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Empirical Analysis between Human Capital and Economic Growth in Malaysia from 1975 to 2009: An ARDL Approach

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Abstract

The main purpose of this research is to examine the short run and long run relationships between human capital and economic growth in Malaysia. This paper applies the co-integration and error correction model (ECM) to explore the short run and long run relationships between education variables and economic growth for Malaysia during 1975 to 2009 period. This paper focuses on human capital as one of the determinants of economic growth in Malaysia. Both economics theory and prior research suggest that investment in both human and physical capital can be expected to enhance economic growth. We use data on education variables as a measure of improvements in the level of human capital. The central question is whether human capital in the form of education attainment is related to economic growth. To achieve this objective, the study employs the autoregressive distributed lag model (ARDL) to examine the long run and short run relationships between the educational variables and economic growth in Malaysia. Our result suggests that there exists a co-integrating relationship between education variables and the economic growth.

Keywords: *Education, Human Capital, Economic Growth, Cointegration, ARDL*

1. INTRODUCTION

Human capital via education contributes significantly to economic growth because it is regarded as one of the main fundamentals in building up the nation. In which, it is the key factor for increasing the continuing competitiveness of an economy. Investment in human capital has vitally different economic attributes to physical investment implying the potential to enhance economic growth over a long time period. In the case of education, there are debates over whether changes in education attainment eventually affect the long-run growth rate of the economy, or only the long-run level of output. Therefore, a full understanding of the education situation is very important where it would require looking at many dimensions. According to the World Bank (1993) in its influential East Asian Miracle report, the high performing Asian economies (HPAEs), which include countries like Japan, Hong Kong, Korea, Singapore, Taiwan, China, Indonesia, Thailand and Malaysia as a grouping, was the fastest growth region in the world from the period 1965 to 1990. For that reason, it is important to develop an understanding of some of the key elements in their ability to sustain economic growth.

Malaysia's economic history can be divided into four distinct development phases, according to major shifts in government policy. They are: (1) market-led development with active government participation from 1957 to 1970, (2) New Economic Policy (NEP) and state intervention from 1971 to 1985, (3) economic liberalization and private sector-led growth from 1986 to 1996 and (4) Asian crisis, the global tech bust, capital controls and Sept 11 from 1997 to 2001. (Chew & Wong). The central issue of this study was that increasing the educational attainment of the population can help to increase the economic growth. Argument put forward by Kim and Lau (1993) for the low TFP in Malaysia is due to relatively poor human resource endowment that prevented the effective absorption of advanced productive technologies and the full exploitation of backwardness. In other words, Malaysia invested heavily but did not have the human capital to use it efficiently.

2. BACKGROUND

Human capital is defined as the stock of ability and knowledge that reflects the accumulated value of information and all forms of education (www.economics.noaa.gov/). In Malaysia, human capital via education has always been an important agenda for the government, in which, about a quarter of the development expenditure of the government budget deservedly goes to the education sector. This can be seen where one of the main strategies of 2009 Budget focuses on developing quality human capital to inculcate the first class Malaysian people (Ninth Malaysia Plan). Malaysia education sector can be divided into three levels namely; primary, secondary and tertiary. The primary and secondary levels are under the jurisdiction of the Ministry of Education (MOE) while tertiary or higher education is the responsibility of the Ministry of Higher Education (MOHE). In this context, this study examines the short run and long run relationships between education variables and Malaysia's economic growth over the 1975 – 2009 periods. The primary focus of this study is to investigate the short run and long run relationships between education variables and economic growth. Specifically the objective of the study is to investigate empirically the possible existence of short run and long run relationships between primary, secondary, tertiary and economic growth and can the economic impact of education variables help to increase the economic growth in the long run.

Our focus in this paper is on human accumulation through the formal schooling. It appears that there are significant long-term growth effects - the more educated is the workforce, the better is it able to implement technological advances, which could increase the productivity level. Therefore, education promotes growth and development. Empirical tests of the hypothesis that education promotes growth are, however somewhat mixed. The research question is whether education causes economic growth or vice versa? The aim of this study is to examine the role of education in Malaysia economic development. This paper is organized into six sections. Section 2 discusses the background of the study. Section 3 reviews relevant literature. Section 4 presents data and research methodology. Section 5 analyses the empirical results of the study. Finally, Section 6 includes conclusion and some recommendations for further studies.

