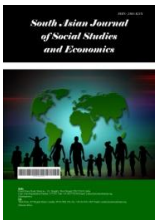

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Ageing Population and Economic Growth: Evidence from Malaysia

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

This main purpose of this article investigated the impact of ageing population on economic growth in Malaysia. Annual time series data for 27-year duration (1990-2017) was used and the autoregressive distributed lag (ARDL) was applied. This study will focuses on addressing role of ageing population in Malaysia by context that failed to receive much attention especially in employment sector. By using Romer [1] endogenous theory, the cointegration result revealed that exists a long run relationship exists between ageing population in Malaysia government development expenditure in education and economic growth. Our analysis recommends further investment in government expenditure in education sector to achieving higher human capital capability as a towards high income country and ageing phenomena.

Keywords: Ageing; economic growth; ARDL; labor; human capital.

1. INTRODUCTION

Most developed countries are facing an aging population because of increased longevity, lower mortality rates and lower fertility levels [2]. In Malaysia, numbers of ageing population showed increasing. In Malaysia, Chart 1 shows that the number of citizen age more than 55-year

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increase steadily. The proportion of people aged 65 and above in Europe is expected to increase from 14 percent in 2010 to 25 percent in 2050 according to the World Health Organization (WHO). Hence, the prime working age group is expected to be lower in the immediate future than the older age group.

Bloom and McKinnon [3] conclude that demographic changes do not inherently impede technological progress and therefore economic growth. The endogenous growth theory Romer [1] emphasizes that human capital is important role to a country economic growth. In recent years, the Malaysia GDP has come increasing due the government policy. Like any developing and develop country with open market economy, labor force playing important role as a country asset to movement economy stability. But demographic transition happen once population growth and this effect to country.

Most economists argue that a country with a higher proportion of inhabitants in the old age group tends to be associated with decreasing productivity levels, lower savings, and higher government spending [3,4]. A typical method for evaluating these changes is to assume age-specific constant habits with regard to jobs, consumption and savings and to evaluate the effects of adjustments in the relative size of different age groups for these main contributors to national income. Lisenkova, Merette, and Wright [5] find that increasing the retirement age will help to overcome a decreasing labour market, workers of different ages are not perfect substitutes and so there will definitely be a decline in productivity per worker. While theoretical and empirical contributions to the ageing population are significant, these contributions are diffuse and lack an integrated view of the various mechanisms by which an aging population impacts economic growth.

The Malaysia Human Development Index (HDI) value in the high human development category ranges from 0.559 in 1980 to 0.802 for 2018

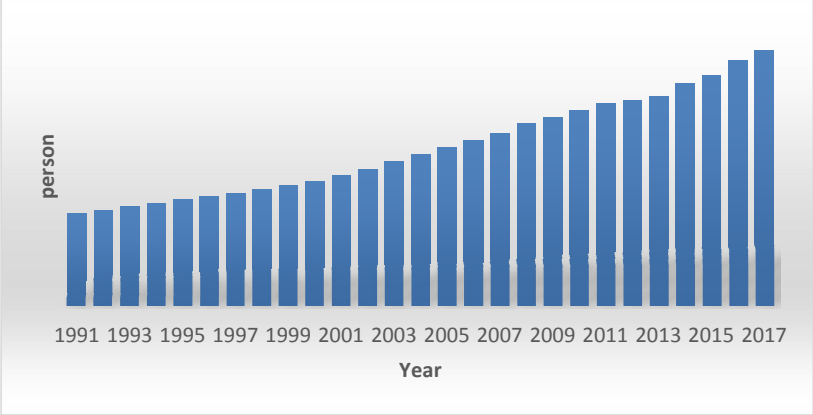

Chart 1. Ageing population in Malaysia
Source: World bank, 2018

Table 1. Malaysia human development index

Year	Life expectancy at birth	Expected years of schooling	Mean years of schooling	GNI per capita	HDI value
2018	75.5	13.7	10.2	26,107	0.802
2011	74.2	12.6	9.5	13,685	0.761
2010	74	12.6	9.5	13,192	0.758
2005	72.9	12.7	8.9	11,220	0.738
2000	72.1	11.8	8.2	9461	0.705
1995	71.1	10.5	7.6	8765	0.674
1990	70.1	9.8	6.5	6375	0.631
1985	68.8	10.0	5.6	5125	0.600
1980	64.4	9.1	4.4	4722	0.559

