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Cointegration Analysis of Social Services Expenditure and Human Capital Development in Malaysia: a Bound Testing Approach

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Government expenditure on social services is essential to the development of the economy. This fact also applies to Malaysia, a developing country that aspires to become a developed nation in a few years to come. As the Malaysian government plays a dominant role in financing public education and health services, an analysis on its investment in these areas, if made available, would be able to assist policymakers in generating a strategic plan to enhance human capital development and economic growth. Hence, the aim of this study is to investigate the long-run and short-run relationships between economic growth and social services expenditure with human capital indicators in Malaysia for the period of 1975-2011. The bound testing approach developed within the autoregressive distribution lag (ARDL) framework is employed. The empirical results show that there is a cointegrating relationship between economic growth and the explanatory variables i.e. investment, social services expenditure and human capital indicators. The results revealed that government expenditure in social services are important to human capital development and economic growth, and an increase in health and education capital can help generate better human capital and attain economic sustainability.

1. Introduction

Health and education play an important role in the process of economic development and human capital accumulation. Human capital is a broad concept that identifies human characteristics which can be acquired and could increase the workers' income and productivity level. It is commonly include knowledge and skills of the workers that obtain partly through education, and also their physical capacities such as

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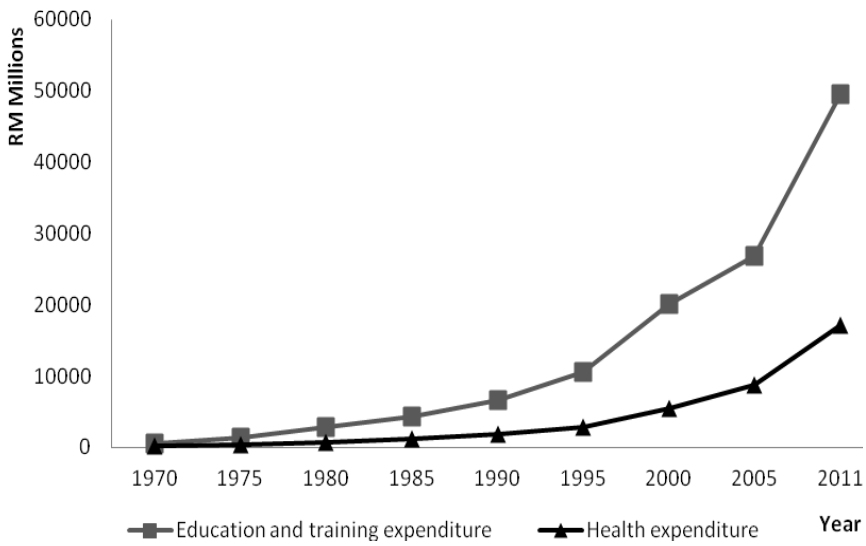
strength and vitality, which are dependent on their health and nutrition. Schultz (1961), Denison (1967), Barro (1991) and Barro and Martin (1995) are among the earliest scholars that measures the important of education, nutrition and health as a factors that determine economic growth. Therefore, an increase in government spending in health and education is expected to result in better quality human capital and enhance the economic growth of the country. The contribution of human capital to productivity level and growth has been one of the main focuses in most growth models in recent years.

As for Malaysia, government expenditure on education and healthcare is prominent to the economic development especially as Malaysia aims to be high-income economy and developed nation by year 2020 (Tenth Malaysian Plan, 2010-2015). The path towards these visions will be filled with challenges and difficulties especially in producing a first-class mentality society and productive human capital that is able to generate the economy above the value chain. In order to meet these challenges, policymakers will have to develop sound strategies for a rapid development of human capital. Greater attention should be given to the development of healthy, educated and well-trained manpower capable of high productivity; hence, a vibrant economy. Therefore, education and health are essential in these processes. The studies by Baldacci et al. (2003) and Gupta et al. (2002) found that government expenditure on social services can improve education and health capital such as education attainment and the health status of the society. Baldacci et al. (2008) also discovered that expenditure on education and health had a positive and significant impact on the accumulation of education and health capital as well as economic growth. Thus, an increase in government expenditure on health and education is expected to result in better quality human capital and enhance the economic growth of the country.

As highlighted in the Tenth Malaysia Plan (2011-2015), the government anticipates adopting an integrated human capital and talent development framework starting from early childhood education, basic education, tertiary education and all the way to adult working lives. This framework will emphasize on revamping the education system to significantly raise student outcome, raising the skills of Malaysians to increase employability and reforming the labour market to transform Malaysia into a high-income nation.