3. LITERATURE REVIEW

The original Solow growth theory was reported in 1956. Since then, we have seen the emergence of modified and endogenous growth theories (Jones, 1995a; Lucas, 1988; Romer, 1986). New growth theories emphasize the role of human capital and R&D in the process of growth. The study by Barro in 1991 and, by Mankiw, Romer, and Weil in 1992 along with many other's empirical studies show the capability to analyze growth behavior. Almost all the empirical studies use panel data or cross-country regressions. The existing literature on the role of education on economic growth usually employs standard sources of growth equations based on a dynamic Cobb-Douglas aggregate production function, which can easily be extended to include human capital as a determinant of the economy's growth rate. Lucas (1988), Becker *et al*. (1990), Romer (1990a), Mulligan and Sala-i-Martin (1993), Caballe and Santos (1993) and Upadhay (1994), bring the role of human capital in the form of education levels. Empirical studies behind these models as Romer (1990b), Barro (1991), Kyriacou (1991), Nunes (1993), Barro and Lee (1993), Benhabib and Spiegel (1994), Villanueva (1994) use educational proxies for human capital. Attempts to empirically test of the hypothesis that education plays an important role in promoting growth have given mixed results. Barro (1991)found that an additional year of average school enrollment in 1960 was associated with approximately 0.3% faster growth in per capita gross domestic product (GDP) over the period 1960-1990. However, Levine & Renelt (1992), find that in many of these regressions the education is not statistically significant. Recent studies by Benhabib & Spiegel (1994), Pritchett (1996), Bils & Klenow (1998), and Self & Grosskopf (2000) also do

not find education to be significant factor in the growth equation. Most of the work cited above has been cross-sectional in nature. The paper by Benhabib and Spiegel (1994) is among the first to note the weak sample correlation between education and growth in the cross-country data.

3.1 Relations between education and human capital

Education and human capital are nowadays considered remarkably important for economic growth. Barro (1991) and Benhabib & Spiegel (1994) state education to be positive correlated with the growth rate of per capita GDP across country. Government investment in education has a direct effect upon the accumulation of human capital especially for future economic growth (Teles & Andrade, 2004; Cullison, 1993; Agiomirgianakis et.al.,2002; Van Leeuwen & Foldvari, 2007). The study by Barro & Sala-i-Martin (1995) shows a 1.5 percent increase of the ratio of public education spending to GDP during the period of 1965-75 would have raised the average growth rate during the same period by 0.3% per year. Ramcharan (2004) suggests government should invest more in both secondary and tertiary level of education in order to increase the composition of human capital stock of unskill and skill labors in the economy. As the global economy shifts towards more knowledge-base sectors (e.g. the manufacture of ICT devices, pharmaceuticals, telecommunication, other ICT-based services and R&D), skill and human capital development become a central issue to policy maker and practitioners. Thus, investments in tertiary education tend to have larger concentration of ICT sectors and R&D (Izushi & Huggins, 2004). Education can also help to equip workers for the task of working with more advanced technologies, providing higher quality of services and for creation of new ideas (Temple, 2001).

3.2 Human capital accumulation and economic growth

Human capital accumulation has long been stressed as a pre-requisite for economic growth. As pointed out by Lucas (1988) the driving force behind economic growth is the rate of accumulation of human capital, in which the rate of economic growth is proportional to the rate of accumulation of human capital and since human capital imposes externalities upon production, the rate of economic growth will respond more than proportionally to increases in human capital accumulation rates, thus configuring increasing return to scale.According to Nelson & Phelps (1966), a larger stock of human capital makes it easier for a country to absorb the new products or ideas that have been discovered, therefore, country with more human capital tends to grow faster because it will affect the speed of technological improvement and diffusion in the economy. It is also strongly approved by Barro (1991), whereas from an empirical study using a secondary school enrollment as a proxy for human capital in 98 countries over a period of 25 years from 1960-1985, he finds out that a country with a better educated workforce is easier to catch up to the technological leader via imitation. Meanwhile, Benhabib & Spiegel (1992) highlight that human capital affects growth through 2 mechanisms; first, human capital level directly influence the rate of domestically produced technological innovation; second, the human capital affects the speed of adoption technology from abroad.The study by Vinod & Kaushik (2007) states human capital has a statistically significant impact on economic growth. The finding shows an investment in human capital in Asian country since World War II has made great leaps in their standard of living. Malaysia, Philippines, Thailand, Turkey and China are good examples of economic achieving growth based on human capital in the recent years. From the study, in most of the country, a one percent increase in literacy increases growth by 1.2 to 4.7 percent. Meanwhile according to Middendorf (2005), the positive link between the human capital stock and growth seems to be confirmed in a panel data framework of OECD country. Whereas an increase in average schooling years of one standard deviation (1.90 years in 1995), raises the growth rate by 0.9 percent.

