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THE IMPACT OF HUMAN CAPITAL AND INNOVATION CAPACITY ON ECONOMIC GROWTH IN MALAYSIA

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1. INTRODUCTION

Human capital, commonly understood as a set of knowledge, skills, and experience of the individuals, is known to be a catalyst of the innovation process employed in the activities that boost economic growth and development. Due to its importance, more effort to develop human capital has been emphasised by most countries. The theory of human capital has considered education as an economic production input whereas human capital development (expenditure on education or training as a proxy) refers to the acquisition and increase in the number of people who have the skills, knowledge, and experience necessary for a country's economic growth (Adelakun, 2011).

Human capital development plays an important role in the Malaysian economy particularly in achieving the status of a high-income country. However, Malaysia appears to be stuck in the middle-income trap for almost 29 years. Among the reason is Malaysia has a slower rate of economic growth, higher income disparity, and a lower proportion of high-skilled employment in which the composition of the labour market is still dominated by the semi-skilled workforce (Economic Planning Unit, 2018). The availability of a skilled workforce is required to support the transition of all economic sectors to knowledge-intensive activities, the creation of new technology through innovation activities, the acceleration of labour productivity gains, and the attraction of investment into Malaysia.

The government has developed strategies to achieve high skilled workforce through education such as in Malaysia Education Blueprint 2013–2025 (Preschool to Post-Secondary Education) and the Malaysia Education Blueprint 2015-2025 (Higher Education). Besides, through Eleventh Malaysia Plan (2016-2020), there is continuous agenda of producing human capital that is equipped with the right knowledge, skills, and attitudes to thrive in a globalised economy.

As human capital plays an important role in economic growth, many studies have been conducted to examine the relationship between economic growth as an endogenous variable and various exogenous variables including human capital and innovation capabilities such as in Law et al. (2020), Mohamad Rusli, and Hamid (2014), Muhamad et al. (2018), Qadri and Waheed (2013), Rizal (2019), and Ulku (2004). Hence, this study aims to examine the relationship between human capital and innovation on economic growth using the secondary data from World Development Indicator (WDI) collected from the World Bank for the period from 1982 to 2016. The model includes variables representing human capital including government expenditure on education and training, secondary and tertiary enrolment while trademarks and patent application representing innovation capacity as a regressor to produce a better result.

2. METHODOLOGY

The data analyses using the Autoregressive Distributed Lag (ARDL) through Bounds testing approach by Pesaran, Shin, & Smith (1996), Pesaran and Shin (1999); Pesaran (1997), and Error Correction Model (ECM) introduced by (Boswijk 1995). The error-correction version of the ARDL model, following Pesaran and Shin (1997), is as follows:

$$\Delta LNGDPC_t = \alpha_1 + \sum_{i=1}^{n} \beta_1 \Delta LNGDPC_{t-i} + \sum_{i=1}^{n} \beta_2 \Delta LNEDU_{t-i} + \sum_{i=1}^{n} \beta_3 \Delta LNSECONDARY_{t-i} \sum_{i=1}^{n} \beta_4 \Delta LNTERTIARY_{t-i} + \sum_{i=1}^{n} \beta_5 \Delta LNTM_{t-i} + \sum_{i=1}^{n} \beta_6 \Delta LNPATENT_{t-i} + \lambda ECM_t + \mu_t \quad [1]$$

where ln is a natural logarithm and α_1 is intercept or constant term. GDPC is measure in gross domestic product per capita, EDU is government expenditure in education and training, SECONDARY is secondary school enrollment, TERTIARY is tertiary enrollment, TM is total trademark applications and PATENT is a patent application on residents.

while $$ECM_{t-1} = \lambda_1 LNGDPC_{t-1} + \lambda_2 LNEDU_{t-1} + \lambda_3 LNSECONDARY_{t-1} + \lambda_4 LNTERTIARY_{t-1} + \lambda_5 LNTM_{t-1} + \lambda_6 LNPATENT_{t-1} + \varepsilon_t \quad [2]$$

where λ represents the speed of adjustment coefficient and ECM_{t-1} represents the error correction term. The value of λ should be in the negative sign and range from 0 to 1.

