MYTHS ABOUT EDUCATION AND ECONOMIC GROWTH IN MALAYSIA: A MEDIATION ANALYSIS

BY

CHEN WEN YEOW
HO CHAN YEAP
PHOON MEI CHAN
TAN CHUI FANG
TAN XIAO JUN

A research project submitted in partial fulfillment of the requirement for the degree of

BACHELOR OF ECONOMICS (HONS)
FINANCIAL ECONOMICS

UNIVERSITI TUNKU ABDUL RAHMAN

FACULTY OF BUSINESS AND FINANCE
DEPARTMENT OF ECONOMICS

APRIL 2016

DECLARATION

We hereby declare that:

(1) This undergraduate research project is the end result of our own work and that due acknowledgement has been given in the references to ALL sources of information be they printed, electronic, or personal.

(2) No portion of this research project has been submitted in support of any application for any other degree or qualification of this or any other university, or other institutes of learning.

(3) Equal contribution has been made by each group member in completing the research project.

(4) The word count of this research report is 19986.

Name of Student:	Student ID:	Signature:
1. Chen Wen Yeow	12ABB03559	_____
2. Ho Chan Yeap	12ABB02671	_____
3. Phoon Mei Chan	12ABB03560	_____
4. Tan Chui Fang	12ABB03500	_____
5. Tan Xiao Jun	12ABB04246	_____

Date: 20 April 2016

ACKNOWLEDGEMENT

First and foremost, we would like to thank Universiti Tunku Abdul Rahman (UTAR) for giving us this opportunity to carry out this research and also providing us the sufficient reading materials for us to refer while doing our research.

We would also like to express our sincere gratitude to our research supervisor, Dr Phoong Suek Wai for her patient guidance, enthusiastic encouragement and useful critiques of this research. Despite her packed schedule, she is always available for consultation and we are grateful for her great sense of responsibility. Besides, she has also been generous to share her knowledge in the field of statistics and has been supportive throughout our research. This research would not be completed without her constant encouragement and guidance. Apart from that, we would also like to thank our FYP coordinator, Ms Thavamalar for providing us the guidelines for our FYP. We also appreciate her for being patient in listening and answering our questions regarding the guidelines.

Besides, we would also like to thank Mr Chong Chee Keong, our second examiner for spending his time in reading our research and giving us precious advices to improve our research. We also acknowledge Ms Vivien Wong Zi Wen for helping us to obtain the data needed for our research and sharing us her knowledge on the issue of missing data.

We are also appreciative for all the hard works and efforts contributed by every members in completing this Final Year Project. The time that we shared in completing this research together will be the most memorable moment in our university life. Lastly, we would like to extend our special thanks to our families for their support both mentally and financially throughout the research.

TABLE OF CONTENTS

LIST OF TABLES

Page

LIST OF FIGURES

Page

LIST OF ABBREVIATIONS

BLS	Bureau Labor Statistics
FER	Fertility Rate
GDP	Gross Domestic Product
GDPPC	GDP per capita
JPA	Jabatan Perkhidmatan Awam
KSSM	Kurikulum Standard Sekolah Rendah
LCU	Current Local Currency
MASTIC	Malaysian Science and Technology Information Centre
NEP	New Economic Policy
NGOs	Non-governmental Organizations
OECD	Organisation for Economic Co-operation and Development
PISA	Program for International Student Assessment
PMR	Penilaian Menengah Rendah
PRI	Primary Education
PT3	Pentaksiran Tingkatan 3
R&D	Research and Development
SEC	Secondary Education
SPM	Sijil Pelajaran Malaysia
STPM	Sijil Tinggi Pelajaran Malaysia

TECH	Technology Innovation
TER	Tertiary Education
UNEM	Unemployment
UNESCO	United Nations Educational, Scientific and Cultural Organization
UPSR	Ujian Penilaian Sekolah Rendah

ABSTRACT

The aim of this research is to investigate the effect of education levels on economic growth in Malaysia from 1984 to 2012. The inefficiency of government's expenditure on education has been one of the concerns that urges us to conduct this research. Specifically, this paper studies how the education levels affect Malaysia's economic growth directly and indirectly through the mediators, unemployment, fertility and technology innovation. Mediation analysis is conducted to examine the direct and indirect effects of education levels on economic growth. The result shows that overall, primary and tertiary education give positive effects to economic growth while secondary education gives a negative effect. Besides, the impact of all education levels on economic growth through indirect effects is higher than direct effects. In addition, tertiary education has the largest effect among the levels of education on economic growth by generating new technology innovation in Malaysia. The finding recommends that government should emphasize in tertiary education and make secondary education compulsory as it will increase students' continuation of studies into tertiary education. The recent reduction in Budget 2016 of Malaysia for education has also suggested government's effort in allocating funds efficiently.

CHAPTER 1: RESEARCH OVERVIEW

1.0 Introduction

This chapter begins with a general introduction about the linkage between education and economic growth. It further discusses about the education system in Malaysia. It includes the research background and problem statement, followed by the research objectives and significance of the study. Last but not least, the outlines of each chapter in this research are also provided at the end of the chapter.

1.1 Overview

Since the 1960s, the economies of eastern Asian countries have experienced high growth rates which the World Bank described as The East Asian Economic Miracle in 1993. Malaysia was one of the countries that experienced high economic growth, from an underdeveloped state into a newly industrialized economy. Since then, the role of human capital in the form of formal and informal education has been repeatedly referred as one of the factors of this high economic growth (Page, 1994).

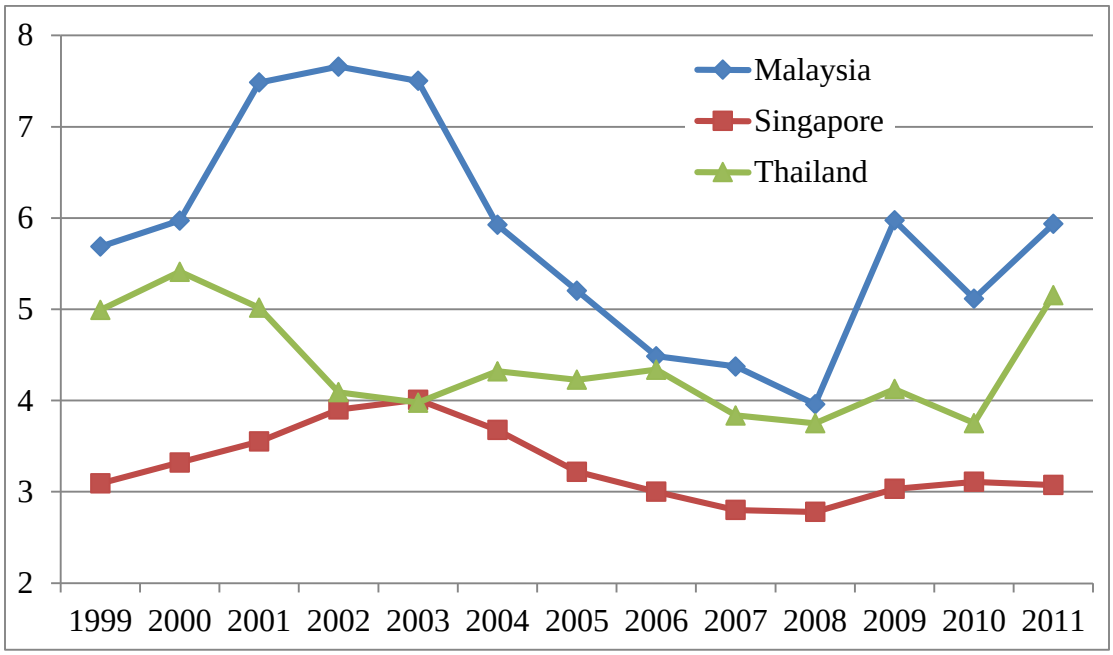
The education sector has always been perceived as one of the potential resources that has a significant impact in a country's economy. It is also one of the main sources for the development of human capital; which is a key factor in increasing the competitiveness of an economy in the long run. Economists have emphasized on how education is able to contribute to the economic development in their models and theories. The augmented growth models of Solow developed by Mankiw, Romer and Weil (1992) together with the model of Romer (1990) are the main theoretical approaches showing the relationship between human capital raised by education and economic performance. According to the theoretical approaches, higher education attainment indicates more skilled and productive workers. Therefore, education promotes growth and development in a country's economy.

