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Does Population Aging Affect Economic Growth in Malaysia?

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ABSTRACT

The purpose of this study is to examine the impact of aging on economic growth. The study used dynamic growth model and employed ARDL approach for the period of 1970 to 2013. Three proxies for aging are used namely fertility rate, life expectancy and old dependency ratio. However, only fertility rate detect to have a long run cointegration. The major findings of this study revealed that a reduction of fertility rate lead to higher economic growth. This implied that even though Malaysia will face aging society by 2020, the economic growth still stable and can increase by investing more on human capital.

Keywords: Population Aging, Fertility Rate, Malaysia, ARDL

INTRODUCTION

Many Asian countries including Singapore, South Korea, Hong Kong, Taiwan, Thailand and Malaysia have experienced more distinct economic growth in the last three decades. According to the World Bank (2014), Malaysia's per capita GDP growth was approximately 3.80% on average per annum during 1978-2008. It was significantly higher than 1.9% for the United States, 1.84% for Europe and 2.07% for Japan. The reasons for Malaysia's remarkable economic growth have been extensively studied. Various factors are argued to be contributing to the growth in Malaysia, including trade openness, foreign direct investment (FDI), and institutional reforms. However the issue on demographic age structure on Malaysia's economic growth has been given less attention as Malaysia has not yet become an ageing society.

According to Coulmas (2007) there are three types of society based on the proportion of elderly: (1) Ageing society if 7% – 14% of the population are 65 years or older, (2) Aged society if 14% – 20% of the population are 65 years or older and, (3) Hyper-aged society if 21% or more of the population are 65 years or older. According to Kinsella and He (2009) and U.S. Census Bureau (2014), Malaysia will become an ageing society by the year 2020 where Malaysia's population aged 65 years or older will reach 7%. However once it reaches 7%, the speed of ageing will be faster i.e. it will take 23 years for Malaysia to double its elderly population to be 14% by 2043, which is much faster than the developed countries such as France who took 115 years to double their elderly population from 7% to 14%.

Population ageing rises with the increasing life expectancy and declining lower fertility rate. This phenomenon is depicted in Malaysia's demographic change over time. According to World Bank (2014), in 1970, Malaysia's elderly population was just 3.3%, however, in 2013 it's already reached at 5.4%. At the same time, the percentage of young population that age less than 14 decreases from 44.8% in 1970 to 26.1% in 2013, meanwhile working population rose from 51.9% in 1970 to 68.5% in 2013. If Malaysia does not make ample preparation for its coming to be ageing society, it will burden the government as a whole. Therefore this study aims to look at the impact of population ageing on economic growth in Malaysia, to alert policy makers and help formulate government policy such as on long-term care.

From theoretical standpoint, population ageing can retard the economic growth. Bloom, Canning and Fink (2011) argues that population ageing will tend to lower both labor-force participation and saving rates, therefore raising concerns about a future slowing of economic growth. However the empirical studies showed ambiguous results, some find population ageing can boost the economic growth and some find otherwise. For example, Park and Shin (2011) identified that there will be a sizable adverse economic impact where population ageing is more advanced. In contrast, Gomez and De Cos (2008) find that the process of population ageing is positively and significantly related to cross-country economic performance.

LITERATURE REVIEW

Economic growth theory states that, in an economy, where the population is ageing, steady state economic growth is not possible. A steady state growth is only possible, if the age structure of the population is constant. Economic growth in an economy where the population is ageing, i.e. the age structure is not constant, is only possible during the transition of the economy towards its steady state. The ageing of the population has a negative effect on economic growth. This result has been demonstrated before in numerous simulations and models with overlapping generations but not in neoclassical growth theory with infinite horizon (Gruescu, 2007).

The analysis of the effect of age-structure on economic growth is based on the main idea that the role an individual plays as an economic agent in the economy varies over his or her lifetime. A typical individual would purely be a consumer when he (or she) is young, then becomes a net saver cum producer once he joins the labor force, and in the final stage of his life, his behavior would be something in between (Bloom and Canning, 2005). As such, besides having an impact on economic growth via labor supply, the age-structure of a population also has an impact on economic growth through savings and investments (Bloom and Williamson, 1998). Another channel through which demography can affect economic growth is human capital (Bloom and Canning, 2001), which also depends on the age-structure of the population.

Demographic changes may not only affect economic growth through the mechanism of the labor market but also savings and capital accumulation. Lee, Mason and Miller (2001), Mason and Lee (2004) and Lee and Mason (2006) argue that a longer life expectancy and a smaller family size may lead to a strong incentive for people to save for their extended period of retirement. Increased savings, no matter investing domestically or abroad, may contribute to economic growth given effective policies in support systems for the elderly. Relying on the life-cycle model and calibrations, Mason and Lee (2004) explain most of the rapid increase in Taiwanese savings by changes in the age structure of the population.