Source: UNDP Human Development Report, 2018

Table 2. Federal government development expenditure 1990-2018 (RM Million)

Year	1991	2000	1991-2000**	2015	2018*	2000-2018**
Economic	4684	11639		23286	26342,1	
Agriculture and rural development	1126	1183		3105	2523	
Energy and public utilities	681	1517		3637	2746	
Trade and industry	969	3667		5638	4149	
Transport	1897	4683		6693	10479	
Communications	1	228		1	105	
Environment	0	0		1331	2013,08	
Others	10	181		2881	4327	
Social	2426	11076		11160	11720	
Education and training	1285	7099	452%	4758	5256	25,96%
Health	572	1272		1442	1910	
Housing	66	1194		2008	1167	
Others	503	1511		2952	3387	
Security	2211	2332		4754	5214	
Defence	1866	1854		4078	3842	
Internal Security	345	478		676	1372	
GENERAL ADMINISTRATION2	244	2894		1568	2724	
TOTAL	9565	27941		40768	46000,1	

**Budget estimate, excluding 2018 Budget measures*
***author calculation*
Source: Malaysia, 2019

according to the United Nations Development Plan (UNDP). In the world, ranking for HDI was 57 in 2018 from 61 during 2011. Table 1, shows the performance Malaysia since 1980. As shows in the table, Malaysia life expectancy increasing from 64.4 years (1980) to 75.5 years (2018), its show we a in phase aging population. From the statistic also, Malaysia in the right track to becoming develop country and sooner ageing population will be higher.

Based on Table 2, Malaysia government expenditure budgeted with lagers investment in human capital capability. According Table 2, education and training almost 13% from total budget in 1990 and 11.3% in 2018. We calculate number of budgets for education decrease since 2000 from RM7099 million to RM5256 million in 2018. But expenditure for health a consistent increasing yearly. Its shows Malaysia has preparation to moving impact of the ageing population in increasing health expenditure. Following human capital theory [6], education and training are thought to improve an individual's skills and thus their productivity. In addition, education expenditure by government may effect to human capital because their skill and experience related to lifelong learning.

The goal of this research is to examine the effect of ageing on economic growth and to identify policies for 55 to 60 years of retirement that are still relevant in Malaysia as a country against ageing. This paper will be organized as follows part 1 begins with a brief introduction and literature review on the previous research that were related to this article. Meanwhile, part 2 will discuss on data and our research economic model. Next, part 3 explains on the theoretical model that employed in this article. Part 4 provides discussion and conclusion on this article and model.

2. LITERATURE REVIEW

A number of empirical studies have been conducted in trying to find out contribution local labor to economic growth. But less in focusing elderly population role in economic has been conducted in Malaysia. According to Doris, Nor Aini, Norlaila and Ong [7] and Field et al. [8] increase in the number of elderly in is due to reduced number of births and mortality, better control of epidemic and improved health facilities. Elderly measurement by age limit but in chronology age represent by mental volatility. Furthermore, Lopes and Albuquerque [9] also demonstrate that population ageing is changing the age structure of the Portuguese workforce with considerable regional heterogeneity. Malaysia [10] in 1980 elderly recorded 7,452,000 where 6,045,000 was age 60-74 years and

1,407,000 people age 75 years above. The estimated global life expectancy, according to Bloom and McKinnon [3] is 65 years, and this is expected to rise to 75 years by 2050.

While the ageing population has a number of significant theoretical and empirical contributions, these contributions are fragmented and lack a comprehensive view of the various mechanisms by which an aging population impacts on economic growth. Malaysia [10] in addition, when our population reaches 60 years and more than 15 percent of the total population, Malaysia projected to become ageing nation in 2030. According to Lisenkova et al. [5] with an ageing population the productivity level of the individual worker would be lower, given their physical capacity to engage effectively in the labor market.

Most of the literature argues that there is a negative relationship between population ageing and economic growth [3]. Even so, some authors, such as Prettner [11] claim the existence of a positive effect. Likewise, Bloom and McKinnon, [3] labor force participation rate will decline for about three quarters of the countries analyzed with constant age and sex specific labour force. The analyzes used demographic impact on labor supply and ultimately on economic growth with demographic shifts in relation between 1960 and 2005 to expected changes between 2005 and 2050. Assuming that labour-force participation will remain constant, i.e. that women and men of a specified age group are equally likely to be active in the labour force in 2050 as they were in 2005 [3].