1.2 Education in Malaysia

1.2.1 Background

During the Malaysian independence in 1957, Malaysia was still unstable in terms of the political and economy conditions. The government initiated monopolizing procedures for the education sector such as government-owned schools that lasted until the middle of 1990s. In addition, the Malaysian education system has been greatly shaped under the New Economic Policy (NEP) in 1970. Investments in education for human capital accumulation are important as it is a vital source of economic growth. There has been significant increase in the government allocations for education expenditure at all levels every year in Malaysia. Figure 1.1 graphs the education expenditure of Malaysia relative to its peers such as Singapore and Thailand. It clearly shows that the government expenditure on education in Malaysia was maintained at the highest throughout the years. Over the thirty years (1978-2010), the education expenditure by the government rose harshly from 17% of total public expenditure to 21%, which also accounted for an average of 5% of GDP. This consistent high level of educational expenditure has resulted in significant improvement in the student enrollment every year. Besides, in the mid-1990s, the government policy widened up to privatize education and encouraged private sectors to invest in education. This policy was implemented to reduce the government budgets, to encourage self-regulation plans and to increase competition among business holders in order to have Malaysia's economy progressing towards a fully independent nation as well as making Malaysia an education hub of the region by 2020. As of year 2013, there are 414 private colleges, 37 private universities, 20 private university-colleges, 7 foreign branch campuses and 20 public universities in Malaysia (Higher Education in Malaysia, 2014).

Figure 1.1: Government Expenditure on Education (% of GDP)

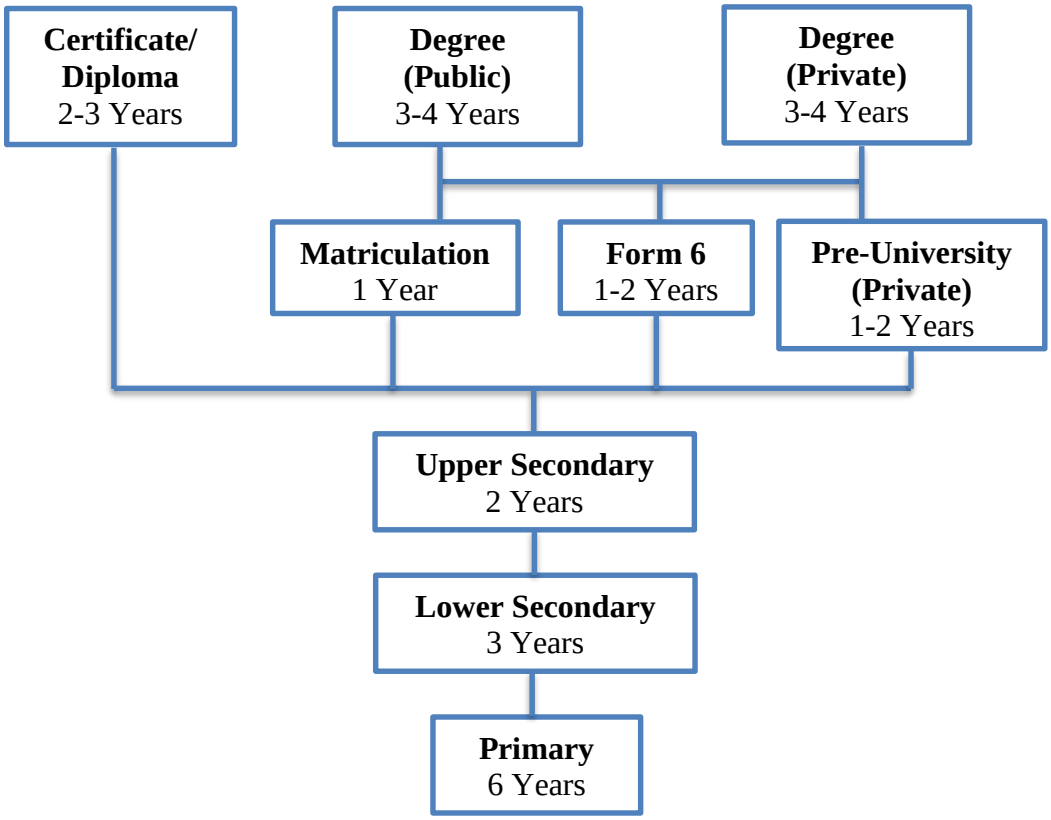


Source: UNESCO

1.2.2 Education System

Figure 1.2 maps out the education system in Malaysia. Basically, Malaysian education system consists of three levels which are primary, secondary and tertiary levels. It includes 6 years of primary education, 3 years of lower secondary education, 2 years of upper secondary education, 1 or 2 years of pre-university studies and 3 or 4 years of university education. All levels of education must follow the practice of national curriculum as well as the school calendar set by the government. According to Cole (2009), the primary education and secondary education have larger effects on basic worker productivity while the tertiary education has a larger effect on technological innovation. As all levels of education have been consistently leaving different sized effects on development and relating to different causal mechanisms, the effects of each levels of education on development need to be considered separately.

Figure 1.2: Education System in Malaysia



Source: Developed for Research

1.2.2.1 Primary

Since 2003, primary schooling has become compulsory in Malaysia while home schooling or home-based teaching is only allowed with permission given by the State Education Department, Ministry of Education. With such policy, the primary level enrollment has been nearly universal for the past decades. In 2011, Malaysia achieved 94% of enrollment at the primary level. It is shown that the percentage of students who drop out from primary school had also reduced from 3% in 1989 to 0.2% in 2011 based on Malaysia Education Blueprint 2013-2025 (Ministry of Education Malaysia, 2013). In the final year of primary school, students are required to take the Ujian Pencapaian Sekolah Rendah (UPSR, Primary School Achievement Test) and they will then be automatically progressed to secondary school education.

1.2.2.2 Lower Secondary

In Malaysia, the enrollment of the lower-secondary level (Forms 1-3) is not compulsory. However, the enrollment is close to universal with a 98.8% gross enrollment rate and 96.4% of net enrollment rate in 2014 (Clark, 2014). The ratio of the labor with secondary or higher education also increased from 37% in 1982 to 58% in 2012 according to the data found in World Bank. The students are required to take the Pentaksiran Tingkatan 3 (PT3), which previously known as Penilaian Menengah Rendah (PMR) at the end of the lower secondary study. The examinations have to be passed in order to move on to upper secondary education and students are to be streamed into arts or science stream, technical and vocational stream or religious stream according to their results.

1.2.2.3 Upper Secondary

Form 4 and 5 are the upper secondary education where the students are streamed according to their results from the Form 3 Assessment. According to Malaysia Education Blueprint 2013-2025, Malaysia has the greatest improvement at this level of education where the enrollment rates had been nearly doubled, from 45% in the 1980s to 78% in 2011 (Ministry of Education Malaysia, 2013). At the final year of upper secondary education, students from various streams are required to take Sijil Pelajaran Malaysia (SPM, Open Certification Examination), which is conducted by the Malaysian Examination Syndicate. To be awarded with a certificate, students are required to pass the subject of national language and history. Students can then precede their studies in matriculation, Form 6 or pursue pre-university studies in private colleges or universities before taking Bachelor Degree or other programs.

1.2.2.4 Pre-Tertiary

The entry into pre-tertiary studies such as Matriculation, Sixth Form, Foundation and A-Level will be based on the results of SPM. Every student is required to undergo 1 or 2 years of post-secondary studies before degree programs. These studies are provided at national secondary schools, technical secondary school, Islamic schools, colleges and universities. Students who take the Sixth Form will be sitting for Sijil Tinggi Pelajaran Malaysia (STPM- Malaysian Higher School Certificate Examination) which is conducted by the Malaysian Examinations Council. As for the other post-secondary studies, the examinations are being conducted at the end of each semester.

1.2.2.5 Tertiary

Certificate, diploma and degree programs are categorized as the tertiary education in Malaysia. According to Vision 2020, Malaysia seeks to achieve its goal of becoming a high-income nation and an international education hub by 2020. In order to achieve this goal, the education and development of quality graduates have to be intensified and a net enrollment of 40% of tertiary education has to be achieved.

Recently, Malaysia has been emphasizing on developing the quality of research and the quantity of its major universities. This is shown by the high government investment on tertiary education level, which is about 7.7% of annual government expenditure in 2014. Based on UNESCO benchmarking, the expenditure on higher education level by Malaysia is the highest among Asian peers, such as Hong Kong, Singapore, South Korea, Japan (developed Asian economies), Indonesia, Thailand, Singapore (ASEAN neighbors) and Chile, Mexico (countries with comparable GDP per capita. Among the universities in Malaysia, there are 5 universities being granted with the “research university” status where there will be additional government funding and increased autonomy. The five research universities are University Malaya, Universiti Kebangsaan Malaysia, Universiti Sains Malaysia, Universiti Teknologi Malaysia and Universiti Putra Malaysia.