4. RESEARCH METHODOLOGY

4.1 Data

This study uses annual data to examine the short run and long run relationships between primary, secondary, tertiary and economic growth for Malaysia. Yearly data on enrollment rates from 1975 to 2009 were collected from the Ministry of Education. The GDP per capita measured in current price (2000 as a base year) and was taken from Asian Development Bank (ADB). This study is carried out in the context of Malaysia, for the period 1975-2009. All the data are transformed into log form in order to standardize the different unit of measurement. In this paper, time series data for Malaysia will be utilized in order to assess the linkages between human capital and economic growth in Malaysia and to determine to what extent human capital has played an important role in economic growth.

4.2 Research instrument

To empirically examine the short run and long run relationships among the variables of interest, the model was estimated by using the bounds testing (or autoregressive distributed lag, ARDL) co-integration procedure, developed by Pesaran & Shin (1995) and further extended by Pesaran, Shin and Smith (2001). Basically, the ARDL method of co-integration analysis is unbiased and efficient. This is because it performs well in small samples size which is also the case in this study (35 observations). It is also applicable irrespective of whether the underlying variables are integrated of *I*(1) or *I*(0). We can also estimate the long run and short run components of the model simultaneously. Finally, the ARDL method can distinguish dependent and explanatory variables. The data analysis will be conducted by using Microfit 5 software.

4.3 Model Specification

We explore the long run and short run relationships between economic growth and education variables, by considering the following model:

$$\ln GDP_t = \beta_0 + \beta_1 \ln PRI_t + \beta_2 \ln SEC_t + \beta_3 \ln TER_t + \varepsilon_t \quad (1)$$

Where β_0 is the intercept point, β_i is the coefficient of independent variables and ε is the error term. GDP denotes GDP per capita for the Malaysia to measure economic growth. PRI denotes the number of pupils enrolled on primary school. We expect a positive influence of these variables where it is a basic knowledge which is crucial for each individual. Meanwhile, SEC & TER denote the level of human capital measured as the number of pupils enrolled on secondary and tertiary education to measure the skills possessed by the workers in the economy. We expect positive influence of these two variables where it is important factor to stimulate the economic growth in Malaysia as in this case.

The error correction model representation of the ARDL model for equation 1 can be written as follows:

$$\Delta \ln GDP_t = \beta_0 + \sum_{j=1}^{k} \beta_{11} \Delta \ln GDP_{t-j} + \sum_{j=0}^{k} \beta_{12} \Delta \ln PRI_{t-j} + \sum_{j=0}^{k} \beta_{13} \Delta \ln SEC_{t-j} + \sum_{j=0}^{k} \beta_{14} \Delta \ln TER_{t-j} + n_{11} \ln GDP_{t-1} + n_{12} \ln PRI_{t-1} + n_{13} \ln SEC_{t-1} + n_{14} \ln TER_{t-1} + \xi_t \quad (2)$$

$$\Delta \ln TER_t = \beta_0 + \sum_{j=1}^{k} \beta_{21} \Delta \ln TER_{t-j} + \sum_{j=0}^{k} \beta_{22} \Delta \ln PRI_{t-j} + \sum_{j=0}^{k} \beta_{23} \Delta \ln SEC_{t-j} + \sum_{j=0}^{k} \beta_{24} \Delta \ln GDP_{t-j}$$
$$+ n_{21} \ln TER_{t-1} + n_{22} \ln PRI_{t-1} + n_{23} \ln SEC_{t-1} + n_{24} \ln GDP_{t-1} + \xi_t \quad (3)$$

$$\Delta \ln SEC_t = \beta_0 + \sum_{j=1}^{k} \beta_{31} \Delta \ln SEC_{t-j} + \sum_{j=0}^{k} \beta_{32} \Delta \ln PRI_{t-j} + \sum_{j=0}^{k} \beta_{33} \Delta \ln GDP_{t-j} + \sum_{j=0}^{k} \beta_{34} \Delta \ln TER_{t-j}$$
$$+ n_{31} \ln SEC_{t-1} + n_{32} \ln PRI_{t-1} + n_{33} \ln GDP_{t-1} + n_{34} \ln TER_{t-1} + \xi_t \quad (4)$$

$$\Delta \ln PRI_t = \beta_0 + \sum_{j=1}^{k} \beta_{41} \Delta \ln PRI_{t-j} + \sum_{j=0}^{k} \beta_{42} \Delta \ln GDP_{t-j} + \sum_{j=0}^{k} \beta_{43} \Delta \ln SEC_{t-j} + \sum_{j=0}^{k} \beta_{44} \Delta \ln TER_{t-j}$$
$$+ n_{41} \ln PRI_{t-1} + n_{42} \ln GDP_{t-1} + n_{43} \ln SEC_{t-1} + n_{44} \ln TER_{t-1} + \xi_t \quad (5)$$