Our article employed Romer [1] model as a guideline to produce our economics model and extension from model purpose by Prettner [11]. Positive effect defined form increases in longevity have positive effects on per capita output growth [11]. The interpretation for this finding is that a decrease in mortality, while holding fertility constant, leads to an increase in the population growth rate. Gobel and Zwick [12] focus metal manufacturing and service sector in Germany using the generalized method moments (GMM), this research showing that for the labour age group at the 55-60 has no significant effect on productivity in both sector. Hence, the study differences between each sector in the size of age group profiles. However, Lisenkova et al. [5] demonstrate that the age-specific impact would, in general, affect productivity in Scotland regardless of the sector in view.

3. MODEL SPECIFICATION

The model used in this study based on Romer [1] which implemented the theory of endogenous growth was the assertion that human capital is a significant determinant of economic growth.

$$Y_t = f(K_t, L_t, H_t) \quad (1)$$

Where Y_t is output, K_t is capital, L_t is labor and H_t is human capital represents aging population (55 years old and above). The normal logarithm is extended to both sides of the equation (1):

$$InY_t = \beta_0 + \beta_1 InK_t + \beta_2 InL_t + \beta_3 InH_t + \varepsilon_t \quad (2)$$

Y in our model represent gross domestic product, K represent allocation budget for education and L for active labor. From equation (2), the error correction model for ARDL is specified below:-

$$\Delta InY_t = \beta_0 + \sum_{i=0}^{k} \beta_1 \Delta InK_{t-i} + \sum_{i=0}^{k} \beta_2 \Delta InL_{t-i} + \sum_{i=0}^{k} \beta_3 \Delta InH_{t-i} + \theta_1 Y_{t-1} + \theta_2 InK_{t-1} + \theta_3 InL_{t-1} + \theta_4 InH_{t-1} + \varepsilon_t \quad (3)$$

Δ is the symbol of differentiation, the coefficients β represent the short run dynamic and θ determines the long run relationship and error term is the white noise error. To test the long run relationship among the variables, the following hypotheses are tested in analysis. The first steps in the ARDL model of analysis are to look at the long-term relationship by using F-test. If the calculated F-test is higher than upper bound and critical value, the null hypothesis of no cointegration is rejected.

H_0: $\theta_1 = \theta_2 = \theta_3 = \theta_4 = 0$ (No cointegration)

H_0: $\theta_1 \neq \theta_2 \neq \theta_3 \neq \theta_4 \neq 0$ (Cointegration exists)

When cointegration has been developed, the long-term ARDL model can be estimated as being:

$$Y_t = \beta_0 + \sum_{i=1}^{k} \beta_1 K_{t-i} + \sum_{i=1}^{k} \beta_2 L_{t-i} + \sum_{i=1}^{k} \beta_3 H_{t-i} + \varepsilon_t \quad (4)$$

For the short run can be estimated

$$\Delta Y_t = \beta_0 + \sum_{i=1}^{k} \varphi_{1i} \Delta Y_{t-i} + \sum_{i=1}^{k} \varphi_{2i} \Delta K_{t-i} + \sum_{i=1}^{k} \varphi_{3i} \Delta L_{t-i} + \sum_{i=1}^{k} \varphi_{4i} \Delta H_{t-i} + \varphi ecm_{t-1} + \varepsilon_t \quad (5)$$

Where φ are the short run dynamic coefficients of the model convergence to equilibrium and the speed of adjustment.

4. EMPIRICAL RESULTS

In this analysis, data from 1991-2017 is used to examine the long run relationship between GDP and senior citizen in Malaysia. First, the results of the unit root test are considered. ADF and PP unit root test is employed to test data stationarity of time series. The results indicate that GDP and population senior citizen are stationary at the first differences. According to Shairilizwan and Remali [13] the aim is to ensure that variables are not I(2) to avoid false results. The results of the unit root test based on ADF and PP are shown in Table 3.

Based on analysis, LGDP and LHUM represented for gross domestic product (current US) and number of ageing population (LSEN) Malaysia. LCAP AND LAB represented for labor force in Malaysia and government expenditure in education sector (current US$). All variable are stationary at first difference (constant and constant & trend). Table 4 presents the results of the cointegration test among variable using bound test.