In the existing literature, there is ambiguous evidence on the impact of population ageing on the economic growth; a mixture of positive and negative impact. Empirical evidence regarding the important role of demography as a determinant of economic growth is rich and can be found in developed as well as developing countries. For example Bloom and Williamson (1998) study the effect of demography on economic growth for European Union countries during the period from 1965 to 1990. In their paper, they found that almost 20% of economic growth is attributed to population dynamics. For developing countries, where population is assumed to be young and the countries have the chance to take advantage of demographic dividend, demography is also shown to have great impact on economic growth. Bloom et al. (2000), among others, show that around one third of economic growth in Asia's 'miracle countries' is assigned to age-structure. China has also gained from its demographic dividend over the recent years, where its age-structure accounts for 15–20% of its economic growth (Cai and Wang, 2006).

However, a demographic dividend only provides an opportunity for an economy to grow more quickly; it is not sufficient in and of itself. Appropriate policies in investment (in both physical and human capital) and job creation are necessary in order to realize the opportunity. The success of the Asia's miracles is a good example. Wei and Hao (2010) extend the growth equation by incorporating age structure dynamics and apply it to China's provincial-level data during 1989-2004. They find that changes in demographic structure, especially the contribution of fertility decline to lower youth dependency, have helped fuel China's economic growth since 1989. The effect of demographic change on income growth operates mainly through its impact on steady state income levels and the effect of age structure is more pronounced in provinces that are more open to market forces. They also find a significant feedback of economic growth on demographic behaviors through the mechanisms of birth rates, marriage age and life expectancy.

Similarly, Minh (2009) find that the change in demographics has contributed up to 15% of economic growth during the last five years based on data from 2002, 2004 and 2006 over 61 provinces using OLS method. The statistics show that Vietnam's demographics have been changing remarkably with an increase in the labor force as well as a decrease in the dependency ratio. He also finds that while being categorized as dependent, the aged population seems to have no negative impact on Vietnam's economic growth, but the young population does. Vietnam's population will probably shift from a demographic dividend to demographic debt in about 10 years. Therefore it is very important for Vietnamese government to take advantage of this dividend period in order to prepare a coming period of demographic debt.

On the other hand, based on data from seventy countries over the period 1961-2003, Choudhry and Elhorst (2010) reveal that GDP per capita growth is positively related to the growth differential between the working-age population and the total population, and negatively related to child and old-age dependency ratios. Based on these results, they find that population dynamics explain 46 percent of economic growth in per capita GDP in China over the period 1961-2003, 39 percent in India, and 25 percent in Pakistan. Furthermore, population dynamics are expected to have a positive effect on economic growth in India and Pakistan over the period 2005-2050, and a negative effect in China.

METHODOLOGY

In examining the dynamic linkage between Malaysia's economic growth and its major determinants, following the previous literature (i.e., Mankiw et al., 1992; Barro and Sala-i-Martin, 2003; Bloom and Williamson, 1998; Choudhry and Elhorst, 2010), we formulate the economic growth model for Malaysia as follows:

$$InGDP_t = \alpha_0 + \alpha_1 InAging_t + \alpha_2 InGE_t + \alpha_3\, InDS_t + \alpha_4\, InHC_t + \varepsilon_t \qquad (1)$$

where GDP_t is the GDP per capita (2005 constant USD); $Aging_t$ is either life expectancy (years), old dependency ratio (in percentage of working-age population) or fertility rate (births per woman); the control variables (CV) which are GE_t the government expenditure (in percentage of GDP); DS_t the domestic savings (in percentage of GDP); and HC_t is the primary education (number of students).

Since an increase in aging causes a decrease in the economic growth, it is expected that an estimate of α_1 is negative. An increase in aging can be indicated by an increase in life expectancy (following Cervellati and Sunde (2009)), an increase in old dependency ratio (following Kelley and Schmidt (2005)) or a decrease in fertility rate (following Choudhry and Elhorst (2010); Barro (1996, 2008) and De Gregario and Lee (2003)).

