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Human Capital Accumulation and Economic Growth in Malaysia – Investigating the Long Run Nexus

(Pengumpulan Modal Insan dan Pertumbuhan Ekonomi di Malaysia – Mengkaji Nexus Jangka Panjang)

Lai Wei Sieng
Ishak Yussof
School of Economics
Universiti Kebangsaan Malaysia

ABSTRACT

The endogenous growth theory emphasises that human capital is crucial to a country's economic growth. The purpose of the present study is to investigate the long term relationship between human capital and economic growth in Malaysia for the period between 1981 and 2010. Based upon the results of the autoregressive distributed lag (ARDL) model employed, the findings indicate that a long run relationship exists between the education level of the labour force and economic growth. Among all education levels, labour with high educational attainment (secondary and tertiary) contributed positively to economic growth. The present study recommends further investment in higher education following the successful experience of many developed countries in order to propel Malaysia towards achieving its ambition of being recognised as a high income country.

Keywords: Human capital; labour; economic growth; educational attainment; autoregressive distributed lag approach (ARDL)

ABSTRAK

Teori pertumbuhan endogenos menekankan bahawa modal insan adalah amat penting kepada pertumbuhan ekonomi sesebuah negara. Matlamat kajian ini adalah mengkaji hubungan jangka panjang di antara tahap pendidikan buruh dan pertumbuhan ekonomi di Malaysia untuk tempoh tahun 1981 hingga tahun 2010. Berdasarkan keputusan dengan menggunakan kaedah autoregressive distributed lag (ARDL), hubungan jangka panjang wujud di antara kedua-dua pemboleh ubah, iaitu buruh berpendidikan tinggi memberi sumbangan yang positif kepada pertumbuhan ekonomi. Kajian ini mencadangkan supaya pelaburan dalam pendidikan tinggi harus ditingkatkan berdasarkan kejayaan yang diperolehi oleh banyak negara maju bagi membantu Malaysia mencapai taraf negara berpendapatan tinggi.

Kata kunci: Modal insan; buruh; pertumbuhan ekonomi; tahap pendidikan; autoregressive distributed lag approach (ARDL)

INTRODUCTION

The assertion that human capital is an important determinant in economic growth under the new endogenous growth theory is made by several contemporary economists, namely Uzawa (1965), Lucas (1988) and Romer (1990). This contrasts with the neoclassical growth theory of Solow (1956) and Swan (1956), which states that there must be continual advances in technological knowledge in the form of new products, new markets, or new processes in order to sustain a positive growth rate of output per capita in the long run. The neoclassical growth theory also assumes that the rate of technological progress is determined by a scientific process that is separate from economic forces. Meanwhile, the endogenous growth theory explains that long-run economic growth is determined by forces that are internal to the economic system. Innovation and investment in human capital are believed to have a positive impact on improvements in productivity and economic growth. Human capital is modelled as a production factor that increases aggregate production possibilities and the marginal product of physical capital, thereby increasing the long-run growth rate. Therefore, endogenous growth theorists emphasise the need for government and private sector institutions, as well as markets which nurture innovation, to provide incentives for individuals to be inventive.

In Malaysia, human capital investment is primarily made through education and training. Education is the responsibility of Malaysian government, which has repeatedly demonstrated its firm commitment

to providing quality education to all. The Malaysian education system encompasses education from pre-school level up to university level. Pre-tertiary education (pre-school to secondary education) is under the jurisdiction of the Ministry of Education (MOE); while tertiary or higher education is the responsibility of the Ministry of Higher Education (MOHE). The Malaysian education system provides free education to students for a period of 11 years, which consists of primary education (a period of 6 years) and secondary education (5 years which encompasses 3 years of lower secondary and 2 years of upper secondary). The enrolment age for the first year of primary education is seven. Primary schooling is mandatory for all children between the ages of 7 and 12. Students sit for common public examinations at the end of primary, lower secondary (PMR) and upper secondary levels (SPM) of education. Upon completion of secondary education, students can opt to pursue 1 to 2 years of post-secondary education, i.e. either STPM or Matriculation. These are university entrance preparatory courses. In total, the first 11 years of primary and secondary level education; and the subsequent 1 to 2 years of post-secondary level education serve as the basic entry requirement to qualify for Year One of a bachelor's degree programme in a higher education institution. At the tertiary education level, institutions of higher learning offer courses that award certificates, diplomas, first degrees and post-degree qualifications (in academic and professional fields). The duration of study for a basic bachelor degree programme is 3 years. The courses for this level are offered by both the public and private education sectors, attracting many international students. Every year, nearly 20 per cent of the expenditures of the Malaysian government are channelled to education. The Malaysian government strives to provide excellent education opportunities and provides training in order to enhance the quality of human capital within the country. Thus, human capital is expected to be a main determinant in Malaysian economic growth.

