$\ln EX_t$	$\ln IM_t$
1	100.0000	0.0000	0.0000	0.0000
2	99.7504	0.0281	0.2178	0.0035
3	98.4366	0.2870	1.1574	0.1188
4	95.9942	0.7443	2.8727	0.3886
5	92.9240	1.2645	5.0758	0.7355
6	89.6823	1.7438	7.4744	1.0993
7	86.5367	2.1285	9.8815	1.4531
8	83.6044	2.4059	12.2017	1.7878
9	80.9158	2.5863	14.3957	2.1020
10	78.4611	2.6886	16.4534	2.3968
11	76.2171	2.7322	18.3771	2.6734
12	74.1592	2.7337	20.1738	2.9331
13	72.2657	2.7061	21.8513	3.1768
14	70.5188	2.6588	23.4170	3.4051
15	68.9042	2.5988	24.8780	3.6188
Variance Decomposition of $\ln Y_t$				
Period	$\ln E_t$	$\ln Y_t$	$\ln EX_t$	$\ln IM_t$
1	2.3577	97.6422	0.0000	0.0000
2	3.8388	95.9523	0.1926	0.0162
3	5.2684	94.0296	0.3508	0.3510
4	6.4832	90.4740	1.9197	1.1229
5	7.4815	86.1633	4.5383	1.8168
6	8.3568	82.1468	7.2208	2.2754
7	9.2245	78.8825	9.3561	2.5368
8	10.1723	76.3762	10.7833	2.6680
9	11.2496	74.4429	11.5875	2.7198
10	12.4807	72.8694	11.9274	2.7224
11	13.8772	71.4773	11.9526	2.6928
12	15.4456	70.1324	11.7804	2.6414
13	17.1894	68.7350	11.4992	2.5762
14	19.1078	67.2083	11.1794	2.5044
15	21.1946	65.4902	10.8816	2.4335

Variance Decomposition of $\ln EX_t$				
Period	$\ln E_t$	$\ln Y_t$	$\ln EX_t$	$\ln IM_t$
1	0.0084	42.0191	57.9723	0.0000
2	0.0765	32.1250	67.6325	0.1657
3	0.2686	23.9371	75.2521	0.5420
4	0.5111	18.7549	79.0027	1.7311
5	0.7766	15.6617	80.6181	2.9435
6	1.0760	13.6479	81.2729	4.0031
7	1.4224	12.1879	81.4838	4.9057
8	1.8267	11.0378	81.4766	5.6588
9	2.2973	10.0804	81.3450	6.2771
10	2.8411	9.2567	81.1218	6.7802
11	3.4630	8.5337	80.8154	7.1877
12	4.1667	7.8903	80.4258	7.5171
13	4.9552	7.3110	79.9509	7.7826
14	5.8305	6.7842	79.3892	7.9958
15	6.7941	6.3007	78.7397	8.1654
Variance Decomposition of $\ln IM_t$				
Period	$\ln E_t$	$\ln Y_t$	$\ln EX_t$	$\ln IM_t$
1	0.2579	59.3613	14.9860	25.3947
2	0.4701	63.4962	15.6336	20.3999
3	0.5298	60.1386	19.4793	19.8521
4	0.4874	54.3019	25.1932	20.0173
5	0.4305	48.7135	30.9924	19.8634
6	0.4017	44.2740	35.8719	19.4521
7	0.4084	40.9368	39.6681	18.9866
8	0.4461	38.4278	42.5605	18.5655
9	0.5103	36.4930	44.7853	18.2112
10	0.5997	34.9409	46.5423	17.9169
11	0.7158	33.6383	47.9773	17.6684
12	0.8617	32.4978	49.1881	17.4523
13	1.0414	31.4652	50.2358	17.2574
14	1.2593	30.5076	51.1573	17.0757
15	1.5198	29.6044	51.9747	16.9009