The terms with the summation signs in the above equations represents the error correction dynamics while the second part (terms with ηijs) correspond to the long run relationship; denotes a first difference operator; ln represents natural logarithmic; β_0 is an intercept and ξt is a white noise. The F-test or Wald test is used to test on the existence of long run relationship. If the computed F-test is higher than the upper bound, the null hypothesis of no co-integration is rejected. If 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, conclusive decision inference cannot be made. Once the co-integration is confirmed, the further two steps procedure in ARDL is taken to estimate the models. The first step is to estimate the long run relationship between LGDP, LPRI, LSEC and LTER in equation (2) until equation (5). Second step is to estimate the association of ARDL error correction models.

Table 1: Null hypothesis and alternate hypothesis

H_0 (No long run relationship)	H_1 (A long run relationship)
$n_{11}= n_{12}= n_{13}= n_{14}= 0$	at least one $n_{ij} \neq 0$
$n_{21}= n_{22}= n_{23}= n_{24}= 0$	at least one $n_{ij} \neq 0$
$n_{31}= n_{32}= n_{33}= n_{34}= 0$	at least one $n_{ij} \neq 0$
$n_{41}= n_{42}= n_{43}= n_{44} = 0$	at least one $n_{ij} \neq 0$

5. EMPIRICAL RESULT

In this section we analyse the time series properties of the data during the 1975-2009 period. The first step is to test for the presence of the long run relationship through the bounds testing approach. The results of the ARDL bound test in regard to Malaysia are reported in Table 2. In the equations (2), (3) and (4) with LGDP, LTER and LSEC as dependent variables, we note that the computed F-statistics for Malaysia is above the upper bound critical values provided by Narayan (2005). Hence, we have strong evidence to reject the null hypothesis of no co-integration at 1%, 5% and 10% significance level, respectively. It

shows that there is a long run relationship between LGDP, LTER, LSEC and LPRI for LGDP Model, LTER Model and LSEC Model.

Table 2: Bounds test results based on equation (2), (3) and (4)

F-statistics	Equation 2	Equation 3	Equation 4
	7.075***	4.2213**	7.3777***
1% I(0)	4.428	4.428	4.428
I(1)	5.816	5.816	5.816
5% I(0)	3.164	3.164	3.164
I(1)	4.194	4.194	4.194
10% I(0)	2.618	2.618	2.618
I(1)	3.532	3.532	3.532

Notes: *,** and *** indicate 10%, 5% and 1% level of significance, respectively.The test statistics of the bound tests are compared against the critical values reported in Pesaran et al. (2001).

Table 3: Long-run estimation results

LGDP Model				
$LGDP_t$ =	-5.477 –	$0.546LPRI_{t-1}$ –	$2.828LSEC_{t-1}$ +	$0.416LTER_{t-1}$
SE:		(0.76)	(0.556)	(0.096)
t :		(0.718)	(5.084)	(4.351)
LTER Model				
$LTER_t$ =	1.4663 –	$0.665LPRI_{t-1}$ –	$2.833LSEC_{t-1}$ +	$1.625LGDP_{t-1}$
SE:		(1.120)	(1.158)	(0.225)
t :		(-0.594)	(-2.446)	(7.217)
LSEC Model				
$LSEC_t$ =	3.2548 –	$0.3316LPRI_{t-1}$ –	$0.092LTER_{t-1}$ +	$0.273LGDP_{t-1}$
SE:		(0.331)	(0.061)	(0.066)
t :		(-1.002)	(-1.499)	(4.132)

Table 3 presents the long run estimation results. We estimated 4 separate models for the period of 1975 to 2009. We used the adjusted R^2 criterion to find the coefficient of the level variables. The results for Malaysia indicated that there is existence of long run co-integrating relationships among the variables. Based on the Johansen and Juselius Co-integration test, there is one co-integrating relationship among the variables in LGDP Model, LTER Model and LSEC Model. For the LGDP model, all estimated coefficients are statistically significant, except for LPRI. The estimated coefficients have correct signs as expected except for LPRI only. In a meantime, only LGDP is statistically significant for LTER and LSEC model.