Figure 1: Government Expenditure on Education and Healthcare Services in Malaysia, 1970-2011 (RM Millions)



Source: Economic Planning Unit, Malaysia

Education expenditure has always been dominating the social services expenditure provisions. For example in 1975, the government allocated 61 percent of the social services expenditure on education and training and this expenditure increased to 64 percent in 2011. This reflects that special focus given to education and training by the Malaysian government in its development plans. Health care services also receive special attention by the government every year. It is highly subsidized by the government in order to ensure that no one is denied access to healthcare in the government facilities regardless of their nationality or income levels. The government expenditure on health has increased from RM5,403 million to RM17,136 million from year 2000 to 2011. Figure 1 shows the trend of the public social services expenditure from year 1970 to 2011. The health care indicator also shows an improvement in health services and health status. For example, the ratio between doctor and population has improved from 1:1,490 in 2000 to 1:791 in 2011 and life expectancy at birth for female has increased from 75 years in 2000 to 77 years in 2010.

2. Literature Review

Early empirical research on growth had intensively focused on education capital as a factor incorporated with human capital development which emphasized on education variables such as years of schooling, school enrollment and literacy ratio. Among these studies, Romer (1990), Barro (1991), Mankiw et al. (1992) and Benhabib and Speigel (1994) found a positive relationship between students' enrollment, schooling and growth.

The study by Romer (1990) formulated an explicit growth model with technical progress. His study showed that the economy with a larger stock of human capital will experience faster economic growth. Meanwhile Mankiw et al. (1992), augmenting the Solow model and include human capital in his study as well as physical capital while maintaining the assumptions of exogenous technological progress and diminishing returns to all capital. Benhabib and Speigel (1994) showed that human capital is a determinant of domestic innovation. Level of education was used as a proxy for education and it has positive correlation with growth.

Based on more refined measure on skills, Coulombe et al. (2004) studied a sample data of 14 OECD countries from year 1960-1995. The study revealed that human capital indicators based on literacy scores have a positive and significant effect on the short-run growth and long-run GDP per capita as well as labor productivity. The measurement of human capital indicators based on literacy scores also outperformed other indicators such as years of schooling. Meanwhile, Ramcharan (2004) developed an analytical framework in analyzing the contribution of education towards economic growth. Their study revealed that an increase in investment in both secondary and tertiary levels of education would lead to an increase in the composition of human capital stock in the economy.

In contrast, recent empirical studies on growth literature ascertained health as another important aspect of human capital that needs to be considered. Basically, a healthy person will work more effectively and efficiently and also allocate more time to productive activities.

Schultz (1961) was one of the earliest scholars to examine the role of health capital as a factor to enhance the quality of human capital. He argued that improvement in health indicators and services not only will generate population growth but also stimulate higher growth in the final output level. This result was in accordance with the findings from Arrow (1962), Mushkin (1962), and Romer (1986), which indicated another importance aspect of human capital is health. Furthermore, Van Zon and Muysken (2003) discovered that health is a principal determinant of economic growth in Western economies.

Meanwhile, Strauss and Thomas (1998) found the existence of a causal impact of health capital on wages and productivity. Furthermore, a panel study by Gyimah-Brempong and Wilson (2004) in the Sub-Saharan African and OECD countries documented that health capital indicators positively influenced aggregate output. Their findings showed that about 22 to 30 percent of the growth rates were attributed to health capital, and a 10 percent increase in health capital investment was associated with a 1 percent and 0.5 percent increase in the growth rate of real per capita income for the Sub-Saharan African and OECD countries, respectively.

Mayer-Foulkers (2003) further emphasized how investment in health could promote economic growth. It was shown that health played a significant role in economic growth and contributed more to growth compared to education. Health increased growth through improvement in education enrollment, productivity level and participation of women in economic activities. Studies by Knowles and Owen (1997) also revealed a strong and robust relationship between life expectancy as a proxy of health capital and economic growth, meanwhile education showed a weak relationship with income level. However, Webber (2002) reached a different conclusion. He found that health capital i.e. nutrition level moderately contributed to economic growth compared to enrollment ratio as a proxy of education capital; hence he suggested that policy makers should prefer investments in education over health. Therefore, from the explanation above, it is clear that the empirical results of the effect of education and health on economic growth are quite mixed.