From Table 4, results indicate that the F-statistic for our model is higher than upper bound critical value at the 10% level. Analysis successful to rejected null hypothesis at 10% significant level. We can conclude that existence of long run cointegration relationships among the variables. Based on the optimum lags selected exceed the upper bound of the critical bounds table develop by Narayan [14].

The results presented in Table 5 show that in the long run aging population has a significant positive relationship with GDP. While government expenditure in education also has a significant relationship with GDP and this suggests that labor (elderly citizen) and

Table 3. Unit root tests

Test	Variable	Level		First difference	
		Constant	Constant & Trend	Constant	Constant & Trend
ADF	LGDP	-1.97	-1.25	-4.47***	-4.87***
	LCAP	-1.08	-1.73	-3.93**	-3.85**
	LAB	-1.95	-3.12	-3.88***	-3.89**
	LHUM	0.96	-2.79	-3.49**	-3.52*
PP	LGDP	-1.98	-2.57	-5.43***	-6.78***
	LCAP	-1.08	-1.73	-3.83***	-3.72**
	LAB	-2.05	-3.12	-4.59***	-4.61***
	LHUM	-0.76	-1.95	-3.48**	-3.48*

Note: (*)Significant at the 10%; (**)Significant at the 5%; (***) Significant at the 1%

Table 4. F-Statistic of cointegration relationship

F-Statistic	Lag	Significant level	Bound critical values	
			I(0)	I(1)
3.65	3	1%	3.65	4.66
		5%	2.79	3.67
		10%	2.37	3.20

Note: number of independent variable k=4

Table 5. Estimated long run coefficients

ARDL (1, 1, 0, 3) selected based on SBC. Dependent variable is LGDP				
Variable	Coefficients	Std error	t-statistic	Prob.
C	102.52*	20.38	5.03	0.00
LCAP	0.23	0.13	1.71	0.10
LHUM	7.88*	1.26	6.25	0.00
LAB	-8.45*	1.83	-4.61	0.00

**significant at the 1% level*

Table 6. Results of ECM

Variable	Coefficients	Std error	t-statistic	Prob.
C	0.02	0.15	0.11	0.91
ECT(-1)	-0.25	0.08	-3.23	0.00*
DLGDP(-1)	-0.03	0.13	-0.22	0.83
DLABOR	2.96	2.99	0.99	0.34
DLSEN	4.57	2.15	2.13	0.05*
DLEX	0.59	0.11	5.27	0.00*
R^2	0.71			
R^{-2}	0.63			
F	9.28*			
DW	1.79			

**significant at the 1% level*

government expenditure in Malaysia has an impact despite the positive sign of coefficient to economic growth.

Table 6, indicates that short run results working aging population is positive and significant at 1%. This mean that a rise in number of aging populations improves growth in short run. The equilibrium correction coefficient of the ECM is estimated at -0.25 and significant at 1%. The results indicate that on average the disequilibrium of the previous period is corrected by about 25% in the following period. Value R-squared is 71% and indicates that 71% dependent variable is explained by independent variable in our model. The adjusted R^2, Durbin Watson statistic and F-statistic indicate that the model is a good fit.

5. DIAGNOSTIC TEST

As suggested by Pesaran, Shin and Smith [15] stability test to analyses stable over the studied period must be within the straight lines of the critical bounds at a 5% significant level. Figs. 1a and 1b of cumulative sum of recursive residual (CUSUM) and cumulative sum of squares recursive residuals (CUSUMQ). The straight lines represent critical bounds at 5% significant level. The test indicates no evidence of misspecification and instability during period estimated by the model.