1.2.3 National Education Blueprint 2013–2025

Malaysia Education Blueprint was launched by the government in 2013 with objectives to find out the current performance and challenges of the Malaysian education system, to create a clear vision for students and education system and to come out with a comprehensive transformation program for the education system. It has set goals to achieve universal access and full enrollment of students from preschool to upper secondary school by year 2020. Besides, the Blueprint also aim to improve the scores of the students on international assessments such as Program for International Student Assessment (PISA) to be the top three of participating countries within 15 years and to tighten 50% of current urban-rural, socio-economic and gender achievement gaps by 2020.

In order to have the goals achieved, the courses of reforms are defined in the Blueprint. There are 11 shifts needed to occur for the change in outcomes envisioned by the Malaysians. Each of the shifts is addressed to at least one of the five system outcomes such as access, quality, equity, unity and efficiency. Firstly, the compulsory schooling that starts from the age of 6 years is being increased to 11 years. Besides, the Secondary School Standard Curriculum or Kurikulum Standard Sekolah Menegah (KSSM) and revised Primary School Standard Curriculum or Kurikulum Standard Sekolah Rendah (KSSR) in 2017 are introduced to promote a comprehensive set of knowledge and skills like imaginative thinking, problem-solving, innovation and leadership among the students. The clear learning standards will also be given to ensure that the students and parents acknowledge the progress expected within each year of schooling. Furthermore, the national examination and the assessments that are school-based will be improved by 2016 where at least 40% of the questions in Ujian Penilaian Sekolah Rendah (UPSR) and 50% questions in Sijil Pelajaran Malaysia (SPM) are higher-grade thinking questions.

Besides, English will be made as a requisite subject to pass SPM from 2016 and by 2025, every student will be encouraged to acquire an additional language to equip themselves before working. The academic and career counseling services will also be embedded into the secondary school timetable by the end of 2013 so that the students are able to make well-informed choices about the pathways of education that are on offers. The entry bar for teachers is also increased to be among the top 30% of graduates from 2013 and teachers are ensured to have their administrative burden being reduced in order to be more focus on their core function of teaching. Moreover, by the year of 2025, the Orang Asli students and other minority groups that have physical or learning disabilities are to be ensured to receive education in schools with facilities and equipment as well as being able to be in a conducive and supportive learning environment. By 2015, the schools are to be made certain in meeting the requirements of basic infrastructure starting with the schools in Sabah and Sarawak. The Trust School model is also ensured to expand to 500 schools by 2025 with alumni groups and non-governmental organizations (NGOs) being included as potential sponsors. The Annual Report on the progress made against each initiative drafted in the blueprint will be published and a stock-take at key milestones in the journey of blueprint in 2015, 2020 and 2025 will be undertaken.

1.3 Problem Statement

Vision 2020 (also known as Wawasan 2020) is an ideal in Malaysia which was introduced by former Prime Minister, Tun Dr. Mahathir bin Mohamad to make Malaysia a fully developed country by year 2020. One of the goals in Vision 2020 is to become a world class educational system. As Malaysia moves towards year 2020, high amounts of expenditure have been invested on education. The UNESCO Institute of Education Statistics showed that Malaysia's government expenditure on education as percent of GDP was the highest as compared to Singapore and Thailand.

However, the return on investment is not as highly attained as desired and Malaysia's education performance still lags behind other countries with similar or lower levels of expenditure like Singapore and Thailand. This shows that Singapore and Thailand have more efficient expenditure on education while Malaysia may not have allocated the funds efficiently. According to an annual report done by Universitas 21 (2014), Malaysia's higher education ranks 27th out of 50 countries in overall while in terms of resources invested, it ranks 12th out of 50 countries. Despite of its resources invested, the return on investment ranks only 44th out of 50 countries. This has clearly shown that Malaysia is not efficient in its expenditure on education as there is big gap between the ranking of the resources invested and the return on the investment.

In Budget 2016, the government has reduced its allocation for governmental scholarship program where the budget for the ministry of education has reduced from RM 873 million in 2005 to RM 388 million in 2006 with a 55.5% decrease. As for ministry of higher education, the budget is reduced to RM 251 million which is 16.4% lower as compare to last year. This has been a concern for the citizens of Malaysia seeing governmental expenditure being cut down in regards to education. Many have doubted the government's decision as they assumed that the government sacrifices education due to the weakening economy in Malaysia. On a side note, as there is lack of evidence showing the effects of different levels of education on economic growth in Malaysia, it remains a question whether the funds allocated to support for free primary and secondary education in Malaysia is a wise decision.

In addition, many researchers have conducted studies that show the effect of education at different levels on economy growth. However, there have been different results produced by different studies. Findings of researches show that both primary and secondary education has insignificant impact on economic growth where the lower education will not lead to an effect on economic growth (Sachs and Warner, 1995). Meanwhile, Loening (2005) uncovered that primary and secondary educations are important for the economy growth. Regarding tertiary education, studies show that there is a significant positive relationship on economy growth (Loening, 2005).

In contrast, Adawo (2011) produced different findings about tertiary education having a negative impact, worsening the growth of economy. Such mixed results imply that the effects of different levels of education on the economy growth remain questionable. Thus, we would like to find out the relationship between different levels of education and the economy growth in Malaysia.

Apart from that, researchers also indicate that education can contribute to economic growth indirectly through the human capital accumulation. According to Gupta and Chakraborty (2006), human capital accumulation is the source of economic growth. Benhabib and Spiegal (1994) mentioned that educated labor force would promote innovation and help increase economic growth. Besides, education also helps to reduce unemployment rate which results in the increase of economic growth (Pirim, Owings and Kaplan, 2014). However, there is a lack of studies that have conducted empirical test to show and prove the indirect effect of education on economic growth. Moreover, there is also a lack of research that uncovers the possibility of education directly affecting the economic growth. Thus, it perks our interest to look deeper into the possible direct and indirect effects of education on economic growth of Malaysia.

To conclude, it is important to find out the effects of education levels on the economic growth in Malaysia and look deeper into the direct and indirect effects of education. The findings will help government allocate the funds more efficiently according to education levels. As such, Malaysia can improve its education performance and achieve the world education system which is one of the objectives of Vision 2020.

1.4 Research Objectives

The purpose of this research is to study the factors that affect the economic growth in Malaysia.

1.4.1 General objective

Education has been one of the important determinants to promote economic performance theoretically as it increases human capital, facilitates the diffusion and transmission of knowledge needed as well as enhances innovative capacity and new knowledge. Despite the theoretical views, the empirical results showed both negative and positive impact of education on economic growth according to previous studies. Therefore, we would like to clarify this impact by analyzing the direct and indirect effects of education on economic growth with the latest data of Malaysia in our study.

1.4.2 Specific Objectives

i. To study the relationship between education and Malaysia's economic growth.
ii. To examine the total, direct and indirect effect of each education level on Malaysia's economic growth from 1984-2012.
iii. To examine the mediators that result in positive or negative relationship of education and economic.
iv. To determine which level of education has the most impact on economic growth.
v. To compare the impact of direct and indirect effects of the level of education to economic growth.

1.5 Research Questions

i. What is the impact of education on economic growth?
ii. What are the direct and indirect effects of each education level on economic growth?
iii. What are the mediators for the positive or negative relationship of education levels to economic growth?
iv. Which level of education shows the greatest effect in promoting economic growth through the different mediators?
v. Is direct effect greater than indirect effect of education levels to economic growth?

1.6 Hypotheses

i. Education levels and economic growth are positively related.
ii. Each education level has significant positive direct and indirect effects on economic growth.
iii. Education reduces fertility rate and unemployment as well as promotes technology innovation that leads to economic growth.
iv. Tertiary education is the most important level of education in promoting economic growth.
v. Indirect effect is greater than direct effect of education levels to economic growth.

1.7 Significance of the Study

Many studies have been conducted in the past to examine the relationship between levels of education and the economic development of a country. The results of the studies indicate that there is a very positive relationship between the education levels and the economic development of a country but some of the results of the studies show that the relationship between education levels and the economic development of a country is negative related. Besides, most of the studies emphasized on the general effect of the levels of education on economic growth while ignoring the truth that education can influence the economic growth directly and indirectly.

Therefore, this study is significant as we can contribute to have more accurate and precise evaluations on the relationship between the levels of education and economic growth of our country, Malaysia. In addition, to examine the effect of human capital accumulation through education levels on economic growth, this study will cover the mediators such as fertility rate, unemployment and technology innovation as well. Moreover, we are also going to examine whether indirect effect of the education levels through the mediators are higher than direct effect of the education levels on economic growth. Our study is also going to show the contribution of education levels to economic growth by using the measurement of the school enrollment rate in different levels of education.

As we obtain the result of the relationship, we will be able to study on the different levels of education and its impact on the economic growth. It is going to benefit the education sector as many will be aware the impact of education and the importance of the each levels of education can be established.

Furthermore, through this research, government will be able to invest the government expenditure on the level of education that will affect the economic growth the most. It will enhance the efficiency and effectiveness of the expenditure spent on the education in Malaysia and at the same time helps boosting the economic growth. By doing so, it allows Malaysia to stay competitive and achieve the vision of becoming international educational hub in the future.