3. Model Specification and Research Methodology

The model of this study is based on the Baldacci et al. (2008) framework. The following production function is based on neoclassical growth frameworks augmented that include investment ratio, education capital and health capital.

$$Y = f(S_k, H_E, E_D)$$

Where:

Y = real GDP

S_k = investment ratio

H_E= health capital

E_D = education capital

Referring to the above model two models will be tested. The first model will emphasize on the role of social services expenditure and investment ratio to growth. Meanwhile, the second model will included two more additional variables i.e. education capital and health capital that represent by tertiary enrollment as a proxy for the former and life expectancy as a proxy for the later. The two models can be written as below:

Equation for Model 1:

$$lnGDP_t = \beta_0 + \beta_1 ln\, INV_t + \beta_2 lnSSP_t + \varepsilon_t \qquad (1a)$$

Equation for Model 2:

$$lnGDP_t = \beta_0 + \beta_1 ln\, INV_t + \beta_2 lnEDU_t + \beta_3 lnLIFE_t + \beta_4 lnSSP_t + \varepsilon_t \qquad (1b)$$

Where:

β_0 = the intercept

β_i = the coefficient of independent variables

ε = the error term

GDP is real GDP and a proxy of economic growth; INV is gross capital formation as a proxy of investment; SSP is social services expenditure that consists of government expenditure in education, health and other services; EDU is tertiary enrollment as a proxy of education capital; and LIFE is life expectancy at birth as a proxy of health indicator.

3.1 Autoregressive Distributed Lag (ARDL) Model

Based on Pesaran and Pesaran (1997), the augmented Autoregressive Distributed Lag, ARDL $(p, q_1, q_2, \ldots, q_k)$ model can be written as:

$$\psi(L,p)y_t = \alpha_0 + \sum_{j=1}^{k} \beta i \ (L, q_i)x_{it} + \delta' w_t + \mu_t \qquad (2)$$

Whereby;

$$\psi(L,p)y_t = 1 - \psi_1 L^1 - \psi_2 L^2 - \ldots - \psi_n L^n \qquad (3)$$

$$\beta_i(L, q_i) = \beta_{i0} + \beta_{i1}L + \beta_{i2}L^2 + \ldots + \beta_{iqi}L^{qi} \qquad (4)$$

$i=1,2,\ldots.k.$

L is the lag operator such that $Lyt = y_{t-1}$ and w_t is a $s \times 1$ vector of deterministic variables such as seasonal dummies, time trends or exogenous variables with fixed lags. Equation (2) shows a Ordinary Least Square (OLS) method for all possible values of $p=0,1,2,\ldots,m;$ $q_i=0,1,2,\ldots,m$ where m is the maximum lag and $i=1,2,\ldots,k.$ The long-run coefficient for a response of y_t to a unit change in x_{it} are estimated by:

$$\beta_i = \frac{\hat{\beta}_i(1,\hat{q}_i)}{\hat{\psi}(1,\hat{p})} = \frac{\hat{\beta}_{i0}+\hat{\beta}_{i1}+\hat{\beta}_{i2}+\cdots+\hat{\beta}_{i\hat{q}i}}{1-\hat{\psi}_1-\hat{\psi}_2-\cdots-\hat{\psi}_{\hat{p}}} \qquad i=1,2,3,\ldots k \qquad (5)$$

Where $\hat{p}$ and $\hat{q}$, $i=1,2,\ldots k$ are the estimated values of p and $q_{i.}$. Likewise, the long-run coefficients associated with the exogenous variables with fixed lags are estimated by

$$\varphi' = \frac{\delta'(\hat{p},\hat{q}_1,\hat{q}_2,\ldots,\hat{q}_k)}{1-\hat{\psi}_1-\hat{\psi}_2-\cdots-\hat{\psi}_{\hat{p}}} \qquad (6)$$

Meanwhile, $\delta'(\hat{p},\hat{q}_1,\hat{q}_2 \ldots,)$ denotes the OLS estimate of δ in equation (2). The error correction model (ECM) associated with the ARDL

