AN EMPIRICAL STUDY ON THE RELATIONSHIP BETWEEN GOVERNMENT EXPENDITURE ON EDUCATION AND ECONOMIC GROWTH IN MALAYSIA

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AN EMPIRICAL STUDY ON THE RELATIONSHIP BETWEEN GOVERNMENT EXPENDITURE ON EDUCATION AND ECONOMIC GROWTH IN MALAYSIA

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ABSTRACT

The main purpose of this study is to investigate the relationship between education and economic growth. The study is based on annually time series data range from period 1970 until 2010. The indicators for education are government operating expenditure and government development expenditure in education sector. Following the endogenous growth theory, log linear model is build based on Cobb Douglas production function. In order to answer the three objectives in this study, the tests been carried out included Augument Dikey Fuller test (ADF) test to test unit root, Ordinary Least Squares (OLS) test to estimate how dependent variable changes when there is an increase in independent variables, Johansen cointegration test to investigate the existence of long run relationship in the model and Granger causality test to determine the direction of causality between all variables. The finding of the study is consistent with most of the empirical studies and theory where there is a long run relationship between education and economic growth. Besides that, the estimated results show that operating expenditure is relatively bring more impact to gross domestic product compared to development expenditure. In addition, the empirical evidence demonstrates that operating expenditure exits bilateral causality relationship with economic growth.

Keywords: Education, Economic growth, Granger causality, Expenditure on education

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CHAPTER 1

INTRODUCTION

1.1 Background

The relationship between education and economic growth has become an issue in the macroeconomic field. The relationship between these two variables remains controversial in theory and empirical findings. There are two things to be determined. The first is the nature of the relationship between the two, if one exists. The second is the direction of causality between education and economic growth. While several researchers and academicians have surveyed the theme, the results obtained are not consistent with some studies suggesting a positive relationship and others a negative or indeterminate relationship.

The ultimate goal of a country is to achieve economic development through economic growth, which is distinct from the former. Economic growth refers to rises in national income per capita from increasing production of goods and services in a country, while economic development refers to benefits from structural changes in economy and society. Examples of structural changes in the Malaysian context are the transition from an agricultural to an industrial economy, reduction in gender inequality, equity of income distribution and reduction of poverty rate. Economic growth alone is necessary but not sufficient for economic development. It is important because the increase in the incomes of the people and increase in government income allow greater expenditure on public services which raise the standard of living of the nation. While this may not benefit every

individual, it at least ensures that part of the population is better off without anyone becoming worse off.

According to the theory of economic growth, economic growth has four determinants which are labour, capital, technological changes and human capital. Human capital refers to skilled labour, which has two requisites namely education and health. In other words, skilled labour must be highly educated and physically viable to operate advanced technology necessary for increasing productivity and economic growth. This is applicable to a developing country such as Malaysia, which is transitioning from an agricultural to an industrial economy. Refer to Figure 1.1.

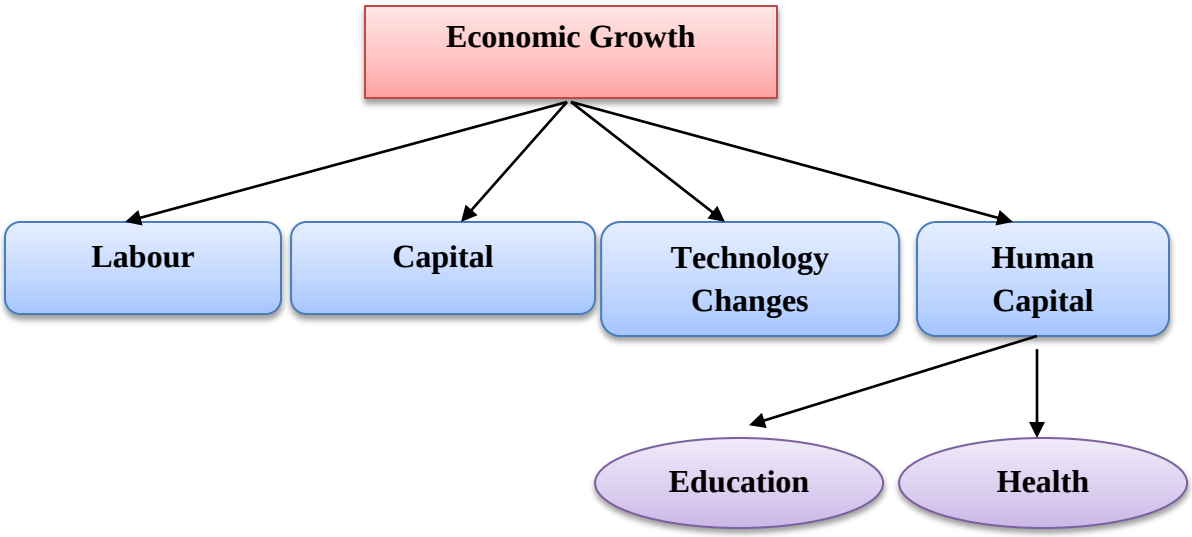


Figure 1.1 The Determinants of Economic Growth

The main purpose of this paper is to investigate the relationship between economic growth and investment in education, as a determinant of economic growth under the theory. This is not a new topic in Malaysia, where some empirical studies on the relationship between the two have been carried out. While the government of Malaysia allocates significant portions of its budget to the education sector, the return in

economic growth remains unknown. Hence this motivated me to do a study about this topic.

I have determined that the proxies used by researchers differ. These proxies include school enrolment at primary, secondary and tertiary levels, employment by level of education, literacy rate, mean years of schooling and government expenditure on education. In this paper, the proxy for education is government expenditure. However, unlike other studies, this study separates government expenditure into operating expenditure and development expenditure represented by two independent variables. The motivation for doing so is to discern their individual contributions to economic growth and lay the foundation for understanding their relative importance. This can contribute to policy decisions on the balance of expenditure in the education sector.

1.2 Problem Statement

Since independence in 1957, the government has promoted education as a primary national agenda in recognition of its importance to economic growth and national development. Malaysia has the highest percentage allocation among countries of government expenditure to the education sector at 25% (Arul, 2009). This allocation exceeds that of other sectors such as the military.

The government invests substantially through student loans (*Perbadanan Tabung Pendidikian Tinggi Nasional*), scholarships, budget allocations for school and universities, and hiring of human capital such as teachers, administrative staff and lecturers. It has also invested through the establishment of additional local universities.

Government expenditure in education has increased over the years. The 2009 EFA Global Monitoring reported that Malaysia is doing well towards achieving its Education for All goals. Director of Unesco Koichiro Matsuura claims that Malaysian teaching staff have increased in number by more than 30% since 1999.

In Malaysia's 2013 budget, the second focus of the budget is strengthening education and training with 21% of the total budget allocated for education and training to produce higher quality of human capital. In September 2012, the Ministry of Education launched the Malaysia Education Blueprint 2013-2015 to ensure that the currently education system can optimize the potential of every Malaysian child. RM38.7 billion will be allocated to the Ministry of Education (MOE) for development and operating expenditures. An additional RM500 million will be allocated to establish the Education Delivery Unit monitor progress in enhancing teaching skills. The Higher Order Thinking Skills approach will be introduced for core subjects such as *Bahasa Melayu*, English, Science and Mathematics. The government will also spend RM2 billion in special funds, up from RM1 billion in 2012, for maintenance of schools, construction, renovation and equipment purchases. RM400 million of the additional RM1 billion will be allocated for nationals schools and the remaining RM600 million allocated equally to boarding schools, national type Chinese schools, national type Tamil schools, Maktab Rendah Sains MARA, mission schools and government-assisted religious schools.

The issue facing these efforts to improve education in Malaysia is that returns on these investments are unknown. Does government investment in human capital via education improve Malaysia's economic growth? Is empirical evidence in Malaysia consistent with the growth theory? Assuming education does increase economic growth,

how many years of education provides good return on investment? Is there a causal relationship? If it exists, is causality one-way or bidirectional? It is necessary from a policy perspective to determine the length of period of investment that yields an economic return to the country directly or indirectly.

1.3 Objective

This paper focuses on investment in human capital as a determinant of economic growth.

1.3.1 General Objective

This paper aims to investigate the effect of government expenditure in education on economic growth in Malaysia for the period 1970-2010.

1.3.2 Specific Objectives

1) To determine the relative impact of operating expenditure and development expenditure on education on economic growth.

2) To determine the relationship between investment in education and economic growth in the long run.

3) To investigate the existence of a causal relationship between investment in education and economic growth, and if the relationship is exists, to determine the direction of the relationship.

1.4 Scope of the Study

This study focuses mainly on the relationship between government expenditure in education and economic growth in Malaysia. The period covered is from 1970 to 2010 which is 41 years. The model specification in this paper is based on Cobb Douglas

production function where output is a function of capital, labour and human capital. In the analysis, human capital is replaced by education.

The analysis consists of time series data and estimation using Eviews. To check the stationarity of the data, the Augmented Dickey Fuller (ADF) test is used. OLS test applied to examine the relative impact of operating expenditure and development expenditure on education on economic growth. Then, to fulfill the objective of determining long run relationships between education and economic growth, the Johansen cointegration test will be used for regression. The Granger causality test will be used to check for the existence of causality between education and economic growth. This study is positioned to give empirical justification to the effect of investment in education towards economic growth in Malaysia. The results can be used as guidance and references for government in making decision on the allocation of budget in education sector.

1.5 Organization of the Study

The main purpose of this paper is to investigate the relationship between government expenditure in education and economic growth. This paper is organized into five chapters. The first chapter introduces the topic with reasons that provide motivation for the study, the differences between this study and previous studies in Malaysia, problem statement, objective, scope of the study and organization of the paper.

The second chapter provides context by discussing the background of education system in Malaysia. Chapter three is about theoretical framework of evolution of growth theory. Chapter four is a literature review and the types of indicators for education. The

case studies are divided into three parts which are case studies in Malaysia, cross country studies and focuses on individual countries.

Model specification, sources of data, classification of variables are presented in chapter five. In addition, description and explanation of unit root test (ADF), cointegration test (Johansen Cointegration), ordinary least squares (OLS) and causality test (Granger Causality) are included in this section.

Chapter six will be the presentation of the results and findings after the regression for each test. Lastly, chapter seven is the summary, suggested policy based on findings and conclusion of this paper.

CHAPTER 2

OVERVIEW OF EDUCATION SYSTEM IN MALAYSIA

2.1 Introduction

In this chapter we discuss the education system in Malaysia which is under the supervision of Ministry of Education (MOE) and Ministry of Higher Education (MOHE). This is followed by the presentation of data and statistics of enrolment rate in public universities at various levels and federal government expenditure in operating and developing the education sector.

2.2 Education System in Malaysia

Two government authorities are responsible for education in Malaysia. The first is MOE for pre-tertiary levels and the second is the MOHE. MOE is responsible for developing the potential of individuals through quality education and provides manpower for development of the country. At the federal level, MOE translates the National Education Policy into programmes, education plans and projects in accordance with national objectives and aspirations. Under MOE, there is the School Inspectorate that is responsible for monitoring the quality of teaching and learning and ensure the implementation of curriculum to achieve high standards of education. Besides that, Policy and Educational Development is another sector under MOE, there is a division called Curriculum Development Division that is responsible for transforming, developing and formulating the national education system towards international curriculum systems, preparing teaching module, syllabus and teacher guidance. However, the highest power

and authority is under the Educational Planning Committee (EPC). All decision-making processes for national education are performed through this decision-making body. EPC is in charge in the coordination, formulation and implementation of general policy guidelines.