Malaysia, a developing country in Asia, is performing relatively well in comparison to other developing countries. Between 2000 and 2012, the average GDP growth rate of Malaysia was an average of 1.18 percent, reaching an all-time high of 5.9 percent in September 2009 and a record low of –7.6 percent in March 2009 due to the world economic crisis. In the first quarter of 2012, the Malaysian economy grew by 4.7 per cent as compared to 5.2 per cent in the previous quarter. On the supply side, all sectors of the economy recorded positive growth with the services and manufacturing sectors remaining the primary catalysts. On the demand side, the resilient private final consumption and gross fixed capital formation led to economic growth. Malaysia, a middle-income country, has transformed itself since the 1970s from a producer of raw materials into an emerging multi-sector economy. Since 1993, the service sector contributes approximately 50 percent to the Malaysian GDP, which suggests that the Malaysian economy is currently largely dependent on knowledge based activities rather than being dependent upon raw materials production. Such evidence provides further support to the assertion that human capital plays an important role in Malaysian economic growth.

According to the Human Development Report released by the United Nations Development Programme (UNDP), the Malaysian Human Development Index (HDI) value for 2011 was 0.761 in the high human development category. As a result, Malaysia was ranked 61 out of 187 countries and territories. Additionally, the Malaysian HDI value increased from 0.559 to 0.761 between 1980 and 2011. HDI is a summary measure for assessing long-term progress in three basic dimensions of human development: a long and healthy life; access to knowledge; and a decent standard of living. Table 1 shows the progress made in Malaysia in relation to each of the HDI indicators during the period between 1980 and 2010. Compared to other countries, the Malaysian HDI in 2011 was above the average of 0.741 for countries in the high development group; and above the average of 0.671 for countries in East Asia and the Pacific. As shown in Table 2, according to the 2011 HDI values, Thailand and Vietnam are the two countries from East Asia and the

TABLE 1. Malaysia's HDI Trends (1980-2011)

Year	Life expectancy at birth	Expected years of schooling	Mean years of schooling	GNI per capita (2005 PPP$)	HDI value
1980	64.4	9.1	4.4	4722	0.559
1985	68.8	10.0	5.6	5125	0.600
1990	70.1	9.8	6.5	6375	0.631
1995	71.1	10.5	7.6	8765	0.674
2000	72.1	11.8	8.2	9461	0.705
2005	72.9	12.7	8.9	11220	0.738
2010	74.0	12.6	9.5	13192	0.758
2011	74.2	12.6	9.5	13685	0.761

Source: UNDP Human Development Report 2011

TABLE 2. Malaysia's HDI Indicators for 2011 relative to selected countries and groups

	HDI value	HDI rank	Life expectancy	Expected years of schooling	Mean years of schooling	GNI per capita (2005 PPP$)
Malaysia	0.761	61	74.2	12.6	9.5	13685
Thailand	0.682	103	74.1	12.6	6.6	7694
Vietnam	0.593	128	75.2	10.4	5.5	2805
East Asia and the Pacific	0.671	-	72.4	11.7	7.2	6466
High HDI	0.741	-	73.1	13.6	8.5	11579

Source: UNDP Human Development Report 2011

Pacific, countries which are similar to Malaysia in terms of ranking and population size) with a HDI ranking of 103 and 128, respectively.

The statistics show that Malaysia is on the right track in developing human capital within the country. Therefore, the main objectives of the present study are to examine the long run relationship between human capital and economic growth in Malaysia; and provide suggestions and recommendation concerning potential policy implications. The remainder of the paper is structured as follows: Part 2 reviews extant research concerning the relationship between human capital and economic growth; Part 3 outlines the theoretical framework and methodology employed in the present study; Part 4 reports the empirical results; and Part 5 concludes by presenting the findings and making suggestions and recommendations concerning potential policy implications.