Before analyses were done, the times series data need to test the condition of stationary using unit root test for all variables. The unit root test consists two-step namely variables in levels I(0) and I(1). The test of unit root follows Augmented Dickey-Fuller (ADF) and Philips-Perron (PP).

3. RESULT AND DISCUSSION

Results will be discussed according to the analysis that has been performed.

3.1 Unit Root Test

A summary of the unit root test results regarding the order of integration based on the Augmented Dickey-Fuller test (ADF) and Philips-Perron (PP) are provided in Table 1 and Table 2. The results indicate that LNGDPC, LNEDU, LNSECONDARY, LNTERTIARY, LNTM, and LNPATENT are stationary at the first difference, I(1). Meanwhile, variable LIFE is stationary at I(0). Having confirmed that all the variables are stationary at I(0) or I(1), the long-run relationship between LNGDPC and the independent variables is examined using the ARDL model.

Table 1: Result of the ADF test for Unit Root Test at Level and First Difference

Variables	Level I(0)		First Difference I(1)	
	Intercept	Trend and Intercept	Intercept	Trend and Intercept
LNGDPC	-0.0064 (0)	-0.295 (0)	-0.981 (0)***	-0.982 (0)***
LNEDU	0.008 (0)	-0.323 (0)	-0.892 (0)***	-0.909 (0)***
LNSECONDARY	-1.950 (0)	-1.875 (0)	-5.776 (0)***	-5.815 (0)***
LNTERTIARY	-1.615 (0)	-0.131 (0)	-5.807 (0)***	-6.427 (0)***
LNTM	-1.997 (0)	-1.271 (0)	-6.055 (0)***	-6.609 (0)***
LNPATENT	-1.280 (0)	-1.610 (0)	-6.198 (0)***	-6.745 (0)***

Table 2: Result of the Phillips-Perron test for Unit Root Test at Level and First Difference

Variables	Level I(0)		First Difference I(1)	
	Intercept	Trend and Intercept	Intercept	Trend and Intercept
LNGDPC	-0.416 (2)	-2.365 (1)	-5.474 (1)***	-5.386 (1)***
LNEDU	0.735 (0)	-3.466 (4)**	-5.236 (4)***	-5.079 (4)***
LNSECONDARY	-1.987 (3)	-2.071 (2)	-6.065 (8)***	-6.355 (11)***
LNTERTIARY	-1.621 (2)	0.142 (1)	-5.847 (2)***	-6.427 (0)***
LNTM	-2.011 (1)	-1.271 (0)	-6.056 (1)***	-6.837 (3)***
LNPATENT	-1.280 (3)	-1.705 (1)	-6.112 (1)***	-6.928 (5)***

3.2 Cointegration

Table 3 presents the results of the cointegration test among the variables using bound tests. Results indicate that the calculated F-statistics for all models is higher than the upper bound critical value at the 10% level (Pesaran et al. 2001). The critical value is also reported in Table 5 based on the critical value suggested by Narayan (2004) for a small sample size between 30 and 80. Hence, the null hypothesis of no cointegration is rejected, implying the existence of long-run cointegration relationships amongst the variables.

Table 3: The Result of Cointegration Test using the Bound Test

Model	F-Statistics	K	Sig.	Bound Critical Value	
				Lower Bound	Upper Bound
Model 1	4.311	3	1%	5.333	7.063
			5%	3.710	5.018
			10%	3.008	4.150
Model 2	18.537	2	1%	6.183	7.873
			5%	4.267	5.473
			10%	3.437	4.470
Model 3	14.137	5	1%	4.537	6.370
			5%	3.125	4.608
			10%	2.578	3.858

Notes: ***significant at the level 1%, **significant at the level 5%, and *significant at the level 10%.

Once the existence of long-run cointegration relationships is confirmed, the conditional ARDL long-run model can be estimated. Tables 4 show the results of estimated long-run coefficients using the ARDL for three models. The results presented show that in the long run, government expenditure in education has a significant and positive relationship with GDP per capita. This suggests that government investment in education will increase Malaysia's economic growth. Meanwhile, secondary, and tertiary school enrolment is not significant in Model 1. But, in Model 3 while combined human capital and innovation secondary school is a significant negative relationship with economic growth. In Model 2 for innovation, trademark and patent have significant and positive relationships with economic growth.