In regards to the impact of life expectancy on economic growth according to Cervellati and Sunde (2009), in countries before the demographic transition, the main effect of reductions in mortality in other words, an increase in life expectancy is to accelerate population growth, which tends to reduce per capita income, while there is little effect on education. Countries that have completed the transition, however, reductions in mortality reduce population growth, accelerate human capital formation and increase income per capita. Therefore, life expectancy can have negative and positive impact on the economic growth. Lee, Mason and Miller (2001), Mason and Lee (2004) and Lee and Mason (2006) argue that a longer life expectancy and a smaller family size may lead to a strong incentive for people to save for their extended period of retirement. Increased savings, no matter investing domestically or abroad, may contribute to economic growth given effective policies in support systems for the elderly. On the other hand, higher life expectancy can also lead to an increase in old dependency dependents which causes working-age population to fall therefore reduces economic growth.

Likewise, a reduction of old-age dependency may reduce tax and social security contributions paid by employed people in order to finance the retirement income and health care of the elderly and therefore also may increase labor supply. It also implies fewer mouths to feed and thus more savings accumulated for productive investment in the economy. Therefore an increase in old age dependency ratio indicates an increase in aging which causes a decrease in the economic growth. That is why the coefficient of old-age dependency ratio is expected to be negative.

In contrast, the reduction in fertility rate in other words having less children frees up the time for women to work. So the increase in female labor participation increases the working-age population which boosts the economic growth. In the short term, a higher fertility rate means that increased resources must be devoted to childrearing rather than production of goods. In the long term, a portion of the economy's investment must be used to provide capital for new workers (after children have grown up) rather than to raise capital per worker. Also with a decline in fertility, in the short-run the youth-age population share declines and the working-age share increases. Working-age people contribute to the labor force more than youth-age, and if these individuals are gainfully employed (Bloom, Canning, Fink and Finlay, 2007) then while income per worker can remain the same, income per capita increases. In Malaysia, the decline in the total fertility rate has bought with it an increase in the working-age share. However, as the total fertility rate falls below the replacement rate in many Asian countries the working-age share will decrease in the long-run (Bloom, Canning, Fink and Finlay, 2008) and old-age shares will increase. Therefore a decline in fertility indicates an increase in aging which causes a decrease in economic growth. That's why the coefficient of fertility rate is expected to be negative.

If the government expenditure leads to an increase in economic activity, thereby increasing the economic growth in Malaysia, it is expected that an estimate of α_2 is positive. Since an increase in domestic savings boosts the economic growth, it is expected that an estimate of α_3 is positive. Finally, if an increase in human capital investment leads to an increase in economic growth, it is expected that an estimate of α_4 is positive.

The empirical focus is on assessing the long-run impact of aging on the economic growth. To achieve the objective, we use an autoregressive distributed lag (ARDL) bound testing approach of cointegration developed by Pesaran et al. (2001). Because an error-correction model (ECM) can be derived from the ARDL model via a simple linear transformation, the ARDL is a convenient tool to investigate the short-run and long-run parameters of the model simultaneously.

To implement the bounds testing procedure, following Pesaran et al. (2001), it is necessary to reformulate equation (1) as a conditional autoregressive distributed lag (ARDL) model as follows:

$$\Delta InGDP_t = \beta_0 + \eta_1 \sum_{i=0}^{p} \Delta\, InGDP_{t-i} + \varphi_2 \sum_{i=0}^{p} \Delta\, InAging_{t-i} + \xi_3 \sum_{i=0}^{p} \Delta\, InCV_{t-i} + \lambda_1\, InGDP_{t-1} + \lambda_2\, InAging_{t-1} + \lambda_3\, InCV_{t-1} + \mu_t \quad (2)$$

where Δ is the first difference operator, where p is lag length, and μ_t is an error term assumed serially uncorrelated. In equation (2), the estimates of λ_1, λ_2 and λ_3 represent the long-run (cointegration) relationship. The coefficients of the summation signs (Σ), on the other hand, show the short-run relationship between Malaysia's economic growth and its major determinants.

Pesaran et al. (2001) show that in this type of specification, the selected variables are said to be cointegrated if all the lagged-level variables are jointly significant in the equation. This can be done by using an F-test with two sets of asymptotic critical values (upper and lower critical values) tabulated by Pesaran et al. (2001). An upper critical value assumes that all the variables are *I*(1), or nonstationary, while a lower critical value assumes that they all are *I*(0), or stationary. If the computed F-statistic falls above the upper bound of critical value, the selected variables are said to be cointegrated. It is worth mentioning that, since the ARDL is based on the assumption that all variables could be *I*(1) or *I*(0), unlike the standard cointegration techniques (e.g., Engle and Granger, 1987; Johansen, 1995), it can be applied irrespective of their order of integration and therefore avoids the pre-testing problems.