LITERATURE REVIEW

Extant researcher provides a considerable amount of empirical evidence that supports the endogenous growth theory. Barro (1991) is among the earliest contributors, concluding that the growth rate of real per capita GDP is positively related to initial human capital. Levine and Renelt (1992) find that secondary school enrolment rates are positively correlated with economic growth. Furthermore, Barro and Sala-i-Martin (1995) find that the average years of schooling of both males and females in secondary and higher education are significantly correlated with GDP per capita growth rates. Table 3 presents a summary of more recent studies that examine the impact of human capital on economic growth in some countries.

The extant studies summarised in Table 3 lend further support to the endogenous growth model. The model is applicable in various countries, as demonstrated in the summary above. In the case of Malaysia, most previous studies consider the impact of foreign direct investment on economic growth (e.g., Anwar and Sun 2011; Lean and Tan 2011; Ahmed 2012; Fazleen et al. 2012). Such studies share a common result: foreign direct investment has a positive impact on economic growth in Malaysia.

A few extant studies utilise human capital investment, mostly explained by education, as one of the determinants of Malaysian economic growth. Tan et al. (2006), for example, find that education, technical progress, labour, capital and the economic growth of Malaysia have a long-run equilibrium relationship, which allows them to increase together over time. Human capital, with the stock of knowledge accumulated through education, contributes to Malaysia's economic growth and is the second most important input factor, after physical capital, in the promotion of economic growth. Rahmah (2009) suggests that Malaysia must produce a workforce with a larger number of employees with high educational attainment to achieve higher economic growth. For education, only enrolment in diploma programmes has a significant relationship with national economic growth in Malaysia (Ishak and Zakariya 2009). Furthermore, Ramesh and Jani (2009) conclude that education has assisted economic growth in Malaysia by strengthening and improving the quality of human capital available.

THEORETICAL FRAMEWORK AND METHODOLOGY

In order to investigate the long run effect of human capital on Malaysian economic growth, a linear function model is formed based upon a basic production model: the Cobb-Douglas production function. The Cobb-Douglas production function with two inputs is written as follows:

$$Y_t = AK_t^{\alpha}L_t^{\beta} \quad (1)$$

Where Y is output, K is physical capital stock, L is quantity of labour, t is time, and A, α and β are all positive constants. However, the production function does not take into account the quality of labour and assumes that labour is homogenous. According to the endogenous growth model, human capital is modelled as a production factor that raises aggregate production possibilities as well as the marginal product of physical capital. As such, the quality of labour is the key determinant in production growth. Thus, the following mathematical equations are utilised to capture the quality of labour:

$$Y_{1t} = ak_t^{a}LP_t^{B} \quad (2)$$

TABLE 3. Previous studies on human capital and economic growth nexus

Researchers	Year	Empirical Findings
Keller	2006	Expenditures toward primary education and expenditures per student at this education stage contribute significantly to economic growth in *Asia* after 1960, while expenditures channelled towards higher education appear to be more inefficiently utilised. Enrolment rate displays significant indirect effects.
Middendorf	2006	The positive impact of the human capital on economic growth suggests that an increase in average schooling years by one year yields an increase in the GDP growth rate of about 0.5 percentage points.
Park	2006	Education policies that create more dispersion in human capital promote growth.
Sarkar	2006	Human capital has an adverse effect on income inequality during economic growth.
Nomura	2006	The contribution of education to economic growth is larger and statistically more significant in countries with relatively low levels of initial education and relatively high levels of improvement in educational equality.
Chi	2006	Workers with college education play a more significant role than those with primary and secondary education in China.
Hassan and Butt	2008	An appropriate policy to educate and develop the human resources of Pakistan, coupled with export oriented policies, can help in accelerating the process of economic development and growth.
Altar et al.	2008	The average GDP growth rate in Romania is approximately 6% due to human capital accumulation, which improves the quality of labour.
Ljungberg and Nilsson	2009	Human capital has been a causal factor in Swedish economic growth since industrialization.
Joao and Miguel	2009	Increasing education in Portugal at all levels except tertiary has a positive and significant effect on growth. Investment in education does not significantly crowd out physical investment and average age years of schooling semi-elasticities have comparable magnitude across primary and secondary levels.
Mimoun and Raises	2009	GDP per capita growth is more likely to be affected by the accumulation of education at the higher education levels in both countries that are members to the Organisation for Economic Co-operation and Development (OECD) and developing countries. In terms of the public funds allocation, the result does not prevent public education expenditures from being reallocated from higher education towards basic schooling levels in DCs. Indeed, such reallocation would improve the quality of education at the basic stages of education, which should, in turn, be accompanied by a faster accumulation of human capital at higher education levels and faster economic growth.
Pradhan	2009	Uni-directional causality exists between education and economic growth in the Indian economy and the direction of causality is from economic to education, but there is an absence of reverse causality. A short run dynamic exists between education and economic growth in India, which has been corrected to bring the Indian economy into a steady equilibrium position in the long run.
Pemani	2009	Education is important for economic growth in East Asia, but it is not a sufficient condition. The complementarity between education and other factors in enhancing productivity and efficiency is commonly seen as the driving force of economic growth. Education is consistently presented as a significant income determinant and, consequently, a growth factor. East Asian economic systems are also formed and extended closely to the stages of their economic development: the higher the level of economic development, the greater the demand for better and higher education systems.
Yueliang	2009	Human capital plays a very significant role in eastern, middle and western China. The study shows that labour quality is not high enough and improving employees' cultural level and work skills are imperative.
Lee	2010	The effect of each additional year of initial schooling on growth rate is the highest for countries in East Asia and the Pacific; Middle East and North Africa; and South Asia in comparison to others.

