

HUMAN CAPITAL AND ECONOMIC GROWTH IN MALAYSIA: A SIMULTANEOUS MODEL

Rahmah Ismail

Idris Jajri

The relationship between economic growth and human capital has long been recognized. Many studies especially in western economies have shown that human capital has a positive impact on economic growth. However, a few studies conducted also show the impact of economic output on human capital. In Malaysia, human capital investment is becoming an important aspect of the development agenda for which a large percentage of its expenditure is being allocated. This study attempts to analyse the relationship between economic growth and human capital in Malaysia using a simultaneous equation model. Human capital variables are represented by literacy rate, life expectancy at birth and government expenditure on education, while economic growth is measured using real gross domestic product.

INTRODUCTION

In the neoclassical growth model, level of output is determined by value of capital and quantity of labour. Solow's analysis (1966; see also Jones 1975) shows that growth in percapita output is always equal to the growth of the labour force. Recently economists are also concerned about endogenous growth when discussing the process of output growth. In this approach, quality of inputs plays an important role in determining productivity and growth of the economy. A concept of effective labour is used to explain labour quality. For this, human capital variables like education, health and nutrition are added into the production function. An improvement in these variables will produce labour augmenting productivity effects (Wheeler, 1980). Thus output can possibly grow higher than the growth in the labour force (Hess & Ross, 1997; Gillis et al. 1996).

In fact, the importance of education in national development has long been recognised. Education has been regarded as a catalyst for economic growth as well as for social development. Adam Smith, in his early contribution to economic of thought viewed education as a kind of capital which acted as a prerequisite to development (Cohn, 1975). Education as a major component of human capital is believed to play an important role in the success of Japanese

and the Newly Industrialised Countries (NICs: Singapore, Hong Kong, Taiwan and South Korea) in Asia. In Malaysia, education is becoming an instrument for achieving national unity and for producing a productive and highly disciplined society (Ministry of Education, 1979, Rahmah, 1997). The emphasis on education can be viewed from large percentage of government expenditure on education as shown in Table 1. Expenditure on education comprises about 20 percent of total government expenditure and 4 percent of nominal gross domestic product (GDP). This figure is larger than that of other countries in Asia averaging among them only 3 percent of the GDP. (Rahmah, 1997).

Table 1: Government Expenditure on Education (RM Mill)

Year	Nominal Gross Domestic Product	Total Government Expenditure	Expenditure on Education	Percentage	
	(1) (RM mill)	(2) (RM mill)	(3) (RM mill)	3÷1	3÷2
1970	9951	2163	476.9	4.792	22.048
1975	22332	4900	1158.2	5.186	23.637
1980	53308	10292.5	2228.3	4.180	21.650
1985	77470	18766.2	3473	4.483	18.507
1990	115701	25026.24	4961.5	4.227	19.825
1996	249784	43865	10397.7	4.163	23.704

Source: Adapted from Bank Negara Report. Quarterly Bulletin, various issues. Ministry of Finance. Economic Report, various issues.

Measuring the impact of human capital on output and economic growth is very complex because both direct and indirect effects are involved. Measurement problems also arise from choosing the correct variables and defining them. Moreover, the goal of improving human capital is not only limited to achieving higher economic growth but it also contains objectives that are related to social and politics. Thus, failure to show its importance to increase output and economic growth does not mean that further investments in human capital should cease. Some countries emphasise social goals above that of the economic goals when investing in human capital. For example, investment in education is aimed to inculcate positive values among individuals which is

crucial for long-term development. Moreover, human capital can be regarded as a basic need as it will improve the welfare of the society.

Human capital can be measured in several ways. Using education as a variable alone will require several possible measures such as years of schooling, number in the enrolment, level of education of the labour force and expenditure on education. Health can be measured using life expectancy at birth and medical facilities as variables. Similarly, the level of nutrition can be measured by calories consumed or are available in the country.

From the view of the economist, what is important is how far the rise in human capital can lead to an increase in output and thereby contribute to economic growth. To this question, human capital is introduced as a variable into the production function (Denison, 1962, 1979; Hicks, 1980, 1980; Otani & Villanueva, 1990; Lau et al. 1993; Walter & Robinson, 1983; Grilliches, 1978). However, most studies apply a single equation approach in which output is used as a dependent variable against a series of independent human capital variables.

The single equation approach cannot capture likely two way relationships between human capital variables and output levels. For example, improvements in human capital will induced higher growth or output but at the same time higher output will also influence higher capacities for investing in human capital. (Wheeler 1980a, 1980b).

The simultaneous equation approach that can capture this two way relationship between human capital and economic growth was attempted by Wheeler (1980a, 1980b). Several variables like literacy rate, life expectancy at birth and calories consumed were use to represent human capital. Data from Asia and Africa between 1960-1970 and 1970-1977 were used in his earlier study and for the latter study, the data period was 1976-1978. His earlier study showed a significant relationship between all human capital variables and economic growth. However, the latter study found that literacy rate was not a significant determinant of changes in gross domestic product (GDP), although he found that output determined literacy rates.