MOHE is responsible for establishing and developing higher education environments that lead to the establishment of a renowned centre for the pursuit of knowledge, and to produce competent, innovative and noble individuals to meet the needs of the nation and the world. This ministry plays a major role in producing quality human capital. Its main roles are to set up strategic plans for higher education, increase capacity and participation levels in higher education, reinforce the management of higher education, increase the quality of higher education in Malaysia, achieve international standards and lastly internationalize higher education in Malaysia. Under MOHE, there is a Malaysian Qualifications Agency (MQF) responsible for the unified system of qualifications offered by universities, colleges, professional organization and vocational institutions in both public and private sectors. The government's commitment to upgrade the level of human capital especially education among the population is evidenced by the large expenditure allocated to this sector. The allocation for education has increased over the period of the New Economic Policy since 1970.

Under the Malaysian education system, the government provides 11 years of free primary and secondary education, 6 years at primary level (Standard 1-6 in two three-year phases) and 5 years at secondary level (Form 1-5). The primary education admission age is 6. There are two types of primary school. First are national schools with classes conducted in *Bahasa Melayu*. Second are national-type school which are national-

type Chinese school and national-type Tamil school. After studying for six years of primary education, pupils sit the Primary School Assessment Test (UPSR) before entering secondary school. Secondary education also uses the national language which is *Bahasa Melayu* as the medium of teaching.

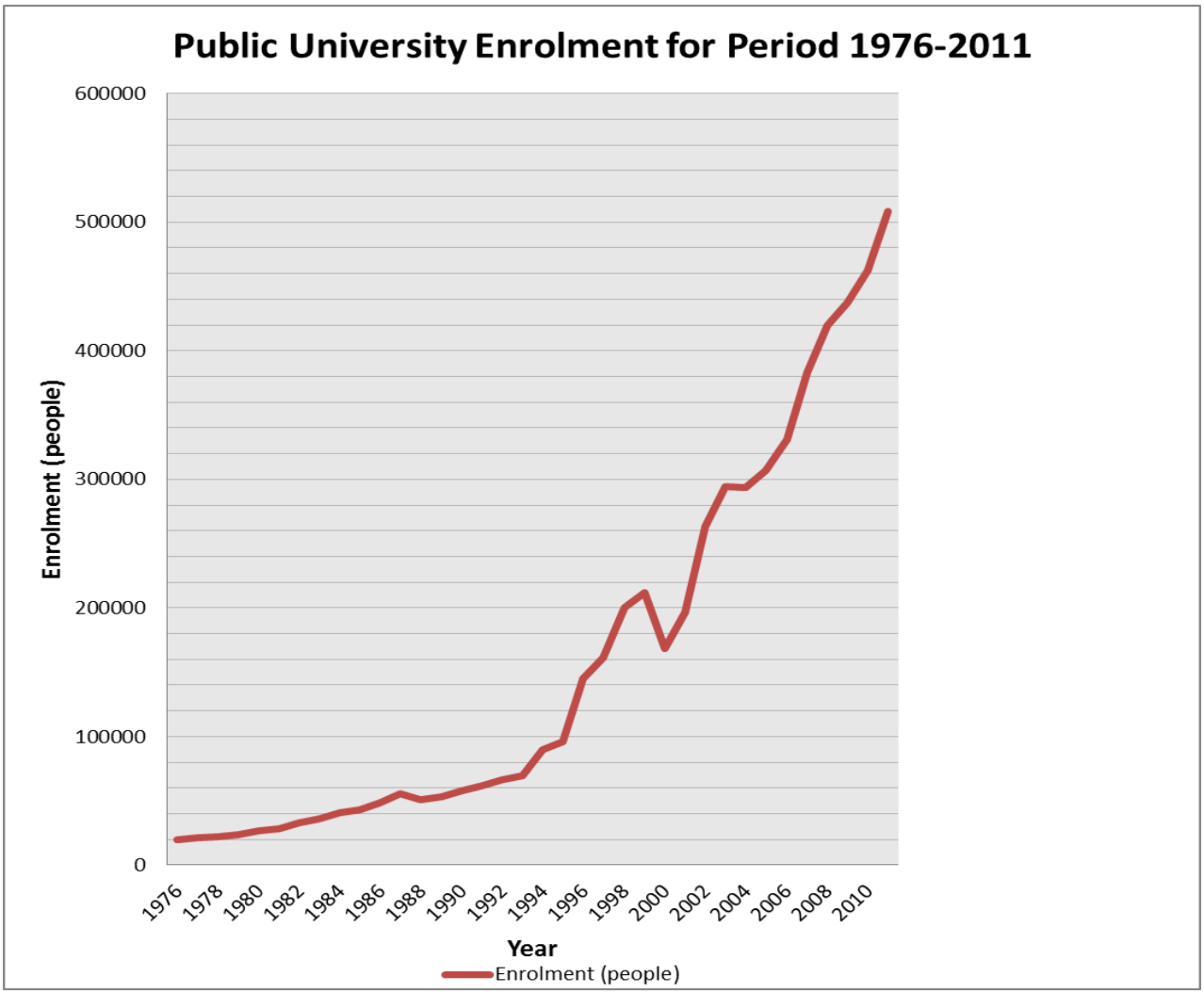
Lower secondary level consists of three years culminating in the Lower Secondary Assessment Test (PMR) as the perquisite for attending upper secondary level. This involves two years of upper secondary education ending with the Malaysian Certificate of Education Examination (SPM). Further study after 11 years is not automatic. An individual must pass the SPM to qualify for the pre-university level which is delivered in two types: the sixth form programme and the matriculation programme. Sixth form takes two years and pupils sit the Malaysian Higher Secondary School Certificate (STPM) while matriculation programme requires one year's study towards the matriculation examination. These two programmes are designed to meet entry requirements to universities and colleges and school fees for study at public schools are sponsored by the government.

Tertiary level is classified into two sectors which are public and private. It includes universities, colleges, vocational institutions, polytechnics and professional programmes. At this level, education is not free. Students pay school fees at public or private universities, with public university tuition fees being lower. The qualifications of higher education are of 5 types: post graduate diploma, bachelor degree, master degree and finally doctorate.

As of April 2013, a total of 20 public universities and 32 private universities operate in Malaysia. Between 1957 and 1990, the growth of institutions of the tertiary education was slow because budget constraint. The government focused the budget on primary education, while there was an increase in the population eligible to pursue university. There was also a shift in policy with the government beginning to privatize higher education. Under the 1996 Private Higher Educational Institutions Act, for the first time government of Malaysia made provisions to establishment of private universities and colleges and started to liberalize the education sector. In addition, the 1997 East Asian economic crisis provided a chance to foreign universities to set up universities and branch campuses in Malaysia to increase Malaysia's competitiveness. Therefore, the total number of universities has increased since 1962, when the first university was established in Malaysia. The list of public and private universities and their date of establishment can be read from Appendix X.

2.3 Statistics on Education Sector

The university enrolment rate has increased with the establishment of universities and the accompanying increase in government expenditure on development and operating costs. Figure 2.1, 2.2, 2.3 and 2.4 are some statistics of enrolment in public universities, and government expenditure in operating and development costs in education.



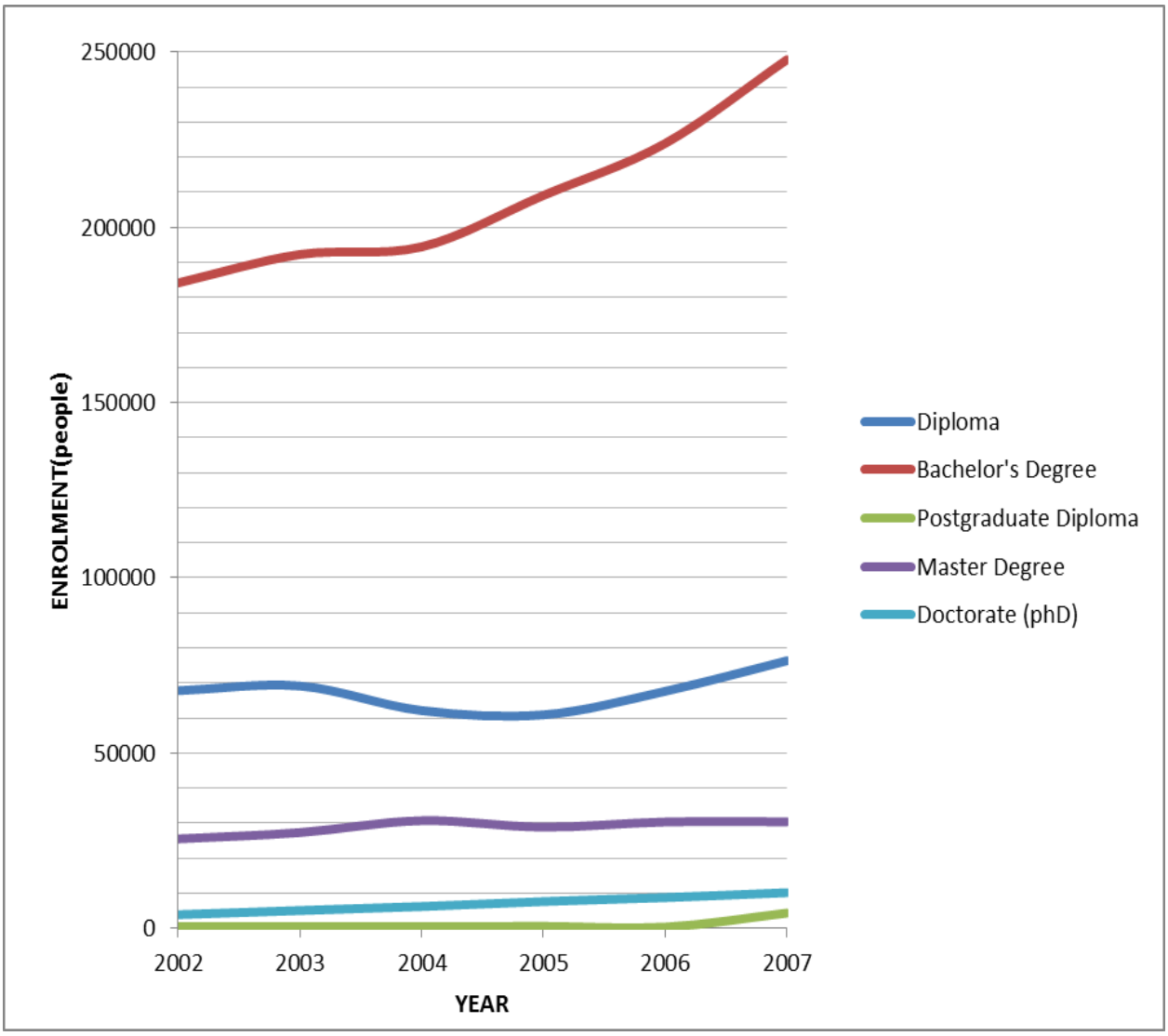
Source: Economic Report Series 1980/1981 – 2011/2012

Figure 2.1 Enrolment in Public University for period 1976-2011

Table 2.1 Enrolment rate in local universities for period 2002- 2007

Level	2002	2003	2004	2005	2006	2007
Diploma	67807	69157	62136	60911	67628	76345
Bachelor's Degree	184190	192288	194470	209148	223968	247881
Postgraduate Diploma	433	530	439	546	330	4341
Master Degree	25527	27316	30711	28877	30347	30383
Doctorate (phD)	3882	5068	6222	7639	8753	10167
TOTAL	281839	294359	293978	307121	331025	369117