$(\hat{p}, \hat{q}_1, \hat{q}_2 \ldots, \hat{q}_k)$ model can be obtained by writing equation (2) in terms of lagged levels and the first differences of y_t, x_{1t}, x_{2t}, ...x_{ka} and w_t as shown below:

$$\Delta y = \Delta\alpha_0 - \emptyset(1,\hat{p})ECM_{t-1} - \sum_{i=1}^{k} \psi^*_j \Delta y_{t-j} + \delta' \Delta w_t + \sum_{i=1}^{k} \beta_{i0}\Delta x_{it} - \sum_{i=1}^{k}\sum_{j=1}^{\hat{q}-1} \beta^*_{ij} \Delta x_{i,t-j} + \mu \quad (7)$$

ECM_t can be defined by

$$ECM_t = y_t - \sum_{i=1}^{k} \hat{\beta}_i x_{it} - \hat{\varphi}' w_t$$

where Δ is the first difference operator; ψ^*_j and β^*_{ij} are the coefficients associated to the short-run dynamics of the model's convergence to equilibrium, whilst $\emptyset(1,\hat{p})$ measures the speed of adjustment.

3.2 Data and methodology

This study employs annual data from 1975 to 2011. The data were obtained from the Department of Statistics and the Treasury Department of Malaysia.

The ARDL bound testing approach has several advantages compared to the Engle and Granger (1987) or the Johansen and Juselius (1990) type of cointegration method. First, the bound test can be implemented irrespective of whether the underlying regressors in the model are purely I(0), I(1) or mutually co integrated. Second, the ARDL approach is able to examine the existence of the short-run as well as the long-run relationships between the independent variables and the dependent variable simultaneously. Third, the ARDL approach provides robust result when applied on a small sample data. Finally, the cointegration relationship can be estimated using the simple ordinary least square (OLS) method once the order of lags in the ARDL model is identified.

There are 3 steps to examine the bound testing procedure using ARDL approach. The first step requires the test of the existence of a long-run relationship (cointegration) by performing the F-test or the Wald test. The unrestricted error correction model regression used in this study has the following form as expressed in the equation below for Model 1 and Model 2 respectively:

$$\Delta \ln GDP_t = \alpha_i + \sum_{j=1}^{n} \gamma i \, \Delta \ln GDP_{t-j} + \sum_{l=1}^{k1} \delta\, i \, \Delta \ln INV_{t-j} + \sum_{m=1}^{k2} \varphi i \, \Delta \ln SSP_{t-j} + \beta_1 \ln GDP_{t-1} + \beta_2 \ln INV_{t-1} + \beta_3 \ln SSP_{t-1} + \varepsilon_t \qquad (8a)$$

H_o: $\beta_1 = \beta_2 = \beta_3 = 0$ (No long- run relationship)

H_1: at least one $\beta_i \neq 0$ (A long -run relationship)

This equation can be denoted as F_{GDP}(GDP | INV, SSP)

$$\Delta \ln GDP_t = \alpha_i + \sum_{j=1}^{n} \gamma i \, \Delta \ln GDP_{t-j} + \sum_{l=1}^{k1} \delta\, i \, \Delta \ln INV_{t-j} + \sum_{m=1}^{k2} \varphi i \, \Delta \ln EDU_{t-j} + \sum_{n=1}^{k3} \sigma i \, \Delta \ln LIFE_{t-j} + \sum_{p=1}^{k4} \psi i \, \Delta \ln SSP_{t-j} + \beta_1 \ln GDP_{t-1} + \beta_2 \ln INV_{t-1} + \beta_3 \ln EDU_{t-1} + \beta_4 \ln LIFE_{t-1} + \beta_5 \ln SSP_{t-1} + \varepsilon_t \qquad (8b)$$

H_o: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$ (No long-run relationship)

H_1: at least one $\beta_i \neq 0$ (A long- run relationship)

This equation can be shown as F_{GDP} (GDP | INV, SSP, EDU, HEL)

The above equations with the summation signs represent the error correction dynamics, while β_t corresponds to the long-run relationship and ε_t is the white noise error term. Based on the result of the F-test, if the computed F-test is higher than the upper bound, the null hypothesis of no cointegration is rejected. If the F-test is lower than the lower bound then the null hypothesis cannot be rejected. Meanwhile, if the F-test lies between the lower and the upper bounds, a conclusive inference cannot be made.