EMPIRICAL RESULTS

Before implementing the ARDL modeling, the important specification issue to be addressed is the determination of lag length for the model. Many empirical studies (e.g., Bahmani-Oskooee and Ardani, 2006; Bahmani-Oskooee and Brooks, 1999) show that the empirical results of the F-test are quite sensitive to change in lag structure on first differenced variables. Following Pesaran et al. (2001), we first determine the lag structure (*p*) in equation 2 in conjunction with the Schwarz Bayesian Criterion (SCB) (due to the small sample size of 32 years) and diagnostic tests for serial correlation based on the Langrange multiplier (LM) statistics (Table 1).

We focus on the equation which has long-run cointegration. Only the equation where fertility rate become aging proxy has long-run cointegration. The equations which are life expectancy and old dependency ratio as proxy for aging found to have no long-run cointegration. The SBC indicates that *p* = 2 is the most appropriate lag length for Malaysia's economic growth in which the fertility rate becomes the aging proxy. The LM statistic, however, shows that the null hypothesis of no serial correlation can be rejected at p = 2 at the 5% level. We then select p = 1, which provides the second lowest SBC statistic as well as the failure to reject the null of no serial correlation. Therefore, a lag length of one year (p = 1) is used for further analysis.

With the selected lag length (p = 1), we then test the existence of a level relationship (cointegration) among the selected variables in equation 2. For this purpose, the null hypothesis of non-existence of the long-run relationship ($\lambda_1 = \lambda_2 = \lambda_3 = 0$) in equation 2 is tested using an F-test. The results show that the calculated F-statistic lies outside the upper level of the 5% critical bounds (4.77) (Table 1), indicating the existence of a stable long-run relationship among economic growth, ageing and the control variables. We then estimate equation 2 using the ARDL approach in order to obtain the long-run and the short-run coefficients. The maximum lag length is set to one (p = 1). Given this, the SBC-based ARDL suggests ARDL (1,2,2,0,0) as the optimal lag structure for the model.

The results of the long-run coefficient of Malaysia's economic growth where fertility is the aging proxy show that all variables are statistically significant at 5% level and have the expected signs (Table 2). More specifically, the economic growth has a negative long-run relationship with fertility rate, indicating that a fall in fertility rate leads to a rise in aging which consequently leads to a decline in economic growth. A 1% decline in fertility rate causes the economic growth to increase by 1.22%. This supports the theory that as the fertility falls, in the long-run, the working-age population also falls. On the other hand, the economic growth has a positive long-run relationship with the control variables, implying that Malaysia's economic growth tend to increase as the control variables i.e. government expenditure, savings and human capital increase. The economic growth increases by 1.05%, given a 1% increase in government expenditure, while a 1% increase in domestic savings causes economic growth to increase by 0.69%. Also a 1% increase in human capital (primary education) causes economic growth to increase by 0.48%

CONCLUSION

This study carried out an investigation whether aging significant impact on economic growth. The estimation is carried out by using dynamic model for the period of 1970 to 2013. The result shows that only fertility rate which proxy for aging have a long run relationship meanwhile the other two proxy namely old dependency ratio and life expectancy did not have a long run cointegration. Our result revealed that aging (proxy by fertility rate) negatively affect the economic growth. In other words, in the long run even though Malaysia will facing the aging society by year 2020, the economic growth can be remained stable as reduction on fertility rate implies that women will be participating more in the labor market and thus contribute to higher labor productivity and economic growth too. The government should keep on investing on human capital so that even though we face the aging society, we already prepared stock of quality human capital.

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TABLE 1 Results of cointegration test among variables.

Lag order	**SBC**	χ^2_{SC}	**F-statistic**
1	-4.76	2.75	5.93**
2	-5.20	6.07*	4.48*

Note:

χ^2_{SC} is Lagrange multiplier (LM) statistic for testing the hypothesis of no serial correlation. F-statistic is the test statistics for cointegration. F-statistic for the 5% critical value bound is (3.35, 4.77, which is obtained from Table case III in Narayan (2005). * An asterisk indicates significance at less than 10% level. ** Double asterisks indicate significance at less than 5% level. *** Three asterisks indicate significance at less than 1% level.

TABLE 2 Estimated long-run coefficients and t-ratios of Malaysia's economic growth

Variable	**Coefficient**	**t-Ratio**
Fertility rate (LFR)	-1.22***	-15.05
Government expenditure (LGE)	1.05***	9.01
Domestic savings (LDS)	0.69***	4.70
Human capital (LHC)	0.47***	2.38
Constant	-1.37	-1.51

Note: ***, **, * indicate significance at the 1%, 5% and 10% level, respectively.