Source: Ministry of Higher Education



Source: Ministry of Higher Education

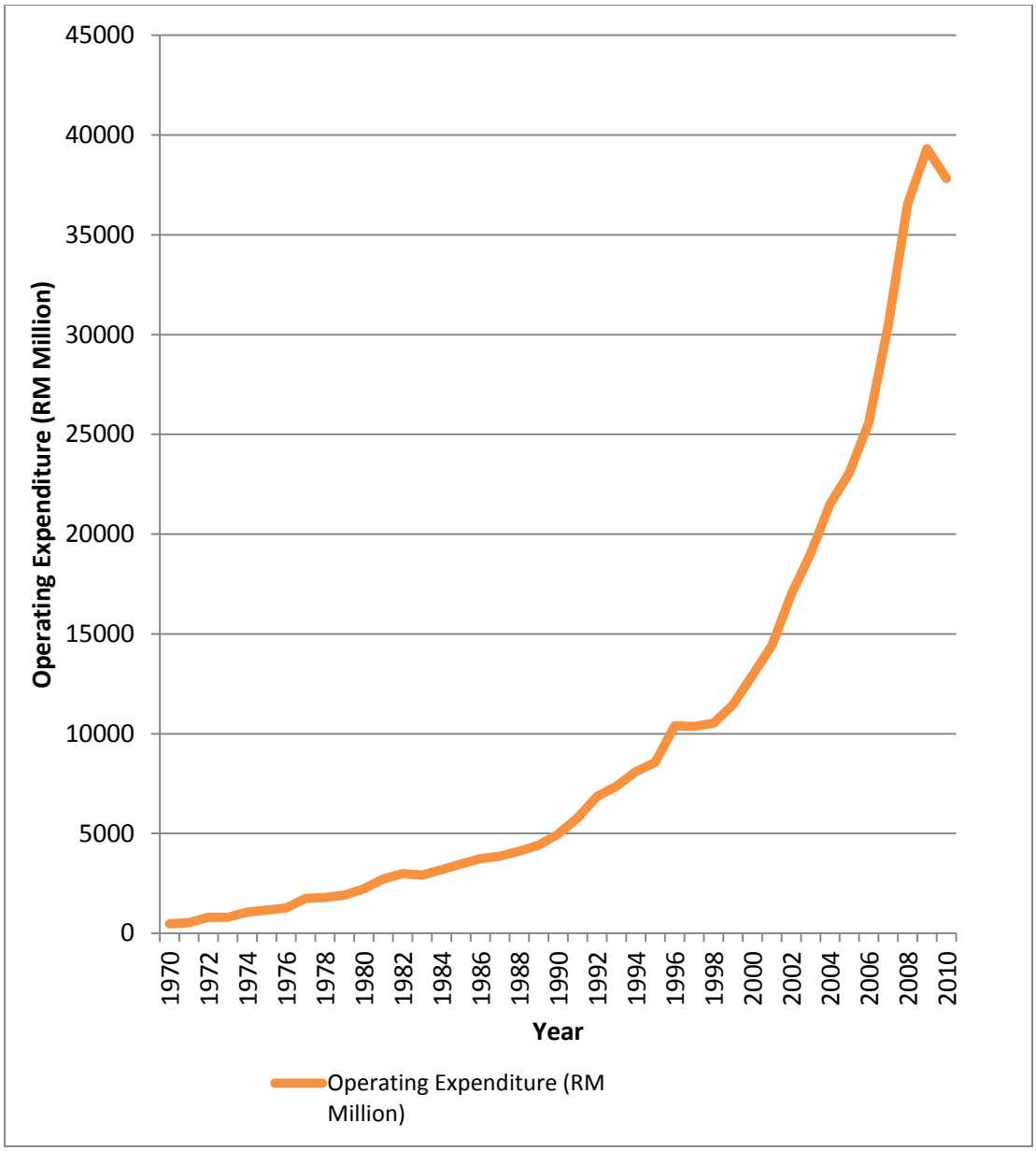
Figure 2.2 Enrolments in Public University at Different Qualification for Period 2002-2007

Table 2.2 Federal Government Operating and Development Expenditure in Education for Period 1970-2011

Year	Operating Expenditure (RM Million)	Development Expenditure (RM Million)
1970	477	44
1971	536	86
1972	798	112

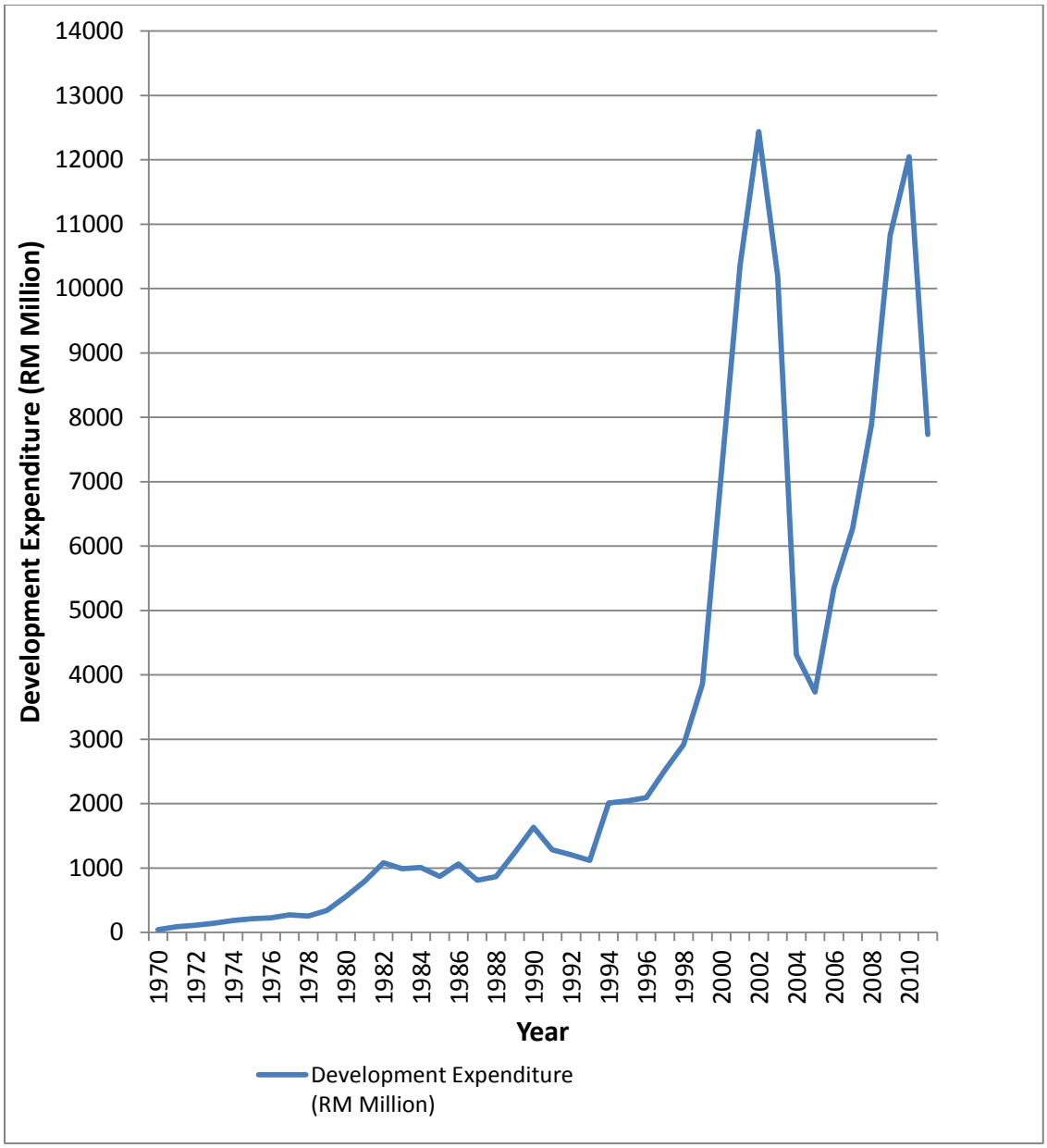
Year	Operating Expenditure (RM Million)	Development Expenditure (RM Million)
1973	805	142
1974	1051	187
1975	1158	212
1976	1261	227
1977	1750	274
1978	1791	252
1979	1918	339
1980	2228	558
1981	2726	791
1982	2991	1082
1983	2915	988
1984	3183	1009
1985	3473	872
1986	3743	1064
1987	3862	810
1988	4115	865
1989	4407	1242
1990	4962	1634
1991	5782	1285
1992	6854	1205
1993	7361	1117
1994	8098	2010
1995	8559	2044
1996	10398	2091
1997	10360	2521
1998	10528	2915
1999	11458	3865
2000	12923	7099
2001	14422	10363
2002	16982	12436
2003	19033	10193
2004	21517	4316
2005	23058	3736
2006	25589	5349
2007	30443	6271
2008	36528	7892
2009	39318	10827
2010	37821	12046
2011	41741	7735

Source: Economic Report 1974/1975- 2011/2012



Source: Economic Report 1974/1975- 2011/2012

Figure 2.3 Federal Government Operating Expenditure in Education



Source: Economic Report 1974/1975- 2011/2012

Figure 2.4: Federal Government Development Expenditure in Education

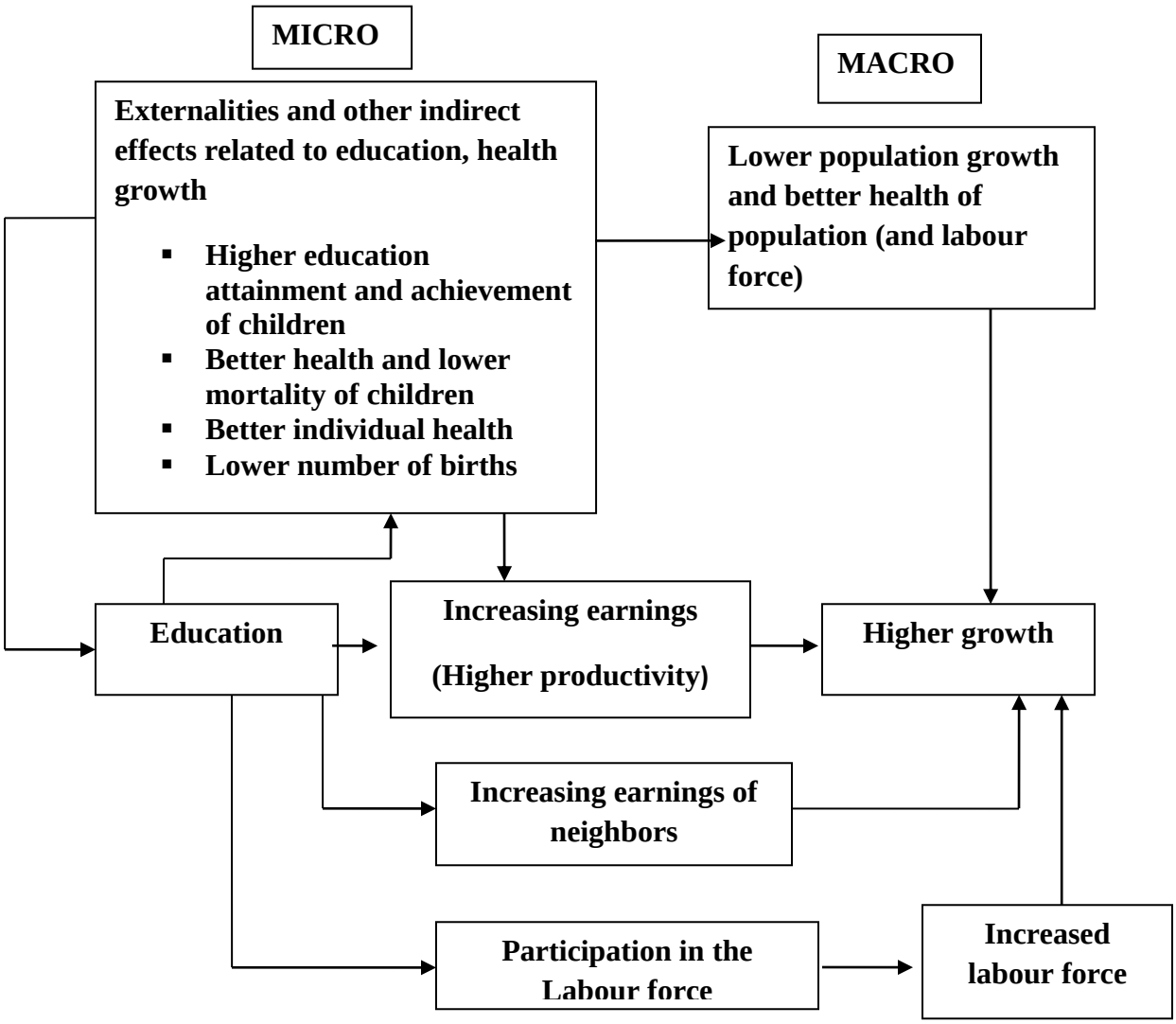
Statistics in Figure 2.2 show that total enrolment into public universities is increasing in all five categories of qualifications and especially in Bachelor Degrees. The total number of enrolments to public university was 19,798 in 1976, rising to 508,256 in 2011. This is a good phenomenon as more university graduates increase the human