Table 4: ARDL Estimate Long Run Coefficients

Dependent variable: LNGDPC

Variables	Model 1 (Human Capital) ARDL (1,4,4,3)	Model 2 (Innovation) ARDL (2,3,0)	Model 3 (Human Capital and Innovation) ARDL (1,3,2,1,3,3)
Constant	-24.900 (-0.656)	0.738 (0.501)	3.733 (2.696)***
LNEDU	0.954 (2.269)**	-	0.284544 (2.980)***
LNSECONDARY	6.959 (0.650)	-	-0.515299 (-1.886)**
LNTERTIARY	0.981 (0.562)	-	0.030209 (0.334)
LNTM	-	0.838 (4.475)***	0.417543 (3.493)***
LNPATENT	-	0.160 (2.208)***	0.109012 (2.901)***

Notes: ***significant at the level 1%, **significant at the level 5%, and *significant at the level 10%. The value in the parenthesis (…) is the t-statistics.

Meanwhile, in the short run, all variables show significant positive relationships with economic growth as shown in Table 5 from the results of the error correction model (ECM). This situation, however, is expected since the endogenous theory that human capital is a production factor that increases aggregate production possibilities. The equilibrium correction coefficient of the ECM for all models is estimated at -0.072, -0.304, and -0.646, significant at 1% and has the correct sign. The coefficient is negative and significant meaning that the system corrects its previous period disequilibrium at a speed of 7%, 30%, and 64% and it indicates that the high speed of adjustment of disequilibrium correction for reaching long-run equilibrium steady-state position for Model 2 and 3.

Table 5: Result of Error Correction Model

Dependent variable: LNGDPC

Variables	Model 1 (Human Capital) ARDL (1,4,4,3)	Model 2 (Innovation) ARDL (2,3,0)	Model 3 (Human Capital and Innovation) ARDL (1,3,2,1,3,3)
DLNGDPC (-1))	-	-0.155 (-1.420)	-
D(LNEDU)	0.184328 (1.179)	-	0.029 (0.355)
D(LNEDU(-1))	0.728279 (4.092)***	-	0.146 (1.862)*
D(LNEDU(-2))	-0.534432 (-3.433)***	-	-0.255 (-3.985)***
D(LNEDU(-3))	0.369095 (2.993)***	-	
D(LNS)	-0.670211 (-3.361)***	-	-0.495 (-5.609)***
D(LNS(-1))	0.179991 (1.047)	-	0.362 (5.536)***
D(LNS(-2))	-0.756523 (-4.407)***	-	-
D(LNS(-3))	-0.326943 (-2.094)**	-	-
D(LNT)	-0.383562 (-2.639)***	-	-0.318 (-4.902)***
D(LNT(-1))	0.199115 (1.718)	-	
D(LNT(-2))	-0.209895 (-1.756)*	-	
D(LNTM)	-	9.61E-05(0.002)	-0.043 (-1.998)*
D(LNTM (-1))	-	-0.248 (-5.189)***	-0.283 (-9.548)***
D(LNTM (-2))	-	-0.208 (-4.373)***	-0.249 (-8.775)***
D(LNPATENT)			0.024 (1.888)*
D(LNPATENT(-1))			-0.013 (-1.000)
D(LNPATENT(-2))			-0.045 (-3.604)***
Ecm (-1)*	-0.072628 (-5.225)***	-0.304 (-9.133)***	-0.646 (-12.026)***

Notes: ***significant at the level 1%, **significant at the level 5% and *significant at the level 10%. The value in the parenthesis (…) is the t-statistics.

3.3 Diagnostic Tests

The diagnostic test was done for the ARDL model to checking the stability of the parameter. Brown et al. (1975) proposed a cumulative sum of the recursive residuals (CUSUM) and squared test (CUSUMSQ) for testing. The result indicates that no evidence of instability during the period estimated by the model. This study follows Ramsey (1969) who proposed the Ramsey RESET test for data specification test. The result was shown in Table 6 is significant for Model 1 and 3, indicate that no misspecification on data exists.