1.8 Chapter Layout

This paper will be divided into five chapters and the sequences will be followed throughout the paper. Chapter 1 discusses the research overview of this study, following by Chapter 2 stating about the literature review by previous researchers. The methodology of our research will be explained in Chapter 3 and the data analysis will be shown in Chapter 4. Lastly, the discussion, conclusion and policies implication are discussed in Chapter 5 which is the last chapter.

1.9 Conclusion

Our research studies the effect of education on the economic growth in Malaysia. In Chapter 1, the background of education in Malaysia is being briefly elaborated before proceeding into the next chapter. The issues of inefficient allocation of expenditure on education in Malaysia and the reduction in Budget 2016 for education sector are also being brought to attention in this chapter. Moreover, it explained the motives of studying the direct and indirect effect of education levels on the economic growth in Malaysia and finding out which level of education has the most effect on economic growth in Malaysia.

Chapter 2: Literature Review

2.0 Introduction

This chapter introduces the factors that contribute to economic growth by focusing on human capital raised by education as the main determinant. This chapter is going to reveal the direct and indirect impacts of education on economic growth according to relevant theories and past empirical studies. The proposed conceptual framework of our study is also outlined at the end of this chapter.

2.1 Impact of Human Capital (Education) on Economic Growth

2.1.1 General Impact

There are generally three basic types of regressions that have been done by past researchers for the studies of growth. Firstly, the regression is formed from the growth decomposition of the Cobb-Douglas production function where the growth of gross domestic product (GDP) is regressed on the growth rates of factor inputs. Secondly, the regression is based on reduced form regressions where the average growth rates of GDP are regressed on the initial condition and variables that will influence growth. However, these two types of regressions showed result of statistically insignificance, low or even coefficient with negative signs on human capital variables (Poulsen, 2004). The third type of regression is formed on the extending predictions in Solow model about steady-state growth which is used by Mankiw et al. (1992). The result shows positive and statistically significant coefficient for human capital yet it has been ambiguous.

Since then, many studies followed the paper by Mankiw et al. (1992). According to Kalaitzidakis, Mamuneas, Savvides and Stengos (2001), the linear models of growth-human capital relationship are unable to be detected but substantial nonlinearities were found instead. Besides, Benhabib and Spiegel (1994) suggested future researcher to include levels of education viewed as a determinant of changes in total factor productivity instead of factor of production. Barro (1991) used cross country regression to find the empirical determinants of an economy's growth rate and found positive impact of human capital to economic growth despite not having all tested human capital approximations significant.

Education, which is a major source of human capital investment, has significant effect towards the economic growth of a country. According to Babalola (2012), there is long-run relationship between education and economic growth in Nigeria. At the same time, Vasile and Camelia (2012) found a sufficient strong positive connection between the growth rates of GDP and the education factors in Romania which is a 12 Europe's New Member State. The similar result of positive relationship between education and economic growth is also found in Pakistan (Abdullah, 2012). Besides, in a study done by Loening (2005) in Guatemala from 1951 to 2002, it is shown that better-educated labor force has significant positive impact on the economic growth. A rise in 1% point of average years of schooling would increase the economic output by approximately 0.33 percent. Moreover, Bassanini, Scarpetta and Hemmings (2001) states that the growth is positively associated with the schooling years in 21 OECD countries. The human capital accumulation is also the source of economic growth in an endogenous growth model of a dual economy developed by Gupta and Chakraborty (2006).

Despite the positive relationship between education and economic growth found from the past studies mentioned previously, there were also uncountable contradicting findings revealed by other studies. For instance, in a research done by Földvári and Leeuwen (2009), it is found that the relationship between the education years and growth is inversely U-shaped. After around 7.5 years of education, the growth of a country's economy starts to decrease. Furthermore, the relationship between economic growth and education in Malaysia is found to be negative related (Abdullah, 2013). Based on the research done by Benhabib and Spiegel (1994), Pritchett (2001) as well as Lau, Jamison and Louat (1991), it is found that the stock of human capital which is measured by mean years of schooling is insignificant and even has negative contribution to the growth in some cases. Pritchett (2001) explained these unfavorable impacts with three reasons. Firstly, he claimed that the education in developing countries is of low quality where the years of schooling have created no human capital. Secondly, the excess supply of schooling that caused an expansion in supply of educated labor surpassed demand and lead to a decrease in the marginal returns to education. Also, the institutional framework was poor and the educated workers have gone to privately lucrative but socially unproductive activities. The empirical findings which employed different proxies for education in the study of its impact on economic will be discussed in the next section.

2.1.1.1 Education Level

There are several research study the relationship of the three different level of education which are primary, secondary and tertiary education with the economic growth. Studies done by Mankiw et al. (1992) together with Bils and Klenow (2000) used enrollment rates for their research and found a positive and significant contribution of human capital toward the output growth. Petrakis and Stamatakis (2002) states that the primary and secondary education are more important for growth in less developed countries while higher education is more important in more developed economies.

However, a different result was found in a study done by Echevarria (2009). The changes in secondary and higher education completion contribute much more to the changes of the economic growth in less developed countries as compared to the more developed countries. Papageorgiou (2003) found that primary education is significant in final goods production while post-primary education is more related to innovation and technology adoption. On the other hand, Krueger and Lindahl (2001) stated that the positive effect of initial education level on economic growth is the phenomenon seen in the low productivity countries.

For primary education level**,** Self and Grabowski (2004) found that the income growth in India was strongly impacted by primary education level for the time period of 1966 to 1996. Moreover, the result from a study done by Lau et al. (1991) shows that primary schooling has positive and significant impact in East Asia. Judson (1996) in his study also revealed that the primary schooling has positive effect on growth of the economy and it is different from secondary and tertiary education which the result showed no important impact on the economic growth. In addition, in the research done by Barro and Sala-i-Martin (1995), the result shows that there is no correlation between the secondary, tertiary education and the growth per capita. Babatunde and Adefabi (2005) study the long-run relationship between education and economic growth in 1970 to 2003 and the result showed that there is long-run relationship between the enrollments in primary and tertiary level with the output per worker. Besides, Adawo (2011) also conducted a research to study the long run relationship of education levels and the economic growth. It is found that the human capital of primary education contributed to the growth while most of the secondary schools and tertiary institutions worsen the growth. Despite having research proving that primary education level has significant positive impact to economic growth, Abbas (2001) found that the effect of human capital that was represented by primary enrollment rates on economic growth in Sri Lanka and Pakistan were negatively related. It was due to the high poverty level in both countries where most of the parents will not send their children to school. Apart from that, the result from Lau et al. (1991) also show the negative effect of primary schooling on growth in Africa and the Middle East, despite having the effects being insignificant in Latin America and South Asia.

Moving on, the secondary and tertiary education levels are found to be significantly impactful to the economic growth of Arab countries (Awad, Halid & Yussof, 2013). According to Shaihani, Harisb, Ismaila and Saida (2011), the primary and tertiary educations are negatively related to economic growth in short run. However, the secondary education and economic growth is positively related. On the other hand, in the long run, only tertiary education has positive relationship with economic growth while primary and secondary education has negatively relationship with economic growth. Besides, Keller (2006) proved that secondary education enrollment rate plays significant role in increasing the growth rates when the separate effect of primary, secondary and higher education on economic growth in Asia were estimated. Jalil and Idrees (2013) also stated that the secondary education is a relatively more important determinant of the economic growth as compared to the other education level. Moreover, the human capital represented by secondary and higher schooling enrollment rate are positively related to the economic growth in Pakistan and Sri Lanka (Abbas, 2001). In addition, Loening (2005) also found that the tertiary education level is very important and significant to the economic growth.

2.1.1.2 Education Expenditure

The education expenditure was also used in many researches as a proxy variable for education to study about the relationship between education and economic growth. According to Keller (2006), the expenditure towards primary education and the expenditure per students in primary level have significantly impacted the economic growth while the expenditure towards the higher education is more utilized inefficiently. In contrast, Mercan and Sezer (2014) found that the resource allocated for higher education have positive effects to the Turkey economy. However, it is argued in the study done by Romer (2000) that the impact of education on economic growth is not determined by the expenditure on education but by the quantity of inputs used in the Research and Development (R&D).

2.1.2 Indirect Impact through Various Variables

2.1.2.1 Fertility Rate

Previous research suggested that there are indirect effects of education on economic growth. Based on the studied done by Barror (2013), the result showed that one of the indirect impacts of female education in stimulating economic growth is through lowering the fertility rate. Becker, Murphy and Tamura (1994) stated that the investments in both human and physical capital are reducing with the higher fertility rate which implies that economic growth will be reduced as population increased. Research done by Guisan (2002) based on 98 countries in 1995 to 1999 showed that fertility rate can be reduced by education level population and in turn it can contribute to the positive level of GDP per inhabitant. In addition, based on the research done by Brander and Dowrick (1994), the authors found that there is a significant negative relationship between fertility rate and economic growth covering the period from 1960 to 1985 by using a 107 country panel data set.