capital available to the country. However, it does not indicate a higher enrolment rate produces more knowledgeable human capital or brings positive impact on economic growth. Moreover, from the expenditure aspect, government expenditure in developing and operating the education sector have also increased over the years. Operating expenditure was RM 477 million in 1970, increasing to RM 41,741 million on 2011. Similarly, government development expenditure was RM 44 million in 1970, increasing to RM 10,193 million in 2003. This decreased to RM 4,316 million in 2004 and resumed increasing to RM 7,735 million in 2011.

According to Figure 2.5 that was developed by Michaelowa (2000), it is shown that process of economic return to education at micro and macro levels. Human capital theory suggests that there is economic benefit from education at both macro and micro levels. From the macro perspective, education increases the earnings potential of an individual by increasing the productivity of labor and promotes higher growth. It also promotes growth through the incremental increase in the labor force. This proves the importance of education to economic growth of a country.

2.4 Conclusion

After the presentation of education system and the statistic about education in Malaysia, in the next chapter, this study discusses the evolution of growth theory and how the human capital and education factors can be internalized into new growth theory.



Source: Michaelowa, Katharina. (2000) "Returns to Education in Low Income Countries: Evidence for Africa."

Figure 2.5 Economic Returns to Education

CHAPTER 3

THEORETICAL FRAMEWORK FOR EVOLUTION OF GROWTH THEORY

3.1 Introduction

There are two broad periods of time that contributed to progress in growth theory. In the 1950s to 60s period, neoclassical growth theory successfully proved that physical capital is an important determinant to the economic growth. The shortcoming of this model is the occurrence of the Solow residual and inability to address how sustainable growth can be achieved. From the 1980s to 90s, Romer (1986) and his PhD student Lucas (1990) rejected the Solow theory and created a new model to prove that acquisition of knowledge and skills is the central key to sustainable growth. Later on, Schultz (1961) suggested that education is the main alternative to increasing the stock of human capital.

3.2 Harrod Domar Growth Model

This model was initially developed by Roy Harrod (1939) and Evsey Domar (1946). The difference between these two models is that Harrod's model involves expectations of variables. Over time the two models have merged and Domar's version has gained more popular because of its simplicity. The Harrod-Domar model is based on the Leontief production function in the below form:

$$Y = \min (\alpha L, \beta K) \quad (3.1)$$

This form has a shortcoming in that it does not allow the substitution of labor for capital or replace capital with labor. This indicates that the rate of growth must be equal to the growth rate of the labor force, which is not consistent with empirical reality.

3.3 Solow's Model

This is also called neoclassical theory in economic growth. The theory places output growth in two categories. The first is growth of factor inputs (labor and capital) and second is growth in output due to the growth in factor inputs. Solow (1957) claims that technological progress was introduced as an exogenous variable in this model. The production function for Solow's model is in the form below:

$$Y = AF(K, L) \tag{3.2}$$

Output (Y) is dependent on two main inputs which are capital (K) and labor (L) and an autonomous growth factor (A). To get the capital labor ratio or output per person, the production function is divided by labor input (L).

$$\frac{Y}{L} = Af\left(\frac{K}{L}\right) \tag{3.3}$$

Through this function, it states that the important sources of growth are the ratio of capital to labor input (K/L) and autonomous growth factor (A). In Solow's model, there is exogenous technological progress which will increase society's productivity over time. Given the original production function (3.4), it can be written into (3.5)

$$Y = F(K, L) \tag{3.4}$$

$$Y = F(K, L^* E) \tag{3.5}$$

E refers to something abstract called efficiency of labor while L*E is refers to the effective number of workers. In other words, L measures the number of workers in the labor market while L*E measures both the workers and the technology with which the typical worker comes equipped.

There are two types of technological change in Solow's model. The assumptions are that technology makes each worker more efficient and the technology shifts the production function relating per person output to per person capital. The first type of change is labor-augmenting technological change. Instead of considering the number of workers, it is necessary to count effective labor input, taking into account improved education and the changes of technology that cause labor to be more effective. The second type of change is neutral technological change. The first type has a shortcoming in assuming that technology makes labor more efficient with no effect on capital input. Hence neutral technology change is a more realistic assumption that technology does make both labor and capital more efficient. This indicates that the autonomous growth factor (A) in Equation (3.2) and (3.3) will grow over time if there is effort to improve education, innovations and research in technology.

However, there is a Solow residual. Under the assumption of the Solow model, the increase in capital and labor inputs will increase the growth rate of economy. There is research that proved that some part of the growth rate cannot be totally explained by capital and labor. This unexplained factor that leads to economic growth is called the Solow residual. Furthermore, Gordon (2012) points out three questions that Solow's model cannot explain. The first is that income per capital varies too much across countries. This phenomenon conflicts with the Solow's growth theory. The theory claims

that difference in saving rates and difference in the slope of steady state investment line cause the differences in per capita income. However, studies show that very large differences in these factors cause only a small variation in income per capita. Secondly, poor countries do not have a higher rate of return on capital. According to the Solow theory, high marginal product of capital in the poorer countries should be accompanied by a higher rate of return on capital in poor countries than in rich countries. This is because the higher marginal product of capital will cause massive flows of capital from rich countries to poor countries which increase the rate of return. The fact is this phenomenon does not occur in the real world. The poor countries retain the same low rates of return on capital without massive flows of capital from rich countries.

3.4 Endogenous Growth Theory

The Solow growth model states that sustainable growth must come from technological change but does not make assumptions on where the technological change comes from. The Solow residual is usually attributed to technological progress, but the concept is not complete without clarify on how the technological progress occurs. Hence since the late 1980s, studies have attempted to explore technological change in detail.

Endogenous growth theory rejected Solow's model assumption of exogenous technological change. In 1990, Paul Romer introduced this model in an attempt to explain technological change as the outcome of market activity in response to economic incentives rather than accept that technological change occurs exogenously without explanation. This model was based on three premises. Firstly, technological change is defined as 'improvement in the instructions for mixing together raw materials' and is the

main reason for growth. Second, technological progress is due to the effort of society who wants to maximize its profits. All motivation for research comes from the profit incentive. Third, technologies as instructions for mixing inputs are different from economic goods because fixed cost occurs in developing new technology. Yet where the technologies is available for use, no further is cost associated with its use. The production function of this model is as below:

$$\dot{A} = \delta H_A A \tag{3.6}$$

A denotes the existing store of knowledge which is accessible by everyone and used in the production of further knowledge $\dot{A}$ with the help of human capital H_A employed in the knowledge industry. Production function for output is as below.

$$Y = (H_Y A)^{\alpha}(LA)^{\beta}(K)^{1-\alpha-\beta} \tag{3.7}$$

Where Y is output, K is capital, L is labor and H_Y is the human capital that used in the production of goods. When the endogenous growth model is used broadly, it boosts the development of better production techniques and high quality of goods especially in automobiles. However, these ideas cannot work without educated human capital.

3.5 Human Capital in Growth Model

Gordon (2012) mentioned that human capital refers to the value of an individual's lifetime of extra earnings made possible through education. In other words, human capital is the value of education. Romer (1986) and Lucas (1990) endogenous growth model already highlights the importance of human resource development and states that education can be used as an alternative to the accumulation of technological knowledge. According to Romer (1986) the production function can be written as such:

$$Y = A (K, L, H) \quad (3.8)$$

where autonomous growth factor (A) is expressed as an index and multiplied by a function of an index of capital (K), labor (L) and human capital (H).

Based on theory, it is believed that education in primary, secondary and tertiary levels contributes to economic growth through various alternatives such as by improving health, reducing the fertility rate and contribute to policy stability. However, the main role of education is to produce a literate, highly skilled, knowledgeable and high quality of labor force in the labor market.

3.6 Conclusion

Above is the evolution process of growth theory. Initially, the focus was on the importance of capital and labor to output. Subsequently, Solow proposed that technological progress is another important factor to productivity. However, Solow did not address how technological progress emanates and additionally, in Solow's model, a technological change is an exogenous variable. Afterwards, Lucas and Romer suggested that human capital is another important factor that can lead to sustainable growth in output because capital and labor are diminishing in returns in terms of output. In addition, they claimed that technological changes should be treated as an endogenous variable in the model of production. This is called the new growth theory and is widely used in recent empirical studies. This model been improved by introducing education and health as the main factors which drive human capital accumulation. This paper uses the latest model, which is endogenous growth theory, to investigate the impact of education on economic growth.

CHAPTER 4

LITERATURE REVIEW

4.1 Introduction

This chapter discusses empirical studies by researchers and academicians and is divided into 4 parts. First are the indicators for education, second are study cases in Malaysia. Third are cross-country case studies which determine the relationship between education and economic growth for many countries over the same period and lastly are individual country case studies. This is challenging in the collection of complete data for all countries over the same period. Mostly the researchers use the data that collected in the previous study. Third are studies focused on one country, which include Korea, Nigeria, India, Taiwan, Pakistan, China and Central American countries.

4.2 Indicators for Education

Several efforts have been made by parties to improve the quality of schooling at all levels. Hence there is a choice of indicators for education between the quality and quality aspects.

According to Vos (1996), there are 4 types of indicators, namely input indicators, access indicators, output indicators and outcome indicators. There are arguments in how to choose the most appropriate indicator to measure education. However, this should depend on the aspect of education which the author wants to examine. The link between these indicators is that input can lead to a response in ‘access’ and that access will bring

impact in ‘output’ in education which contributes to development in society, health, productivity.