Once the cointegration is confirmed, the second step will be taken to estimate the long-run relationship between growths, as the dependant variables, and the independent variables in both models using ARDL (n, k_1, k_2) and ARDL (n, k_1,k_2,k_3,k_4) for Model 1 and Model 2 respectively. The equation can be estimated as:

$$\ln GDP_t = \alpha_i + \sum_{j=1}^{n} \gamma i \, \Delta \ln GDP_{t-j} + \sum_{l=1}^{k1} \delta\, i \Delta \ln INV_{t-j} + \sum_{m=1}^{k2} \varphi i \Delta \ln SSP_{t-} \qquad (9a)$$

$$\Delta \ln GDP_t = \alpha_i + \sum_{j=1}^{n} \gamma i \, \Delta \ln GDP_{t-j} + \sum_{l=1}^{k1} \delta\, i \, \Delta \ln INV_{t-j} + \sum_{m=1}^{k2} \varphi i \, \Delta \ln EDU_{t-j} + \sum_{n=1}^{k3} \sigma i \Delta \ln LIFE_{t-j} + \sum_{p=1}^{k4} \psi i \, \Delta \ln SSP_{t-j} \qquad (9b)$$

Finally, in the third step, short-run elasticity can be derived by constructing an error correction model as stated in the equation for Model 1 and Model 2 below:

$$\Delta ln\ GDP_t = \beta_0 + \sum_{j=1}^{n} \gamma i\ \Delta\ ln\ GDP_{t-j} + \sum_{l=1}^{k1} \delta\ i\ \Delta\ ln\ INV_{t-j} + \sum_{m=1}^{k2} \varphi i\ \Delta\ ln\ SSP_{t-j} + \phi ECM_{t-1} + \varepsilon_t \quad (10a)$$

$$\Delta\ ln\ GDP_t = \beta_0 + \sum_{j=1}^{n} \gamma i\ \Delta\ ln\ GDP_{t-j} + \sum_{l=1}^{k1} \delta\ i\ \Delta\ ln\ INV_{t-j} + \sum_{m=1}^{k2} \varphi i\ \Delta\ ln\ EDU_{t-j} + \sum_{n=1}^{k3} \sigma i\ \Delta\ ln\ LIFE_{t-j} + \sum_{p=1}^{k4} \psi i\ \Delta\ ln\ SSP_{t-j} + \phi\ ECM_{t-1} + \varepsilon_t \quad (10b)$$

where γ_i, δ_i, φ_i, σ_i and ψ_i are the short- run dynamic coefficients of the models' convergence to equilibrium and ϕ measures the speed of adjustment.

4. Results and Discussion

The result from the bounds test is shown in Table 1. The computed F-tests in Model 1 and Model 2 are above the critical value proposed by Narayan (2005) at 10 percent and 1 percent significant levels, respectively. Hence, it can be concluded that the null hypothesis of no cointegration is rejected showing that there is a long-run relationship between economic growth and the explanatory variables.

Table 1: Bounds Test Results Based on Equation (3) and (4)

Model	F-statistics	Critical value of the F-statistics with intercept and no trend					
		1%		5%		10%	
		I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
Model 1[a]	3.7336***	6.183	7.873	4.267	5.473	4.470	3.008
Model 2[b]	8.1541*	4.768	6.670	3.354	4.774	2.752	3.994

Source: Critical value bounds are taken from Narayan (2005), case III: unrestricted intercept and no trend.

a and b refer to the number of parameters (variables); a=2 and b=4.

Note: *, ** and *** denote significance at 1%, 5% and 10% levels respectively

The results in Table 2 show long-run relationship for growth determinants. Based on the findings for Model 1, social services expenditure and investment significantly have a long-run relationship with real GDP at 1 percent and 10 percent significant levels, respectively. It explains that an increase in social services expenditure will lead to 0.6 point increase in real GDP. Meanwhile, an increase in investment will lead to 0.3 point increase in real GDP. Model 2 shows that investment, social services expenditure and health capital have positive relationships with real GDP at 1 percent significant level. Education also has a long run relationship with real GDP at 10 percent significant level. Life expectancy as a proxy of health capital shows a bigger effect to real GDP compared to education capital as an increase in life expectancy will increase 10 point of real GDP. These results are consistent with the findings documented by Bloom and Canning (2003); Bloom, et al. (2004); Gyimah-Brempong and Wilson (2004) where health capital shows a bigger impact on aggregate output compared to education capital.