Our study attempts a similar look at the relationship between output and human capital. Literacy rate, government expenditure on education and life expectancy at birth are used as variables to represent the level of human capital. The following sections will discuss details concerning data, model

specification, analysis of the results, policy implication before we make our conclusion.

DATA AND MODEL SPECIFICATION

The data for this study were collected from four main sources - Economic Report, Bank Negara Report, World Development Report and World Tables. The study covers 27 years from 1970 to 1996. In addition to literacy rate, life expectancy at birth and educational expenditure, we collected data on number of enrolment at every level of schooling, enrolment rate, educational level of employees, and number of doctors.

In the production function, human capital variables and exports data are incooperated as independent variables together with data relating to physical capital and labour. The importance of the exports sector can be viewed from three main aspects. First, export is regarded as an engine of technology transfer through the accumulation of capital goods (Bardhan & Lewis, 1970; Chen 1979 and Khang, 1987). The exports sector also generates positive externalities between sectors through competition in training and management producing skilled labour (Keesing, 1967; Feder, 1986). Second, export expansion will increase the inflow of foreign direct investments. Third, countries with high export volumes are able to achieve higher economic growth (Balassa, 1978; Krueger, 1978; Bhagwati & Srinivasan, 1979).

We formulated two sets of simultaneous equation model. In the first model literacy rate is included while in the second model we substitute this with government expenditure on education lagged 10 years. This lag was imposed to reflect the relatively slow impact that education will have on output. A longer lag could not be specified due to the lack of data in the series. Analysis based on shorter lags provide significant results.

Estimation Model

Model I

$$\text{gdp} = c_1 + c_2 \text{ cap} + c_3 \text{ lab} + c_4 \text{ export} + c_5 \text{ lit} + \mu_1 \quad (1)$$

$$\text{lit} = c_6 + c_7 \text{ cgdp} + c_8 \text{ prime} + \mu_2 \quad (2)$$

$$\text{life} = c_9 + c_{10} \text{ lit} + c_{11} \text{ gdpp} + c_{12} \text{ dokpop} + \mu_3 \quad (3)$$

Model II

$$\text{gdp} = c_1 + c_2 \text{ cap} + c_3 \text{ lab} + c_4 \text{ export} + c_5 \text{ exed} + \mu_1 \quad (4)$$

$$\text{exed} = c_6 + c_7 \text{ cgdp} + c_8 \text{ enrol} + \mu_2 \quad (5)$$

$$\text{life} = c_9 + c_{10} \text{ gdpp} + c_{11} \text{ exed} + c_{12} \text{ dokpop} + \mu_3 \quad (6)$$

definition of the variables

gdp = real gross domestic product

cap = real investment

lab = number of labour force

export = value of real export

lit = literacy rate (in percent)

exed = government expenditure on education lagged 10 years

life = life expectancy at birth

cgdp = change in real gdp

gdpp = per capita real gdp

enrol = total enrolment lag 10 years

prime = enrolment ratio at primary level

dokpop = ratio of doctors and population

μ_1, μ_2, μ_3 = error terms

Analysis of Results

Equations in model I and model II are estimated simultaneously using two stage least-squares (2SLS). The results of the estimation are shown in Table 3 and Table 4. In model I, when literacy rate was used, there was significant relationship between human capital and output (gdp). An increase in 1 percentage point of literacy rate increased gdp by RM363.908 million. However, in the literacy rate equation cgdp instead of gdp was used since it gave a better result. This variable was not a significant determinant of literacy rate. Instead, literacy rate was significantly determined by enrolment ratio at the primary school level.

In the life expectancy equation, literacy rate seemed to have a very significant effect on life expectancy besides gdpp and dokpop. An increase in 1 percentage point of literacy rate increased life expectancy by 0.329 year, while an increase in 1 unit of gdpp will increase life expectancy by 1.654 years. The ratio between doctor and population appear to give the highest positive impact on the life expectancy. An increase of 1 unit of this ratio increased life expectancy by 2.103 years.

The results in Table 4 also showed that there was a significant relationship between human capital and output growth. From equation (1), it was shown that government expenditure lagged 10 years significantly related to the level of real gross domestic product (gdp). On the other hand, from equation (2) a change in gdp determined government expenditure on education. Government expenditure on education and percapita gdp were also found to be a significant determinant of health, which was represented by life expectancy at birth. The magnitude of the impact of these variables is quite large. From equation (1) a 1 unit change in government expenditure on education will increase gdp by 5.794 unit. In the real measure, RM1 million increase in educational expenditure will increase gdp by RM5.79 million. In contrast, a 1 unit change in gdp will increase educational expenditure by 0.055 unit or RM0.055 million. In the life expectancy equation, the largest determinant was gdp percapita as shown in the table, an increase of RM1 million of this variable would increase life expectancy by 1.692 years.