Input indicators relate to the human resources and capital resources to operating and develop the education sector. This includes the numbers of teachers, lecturers, numbers of school buildings, public and private expenditure in education and teaching material supplies. Also, some researchers prefer to use the ratio of teachers to students or the average cost per student.

Next is the access indicator. This type of indicator measures the accessibility of student in learning. Generally, people measure the geographical distance to obtain the source of education such as the distance of home to school. In addition, the family background of the student also is an important access indicator. The necessary expenditure such as costs of uniform, textbooks and school fees is related to the ability to pay. Poor families are willing to stop their schooling due to financial constraints. However, this type of indicator is rarely use by researchers as a proxy of education.

Output and outcome indicators are commonly used to measure the impact of certain government policies. Output and outcome indicators are almost the same, but have a minor difference which depends on the objectives. Output focuses on examining to what extent the immediate objective of educational policies are achieved. Output indicators include school enrolment rate for primary, secondary and tertiary level, achievement tests, and years of schooling. Outcome indicators examine beyond the immediate objective. They focus on the development of education, lowering inequality in society, increasing labor productivity, reducing poverty and increasing the health status

through education. The outcome indicators are productivity and income of graduates of higher and tertiary levels.

From the literature review, there are various types of indicators for their researches. Adawo (2011) and Afzal et al. (2010), Shahaini et al. (2011) used school enrolments at primary, secondary and tertiary levels as the indicator for education. Leoning (2004), Bassanini and Scarpetta (2001), Lin (2004), Rada and Taylor (2006) used average years of schooling for the population range from age 24 to 64 years of age. However, the most popular indicator in empirical studies is public investment or expenditure in the education sector. Babatunde (2005), Baldacci et al. (2008), Jung and Thorbecke (2001), Kakar, Khilji and Khan (2011), Hussin et al. (2012), Sikiru (2011), Tamang (2011) used public expenditure on education as the proxy for human capital. In addition, Barro (2013) measured the quantity of education by years of attainment at primary, secondary and tertiary levels while to measure quality, he used international examinations scores. In examining the importance of education, Jajri and Ismail (2010) used labor of various levels of education as the proxy for productivity of labor to estimate the return on education.

4.3 Empirical Studies in Malaysia

Empirical study into the relationship between education and economic growth is relatively new in Malaysia. Hussin et al. (2012) proved that human capital as represented by education plays an important roles in the progress of economic growth in Malaysia. Their study investigates the long run relationship between education and economic growth and determines the causality of these two variables. The findings show that not

only education effects economic growth; economic growth itself does influence education in the short run. This implies the existence of a bilateral causality relationship. The higher the standard of education system, the greater the efficiency of the labour force. This paper suggests that government should invest more in education to raise the productivity of human capital.

Rahmah and Doris (1999) used a simultaneous equation model which is the three stage least squares (3SLS) to study the relationship between economic growth and human capital for 27 years from 1970 to 1996. By human capital, they refer to education and health. They insert expenditure on vocational and technical education, tertiary education and research and development (R&D) as explanatory variables in the output growth equation. The result shows that a 1 per cent increase in expenditure on vocational and technical education will increase output by 2.605 per cent while a 1 per cent increase in expenditure on tertiary education also increases output by 2.365 per cent. This proves that there are strong relationships between education and economic growth, in that expenditure on vocational and technical as well as tertiary education have positive impact on economic growth.

Contrary to the previous research, Jajri and Ismail (2010) found out that human capital does not directly determine economic growth because physical capital is still dominant and plays an important role. The education system in Malaysia does not reach the standard that produces effective human capital that can be used in the labour market. This indicates that although the total number of university graduates has increased over the years, this group of people does not meet the criteria of market demand. This study investigates to what extent the expansion on education brings benefits to the Malaysia

economy within the period 1981 to 2007 by using the Cobb-Douglas production function and endogenous growth model. They built production and productivity function by using quality of labour and capital stock as independent variables. The result obtained shows that effective labour haw a positive relationship with economic growth but its contribution is less than that of physical labour.

In addition, Shaihani et al. (2011) proved that investment in tertiary education produces return in the economy in the long run period. Autoregressive distributed lag model (ARDL) was used to study the impact of education on economic growth in Malaysia for the short run and long run using the data from the period 1978 to 2007. The result is not consistent for all levels of education. Primary education is in the age range of 6 to 11, secondary education age 12 to 17 and tertiary education age 18 24. Control variables such as trade openness and foreign direct investment were added to the model of this study. The results show that in short run, a 1 per cent increase in primary and tertiary education will reduce economic growth by about 8.72 and 10.93 per cent respectively. In other words, primary and tertiary education is negatively significant on economic growth but for secondary education, there is positive significance on economic growth by which a 1 per cent increase in secondary education will increase economic growth by 3.56 per cent. On the other hand, in the long run, a 1 per cent increase in tertiary education will causes economic growth by about 0.95 per cent. This proved that tertiary education has positive relationship with economic growth and it is significantly important to explain economic growth in the long run.

4.4 Empirical Studies for Cross Country

Furthermore, there are some cross country studies on the impact of education on economic growth. However, the problem that researchers face in cross-country studies is a lack complete data especially in developing countries. The law of diminishing returns in education states that developed countries have a tendency to have impact of education on economic growth compared to developing countries. Barro (2013) used panel data to examine the impact of education toward economic growth for 100 countries over the period 1960 to 1995. The main finding shows that years of school attainment of females at secondary and tertiary level does not bring impact to the growth. Barro explains that in most countries, the labour market does not utilize the capability of females. Barro also measured the quality of education against growth and showed that it is positively related to subsequent growth.

Lee (2010) used data from previous studies which are Heston, Summers and Aten (2006), Barro and Lee (2000) to study 75 countries over the period 1960 to 2000. The countries were divided into categories by continents in this study. Hence, to study for the presence of different continent-based contributions of initial schooling to economic growth, each of these four continental dummy variables was allowed to interact with initial schooling as continental slope dummy variables. The results showed that the effect of initial schooling on per capita growth rate or per worker growth rate is lower for advanced countries which are Latin America and the Caribbean and Sub-Saharan Africa but the additional year of initial school on growth rate is high for countries in East Asia and the Pacific, Middle East and North Africa, and South Asia. From this finding, it can be concluded that additional initial year of schooling is important for Malaysia, such a

developing country in East Asia because the responsiveness of growth to additional year of schooling is huge.

Baldacci et al. (2008) investigated the linkages between human capital, social spending and growth for 118 developing countries for the period 1971 to 2000 using panel data. The base model that they implemented is fixed-effect model while 2SLS and General Method of Moments were used to further correct the endogeneity problem. The findings showed that expenditure in education has both immediate and lagged effect on education capital. In other word, education spending has a significant and direct effect on the accumulation of education capital and indirect effect on economic growth. From the time span aspect, two-thirds of the direct impact of spending in education is felt within five years while full impact can be felt after 10-15 years of spending. This indicates that it takes time to benefit from the total impact of investment in education.

Bassanini and Scarpetta (2001) estimated the human capital augmented growth equation for 121 countries of OECD for the period 1971 to 1978 based on the neoclassical growth model and the method they used is called the Polled Mean Group (PMG) estimator. The proxy for human capital is average number of years of formal education. The results pointed to a positive and significant impact of human capital accumulation to the output per capital growth. However, the empirical results do not support the human capital augmented version of Solow's model. On the other hand, it was found that the result supported the endogenous growth model by Uzawa Lucas with constant scale of return to human and physical capital.

Contrary to the above studies, there are some studies which showed negative or insignificant relationship between the education and growth variables. Rada and Taylor (2006) studied the factors that stimulate growth rates of per capita GDP in the late 20th century. They measured the relationship between education and economic growth by the average schooling years and GDP growth per capita. The findings showed that education is indeed necessary in East Asian but is not sufficient to ensure growth in the long run.

Besides that, Sacerdoti, Brunschwig and Tang (1998) found that the relationship between human capital and economic growth is not significant. They did a survey of nine countries in West Africa using the growth-accounting method and critiqued that those empirical studies which used school enrolment ratio as human capital accumulation and that show positive relationship with growth are not accurate because school enrolment is poorly correlated with human capital accumulation. Two series were built for countries in West Africa. The first one was derived from methodology developed by Nehru, Swanson and Dubey (1995) by using the average years of schooling in the working population. The second used the Denison (1967) methodology of wage-weighted measure of relative labour productivity resulting from education, or in other words converted the indicator of human capital into an index of labour productivity. The indicator of human capital is schooling and excludes health. The results showed that investment in human capital accumulation is not significantly related to growth.

Furthermore, Knowles and Owen (1997) used education and health as variables in an aggregate production function for cross countries study but education and health were treated as labour-augmenting factors in their model. They used the extension of Solow-Swan neoclassical approach and aggregate cross country data for 77 countries and

subsample of 55 less developed countries after excluding 22 high income developed countries. Surprisingly, the relationship between output per worker and education was not significant.

4.5 Empirical Studies in Individual Countries

In Korea, Kwack and Lee (2006) examined the determinants of long run growth for the period 1971 to 2002 using neoclassical growth theory. They found out that education represented by years of schooling had a direct impact on economic growth in Korea. Similarly, Lee (2000) claimed that human capital was an important determinant key to the fast growing economy of South Korea. He used the enrolment rates at primary, secondary and tertiary level as the proxy for education and the results showed positive significant relationship between education and economic growth. However, when examine the quality of education to economic growth by using student-teacher ratio and government expenditure in education, the results showed negative significant relationship with economic growth.

In India, Sushil and Girijasankar (2010) and Tamang (2011) consistently proved that education expenditure and economic growth have positive long run relationship. Sushil and Girijasankar (2010) investigated the effect of human capital towards economic growth in India for the period 1960 to 2006 by using endogenous growth model as the basic of the production function. The proxy for human capital was education expenditure and enrolment. Empirical findings showed that investment in education has a significant positive long run impact on per capita GNP growth. They also found that year eight enrolments have positive and significant effect on GNP growth after three years. Indeed

there is a long run relationship between education and growth in India. Self and Graboswski (2003) found that female representation at all levels of education has more potential to contribute to economic growth compared to male. The result showed that female education has causal impact on growth which male education does not have. As a result, the empirical evidence showed that primary education has a strong causal impact on growth but more limited evidence of such an impact for secondary education.

In contrast, the empirical studies in Nigeria have shown inconsistency in results. Babatunde and Adefabi (2005) found a significant long run relationship between education and economic growth. This was examined through two channels. The first was human capital as the direct input in the production function while the second was indirect input where human capital influenced technology parameters. This was followed by Adawo (2011) who examined the contribution of primary, secondary and tertiary education to economic growth in Nigeria. The variables he used for education were school enrolment and economic growth represented by real GDP, while physical capital formation, expenditure in health were added as variables to the model. The results showed that primary education has consistently contributed to economic growth. However, in the long run, secondary and tertiary education does not bring positive impact to economic growth. Adawo said this result may be due to the failure of Nigeria government policy and the poor quality of secondary and tertiary education. He thus emphasized that government should improve primary education in both quality and quantity. Babalola (2011) also investigated the long run relationship of education and economic growth and produced findings which contradicted with the previous studies. He

found the existence of unidirectional causality whereby economic growth causes the development of education but education does not affect economic growth in the long run.