Lee and Hong	2010	GDP growth in Asia can be increased by policy reforms in education; property rights; and research and development. Additionally, such reforms can partly offset the slowdown in growth caused by the convergence phenomenon.
Prochniak	2010	The most important economic growth determinants in Central and Eastern European countries are investment rate (including FDI); human capital measured by the education level of labour force; financial sector development; good fiscal stance (low budget deficit and low public debt); economic structure (high services share in GDP); low interest rate and low inflation; population structure (high share of working-age population); development of information technology and communications; high private sector share in GDP; and favourable institutional environment.
Ilon	2011	Education equality is a strong predictor of South Korean economic growth.
Wang and Wong	2011	If the quality of education is improved, a lower quantity of schooling is required for inward FDI to have a positive impact on economic growth in the host country.
Ajakaiye and Kimenyi	2011	For Africa to achieve and sustain a high rate of growth, major transformations are required in the structure of production as well as a reduction in the technological gap. Such initiatives require a large labour force pool with tertiary education.
Curs et al.	2011	The findings of a study of states in the US suggest that the channelling of large shares of public spending to students has a positive relationship with economic growth.
Kreishan and Al Hawarin	2011	A long run relationship exists between education and economic growth. The evidence demonstrates that a well-educated labour force appears to influence economic growth in Jordan.
Afzal et al.	2011	Feedback causality exists between education and all levels of education with economic growth in Pakistan. Among all levels of education, general higher education results in higher and significant economic growth.
Renuka and Alicia	2011	The returns to investment in education are positive in Sri Lanka, but significantly lower than those found in other developing economies.
Simoes	2011	Significant long term relationships are found between higher education and growth; and between lower schooling level and growth. Public spending on education in OECD countries should be spread across the different levels of education in a balanced way.
Safdari et al.	2011	The growth of the physical capital to labour ratio and the growth of the human capital to labour ratio have positive effects on economic growth in Iran.
Sequeira and Ferreira	2011	Subsidies for human capital have important implications on economic growth and allocation redistribution.
Bahmani et al.	2012	Entrepreneurship activities and human capital; and improvements in education promote economic growth.
Soukiazis and Antunes	2012	Human capital and external trade have significant effects on economic growth in European Union countries.
Neelankavil et al.	2012	In the long run, the following economic factors internal to a country have the most influence on real GDP over time: human capital (measured by literacy rates); export trade; and monetary and fiscal policies.
Jong and Kiseok	2012	GDP growth in Asia can be substantially increased by policy reforms in relation to education; property rights; and research and development.
Sahoo and Dash	2012	Gross domestic capital formation, labour force, export and expenditure on human capital exhibit positive contributions to output.
Roseline and Esman	2012	Institutional variables, human capital formation and foreign aid are key factors in explaining growth in Sub-Saharan Africa.
Qadri F.S. and Waheed, A	2013	Returns to human capital vary with countries having different income levels.
Tham Sook Fan et al.	2013	Returns to education for the first generation (parents) are higher than that for the second generation (children).

$$Y_{2t} = ak_t^a LS_t^B \quad (3)$$

$$Y_{3t} = ak_t^a LT_t^B \quad (4)$$

Where, Y_{1t}, Y_{2t} and Y_{3t} represent the production of labour with primary, secondary and tertiary education, respectively.