According to Klasen (2002), a lower fertility rate can improve the economic growth in four different ways. Firstly, investments could be targeted for capital deepening rather than capital widening because the population growth have been reduced with the reduction in fertility rate. Besides, growth of a country will increase due to the increasing savings rates caused by the lower dependency burden accompanied by the lower fertility rate. Thirdly, share of population is increased with lower rate of fertility. Lastly, the employment rate will increase when the fertility rate is lower because the growth in the labor force is absorbed and per capita economic growth will then be increased.

2.1.2.2 Unemployment Rate

The indirect impact of education on economic growth can also be transmitted through reducing unemployment rate which has been verified by Hanushek (2004). According to Mitra (2011) and Woessmann (2014), unemployment rates are reduced with better education. Based on the research conducted, result showed that lower rate of unemployment is completely related to higher rate of economic growth. This is mainly due to the decrease in the reliance on public assistance programs which help in promoting the economic growth. Besides, based on Pirim, Owings and Kaplan (2014), education is one of the efficient ways in reducing the unemployment rates. The relationship between unemployment and education is also observed from the study done by Bureau Labor Statistics (BLS) (2011). The study revealed that higher unemployment is experienced by those without a high school diploma, in which the unemployment for young men was 27.7 percent while the unemployment for women was 31.4 percent. The finding also suggested that the unemployment rate faced by those who are graduated from college was lower with 9.9 percent for male and 9.3 percent for women. As a result, it clearly showed that with a diploma holder, the unemployment rate is lowered by around 3 times compared to those with lower education.

In other words, the contribution of education on economic growth can also be channeled through its extreme effect on employment. In addition, this indirect impact on economic growth by reducing the unemployment rate is due to the higher tax revenues received by the government. When employment rate is high, the large amount of taxable earnings can actually help the country in supporting more government services. In short, the economy will grow with this positive impact through lowering unemployment rates.

2.1.2.3 Technology Innovation

According to Psacharopoulos & Schultz (1984), education can indirectly promote economic growth via the adoption and efficient use of new inputs through technology innovation. In addition, Romer (1990) stated that education can improve economic growth by providing the country the ability to generate innovations as well as stimulating and embracing new technology. The author emphasized that producers with educations are able to use new technology more effectively, and therefore the process of technological diffusion is speeded by education (Nelson & Phelps, 1996). According to Solow (1956), he found that seven-eighths of the growth in United State economy and the increase in capital stock are mainly due to technological change. The theory of Solow model is supported by his empirical assessment where he suggested that advancement in technology plays an important role to promote growth in order to achieve a long-run economic development. Other than that, Bils and Klenow (2000) also found that with larger school enrollment, the annual growth had increased at a faster rate. Based on the authors, this favorable effect is due to the changes in technology as education can generate positive external benefit on technology.

2.2 Review of Relevant Theoretical Models

The relationship between education and economic growth is the hottest topic among the education and academic sector. Past studies found that education will actually contribute to the economic growth of a country. However, there are also few researchers with different point of views and believed that education is insignificant to a country's economic growth. Thus, this section will be discussing the past theories and models that have been carried out regarding the relationship between education and economic growth before developing the proposed theoretical framework for our study.

2.2.1 An Overview of Cobb-Douglas Production Function

In economics study, Cobb-Douglas production function appears frequently and is widely used to describe an empirical relationship between output and inputs. The production function was published by Charles Cobb and Paul Douglas in 1928 where they had measured the economy in the simplest view by analyzing the labor and capital as the factor input.

The Cobb-Douglas productions function is denoted as:

$$Y = AL^{\propto}K^{\beta}$$

Whereby, the Y, L, K, A, α and β are total production or output, labor input, capital input, total factor productivity and output elasticity of labor and capital respectively. This production could determine the perspective of economy by the amount of labor involved and the amount of capital invested.

However, Stern (2004) argued that this mainstream theory of economic growth is weak as it focuses only the labor and capital as factor input while it ignores the other variables such as human capital. Tan (2008) stated the Cobb-Douglas production function consist of limitations which have decreased the accuracy of a study. Firstly, the function lacks microeconomics and counted only two factors which are not sufficient to determine the movement of economy. Next, the basic assumption of the Cobb-Douglas production function assumes constant returns to scale while this assumption cannot be hold in practice. Also, it does not fit to all industries as well, such as engineering and technology. It is unrealistic because it assumes perfect competition in the market and the parameters would not provide a proper economic implication. Therefore, many economists extended and enhanced the Cobb-Douglas function which brings higher credibility to the study of growth model such as the Solow Growth model.

2.2.2 The Solow Growth Model (Neoclassical & Augmented)

The original Solow Growth model developed by Robert Solow in 1956 is an exogenous growth model that grew out of the neoclassical growth model. This neoclassical growth model believes that technological progress, capital accumulation and productivity are crucial in the long run of economic growth.

Solow (1956) expressed the concept in a more intensive form where per capita term is used in his model. It implies that population does matter the total output of economy and thus per capita term used is more appropriate. He also extended the Cobb-Douglas model by adding the technological change together with the original factor inputs (i.e. labor and capital) in estimating their contribution to economic growth in United States for the period of 1909 and 1949. He attributed the unexplained part of the total growth, which is the total factor productivity denoted by "A" in Cobb-Douglas production function to technological progress.

Solow rewrote the Cobb-Douglas productions function as per capita form:

$$\frac{Y_t}{L_t} = (\frac{K_t}{L_t})^{\propto} A_t{}^{\beta}$$

Whereby, Y, K, L, N, t, α and β are represent the total production, capital stock, labor-augmenting technology, effective unit of labor, time, output elasticity of capital per labor and technological progress respectively.

Despite the model being developed to enhance the Cobb-Douglas model which discussed in the earlier part, there are still limitations to it. Filho, Silva and Diniz, (2005) suggested that the estimated convergence rate for the Solow Growth model is very low as the long-run growth rate is exogenously determined by a rate of technical progress only. In this regard, Mankiw et al. (1992) augmented the Solow's model by incorporating human capital into the model. They concluded that the long run economic growth could be explained excellently with the augmented Solow model that includes both the human and physical capital accumulation.

2.2.3 An Overview of Romer's and Lucas Growth Model

Due to the dissatisfaction and limitation of neoclassical model (exogenous growth model) developed by Solow (1956), Paul Romer and Robert Lucas enhanced and created the new growth model in exploring the long run economic growth. The new growth theory of Romer and Lucas widen the human capital scope by focusing on the contribution of education on economic growth.