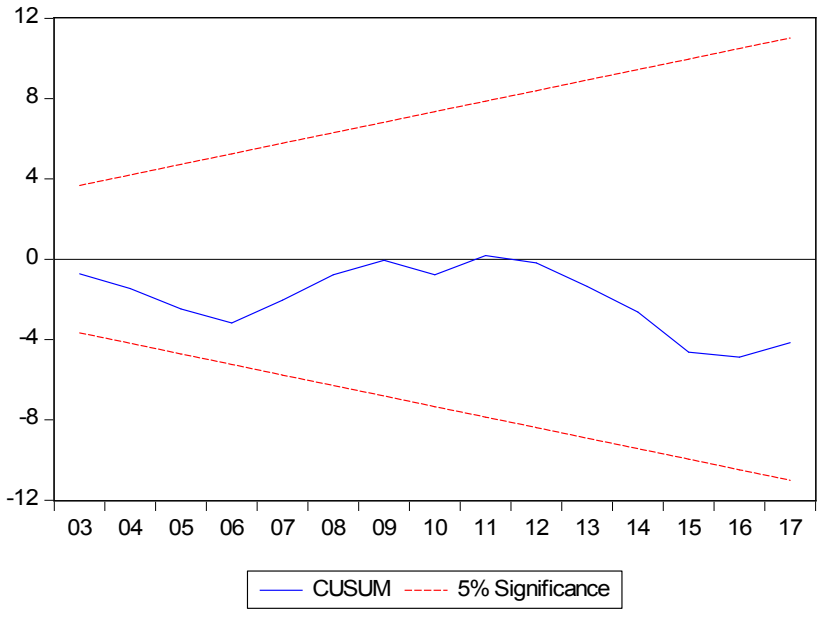

Fig. 1a. Plot of CUSUM – Cumulative sum of squares of recursive residuals

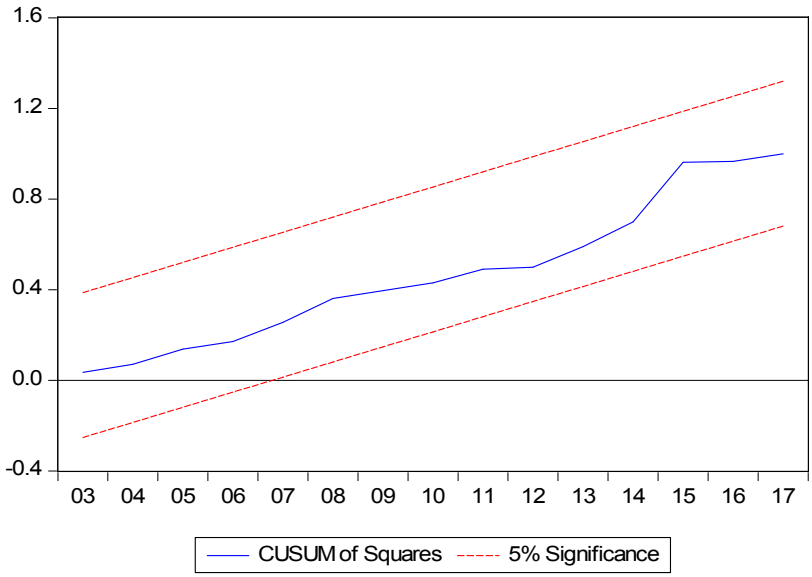

Fig. 1b. Plot of CUSUMSQ

6. CONCLUSION

The paper presented examined the long run and short run impacts of increasing ageing population in Malaysia on economic growth during period between 1991-2017. There are some studies that support such a finding Bloom and McKinnon [3] and Prettner [11]. The findings of this study argue that how economy operates although higher ageing population and effect positive implication to economic growth in Malaysia. Doris et al. [7] life expectancy increasing government expenditure pension, EPF and medical cost to elderly as a proven by government data. Similar, Bloom and McKinnon [3] most economists claim that a country with a higher proportion of the older age group appears to be correlated with lower rates of production and investment and higher government spending. This study findings education investment by Malaysia government has positive relationship and special cases for Malaysia budget yearly education is higher portion every year. This effect to productivity workers in Malaysia although ageing population is increasing yearly. Based on Malaysia vision to education in lifelong learning ecosystem given an impact to productivity workers even though ability and healthy decrease. Malaysia [10] the Malaysian federal government's spending on primary and secondary education, as a percentage of Gross Domestic Product (GDP), was the highest in East Asia.

Finally, in terms of the social need to age in place, the biggest issue which needs to be addressed ability of elderly in labor force limited due of healthy and capability especially labor force in construction industry. Research by Lisenkova et al. [5] in Scotland, regardless of the sector in focus, the age-specific will influence productivity. As purposed by Romer [1] government and private sector play a crucial role in providing incentive for individuals to be inventive. Further research should be done in Malaysia to identify category of industry applicable to implementation retirement age as an each have own policy and scope of work. Lopes and Albuquerque [9] ageing population changing structure of workforce industry. From analyze ARDL method by Romer [1] model, we found that each of variable have positive relationship and further research to separate age by sector.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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