Taking the natural logarithm to both sides of equations (2) – (4):

$$\ln y_{1t} = \ln a_1 + \alpha_1 \ln k_{1t} + \beta_1 \ln LP_t \quad (5)$$

$$\ln y_{2t} = \ln a_2 + \alpha_2 \ln k_{2t} + \beta_2 \ln LS_t \quad (6)$$

$$\ln y_{3t} = \ln a_3 + \alpha_3 \ln k_{3t} + \beta_3 \ln LT_t \quad (7)$$

Then the total of all production by labour with primary, secondary and tertiary education can be expressed in the following form:

$$\ln Y_t = \ln A + \alpha_4 \ln K_t + \beta_1 \ln LP_t + \beta_2 \ln LS_t + \beta_3 \ln LT_t + \varepsilon_1 \quad (8)$$

The resulting estimation model applied in the present study is as follows:

$$\ln \text{GDP}_t = \delta_0 + \delta_1 \ln \text{CAP}_t + \delta_2 \ln LP_t + \delta_3 \ln LS_t + \delta_4 \ln LT_t + \varepsilon_1 \quad (9)$$

Where, ln is natural logarithm; and δ_0 is the intercept term. GDP represents GDP at purchaser's prices (sum of gross value added by all resident producers in the economy plus any product tax and minus any subsidy not included in the value of the products), which is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Additionally, Dollar figures for GDP, in the form of constant 2000 US dollars, are converted from domestic currencies using the 2000 official exchange rates. CAP represents gross capital formation, which consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements such as fences, ditches, drains, and so on; plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. CAP data are presented in constant 2000 U.S. dollars. LP, LS and LT represent the population of the labour force with primary, secondary and tertiary education, respectively.

Time series data from 1981 to 2010 for all the variables are obtained from the World Bank database and Department of Statistics, Malaysia. The present study employs the Autoregressive Distributed Lag (ARDL) approach of Pesaran et al. (2001) to determine the presence of relationships between the variables examined and the relationship pattern of these variables. The ARDL approach is chosen since it can accommodate greater number of variables and allows for inferences on long run estimates which are not possible under other cointegration procedures. Additionally, the ARDL approach can be applied irrespective of whether the regressors are purely I(0), I(1) or mutually cointegrated. Furthermore, the ARDL approach is more robust for a study with a small sample (Pesaran et al., 2001).

The ARDL approach involves four principal steps, as well as including tests that must be performed. The first step is to ensure that all time series data are purely stationary. For this purpose, unit root tests are conducted that examine the time series characteristics of the selected variables to overcome the problems of spurious correlation often caused by non-stationary time series data. The present study applies two unit root tests to ensure none of the variables is of I(2) or higher order: the Augmented Dickey-Fuller test (ADF) and the Phillips-Perron test (PP). Once the data are confirmed as stationary or found to be either I(0) or I(1), the second step is to test for cointegration among the variables in accordance with the ARDL approach. The third step is to test for the existence of long run relationships among the variables; and the final step is to test for short run relationships among the variables.

The present study utilises the ARDL approach together with the computer software Microfit 4.0. The error-correction version of ARDL model (9), following Pesaran and Shin (1997), is as follows:

$$\begin{aligned}\Delta \text{GDP}_t = {} & \alpha_1 + \sum_{i=1}^{n} b_i \Delta \text{GDP}_{t-i} + \sum_{i=1}^{n} c_i \Delta \text{CAP}_{t-i} \\ & + \sum_{i=1}^{n} d_i \Delta \text{LP}_{t-i} + \sum_{i=1}^{n} e_i \Delta \text{LS}_{t-i} + \sum_{i=1}^{n} f_i \Delta \text{LT}_{t-i} \\ & + \gamma_1 \text{GDP}_{t-1} + \gamma_2 \text{CAP}_{t-1} + \gamma_3 \text{LP}_{t-1} + \gamma_4 \text{LS}_{t-1} \\ & + \gamma_5 \text{LT}_{t-1} + \varepsilon_t \end{aligned} \quad (10)$$