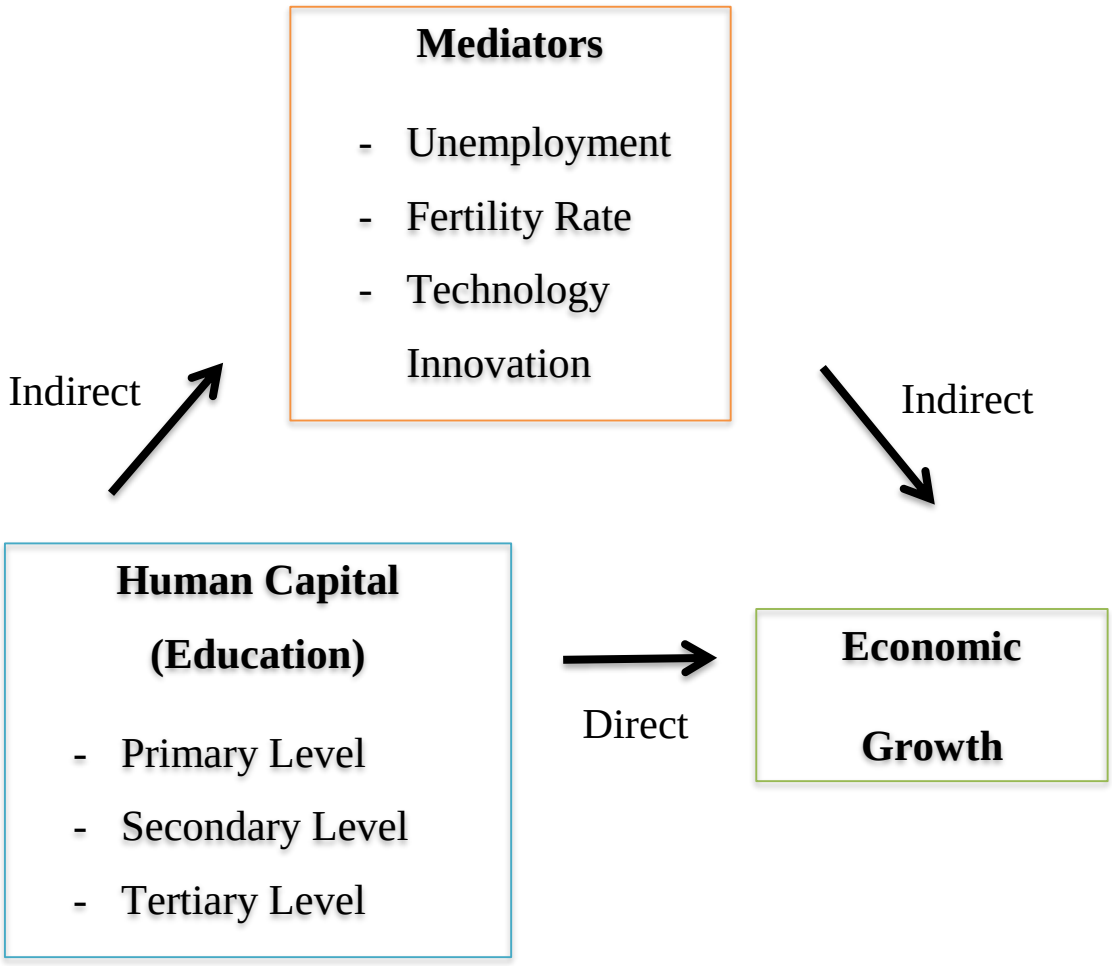
Firstly, Romer (1986) argued that long run economic growth could be achieved once the problem of diminishing returns is solved by raising more and more human capital through having investment in education, training and research. He further emphasized that human knowledge should be continuously acquired and included as part of the factor inputs for production since it has an increasing marginal productivity. He analyzed that research and development (R&D) has large incentives for firms in generating new ideas and thus it becomes an important role in the long run of growth. In other words, the production function developed by Romer (1986) not only compounded with human capital, it suggested that economic growth will be enhanced as well by adopting new technologies. Technology will allow education to increase and make human capital more productive (Glewwe, Ma ̈ga and Zheng, 2014). The simplest Romer's model which is extended from the origin concept of AK endogenous growth model involved two important variables, which are the technology capital and human capital.

On the other hand, similar to Romer's model, Lucas (1988) based his model on knowledge accumulation but in a more direct way. He argued that the stock of human capital would affect the level of output, but the human capital was referred to knowledge, which is obtained by enrolling in education rather than skills. Dowrick (2003) discovered that the policy intervention and aspects of institutions that influence the long run economic growth rate are made possible to be taken into consideration in Lucas's model.

2.3 Proposed Theoretical/ Conceptual Framework

According to the theories discussed above, it clearly showed that human capital raised by education has been emerged to be one of the important determinants in explaining the economic growth. It is true that there are explanations on how human capital could contribute to economic growth. In fact, there is little empirical evidence in showing the relationship. Thus, our study would like to further analyze on how the effect of human capital raised by education is channeled through the variable of unemployment, fertility and technology innovation. These three variables are adopted after analyzing the human capital theory and the details of how these variables are connected with the theories will be discussed below.

Figure 2.1 Theoretical Framework



Given relevant theories and literatures discussed above, Figure 2.1 sketches the conceptual framework regarding the direct and indirect impacts of education on economic growth after considering the mediators (unemployment, fertility and technology innovation). The linkage between education and economic growth could be explained by the theory of human capital (Becker, 1964). According to Solow's neoclassical growth model (1956), the number of labor force and the level of capital stock have been demonstrated as the two most important determinants of output, which is shown by the Cobb-Douglas production function. However, based on the augmented neoclassical model developed by Mankiw et al. (1992) and most of the endogenous growth models, human capital is an important determinant of economic growth. Education which has been served as one of the major source of human capital investment plays a key role in the formation of skilled workers which leads to an increase in the productivity as well as the economic growth.

Indeed, education could affect the economic development indirectly through affecting human capital variables. One of this indirect impacts have been shown in the endogenous theory that developed by Romer (1968) and Lucas (1988). This New Growth Theory extended the Solow's neoclassical growth model by focusing on human capital and innovation capacity. It concentrates and emphasizes on the positive contribution of education towards technology development, which in turns lead to economic growth. Based on this theory, education basically contributes to economic through raising high skill human capital that would make them more productive as they are more capable in applying new technologies or techniques in production.

In addition, according to human capital theory, the level of education is positive related to the acquisition of further qualification through training or learning by doing (Nickell, 1979). Generally, the higher the education, the more skills an individual possesses and the less likely he or she is to quit or to be made redundant by the employer. Thus, the human capital theory provides explanation on why higher level of education should reduce the probability of entering unemployment, where lowering unemployment would help in boosting the consumptions and the economic growth.

Moreover, a higher rate of female education is normally associated with a lower birth rate. This is explained by the higher the education level, the higher the female labor force participation rate, which in turns reduces the fertility rate. This effect is believed to raise the GDP per capita simply because there will be fewer people sharing the GDP and lower costs of childcare. However, Solow (1956) did claim that developing countries with slow population growth have had the strongest economic growth per capita. This is happened because of more physical capital stock have been made available for each worker. As a result, it increases output for each unit of capital, which is relatively higher than the developed countries. Solow (1956) explained this by saying that once the population grows; less capital is available per worker given the fixed amount of capital, which causes a capital dilution to occur. In other words, Robert Solow's model describes the positive effect of lower fertility rates due to the educational effect on economic growth (Weil, 2009).

Overall, the relationship between education and economic growth has been often portrayed in the form of human capital accumulation. This effect of education can be transferred to economic growth through several mediating factors such as lower unemployment and fertility rate together with better technology innovation. Thus, this study is going to provide empirical evidence on such indirect relationship by conducting mediation analysis.

Chapter 3: Methodology

3.0 Introduction

This chapter consists of three sections that describe the methodology of the research. The first section discusses the data of each variable used, which includes the measurements and sources of the data. Subsequently, the second and third section describes the econometric model and technique used respectively.

Basically, the econometric technique used in our research is known as mediation analysis. Mediation is a chain of hypothesized causal relationship in which one variable influences a second variable and thereafter affects a third variable. The ideology behind mediation analysis is to investigate how the independent variable changes the dependent variable through additional variables. These additional variables that explain the relationship between independent and dependent variable are known as the mediators.

In the present study, mediation analysis is conducted by forming a series of regression models to find out both the values and significances of total effect, direct effect as well as indirect effect of education on economic growth in Malaysia. Three mediators are included in our study and the product of coefficient approach is deployed to compute the value of indirect effect through each mediator separately.

After computing the value of the indirect effect, bootstrapping test is conducted to calculate the standard error of each indirect effect. Standard error is necessary to construct the confidence intervals so that the significance of indirect effect could be determined. The evidence for mediation occurs when the indirect effect is found to be significant. Under mediation analysis, the only assumption is that the homogeneity of regression needs to be tested in order to ensure that the direct and indirect effect do not across each other and can be interpreted.

3.1 Data Description

Our study includes seven variables in total, where the secondary data of each variable for the year of 1984 to 2012 was retrieved from a variety of sources according to annual basis. The details of the data are described as follows.

3.1.1 Dependent Variable and Measurement

3.1.1.1 GDP Per Capita

Gross domestic product (GDP) is a major economic indicator because it is able to needlepoint a country's economic health solely on its own (Latham, 2013). According to Terzo (2015), GDP is an important economic measure as it stands for a country's business activities and level of productivity. Other than that, GDP also considers the barometers of other major economic variables that seriously influence the economic growth in a country. Therefore, GDP has been commonly used as a measure of economic growth.

In our study, instead of using just the GDP, we adopted the GDP per capita expressed in current local currency (LCU) as the proxy for economic growth which is our dependent variable. GDP per capita has been defined as the gross domestic product of a country divided by the population of the country itself. GDP per capita is more powerful than GDP as the measurement of economic growth because a nation's GDP is expected to rise with its increase in the population. Therefore, the result may be misleading if we simply compare the GDP without taking the population into account. Thus, GDP per capita that consider the population is the most suitable indicator of economic growth. The data of GDP per capita was collected from the World Development Indicators section of World Bank.

3.1.2 Independent Variables and Measurements

Education is the independent variable used in this study to examine its direct and indirect effect on economic growth. The alternative measurements of education consist of enrollment rates, number of years of schooling, education expenditures, literacy rates, test scores, student's effort as well as market value of human capital. Those alternatives can be classified into either quality or quantity measurement. Despite the fact that educational quality such as test scores, student's effort or educational expenditures were said to be more useful in analyzing the effect of education on economic growth, it still faces some difficulties. According to Benos and Zotou (2014), it is challenging if the proxy of education under the quality category was chosen since the data is limited and thus it is difficult for researchers to determine the relationship. Besides, Dahlin (2002) stated that the educational quality is difficult to be measured and is subject to standardized tests in which the test may not be reliable.