Yang (2004) did a study on the contribution of schooling to rural area in China using panel data for period 1986 to 1995. The data consisted of two panels, one for 1986 to 1989 and another for 1991 to 1995. The Chinese government implemented policies to encourage farmers' involvement in nonfarm activities to increase their income. The main objective was to investigate farmers' responses to factor market liberalization through how they expanded nonfarm production and how their education had effects in their making decisions to facilitate resource allocation. The results showed that education promoted productivity in the agricultural sector thus contributing to economic growth. This is because educated farmers could easily adapt to the changing market and new or imported technology and explore opportunities to maximize their income. Education enhanced the ability of rural people to allocate limited resource and maximize profits from it. Wang and Yao (2001) studied the source of economic growth in China by incorporating human capital accumulation. By using growth accounting analysis, they measured the human capital stock from 1952 to 1999. The period of study was divided into two periods, the pre-reform period 1953 to1977 and the period of reforms from 1978 to 1999. The rate of growth of human capital declined in the reform period, and it is indicated that its contribution to economic growth was smaller compared to in the pre-reform period. Additionally, the growth of total factor productivity had a positive and significant role during the reform period of 1978 to 1999 after incorporating human capital but presented negative productivity growth during the pre-reform period 1952-1977. From these studies, it can be concluded that rapid growth in human capital

accumulation through education did bring significant impact to economic growth in China.

In addition, Liu and Armer (1993) studied the relationship between economic growth and education system in Taiwan. They used the Cobb-Douglas production function and time series data from 1953 to 1985 to study the impact of expansion of education on Taiwan's economic growth. Economic output was measured by gross domestic product at 1981 constant prices, capital input defined as real net capital stock, labour input measured by total hours of labour invested annually in productive activity and educational variables measured by educational stock which indicated number of people who attained different education levels. Their findings showed that only primary and junior high education had strong and positive effect on economic growth. However, senior high and tertiary education in Taiwan had no significant effect on economic growth. 11 years later, Lin (2004) provided a different angle for discussion. He investigated the roles of curricular structure to the economic development in different industries. The results revealed that higher education had a positive and significant effect on economic development in Taiwan over the period 1965 to 2000. In addition, the courses that brought most significant effect to economic growth were engineering and natural science. This finding contradicted with Liu and Armer's (1993) findings that stated only primary and junior high education influenced the economy's growth.

Afzal et al. (2010) investigated the relationship between education and economic growth in Pakistan for the short run and long run period using the Autoregressive Distributive Lag (ARDL) approach to cointegration developed by Pesarsan et al. (2001). The net school enrolment ratio is the measurement for education. The finding proved the

existence of a direct relationship between education and economic growth in both the short run and long run. Another study done by Kakar, Khilji and Khan (2011) also examined the long run relationship between education and economic growth in Pakistan over the period 1980 to 2009 using VECM model, but used a different indicator which was government expenditure on education. The results were similar to Afzal et al. (2010) in confirming that education has a long run relationship with economic growth but no significant relationship in the short run. It is hence believed that a quality system of education does improve efficiency in the labour force and increase productivity to contribute to economic growth in Pakistan.

Leoning (2004) investigated the impact of education on economic growth in Guatemala in Central America for the period 1951 to 2002 using the same method as Kakar, Khilji and Khan (2011), the VECM model. As expected, the results show that human capital plays an important role as it explains about 50% of the output growth. Additionally, a 1% increase in point of average years schooling increases output by 0.33%. Human capital has significantly positive impact on long run growth. Investment in education does leads to the formation of skilled human capital and thus this group of people significantly contribute to the economic growth of the country. Sharif, Ahmed and Abdullah (2013) investigated the effect of human resource development on economic growth in Bangladesh. Public spending on education is this country is approximately 14 to 15%, which is much more lower than in Malaysia and Hong Kong. The finding showed that investment in education has positive relationship and stimulates economic growth. There exists a long run relationship between these two variables.

4.6 Conclusion

Numerous empirical studies have been done to test the endogenous economy growth theory which claims that education as a source of human capital does influence economic growth through output. Even though the objective to investigate is similar, various indicators were used as a proxy for education and the methods adopted also differed between studies. Generally, the sample of countries, model specifications, indicators and methodologies differed in every study. This may account for the inconsistency of results. In this paper, the theory used is endogenous growth model, indicator for education are government operating and development expenditure. There are three possibilities of findings. The first is positive a relationship and a significant impact on economic growth. The second is no relationship between the variables and the third is an indeterminate relationship.

Chapter 5

Methodology

5.1 Introduction

This section discusses the sources of data and provides a description of all dependent and independent variables, the model specification and process to get the econometric model, and lastly an explanation of all tests that will be conduct in the next chapter which include the unit root test, cointegration test and causality test.

5.2 Source of Data

The model specification of this study is estimated by using annual time series data started from year 1970 to 2010. Data for all five variables are obtained from various sources. Gross domestic product, fixed capital formation and federal government operating and development expenditure are obtained in nominal form. Data sources for five variables are shown in the Table 5.1.

Table 5.1 Data Sources

Variable	Unit	Sources
Gross Domestic Product	Ringgit Malaysia	Department of Statistic (http://www.statistics.gov.my/portal)
Fixed Capital Formation	US Dollar	World Bank (http://data.worldbank.org)
Total Employment	People	Malaysia Economic Report Series 1974/1975- 2011/2012
Federal Government Operating Expenditure	Ringgit Malaysia	Malaysia Economic Report Series 1974/1975- 2011/2012
Federal Government Development Expenditure	Ringgit Malaysia	Malaysia Economic Report Series 1974/1975- 2011/2012

5.3 Description of Variables

According to the production function, *Y* refers to output. The proxy for output is gross domestic product for Malaysia, which is the total market value of final goods and services produced in Malaysia in a year. Next, *K* refers to capital stock. The proxy for capital stock is fixed capital formation. As defined by the World Bank, gross fixed capital formation, formerly gross domestic fixed investment includes land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings.

L denotes the labor force. Due to incomplete data on the labor force participation rate from period 1970 to 2010, the proxy for the labor force is total employment. Employment is the number of people currently employed in the market. The most important variable is *H* which denotes to human capital. According to theory, it is divided into the two aspects of education and health. However, this study selects education to estimate the impact to economic growth. The proxy for education is divided into federal government operating expenditure in education and federal government development expenditure in education. Operating expenditure refers to the government expenses in paying salaries for teachers, lecturers and administrative in the public education sector while development expenditure includes the building of schools, renovation, new equipment and so on.

5.4 Model Specification

In this study, following case studies by Babatunde (2005), Bassanini and Scarpetta (2001), Loening (2002), Hussin et al. (2012), Tamang (2011), the Cobb Douglas production function with constant return to scale is used as the basic of the model. The production function is written as:

$$Y = A.K^{\propto}L^{\beta}H^{\gamma} \quad (5.1)$$

Y = output

A = technological progress

K = capital stock

L = labor force

H = human capital

By referring to Sikiru (2011), the model has one independent variable to study the effect of education towards economic growth. The equation is as below:

$$GDP = f(EDU) \quad (5.2)$$

Next, this model is developed by adding more variables such as capital stock and labor force. Although the main purpose is to investigate the relationship between education and economic growth, these two variables are important according to the production function theory. By followed the Hussin et al. (2012) model, a new econometric model is built as below:

$$Y_t = A\ CAP_t^{\alpha}\ LAB_t^{\beta}\ EDU_t^{\gamma} \quad (5.3)$$

Y = Gross Domestic Product

A = Technological changes

CAP = Fixed Capital Formation

LAB = Total Employment

EDU = Government Expenditure on Education

In this study, investment in education which is government expenditure on education is divided into operating and development expenditure. Hence the model above is modified to include two independent variables for education.

$$Y_t = A\ CAP_t^{\beta_1}\ LAB_t^{\beta_2}\ OPE_t^{\beta_3}\ DEV_t^{\beta_4} \quad (5.4)$$

Y = Gross Domestic Product

A = Technological changes

CAP = Fixed Capital Formation

LAB = Total Employment

OPE = Federal Government Operating Expenditure

DEV = Federal Government Development Expenditure

The econometric model in Equation (5.4) is a nonlinear model. Parameters such as A, β^1, β^2, $\beta^3$and β^4 are not able to be directly estimated. To solve this problem, the model in

Equation (5.4) will be changed to the log linear model by logging all the exogenous and endogenous variables. Thus, the econometric model will be:

$$LnGDP_t = lnA + \beta_1 lnCAP_t + \beta_2 lnLAB_t + \beta_3 lnOPE_t + \beta_4 lnDEV_t + \varepsilon_t \quad (5.5)$$

5.5 Augmented Dickey Fuller Test

The time series data was used in this study to find out the relationship between expenditure in education and economic growth. Prior to time series econometric analysis, it is necessary to investigate the stationarity properties of the variables. In all empirical studies, it is a must to start the analysis with unit root hypothesis because statistical properties of time series variables are different depending on order of integration. If the variables does not contain unit root, it indicates that the stationary series fluctuates around a constant long run mean and this implies that the series of variables have a finite variance which does not depend on time. On the other hand, if the series has unit root, this indicates that it is non-stationary. The series has no tendency to return to a long run deterministic path and the series of variables have finite variances that depend on time.

To avoid spurious regression, it is necessary to determine whether time series for all variables are stationary or not before proceeding to regression analysis. Clive Granger and Paul Newbold (1974) contributed to the econometric field by identifying the phenomenon of spurious regression when working with integrating variables. If the time series have unit root, it can induce spurious correlation among time series. Hence if regression proceeds with non-stationary time series, the t-statistics are not reliable and the result may be spurious whereby it shows significant relationship while in fact there is none.

Dickey and Fuller (1979) tabulated critical values for τ (tau) statistics under the null hypothesis of the existence of a unit root in the process of generating time series and used the basis of Monte Carlo simulations. Afterwards, MacKinnon (1991) extended the critical values by using the same method which is Monte Carlo simulations. The Dickey Fuller test can be divided into 3 conditions. First, no constant and no trend. Second, with constant but no trend. Third, with constant and with trend. The equations for 3 conditions are described as below.

$$Y_t = \rho Y_{t-1} + \varepsilon_t \quad \text{(Without constant and trend)} \quad (5.6)$$

$$Y_t = \alpha + \rho Y_{t-1} + \varepsilon_t \quad \text{(With constant but no trend)} \quad (5.7)$$

$$Y_t = \alpha + \rho Y_{t-1} + \beta T + \varepsilon_t \quad \text{(With constant and trend)} \quad (5.8)$$

Where:

Y_t = relevant time series

α = constant/ intercept

T = time trend

ε_t = error term

Next, both sides of the Equations (5.6), (5.7) and (5.8) will subtract Y_{t-1} and new equations are obtained as below:

$$\Delta Y_t = \delta Y_{t-1} + \varepsilon_t \quad \text{(Without constant and trend)} \quad (5.9)$$

$$\Delta Y_t = \alpha + \delta Y_{t-1} + \varepsilon_t \quad \text{(With constant but no trend)} \quad (5.10)$$

$$\Delta Y_t = \alpha + \delta Y_{t-1} + \beta T + \varepsilon_T \quad \text{(With constant and trend)} \tag{5.11}$$

Where:

$\Delta Y_t = Y_t - Y_{t-1}$

$\delta = \rho - 1$

The null and alternative hypothesis are:

$H_0: \delta = 0$ (has unit root and non-stationary)

$H_1: \delta \neq 0$ (do not has unit root and stationary)

The Augmented Dickey Fuller (ADF) test is the extension of the Dickey Fuller test by augmenting the equations in DF test with extra lagged differenced terms. The purpose of doing this is to eliminate possible autocorrelation from the disturbances. If under the DF test the disturbance terms are autocorrelated, then the result is not valid. Akaike's information criterion (AIC) and Schwartz criterion (SC) can be used in order to decide how many extra terms are needed to be included in the equations. The ADF test is to check the order of integration for each variable in the model. The order of integration is written as *I*(*d*) and indicates the d times for time series to be differenced before attaining stationarity. If the variable is stationary at first differenced, then it is integrated in first order. Similarly, if the variable is stationary at second difference, then it is integrated in second order.