Δ is the symbol of differentiation, the coefficients b, c, d, e, f and g of part one of the model (10) represent short run dynamic, γs determines long run relationship and ε_t is the white noise errors. The first step in the ARDL model is to examine the long run relationships among the variables by employing the F-test. The null hypothesis for no cointegration for the variable GDP_t against alternative hypothesis is given as:

H_0: $\gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = \gamma_5 = 0$ (no cointegration between the variables)

H_0: $\gamma_1 \neq \gamma_2 \neq \gamma_3 \neq \gamma_4 \neq \gamma_5 \neq 0$ (cointegration exists between the variables)

Since the F-test does not have a standard distribution, appropriate critical values are reported in Pesaran et al. (2001) for different numbers of regressors (4 in the present case) and whether the ARDL model contains intercept and/or trend terms. Two critical values are given for the upper critical bound and lower critical bound. If the calculated F-statistic is higher than the upper bound critical value, the null hypothesis of no cointegration is

TABLE 4. Results of the ADF and PP tests for unit root test at level and first difference

Variables	ADF				PP			
	Level I(0)		First Difference I(1)		Level I(0)		First Difference I(1)	
	Intercept	Intercept and trend	Intercept	Intercept and trend	Intercept	Intercept and trend	Intercept	Intercept and trend
LNGDP	–3.68 (0)	–1.14 (0)	–4.22*** (0)	–4.21** (0)	–0.91	–1.36	–4.23***	–4.23**
LNCAP	–1.11 (0)	–1.75 (0)	–4.52*** (0)	–4.39*** (0)	–1.14	–1.87	–4.51***	–4.37***
LNLP	0.95 (0)	0.92 (6)	–6.07*** (0)	–6.96*** (0)	0.26	–0.79	–6.02***	–7.16***
LNLS	–5.53*** (2)	–1.44 (2)	–4.52*** (0)	–6.95*** (0)	–21.2***	–2.40	–4.51***	–17.5***
LNLT	–1.20 (1)	–5.40*** (0)	–9.16*** (0)	–8.98*** (0)	–1.91	–5.40	–29.0***	–29.2***

Notes: The numbers in parentheses represent the length of lag utilised in the ADF test (as determined from the set of SIC to a maximum of 7) for the rejection of serial correlation in the residuals. ** and *** indicate significance at the 5% and 1% levels, respectively.

rejected. Rejection would imply the existence of a long run relationship between the variables. If the calculated F-statistic is less than the lower bound critical value, then the null hypothesis of no cointegration cannot be rejected. If the calculated F-statistic falls in between the lower and upper bounds' critical values, the test is inconclusive.

Once cointegration is established, the conditional ARDL long-run model for can be estimated as:

$$\mathrm{GDP}_t = \alpha_2 + \sum_{i=1}^{n} b_i \,\mathrm{GDP}_{t-i} + \sum_{i=1}^{n} c_i \,\mathrm{CAP}_{t-i} + \sum_{i=1}^{n} d_i \,\mathrm{LP}_{t-i} + \sum_{i=1}^{n} e_i \,\mathrm{LS}_{t-i} + \sum_{i=1}^{n} f_i \,\mathrm{LT} + \varepsilon_t \quad (11)$$

This involves selecting the order of the ARDL models of the 5 variables using the Schwarz-Bayesian Criteria (SBC). In the final step, short run dynamic parameters (ECM) are obtained by estimating an error correction model associated with the long run estimates. This is specified as follows:

$$\Delta\mathrm{GDP}_t = \alpha_3 + \sum_{i=1}^{n} \partial_{1i} \,\Delta\mathrm{GDP}_{t-i} + \sum_{i=1}^{n} \partial_{2i} \,\Delta\mathrm{CAP}_{t-i} + \sum_{i=1}^{n} \partial_{3i} \,\Delta\mathrm{LP}_{t-i} + \sum_{i=1}^{n} \partial_{4i} \,\Delta\mathrm{LS}_{t-i} + \sum_{i=1}^{n} \partial_{5i} \,\Delta\mathrm{LT}_{t-i} + \partial ecm_{t-1} + \varepsilon_t \quad (12)$$

Where, ∂_{1i}, ∂_{2i}, ∂_{3i}, ∂_{4i} and ∂_{5i} are the short run dynamic coefficients of the model's convergence to equilibrium and is the speed of adjustment.