Table 2: Long-run Relationship of Growth Determinants

Regressor	**Model 1 (3,1, 0)**	**Model 2 (1, 1, 3, 3, 3)**
lnINV	0.3184***	0.05412*
lnSSP	0.6196*	0.3094*
lnEDU		0.1188**
lnLIFE		10.2455*
Constant	2.8443*	-14.4652*

Dependent variable: lnGDP
Note: *, ** and *** denote significance at 1%, 5% and 10% levels respectively

The generated long-run coefficients are used to estimate the error correction terms for the two models. The results for short-run relationship and the error correction model are shown in Table 3. The error correction model (ecm_{t-1}) measures the speed of adjustment to restore equilibrium in the dynamic model. The negative sign in both models are statistically significant at 1 percent level, thus confirming a long-run relationship existence among the variables. The error correction in Model 1 is -0.3120 and -0.5694 in Model 2. It implies that a deviation from long-run growth in this period is corrected by about 30 percent in Model 1 and 57 percent in Model 2. This means the speed of adjustment for both models are quite fast.

Table 3: Error Correction Representation of ARDL Model

Dependent variable is ΔlnGDP		
Regressor	**Model 1**	**Model 2**
ΔlnINV	0.4329*	0.01633
$\Delta lnINV_{t-1}$	-0.1893***	
$\Delta lnINV_{t-2}$	-0.36381*	
ΔlnSSP	0.1933***	0.1680*
$\Delta lnSSP_{t-1}$		-0.0788*
$\Delta lnSSP_{t-2}$		-0.0460
ΔlnEDU		0.0509**
$\Delta lnEDU_{t-1}$		0.0560***
$\Delta lnEDU_{t-2}$		0.0505**
ΔlnLIFE		11.4084*
$\Delta lnLIFE_{t-1}$		0.7423**
$\Delta lnLIFE_{t-2}$		0.1680
ΔConstant	0.88734**	-8.2359*
Ecm_{t-1}	-0.3120*	-0.5694*
OLS Results:		
R^2	0.5054	0.9985
Adjusted R^2	0.4372	0.9978
F-statistics	9.8779*	1513.8*
Stability test	Stable	

Note: *, ** and *** denote significance at 1%, 5% and 10% levels respectively

5. Conclusions

Developing human capital through education, training and health care is seen as a key driver to improve the quality of human resource. As the government plays an important role in financing public education and health services in Malaysia, it is important to measure the effectiveness of the social services expenditure towards the development of human capital and economic growth.

The objective of this paper is to examine the long-run and short-run relationships between economic growth and social services expenditure with human capital variables. This study employs the Autoregressive Distributed Lag (ARDL) bound testing approach that covers a sample of annual data from 1975 to 2011.

The empirical results show that there is cointegration between economic growth and the explanatory variables i.e. investment, social services expenditure and human capital indicators. In Model 1, investment and social services expenditure show a positive impact on economic growth in the long run and the short run. Meanwhile, the results in Model 2 proved that life expectancy at birth as a proxy of health indicator and tertiary enrollment as a proxy of education indicator also have a long-run and short-run relationship with economic growth.

The results revealed that there are two major conclusions: firstly, government expenditure in social services is important to human capital development and economic growth. This result is consistence with the studies by Gupta et al. (2002), Baldacci et al. (2003), and Baldacci et al. (2008) whereby expenditure in social expenditure can generate quality human capital through better education system and health-care services. Secondly, findings showed that an increase in life expectancy and enrollment at tertiary level can help to generate quality human capital, thus contribute to economic development. This can be proved with the continuous improvement by the government in providing better facilities for primary healthcare and higher education services.

As Malaysia enters a critical phase to become a high-income economy and developed nation by 2020, the government has continuously formed new policies to ensure this vision can be achieved. In the recent Tenth Malaysia Plan (2011-2015), the government has emphasized on nurturing and retaining top talent among the labor. In order to achieve these objectives, the government has to undertake a comprehensive reform across the entire life-cycle of human capital development starting from upgrading early childhood education right through to upskilling the existing adult workforce. Due to this, the government needs to increase their expenditure in education and skill training. At the same time, the government constantly enhances the healthcare system in Malaysia especially by providing better facilities for healthcare services through developing more clinics in rural areas and new hospitals with upgraded technologies and sufficient numbers of manpower. However, the policymakers should revise on the dependency of this country to the government on supplying education and healthcare system. The involvement of private sector should be encouraged. This step will help to reduce the government financial burden and assist the government sector to be more competitive in the future. Nonetheless, the government should continuously monitor the services offered by the private sector to ensure it is affordable to the public.

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