Among the measurements of education either in terms of quality or quantity, each measurement has its own advantages and disadvantages in representing the education. For instance, according to Le, Gibson, and Oxley (2005), human capital accumulation can be reflected in literacy rates. However, literacy rates ignore the important human capital components since literacy refers to just a very basic skill, which is the requirement of the ability to read and write for a person aged 15 and above. This definition implies that literacy rates omit more advance skills such as scientific, mathematical, logical and analytical thinking. Also, literacy rates are a good proxy for education only for countries with little education (Judson, 2002). Thus, literacy rate is not a suitable proxy for Malaysia since the country is a nation that emphasizes much on education. This can be evidenced by the launching of Education Blueprint in year 2013 after Malaysia identified education reforms and responded to the challenges faced in education.

Besides, education expenditures are also considered as poor proxy for education since it ignores the effect of different levels of education on economic growth. Similarly, year of schooling is also not a good measure of human capital stock because this measurement implies that an additional year of primary education is just the same with an additional year of tertiary education. In fact, primary education should not be justified as equally important as tertiary education in raising human capital (Jalil & Idrees, 2013). The contribution of different levels of education on economic growth should be studied instead.

In this regard, we adopted school enrollment rates by levels as our proxy for education. Based on Van Leeuwen (2007), enrollment rate is preferred because it is commonly used and the data is widely available. This data can be obtained from both national and international statistical. Besides, future human capital stock can also be reflected in the enrollment rates. This is because the enrollment rate can measure current human capital stock and then reflect it to future human capital stock through the accumulated flows of schooling (Abbas, 2001). In addition, Barro (2013) also suggested that by using enrollment rate with different levels, the connection of attainment stock to subsequent stocks through the investment flow from enrollment could be captured.

Despite the support of using school enrollment rate as the measure of education from various researchers, it is argued that the problem of starting school earlier or later than the normal age may interrupt the data of enrollment rate in different education levels. Also, there will be higher number of enrollment found in developed countries than developing countries like Malaysia. However, in this research, we adopt gross enrollment rates as our proxy, which has considered all the enrollments at a particular education level regardless of age and thus it is unaffected by the first problem. While for the second problem, it would be an issue only when there is comparison between countries. In fact, our study mainly focuses on only one country, Malaysia, which implies that the utilization of school enrollments is the most suitable proxy for education. The three different levels of school enrollment rate which are primary, secondary and tertiary education will be further discussed below.

3.1.2.1 Primary Education

Primary education is very important for human resource development. It is a free education supported by government and has been made compulsory in Malaysia since 2003. This education provides basic learning skills for children such as reading, writing and mathematics skills. In this paper, we use gross enrollment rate for primary school as the proxy for primary education. It is the ratio of total enrollment to the population, which is measured by the total enrollment in primary school divided by the population with the age group between 7-12 years old. The total enrollment refers to the total number amount of students enrolled in primary school regardless of age, and therefore it is possible to get the value of more than 100%. The data for year 1997 and 2006 to 2008 are unavailable. Thus, averaging method which is also known as mean imputation approach as described in Cokluk and Kayri (2011) was used to fill up those missing data. Basically, in order to estimate the missing data, the mean of those obtained data was first calculated and then being imputed for variables that have missing values. Averaging method is preferred as Schafer and Graham (2002) concluded that averaging method is more efficient than direct case deletion.

3.1.2.2 Secondary Education

Secondary education in Malaysia can be divided into two stages, which are the lower secondary education from Form 1 to Form 3, and the upper secondary education from Form 4 to Form 5. Secondary education is the further study of primary education in which more subjects are offered and more skill-oriented instructions are given. Based on Tsai, Hung, and Harriott (2010), secondary enrollment is more significant on economic growth in developing countries than in developed countries. As discussed above, secondary education was proxy by gross secondary school enrollment expressed in term of percentage. It is the ratio of total enrollment, regardless of age in secondary school to the population with the age group between 13-17 years old. The data of school enrollment, secondary (% gross) were extracted from the World Development Indicator.

3.1.2.3 Tertiary Education

Tertiary education in Malaysia consists of the undergraduate and postgraduate education. Tertiary education is the further study of secondary education in which students are now more focused on one particular area. Tertiary education plays an important role in realizing "Vision 2020" to become a high income nation. Therefore, the development of quality graduates through education is one of the ways of achieving this goal. The proxy for tertiary education is the gross school enrollment expressed in term of percentage. That is, the ratio of total enrollment in the tertiary education, regardless of age divided by the total population with five-year age group. Similarly, the missing data of tertiary enrollment rate for year 1996 and 1997 are also handled with the mean imputation method as described in primary education.

3.1.3 Mediation Variables and Measurements

3.1.3.1 Unemployment

Referring to World Development Indicator, unemployment is defined as the proportion of labor force that is without work but available and seeking for employment. According to Koba (2014), unemployment rate is very important because it clearly indicates the way an economy moves. Unemployment rates are something that the public is concerned with because unemployment is a crucial issue in developing economy which would badly affect the overall economic performance. In addition, the utilization of the unemployment data to investigate its long term relationship with education has also been supported by Garrouste, Kozovska and Perez (2010). The data for unemployment total (% of total labor force) were collected from World Development Indicator.

3.1.3.2 Fertility Rate

Education plays an important role in explaining the reproductive behavior of a country. The fertility rate as the proxy of the reproductive level denotes the number of children borne by a single woman for her life time. As reinforced by various kinds of studies and researches, we retrieved the data of fertility rate total (births per woman) from World Development Indicator. Fertility rate will be one of the variables which mediates the effects of education to observe the economic growth as well as the long-term vision of Malaysia in order to become an international education hub in the year 2020 (Chu, 2014).

3.1.3.3 Technology Innovation

According to past studies, economic growth is influenced by education through the accumulation of knowledge or research and development (R&D) expenditure (Romer, 1990). Sterlacchini (2008) stated that R&D expenditure can exactly explain the rate or the trend of technology innovation. Besides, McMahon (1984) used the data of R&D expenditure to reflect the current state of technology implemented by the country in order to investigate the economic growth of the country. With the support from Romer's model and past research, we adopted R&D expenditure as the proxy of the technology innovation. This is because it reflects the total efforts the public and private sectors have contributed in obtaining new knowledge and technologies. By referring to World Development Indicator, it explains that research and development are expenditures on work to enhance knowledge, in terms of humanity, culture and society. Also, R&D involves research, applied research and experimental development for future technology innovation. The data of Malaysia's R&D expenditure is retrieved from a variety of sources which include United Nations Educational, Scientific and Cultural Organization (UNESCO), Malaysian Science and Technology Information Centre (MASTIC) as well as World Development Indicator.

Table 3.1: Summary of Variables and Source of Data

	Abbreviation	Variable	Source
Economic Growth	GDPPC	GDP per capita (current LCU)	• World Bank
Education	PRI	School enrollment, primary (% gross)	• World Bank • Malaysia Educational Statistics, ERPD, MOE
	SEC	School enrollment, secondary (% gross)	
	TER	School enrollment, tertiary (% gross)	
Unemployment	UNEM	Unemployment, total (% of total labor force)	• World Bank
Fertility Rate	FER	Fertility rate, total (births per woman)	• World Bank
Technology Innovation	TECH	R&D expenditure (RM' Million)	• United Nations Educational, Scientific and Cultural Organization (UNESCO) • Malaysian Science and Technology Information Centre (MASTIC) • World Bank

3.2 Econometric Model

This study proposes an empirical model that estimates Malaysia's economic growth as a function of three different levels of education, which are primary, secondary and tertiary (measured by enrollment rate, %) together with three mediators, which are unemployment rate, fertility rate and technology innovation. The functional form of the growth model is constructed as below:

Economic Growth = F (Primary Education, Secondary Education, Tertiary Education, Unemployment, Fertility Rate, Technology Innovation)

[Eq. 3.1]

$$\ln GDPPC_t = F\ (PRI_t, SEC_t, TER_t, UNEM_t, FER_t, lnTECH_t)$$

[Eq. 3.2]

Since the data for the variables of GDPPC and TECH are expressed in dollar form, natural logarithm is taken to convert the data into smaller scale in order to reduce extremities in the data. In contrast, variables such as PRI, SEC, TER, UNEM and FER that are expressed in ratios themselves are left in levels as beta coefficient is more meaningful during interpretation. In other words, log linear functional model is used in this study.