RESULTS AND DISCUSSION

The presentation of the results and discussion is conducted in three principal parts. First, the results of the unit root tests are considered. Next, the cointegration test results are examined and interpreted. Finally, the results of the diagnostic tests performed are reviewed.

UNIT ROOT RESULTS

A summary of the unit root test results regarding the order of integration based on the ADF and the PP are provided in Table 4. The results indicate that GDP_t, CAP_t, LP_t, LS_t and LT_t are stationary at the first difference, I(1). Having confirmed that all the variables are stationary at I(0) or I(1), the long run relationship between RGDP and the independent variables is examined using the ARDL model.

COINTEGRATION

Table 5 presents the results of the cointegration test among the variables using bound tests. Results indicate that the calculated F-statistics for model (Equation 10) is higher than the upper bound critical value at the 5% level. Hence, the null hypothesis of no cointegration is rejected, implying the existence of long run cointegration relationships amongst the variables.

TABLE 5. F-statistic of cointegration relationship

F-Statistic	Lag	Significant level	Bound Critical Values (unrestricted intercept and no trend)	
			I(0)	I(1)
4.739	3	1%	3.74	5.06
		5%	2.86	4.01
		10%	2.45	3.52

Note: Number of independent variables (k) = 4.

Once the existence of long run cointegration relationships are confirmed, the conditional ARDL long-run model for can be estimated. Tables 6 and 7 display the results of estimated long run coefficients using the ARDL model and the results of the error correction model (ECM), respectively.

The results presented in Table 6 show that, in the long run, a highly educated labour (secondary and tertiary) has a significant positive relationship with GDP, while labour with primary education has an insignificant impact despite the positive sign of the coefficient. This suggests that labour with high education contribute to the economic growth of Malaysia, which is consistent with the findings of Afzal et al. (2008) and Chi (2006). In the short run, all labour variables show insignificant positive relationships with economic growth. This situation, however, is expected since the endogenous theory posits that human capital is a production factor that increases aggregate production possibilities, as well as the marginal product of physical capital, alongside the long-run growth rate. Capital formation demonstrates a highly significant positive relationship with GDP, which suggests that physical capital is still an important determinant of economic growth in both the short run and the long run. Highly educated labour is the crucial human capital component in driving the economic growth of a country. The knowledge and soft skills acquired by members of the labour force during their studies at higher education institutions equips them with the necessary means to become high quality workers or entrepreneurs. As a result, such labour attain a higher quality of living and income, which consequently increases real GDP per capita. Meanwhile, labour with lower education possess a more limited set of knowledge and skill. Furthermore, since the service sector contributes about 50 percent to GDP in Malaysia, this suggests that the Malaysian economy is largely dependent on knowledge based activities. Therefore, demand exists in the country for highly educated labour to boost economic growth.

TABLE 6. Estimated long run coefficients

ARDL (1, 0, 0, 1, 1) selected based on SBC. Dependent variable is LNGDP				
Variable	Coefficient	Std. error	t-Statistic	Prob.
C	8.5478*	4.7950	1.7826	0.089
LNCAP	0.3946***	0.1105	3.5730	0.002
LNLP	0.1898	0.5539	0.3426	0.735
LNLS	0.5462*	0.2684	2.0352	0.055
LNLT	0.1998*	0.0968	2.0645	0.052

* and *** indicate significance at the 10% and 1% levels, respectively.

TABLE 7. Results of ECM

ARDL(1, 0, 0, 1, 1) selected based on SBC. Dependent variable is LNGDP				
Variable	Coefficient	Std. error	t–Statistic	Prob.
DC	1.372	1.1326	1.2113	0.238
DLNCAP	0.1687***	0.0237	7.1327	0.000
DLNLP	0.0305	0.0825	0.3693	0.715
DLNLS	0.0877	0.0649	1.3511	0.190
DLNLT	0.0081	0.0081	0.9988	0.328
ECM(–1)	–0.1605***	0.0539	–2.9771	0.007
R^2	0.892			
R^{-2}	0.856			
F	36.645***			

*** indicates significance at the 1% level.

The equilibrium correction coefficient of the ECM is estimated at –0.16, significant at 1% and has the correct sign. This indicates a slow speed of adjustment to equilibrium. The results indicate that, on average, the disequilibrium of the previous period is corrected by about 16% in the following period. Furthermore, the adjusted value of the ARDL model indicates that 89% of the dependent variable is explained by the independent variables.