The estimated Error Correction Models for Short Run Analysis are presented and discussed in the Table 4. Short run estimation results in the error correction representations of LGDP model, LTER model and LSEC model are provided in Table 3. The error correction terms (EC_{t-1}) of the LTER model an LSEC model are statistically significant at 1% level; meanwhile, LGDP model is statistically significant at 5% level with appropriate sign (negative), verifying the established cointegrating relationships among the variables. The coefficient of EC_{t-1} measures the speed of adjustment back to the long run equilibrium after a short run shock. The absolute values of the coefficients of EC_{t-1} in 3 models are quite high, indicating the fairly high speed adjustment to the long run equilibrium following short run shocks. For example, the coefficient of EC_{t-1} is 0.597 in the case of LGDP Model. This implies that, nearly 60% of the disequilibria in LGDP of the previous year's shock adjust back to the long run equilibrium in the current year. The results of the diagnostic tests are presented in the lower part of Table 3, shows no evidence of serial correlation, functional form, normality or heteroscedasticity. Structural stability of the models is examined using the

CUSUM and CUSUM of squares tests on the recursive residuals and are well within the 5% confidence interval band. This implies that all coefficients in the ECM model are stable.

Table 4 : The error correction representation for the selected ARDL model

LGDP Model;

$$\Delta LGDP_t = -3.272 - 3.05\Delta lnPRI_t - 4.041\Delta lnPRI_{t-1} - 2.34\Delta lnPRI_{t-2} + 0.36\Delta lnSEC_t + 0.249\Delta lnTER_t^* - 0.597ECT_{t-1}^{***} + \xi_t$$

$\bar{R}^2$ = 0.063, F-statitstics = 1.582, SSE = 0.076, EC_{t-1}= -0.597
χ^2_{sc} = 0.179; χ^2_{ff} = 0.517; χ^2_{nor} = 0.260; χ^2_{het} = 0.301

LTER Model;

$$\Delta LTER_t = 0.845 + 4.998\Delta lnPRI_t^{***} + 2.844\Delta lnPRI_{t-1} - 2.22\Delta lnSEC_t - 0.914\Delta lnSEC_{t-1} + 0.192\Delta lnGDP_t - 0.91\Delta lnGDP_{t-1}^{**} - 0.576ECT_{t-1}^{***} + \xi_t$$

$\bar{R}^2$ = 0.362, F-statitstics = 3.649, SSE = 0.076, EC_{t-1}= -0.576
χ^2_{sc} = 0.318; χ^2_{ff} = 0.844; χ^2_{nor} = 0.188; χ^2_{het} = 0.945

LSEC Model;

$$\Delta LSEC_t = 1.482 + 1.04\Delta lnPRI_t^{***} - 0.042\Delta lnTER_t + 0.037\Delta lnGDP_t - 0.455ECT_{t-1}^{***} + \xi_t$$

$\bar{R}^2$ = 0.503, F-statitstics = 9.329, SSE = 0.019, EC_{t-1}= -0.455
χ^2_{sc} = 0.16; χ^2_{ff} = 0.476; χ^2_{nor} = 0.750; χ^2_{het} = 0.298

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6. CONCLUSION

The current paper investigated the link between human capital and economic growth in Malaysia for the 1975–2009 periods. The ARDL approach was employed to determine the short run and long run relationships of LGDP, LTER, LSEC and LPRI. The F-statistics indicates that the null hypothesis of no co-integration at 1% and 5% cannot be accepted for LFDI model, LTER model and LSEC model. The negative sign in these three equations are statistically significant at 1% and 5% level, thus confirming the existence of long run relationship among the variables. It can be concluded that long run relationship between primary, secondary, tertiary enrollment and economic growth does exist in Malaysia. The implication of the co-integration among the variables studied would imply that all series in the model move together in the long run. The positive significant sign of LTER and LSEC in the long run demonstrate that these variables are very important for Malaysia's economic development. This means that LGDP, LTER and LSEC are an important indicator as endogenous variables as well as exogenous variables. Interestingly, the results also suggest that there is a bidirectional flow from LSEC and LTER to economic growth (GDP) in long run.

The results are consistent with the findings documented by Vinod & Kaushik (2007), indicate that human capital has a statistically significant impact on economic growth. The finding shows an investment in human capital in Asian country since World War II has made great leaps in their standard of living. Malaysia, Philippines, Thailand, Turkey and China are good examples of economic achieving growth based on human capital in the recent years. The results of this study are limited to the 1975–2009 periods. Further analysis may be preceded by incorporating longer sample period and other variables that may link between human capital and GDP. The empirical studies generally agree that human capital has a significant impact on economic growth either in the short run or long run. For the improvement of the educational quality, the level and effectiveness of educational inputs should be increased.

Malaysia government should focus on educational development especially the first two stages of education in order to achieve the highest possible enrollment rates and a rising educational level for its labor force. In other words, educational system must provide the education related to and needed by the labor market.

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