Table 2: Mean of the Variables

Variable	Mean
gdp	58416.81 (RM mill)
cap	19465.27 (RM mill)
lab	5511.42 (thou)
export	42167.47 (RM mill)
lit	68.648 (per cent)
life	70.96 (year)
exed	1929,712 (RM mill)
cgdp	4307.346 (RM mill)
prime	95.192 (percent)
enrol	31601.11 (thou)
gdpp	4839 (RM)
dokpop	0.0004 (ratio)

**Table 3: Estimation Result With Literacy Rate in the
Production Equation**

Variable	Equation		
	1 (gdp)	3 (lit)	2 (life)
intercept	-15236.32 (-1.655)*	-140.422 (-1.808)*	49.478 (12.436)***
cap	0.340 (2.162)**		
lab	4.523 (5.394)***		
export	0.412 (5.920)***		
lit	363.908 (1.904)*		0.329 (3.498)***
gdpp			1.654 (1.633)*
dokpop			2.103 (1.805)*
cgdp		-7.264 (-0.169)	
prime		2.197 (2.738)***	

Note: figures in brackets are t-values.
 *** - significant at 10 percent.
 ** - significant at 5 percent.
 * - significant at 1 percent.

Table 4: Estimation Result With Educational Expenditure in the Production
Production Function

Variable	1 (gdp)	2 (exed)	3 (life)
intercept	-1795.021 (-0.123)	-204.195 (-1.404)	70.045 (38.836)***
cap	0.650 (3.862)***		
lab	6.061 (2.063)**		
exed	5.794 (2.355)**		0.002 (2.340)**
export	0.138 (1.435)		
cgdp		0.055 (2.077)**	
enrol		0.068 (8.949)***	
gdpp			1.692 (3.026)***
dekpop			14.470 (1.359)

Note: numbers in parentheses are t-values.

*** - significant at 1 percent.

** - significant at 5 percent.

* - significant at 10 percent.

The results of this study are consistent with that of Wheeler's studies at least for the growth equation. In Wheeler's first study (for the period 1960-70) it was found that economic growth (real gdp) and literacy rate had a strong significant relationship. A 1 percentage point change in literacy rate would increase economic growth by 0.016 percentage point. On the other hand, changes in 1 percentage point of the growth of real gdp percapita would change literacy rate by 8.313 percentage point. For the later period (1970-77) it was shown that a 1 percentage point increase in literacy rate would increase economic growth by 0.008 percentage point. Whereas a 1 percentage point increase in the growth of real gdp percapita would change literacy rate by 14.485 percentage point. However in Wheeler's second study (for the period 1976-78), he found that changes in literacy rate did not have a significant relationship with the growth of real gdp. But the growth of real gdp percapita

was significantly related to the change in literacy rate. In this study he added life expectancy at birth as another human capital variable in the growth equation. But he did not estimate this variable endogenously. This variables was significantly related to the growth of real gdp. A one percentage point change in life expectancy at birth was related to a 1.697 percentage point change in the growth of real gdp.

POLICY IMPLICATION

The results of our study confirm that there is a significant relationship between GDP and human capital variables. The coefficient for government expenditure on education in model I seemed to produce a higher significant level compared to literacy rate in model I. However, the magnitude of this impact cannot be compared because different measurements were used. Literacy rate was measured in terms of percentage, but educational expenditure was measured in million ringgit. Nevertheless, it is obvious that both variables are important determinants of output. Literacy rate and government expenditure on education seemed to improve life expectancy as shown in column (3) in Table 3 and Table 4. An improvement in these variables reflect the improvement in health and the welfare of the society. Therefore, expenditure on education cannot be neglected instead it must be given a high priority.

The impact of output on human capital is not direct. Instead the utilization of per capita GDP and change in GDP rather than the level of GDP in the life expectancy and literacy rate equations respectively gave a better estimation. The coefficient for the per capita GDP variable showed a significant positive relationship with life expectancy. In this case, per capita GDP was an important determinant of life expectancy. The results suggest that per capita GDP should be given emphasis if we are trying to promote development.

The ratio between the number of doctors and population did not seem to be important determinants of life expectancy. This result is unexpected. One explanation has to do with the data that were used in the analysis. Some parts of the country have many doctors while in other parts there are only few doctor available. Therefore, a relatively large size of the population could not receive this. When the number of doctors was used in the estimation the results worsen. Apparently, the mean value for doctors per unit population as shown in Table 2 is very small. One doctor attends to more 2500 population.

CONCLUSION

The results from this study showed that output and human capital form a two-way relationship which most other studies that were based on single equations could not capture. In our model, the level of GDP was determined by human capital and in turn the quality of human capital was simultaneously determined by the components of GDP, GDP per capita and change in GDP. Therefore, investments into human capital cannot be neglected. This argument is further strengthened when we look at the objective for improving human capital which is not merely to achieve a high level of economic growth but also to fulfil social needs.

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