DIAGNOSTIC TESTS

Table 8 displays the diagnostic tests of the ARDL model. Results indicate that the model does not have problems relating to serial correlation, functional form, normality of residuals or heteroscedasticity. Furthermore, Figures A and B of Cumulative Sum of Recursive Residual (CUSUM) and Cumulative Sum of Squares of Recursive Residuals (CUSUMQ) tests indicate no evidence of misspecification and instability during the period estimated by the model.

TABLE 8. Diagnostic results

Test	LM Version	F Version
Serial Correlation	0.0105 (0.918)	0.0073 (0.933)
Functional Form	0.2293 (0.632)	0.1594 (0.694)
Normality	0.5766 (0.750)	Not applicable
Heteroscedasticity	0.5626 (0.453)	0.5341 (0.471)

P values in parentheses

CONCLUSION

The present paper examines the long run and short run impacts of human capital on economic growth in Malaysia during the period between 1981 and 2010. The empirical analysis is performed by using the bounds testing Autoregressive Distributed Lags (ARDL) approach

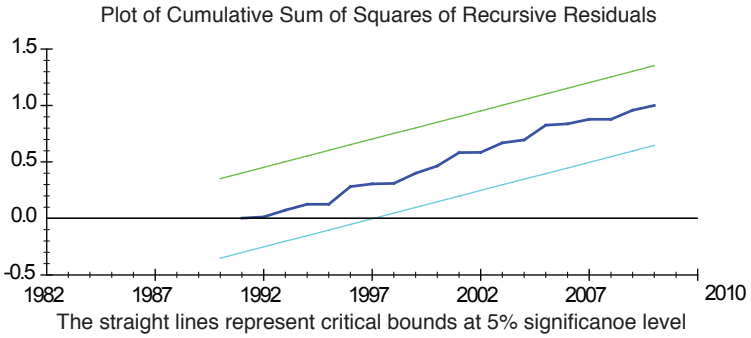

FIGURE A. Plot of CUSUM

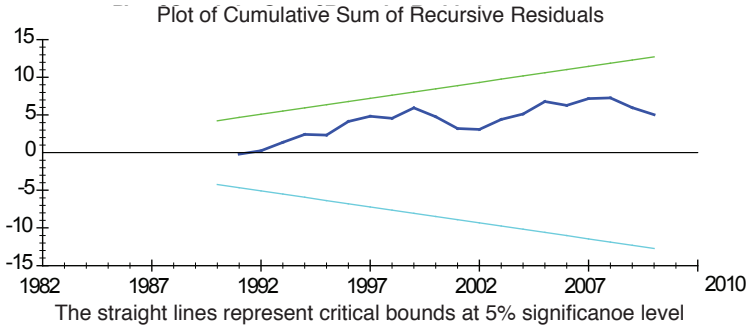

FIGURE B. Plot of CUSUMSQ

and estimating the long run impacts of the varying levels of education attained by labour in the labour force. The bounds test suggests that the variables included in the model designed in the present study are bound together in the long run. The results also indicate that labour with a high level of education has a positive impact on GDP, while labour with a low level of education have an insignificant positive effect on GDP. Therefore, investment in human capital through higher education is an important key to drive the progress of Malaysia towards becoming a high-income country. Policymakers should consider policy reforms relating to education and training by observing the successful education models adopted by other developed countries, such as Singapore, South Korea, Japan and the United Kingdom. Furthermore, members of the labour force with a low level of education should take the initiative to improve themselves through further studies rather than being satisfied with their current condition, which is in line with the national policy to encourage lifelong learning among Malaysian citizens (Malaysia 2010). As proposed by the endogenous growth theory, government and private sector institutions, as well as markets which nurture innovation, play a crucial role in providing incentives for individuals to be inventive.

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Lai Wei Sieng
Ishak Yussof*
School of Economics
Faculty of Economic and Management
Universiti Kebangsaan Malaysia
UKM Bangi
43600 Selangor
Malaysia

*iby@ukm.edu.my