Table 6: The Result of Diagnostics Testing for ARDL Bound test

Diagnostic test	Model 1 (Human Capital)	Model 2 (Innovation)	Model 3 (Human Capital and Innovation)
Normality (Jarque-Bera)	0.433 (0.805)	0.952 (0.621)	2.333 (0.311)
Serial Correlation LM test (1) (Breusch-Godfrey)	1.952 (0.05)	1.256 (0.197)	0.090 (0.624)
Heteroskedasticity (ARCH test)	0.387 (0.522)	4.647 (0.03)	0.026 (0.866)
Ramsey RESET	10.837 (0.005)	0.377 (0.545)	7.600 (0.017)

Notes: *p*-value for a diagnostic test in parenthesis (…)

4. CONCLUSION

In this study, the relationship between human capital and innovation capacity on economic growth in Malaysia during the period 1982-2016 was examined. The empirical analysis is performed by using the bounds testing Autoregressive Distributed Lags (ARDL) approach. The bound test suggests that the variables included in the model designed in the present study are bound together in the long run. Empirically, the baseline estimation and sensitivity analysis have shown that secondary education has a significant positive relationship with economic growth. Besides that, government expenditure on education also demonstrates a significant positive relationship with economic growth in the long run. Therefore, investment in human capital through education is an important key to drive the progress of Malaysia towards becoming a high-income country. Trademark application and patent application demonstrate a significant positive relationship on economic growth which indicates that innovation plays a significant role in developing economic growth in Malaysia. Based on model 1(human capital), model 2 (innovation capacity), and model 3 (human capital & innovation capacity), human capital especially tertiary education and innovation capacity shows a significant role in economic growth in Malaysia in the long run. From the policy context, the study recommends that there is a need of proposing a comprehensive policy to develop the innovation capacity and high education to advance the capability of Malaysia as an innovator country especially in undergoing the Industrial Revolution 4.0.

5. REFERENCES

Adelakun, O. J. (2011). The human capital development and economic growth in Nigeria. *European Journal of Business and Management, 3*(9).

Boswijk, H. P. (1995). Efficient inference on cointegration parameters in structural error correction models. *Journal of Econometrics*.

Economic Planning Unit. (2018). *Mid-term Review of 11th Malaysian Plan (2016-2020).* Malaysia: Economic Planning Unit, Prime Minister's Department.

Law, S.H., Sarmidi, T. & Goh, L.T. (2020). Impact of innovation on economic growth: Evidence from Malaysia. *Malaysian Journal of Economic Studies.*

Mohamad Rusli, N. A., & Hamid, Z. (2014). *Human capital and economic growth: Empirical evidence from Malaysia.* In Recent Trends in Social and Behaviour Sciences - Proceedings of the 2nd International Congress on Interdisciplinary Behavior and Social Sciences 2013, ICIBSoS 2013.

Muhamad, S., Che Sulaiman, N. F., & Saputra, J. (2018). The role of human capital and innovation capacity on economic growth in ASEAN-3. *Jurnal Ekonomi Malaysia.*

Narayan, P. K. (2004). *Reformulating critical values for the bounds f- statistics approach to cointegration: An application to the tourism demand model for Fiji*. Victoria, Australia: Department of Economics, Monash University.

Pesaran, M., Shin, Y., & Smith, R. (1996). *Testing for the existence of a long-run relationship.* Cambridge Working Papers in Economics 9622, Faculty of Economics, University of Cambridge.

Pesaran, M. H., & Shin, Y. (1999). *An autoregressive distributed lag modeling approach to cointegration analysis.* In Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium.

Pesaran, M. H. (1997). The role of economic theory in modeling the long run. *Economic Journal.*

Pesaran, M. H., Shin, Y. & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*.

Qadri, F. S., & Waheed, A. (2013). Human capital and economic growth: Cross-country evidence from low-, middle- and high-income countries. *Progress in Development Studies.*

Ramsey, J. B. (1969). Tests for specification errors in classical linear least-squares regression analysis. *Journal of the Royal Statistical Society: Series B (Methodological).*

Rizal, A. (2019). Contribution of human and capital on the regional economic growth of Sumedang district of Indonesia. *International Journal Management Science and Business.*

Ulku, H. (2004). *R&D, innovation, and economic growth: An empirical analysis*. IMF Working Papers.