Generally, time series is non-stationary at level but turn into stationary after first differenced. The ADF test is one of the important and popular tests for stationarity and it

will be used in this study to check for stationarity. The test is based on random walk and the fact that random walk has a unit root. Hence if the variables follow a random walk, they are not stationary because a random walk has unit root. The equation for ADF unit root test is as below.

$$\Delta Y_t = \alpha + \beta T + \delta Y_{t-1} + \gamma_i \Delta Y_{t-1} + \varepsilon_t \quad (5.12)$$

The error term ε_t in the ADF test usually has autocorrelation. Thus it is necessary to remove it to get precise results. The only way to remove autocorrelation is by adding lagged dependent variables until the autocorrelation has been mopped up.

5.6 Ordinary Least Squares (OLS)

The model in this study is a multivariate regression model which is more than one independent variable inside the model. In this paper, the model contain of 4 independent variables. The model can be written in econometric form as Equation (5.13).

$$GDP_t = \beta_0 + \beta_1 CAP_t + \beta_2 LAB_t + \beta_3 OPE_t + \beta_4 DEV_t + \varepsilon_t \quad (5.13)$$

The main purpose of OLS is to get the coefficient β. This coefficient measures the impact on dependent variable when there is one percent increase in independent variable by holding other independent variables are constant. While the coefficient β_0 is the value of dependent variable when all independent variables and error term are equal to zero. Multivariate regression coefficient indicates the changes in dependent variable when one unit or one percent increase in independent variable with the assumption that holding other independent variables are constant in the model. From this test, it can be shown that

which independent variables are significant to the dependent variable and brings the most influence to the dependent variable.

5.7 Johansen Cointegration Test

If the ADF test gives a non-stationary result for the time series variables, then first difference usually is proceeded to convert non-stationary series into stationary. However, the shortcoming of this alternative is that it might throw away information that economic theory can provide in the form of equilibrium relationships between the variables when they are expressed in their original units such as X_t and Y_t. Therefore, first difference should not be used until the residuals have been tested for cointegration.

Cointegration test can be applied if all variables in the model are integrated at the same order. The purpose of performing this test is to check whether a set of variables have a long run equilibrium relationship. The definition of cointegration is X_t and Y_t share similar stochastic trend. Since the difference e_t is stationary, X_t and Y_t will never diverge by too much. Thus even though the time series of variables are not stationary at level, there is a possibility for linear combinations of these non-stationary variables to be stationary, a phenomenon known as cointegration. If the series of variables are cointegrated, spurious regressions can be avoided even though the variables are non-stationary at level. It can be shown in Equation (5.14) and (5.15).

$$Y_t = \alpha_0 + \beta_0 X_t + \mu_t \tag{5.14}$$

$$\mu_t = Y_t - \alpha_0 - \beta_0 X_t \tag{5.15}$$

In Equation (5.14), X_t and Y_t are not stationary. We rearrange the Equation (5.14) to become (5.15). Now, μ_t is a function of two non-stationary variables. Since economic theories support Equation (5.14) as equilibrium, then departures from that equilibrium should not be arbitrarily large. So, assuming that X_t and Y_t are related, then residual μ_t will be stationary although X_t and Y_t are non-stationary. Since residual is stationary, then there is no more unit root in the X_t and Y_t and are said to be cointegrated.

In this study, Johansen's cointegration approach is adopted to estimate the long run equilibrium among the variables. Johansen developed a maximum likelihood estimation to test the existence of the cointegration vector which allows for more than one cointegrating relationship among variables. Johansen's model (1988) can be written as:

$$X_t = A + \sum \prod_i X_{t-1} + \varepsilon_t \tag{5.15}$$

Where X_t is a (n x 1) vector of non-stationary variables, A is (n x 1) vector of intercept, Π is a (n x n) matrix of coefficient, ε_t is a (n x 1) vector of error terms and *i* is the lag order.

By using the eigenvalue, Johansen and Juselius (1990) proved that null hypothesis for existence of a number of cointegrating vectors can be tested by using the Trace statistic test and Max-eigenvalue test. The equation for these two tests can be written as:

$$\lambda_{trace}(r) = -\mathrm{T} \sum_{i=r+1}^{n} \ln (1 - \bar{\lambda}_i) \tag{5.16}$$

$$\lambda_{max}(r, r+1) = -\mathrm{T} \ln (1 - \bar{\lambda}_{r+1}) \tag{5.17}$$

Where $\bar{\lambda}_i$ is the eigenvalue obtained from matrix Π. The Trace test will examine the null hypothesis that states the number of cointegrating vectors is equal or more than r + 1. On

the other hand, the Max-eigenvalue test will examine the null hypothesis which states that there are at least r cointegrationg vectors while the alternative hypothesis is the number of cointegrating vectors is equal to r + 1.

The statistic value from the Trace test and Max-eigenvalue test will be compared with the critical value. If the statistic value is larger than the critical value, null hypothesis will be rejected. On the other hand, if the critical value is larger than the statistic value, the null hupothesis will not rejected.

5.8 Granger Causality Test

This test is to determine the direction of the causality relationship between all the variables in the model. There are two types of relationship under this test. The first is unidirectional causality where X_t Granger causes $Y_t$but Y_t not Granger causes X_t. Second is the bilateral causality where X_t does causes $Y_t$and at the same time Y_t also does causes X_t.

According to Granger (1969), dependent variable Y_t is said to be Granger causes for explanatory variables X_t if the changes in variable Y_t induces the change in variable X_t. Coefficient λ GDP will estimate long run effect of CAP, LAB, OPE and DEV on GDP which is to determine whether explanatory variables have effects on dependent variable. On the other hand, coefficient λ CAP, LAB, OPE and DEV will estimates the long run effect of GDP on explanatory variables. Null hypothesis and alternative hypothesis are written as below.

$H_0 : \lambda$ GDP = 0

$H_1 : \lambda$ GDP $\neq$ 0

H_0 : λ CAP, LAB, OPE, DEV = 0

H_1 : λ CAP, LAB, OPE, DEV $\neq$ 0

If the null hypothesis H_0 : λ GDP = 0 has been rejected, this implies that CAP, LAB, OPE, DEV does Granger causes for GDP in the long run. If null hypothesis H_0 : λ CAP, LAB, OPE, DEV = 0 been rejected, this indicates that GDP Granger causes for CAP, LAB, OPE, DEV in the long run. Causality test is very important because it allow us to determine which variables will lead the other variables. Therefore, it is useful for policy maker to invent new policy for a country.

5.9 Conclusion

The data used in this study, for the period 1970 to 2010 are obtained from various sources. In order to start the analysis, it is necessary to check for the stationarity for all variables. Generally time series variables will be stationary at first difference which is integrated in first order. Next cointegration test will be carried out if times series for all five variables are integrated at the same order. If the cointegration test shows that the series are cointegrated, this indicates that all the variables are moving closely and converge in the long run. Ordinary least squares are to estimate which independent variables will influence gross domestic product. Finally, the Granger causality test is conducted to determine the causality relationship among the variables

CHAPTER 6

RESULTS AND ANALYSIS

6.1 Introduction

This chapter presents the results of the regression after conducting the unit root test, cointegration test, ordinary least squares (OLS) test and Granger Causality test. The model in this study is the log linear model.

The data obtained is nominal GDP, current fixed capital formation, current operating and development expenditure in education. All data is in nominal form except for total employment whose unit is in number of people. Hence in order to obtain real GDP, real fixed capital formation and real government expenditure, all amounts are divided by the GDP deflator. The base year chosen by the World Bank for GDP deflator is 2000. This year is a suitable choice for the GDP deflator because of the stable state of the economy at the time without crisis.

With reference to Equation (5.5) in the previous chapter, the econometric model of this study uses the log linear form. Hence after division by the GDP deflator, GDP, fixed capital formation, operating and development expenditures, all variables are changed to log form, which makes them numerically smaller. This is followed by analysis in Eviews software.

6.2 Augmented Dickey Fuller Test (ADF)

As this study involves time series data, the unit root test must be carried out to avoid spurious regression. ADF test is carried out to check the order of integration of the

variables. Firstly, time series of the variables are tested with level-intercept. Next is level-trend and intercept. If the time series of the variable are found to be not stationary at level, testing is continued with first differences. Thus, proceed with first difference with intercept and first difference with trend and intercept. If the variables exists unit root, then it is claim to be not stationary.

The null hypothesis is $H_0: \beta_1 = 0$. If the test statistic is smaller than the critical value, the null hypothesis is not rejected. Hence the time series for that variable has unit root and is not stationary. On the other hand, if the test statistic is larger than critical value, then the null hypothesis is rejected. Hence the times series for that variable does not has unit root and it is stationary. The result of the unit test is presented in Table 4.1.

Table 6.1 Result of ADF test

Variable	Level		1st Difference	
	Intercept	Trend and Intercept	Intercept	Trend and Intercept
ln GDP	-1.9648 (0.3006)	-2.1114 (0.5239)	-5.8199*** (0.0000)	-6.2692*** (0.0000)
ln CAP	-1.9277 (0.3166)	-2.9331 (0.1637)	-4.0787*** (0.0029)	-4.1502** (0.0117)
ln LAB	-1.5740 (0.4863)	-2.2410 (0.4550)	-6.4485*** (0.0000)	-5.6602*** (0.0002)
ln DEV	-1.1279 (0.6950)	-3.3251* (0.0772)	-4.7179*** (0.0005)	-4.6388*** (0.0033)
ln OPE	-1.0166 (0.7375)	-2.3333 (0.4063)	-3.6050** (0.0106)	-3.5257* (0.0516)

Notes: *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level
Items in the bracket are p-value

According to the results of stationarity test in Table 6.1, it is found that time series for all variables are not stationary at level except ln DEV. After first difference, it is found that time series for all variables are stationary at first difference. For first difference with intercept, GDP, CAP, LAB and DEV are stationary and significant at 1% level (statistic > critical value) while OPE is significant at 5% level. When all the variables were regressed at first difference with trend and intercept, it was found that GDP, LAB and DEV are significant at 1% level, CAP at 5% level and OPE at 10% level. Number of lags is determined automatically by Akaike's information criteria (AIC). Given these results, all the five variables are stationary at first difference and fulfill the requirement to proceed to the cointegration test.

6.3 Ordinary Least Squares (OLS)

Table 6.2 Result of OLS

Variable	Coefficient	Standard Error	t-Statistic	Probability
CAP	0.129200	0.024001	5.383176	0.0000
LAB	2.029659	0.225877	8.985688	0.0000
DEV	0.075721	0.023587	3.210228	0.0028
OPE	0.160353	0.081186	1.975122	0.0560
C	-14.54542	1.957860	-7.429243	0.0000

To answer the first objective, which is to investigate the type of expenditure with greater impact on gross domestic product, OLS test will be used. As shown in Table 6.2, all variables were found to be significant. This paper uses a log- linear model, hence all interpretation is conducted in percentage form. CAP is significant at the 1% level. When

capital fixed formation (CAP) increases by 1%, GDP will increase by 12.92%. Similarly, LAB is also significant at the 1% level. When total employment (LAB) increases by 1%, GDP will tend to increase by 202%. Next are the important variables that represent education in this study: operating and development expenditure. DEV is significant at the 1% level. When development expenditure in education (DEV) increases by 1%, GDP increases by 7.57%. OPE significant at the 5% level. When operating expenditure in education (OPE) increases by 1%, GDP will increases by 16.03% holding other variables constant. The equation can be written in the below form.

$$GDP = -14.54 + 0.1292\ CAP + 2.0296\ LAB + 0.0757\ DEV + 0.1603\ OPE$$

(t-statistic) (5.3831) (8.9856) (3.2102) (1.9751)

6.4 Johansen Cointegration Test

We proceed to the second objective of the study, which is to check for the existence of long run relationships in the model. Hence the Johansen test is utilized.

Table 6.3 Unrestricted Cointegration Rank Test (Trace)

No Cointegration	Eigenvalue	Trace Statistic	0.05 Critical Value	Probability**
r = 0 *	0.647558	83.31106	69.81889	0.0029
r ≤ 1	0.414405	43.68201	47.85613	0.1168
r ≤ 2	0.263658	23.34722	29.79707	0.2294
r ≤ 3	0.198624	11.71690	15.49471	0.1710

r ≤ 4 *	0.083245	3.302752	3.841466	0.0692

Trace test indicates 1 cointegrating equation at the 0.05 level

According to Table 6.3, for null hypothesis r = 0, the Trace test indicates the trace statistic value is bigger than the critical value (83.31106 > 69.81889). Thus the null hypothesis rejected. All five variables have cointegrating equation at the 5% significance level. For null hypothesis r ≤1, the trace statistic is smaller than the critical value (43.68201 < 47.85613). Thus the null hypothesis is not rejected and all variables do not have cointegrating equations at the 5% significance level. In conclusion, the Trace test shows that there is only 1 cointegrating equation at the level of 0.05 in the long run.

Table 6.4 Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

No Cointegration	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Probability**
r = 0 *	0.647558	39.62904	33.87687	0.0092
r ≤ 1	0.414405	20.33480	27.58434	0.3184
r ≤ 2	0.263658	11.63032	21.13162	0.5844
r ≤ 3	0.198624	8.414144	14.26460	0.3382
r ≤ 4	0.083245	3.302752	3.841466	0.0692

Max-eigenvalue test indicates 1 cointegration at the 0.05 level

Referring to Table 6.4, for null hypothesis r = 0, the trace statistic is larger than the critical value (39.62904 > 33.87687). Thus the null hypothesis is rejected. Hence all five variables have 1 cointegrating equation at the 5% significance level. On the other hand,

for null hypothesis r ≤1, the trace statistic is smaller than the critical value (20.33480 < 27.58434). Thus the null hypothesis is not rejected and all variables do not have cointegrating equation at the 5% significance level. In conclusion, the Max-eigenvalue test shows that there is 1 cointegrating equation at the level of 0.05 in the long run. Both the Trace and Maximum Eigenvalue tests show the same result that there is 1 cointegrating relationship in the long run for all given variables. This is the best result in Johansen test where just 1 cointegrating relationship in the long run.

6.5 Granger Causality Test

After carrying out the Johansen cointegration test and confirming the existence of 1 cointegrating relationship among variables, we proceed with the Granger causality test to answer the third objective which is to determine the direction of long run relationships of causality among the five variables in the model.

Table 6.5 Result for Granger Causality Test

Null Hypothesis	Obs	F-Statistic	Prob
CAP does not Granger Cause GDP	40	0.26590	0.6092
GDP does not Granger Cause CAP		1.77615	0.1908
LAB does not Granger Cause GDP	40	5.84476	0.0207
GDP does not Granger Cause LAB		0.05665	0.8132
DEV does not Granger Cause GDP	40	0.10929	0.7428
GDP does not Granger Cause DEV		9.17616	0.0045
OPE does not Granger Cause GDP	40	3.72004	0.0615
GDP does not Granger Cause OPE		6.71461	0.0136
LAB does not Granger Cause CAP	40	1.86764	0.1800

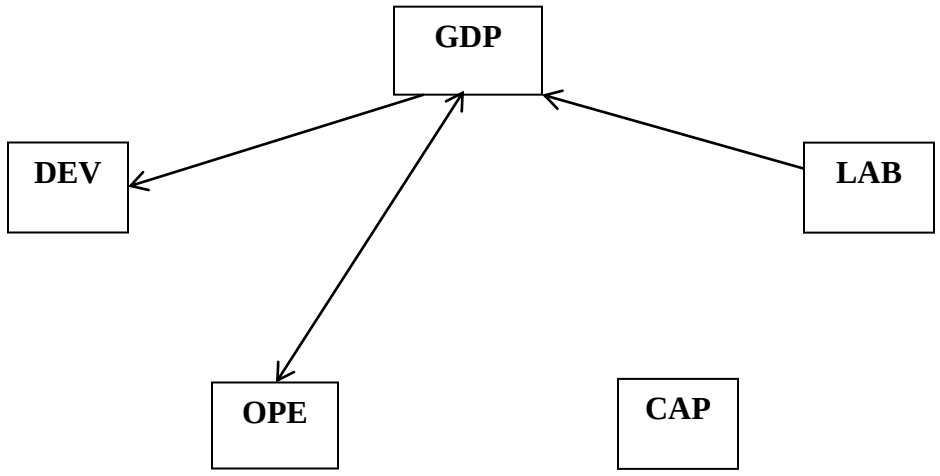
Null Hypothesis	Obs	F-Statistic	Prob
CAP does not Granger Cause LAB		0.03615	0.8503
DEV does not Granger Cause CAP	40	0.25833	0.6143
CAP does not Granger Cause DEV		1.28891	0.2636
OPE does not Granger Cause DEV	40	2.77376	0.1043
DEV does not Granger Cause OPE		0.68569	0.4129
DEV does not Granger Cause LAB	40	0.35678	0.5539
LAB does not Granger Cause DEV		6.87239	0.0126
OPE does not Granger Cause LAB	40	0.28635	0.5958
LAB does not Granger Cause OPE		10.5029	0.0025
OPE does not Granger Cause DEV	40	4.58869	0.0388
DEV does not Granger Cause OPE		0.19337	0.6627

According to Table 6.5, the null hypothesis that CAP does not Granger cause GDP is not rejected because the p-value is greater than 0.1 (0.6092 > 0.1). The null hypothesis that GDP does not Granger cause CAP is also not rejected because the p-value is greater than 0.1 (0.1908 > 0.1). This indicates that there is no causality relationship between fixed capital formation and gross domestic product in the long run.

The null hypothesis that LAB does not Granger Cause GDP is rejected because the p-value is smaller than 0.1 (0.0207 < 0.1). The null hypothesis that GDP does not Granger cause LAB is not rejected because the p-value is greater than 0.1 (0.8132 > 0.1). This indicates that total employment has impact on gross domestic product but gross domestic product does not cause total employment in the labour market. There exists a unidirectional causality relationship.

The null hypothesis that DEV does not Granger Cause GDP is not rejected because the p-value is bigger than 0.1 (0.7428 > 0.1). The null hypothesis that GDP does not Granger cause DEV is rejected because the p-value is smaller than 0.1 (0.0045 < 0.1). This indicates that development expenditure does not have impact on gross domestic product. However, gross domestic product will cause government development expenditure in education sector. There exists a unidirectional causality relationship.

The null hypothesis that OPE does not Granger cause GDP is rejected because the p-value is smaller than 0.1 (0.0615 < 0.1). Similarly, the null hypothesis that GDP does not Granger cause OPE is rejected because the p-value is smaller than 0.1 (0.0136 < 0.1). This indicates that government operating expenditure will cause gross domestic product and at the same time gross domestic product will influence operating expenditure. Thus a bilateral causality relationship exists between the two variables. The overall causality relationship is presented in the Figure 6.1.



Direction:

Unidirectional Causality **Bidirectional Causality**

Figure 6.1 Granger Causality Relationship

6.6 Conclusion

For ADF test, all variables are shown to be stationary at first difference. Next, the OLS test indicates that all variables have a significant impact on the gross domestic product. It is also shown that operating expenditure in education has greater impact on GDP compared to development expenditure. Afterwards, the Johansen test shows that there exists 1 cointegrating equation in the long run. Following Granger causality test shows that there is unidirectional causality between development expenditure and GDP while bilateral relationship for operating expenditure and GDP in the long run.

CHAPTER 7

SUMMARY AND IMPLICATIONS

7.1 Summary

The main purpose of this study is to investigate the relationship between education and economic growth. Annual time series data is used for the period 1970 to 2010. The indicators for education are government operating expenditure and government development expenditure in the education sector. Following the endogenous growth theory, a log linear model is built based on Cobb Douglas production function. In order to answer the three objectives in this study, ADF test to test unit root, OLS test to estimate how GDP changes when 1% increase in independent variables, Johansen cointegration test to investigate the existence of long run relationship in the model and Granger causality test to determine the direction of causality between all variables had been carried out.

The main finding is that operating expenditure has more impact on gross domestic product compared to development expenditure in education. Additionally, in the long run there exists unidirectional causality in that development expenditure is influenced by total of gross domestic product. However, operating expenditure influences gross domestic product in the long run and vice versa. The findings in this paper are consistent with previous empirical studies such as Rahmah and Doris (1999), Hussin et al. (2012) which proved that education and economic growth have a positively significant long run relationship.

7.2 Suggested Policies

From the regression results, it is known that operating expenditure has a more significant impact on economic growth in the long run compared to development expenditure, which is dependent on the gross domestic product. This indicates that if there is an increase in GDP, then allocation for development expenditure tends to increase as well. The findings suggest that the government should change budget allocations to spend more on operating expenditures rather than development aspects. By employing more teachers and lecturers, the ratio of teachers to students is decreased. Placing more attention on each student may increase efficiency of learning. Additionally, the teacher selection criteria should be changed to increase the quality of teachers.

Second are changes to teaching methods. In a globally competitive world, the young generation should be educated in new teaching method to increase their creativity, analytical ability, cognitive skill, communication skills, decision making and innovation. Traditional methods which focus on academics are not suitable for implementation. In addition, as mention in Chapter one, human capital is the combination of education and health. The government should provide further sporting facilities in schools and universities to encourage a healthy lifestyle among students and not focus only on academics. A knowledge based economy requires quality human capital to contribute to economic growth.

7.3 Limitations of the Study

The findings show that investment in education does have positive impact on economic growth. However, by using two types of government expenditures in education as indicators, this study has limitations in determining which levels between primary, secondary and tertiary levels have the most significant impact on economic growth. It is difficult to determine which levels give the highest return of investment in education.

7.4 Conclusion

In conclusion, the empirical tests generally show that education is important in enhancing the stock of human capital, but the impact on economic growth is still not consistent depending on which type of education indicator. The returns in terms of enhanced economic growth are widely appreciated by policy makers. In my point of view, the only way to sustain economic growth is by providing a good education system and distributing the educational resources equally across the country. To achieve sustainable growth, not only the quantity, but the quality of the education plays an important role in economic growth. Although increasing numbers such as enrolment rate and expenditure in education boosts the economic growth in the long run, it is not alone sufficient for sustainable growth. In a competitive world, individual cognitive skills, creativity and innovation have become the new prerequisites to contribute to the economic growth of a country.

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