3.3 Econometric Techniques

3.3.1 Mediation Analysis

Instead of questioning whether the change in the dependent variable (Y) is affected by the independent variable (X), mediation analysis seeks to go beyond this question by addressing the question of how that change occurs. Mediation, which is also called as indirect effect, occurs in an observed relationship between the X and Y through the inclusion of third explanatory variable. This third variable is known as the mediation variable or mediator (M). Instead of a direct causal relationship between X and Y, the link goes from the X causes the M, and M is actually the cause of Y (Preacher, Rucker & Hayes, 2007). In the present study, the dependent variable is the economic growth of Malaysia (lnGDPPC) while the independent variables are the school enrollment rate of primary education (PRI), secondary education (SEC) and tertiary education (TER) with three mediators, which are unemployment rate (UNEM), fertility rate (FER) and technology innovation (lnTECH). Mediation analysis is conducted in this study to investigate the direct and indirect effect of education on economic growth in Malaysia.

There are two main approaches to the statistical mediation analysis, which are the causal steps strategy and the product of coefficient approach. The causal steps strategy is the most common approach that is promulgated by Baron and Kenny (1986). Basically, researcher who adopts this strategy is required to conduct a series of multiple regression analyses. Despite its simplicity and popularity, the casual steps strategy comes with limitations. Preacher and Hayes (2014) argued that this strategy is not as readily adjustable as the other method in accommodating problems such as the violation of normality assumption. Besides, MacKinnon, Lockwood, Hoffman, West and Sheets (2002) also claimed that this strategy is underpowered as the mediation cannot be interpreted unless the significance of all the relevant paths is confirmed. They emphasized that the statistical significance requirement on all paths is not imposed to the alternative method, which is the product of coefficient approach.

With those limitations of causal steps strategy, this study is going to apply the product of coefficient approach to find out the indirect effect of education as recommended by Preacher and Hayers (2008). The details of how this approach is applied will be discussed in the later part. Product of coefficient approach is the best method as it allows us to compute the indirect effect through each mediator separately and thus the comparison on the effect intermediated by each mediator could be captured.

Basically, this research used the notation of the study done by Russell et al. (2009) to form several regression models in order to examine the total effect, direct effect as well as indirect effect which will be further described below.

3.3.1.1 Total Effect Model

Total effect model is a model of the dependent variable as a function of just the independent variables. The mediators are excluded from the model. The alpha coefficients (α_i) in this model represent the total effect of each level of education on economic growth.

Model 1:

$$lnGDPPC_t = i_1 + \alpha_1 PRI_t + \alpha_2 SEC_t + \alpha_3 TER_t + e_{1t}$$

[Eq. 3.3]

Where subscript t represents the year, i_1 represents the intercept of model 3, α_1, α_2 and α_3 denote the total effect of primary, secondary and tertiary education on economic growth respectively and e_1 denotes the unexplained variability in model 1.

In order to know how the total effect of education is transmitted, whether directly or indirectly through mediators, direct effect model and indirect effect model are constructed in the next section. Generally, total effect is the summation of both direct and indirect effect.

3.3.1.2 Direct Effect Model

Direct effect model is a model of dependent variable as a function of all the independent variables together with all the mediators. When the mediators are included into the model, the beta coefficients (β_i) now represent the direct effect of each education level on economic growth.

Model 2:

$$lnGDPPC_t = i_2 + \beta_1 PRI_t + \beta_2 SEC_t + \beta_3 TER_t + m_1 UNEM_t + m_2 FER_t + m_3 lnTECH_t + e_{2t}$$

[Eq. 3.4]

Where i_2 represent the intercept of model 2, β_1, β_2 and β_3 denote the direct effect of primary, secondary and tertiary education on economic growth respectively after adjusting for the effect of unemployment rate (1st mediator), fertility rate (2nd mediator) and technology innovation (3rd mediator), m_1, m_2 and m_3 relates the mediators of unemployment rate, fertility rate and technology innovation to economic growth respectively, e_2 denotes the unexplained variability in model 2.

3.3.1.3 Indirect Effect transmitted by each Mediator

As mentioned previously, the indirect effect of this study is calculated by using the product of coefficient approach. This approach requires the multiplication of the extent to which the independent variables affect each mediator and the extent to which each of the mediator changes the dependent variable. The extent to which the mediator changes the dependent variable is represented by m_1, m_2 and m_3 from model 2. In order to find the extent to which the independent variables affect the mediator, another three models need to be formed, where each mediator is regressed on primary, secondary and tertiary education as shown in model 3, 4 and 5.

Model 3:

$$UNEM_t = i_3 + \lambda_1 PRI_t + \lambda_2 SEC_t + \lambda_3 TER_t + e_{3t} \quad \text{[Eq. 3.5]}$$

Model 4:

$$FER_t = i_4 + \gamma_1 PRI_t + \gamma_2 SEC_t + \gamma_3 TER_t + e_{4t} \quad \text{[Eq. 3.6]}$$

Model 5:

$$lnTECH_t = i_5 + \delta_1 PRI_t + \delta_2 SEC_t + \delta_3 TER_t + e_{5t} \quad \text{[Eq. 3.7]}$$

Where i_3, i_4 and i_5 represent the intercept of model 3, 4 and 5 respectively, λ_1, λ_2 and λ_3 are the effect of primary, secondary and tertiary education on unemployment rate (1st mediator) respectively, γ_1, γ_2 and γ_3 are the effect of primary, secondary and tertiary education on fertility rate (2nd mediator) respectively, δ_1, δ_2 and δ_3 are the effect of primary, secondary and tertiary education on technology innovation (3rd mediator) respectively, e_5, e_6 and e_7 denote the unexplained variability in model 7, 8 and 9 respectively.

3.3.1.3.1 Unemployment Rate as Mediator

To compute the indirect effect of each education level on economic growth transmitted by affecting unemployment rate, we multiply the coefficient of that particular education level on unemployment (represented by "λ_i" from model 3) with the coefficient of unemployment on economic growth (represented by "m_1" from model 2). The equations are shown as follow.

Primary Education : Indirect Effect = $\lambda_1 \times m_1$

Secondary Education : Indirect Effect = $\lambda_2 \times m_1$

Tertiary Education : Indirect Effect = $\lambda_3 \times m_1$

3.3.1.3.2 Fertility Rate as Mediator

To compute the indirect effect of each education level on economic growth transmitted by affecting fertility rate, we multiply the coefficient of that particular education level on fertility (represented by "γ_i" from model 4) with the coefficient of fertility on economic growth (represented by "m_2" from model 2). The equations are shown as follow.

Primary Education : Indirect Effect = $\gamma_1 \times m_2$

Secondary Education : Indirect Effect = $\gamma_2 \times m_2$

Tertiary Education : Indirect Effect = $\gamma_3 \times m_2$

3.3.1.3.3 Technology Innovation as Mediator

To compute the indirect effect of each education level on economic growth transmitted by affecting technological innovation, we multiply the coefficient of that particular education level on technology innovation (represented by "δ_i" from model 5) with the coefficient of technology innovation on economic growth (represented by "m_3" from model 2). The equations are shown as follow.

Primary Education : Indirect Effect = $\delta_1 \times m_3$

Secondary Education : Indirect Effect = $\delta_2 \times m_3$

Tertiary Education : Indirect Effect = $\delta_3 \times m_3$

The mediation can occur in partial or complete form. When the total effect is exactly equal to the indirect effect, which in other words, the direct effect of education on economic growth is zero, the mediation is known as complete mediation. Conversely, when there are both direct and indirect effects of education on economic growth, the mediation is known as partial mediation.

3.3.1.4 Inference for Indirect Effect

Evidence for mediation occurs when the indirect effect is found to be significant. In order to test for the significance of indirect effect, standard error for each of the indirect effects needs to be obtained. By using the standard error, confidence interval around the indirect effect can be constructed. The indirect effect is deemed to be statistically significant if zero is not included in the constructed confidence interval.

Under mediation analysis, there are two common approaches that can be used to compute the standard error, which are the multivariate delta method derived by Sobel (1982) and the bootstrapping method. The approximate formula derived by Sobel (1982) using multivariate method was the most commonly used estimate of standard error for indirect effect ($\hat{\sigma}_{\alpha\beta}$). The formula is shown below.

$$\hat{\sigma}_{\alpha\beta} = \sqrt{\hat{\alpha}^2\hat{\sigma}_{\beta}^2 + \hat{\beta}^2\hat{\sigma}_{\alpha}^2}$$

Where $\hat{\sigma}_{\alpha\beta}$ denotes the estimated standard error of indirect effect, $\hat{\alpha}$ denotes the estimated coefficient of independent variable on mediator, $\hat{\beta}$ denotes the estimated coefficient of mediator on dependent variable, $\hat{\sigma}_{\alpha}$ denotes the standard error of $\hat{\alpha}$ and $\hat{\sigma}_{\beta}$ denotes the standard error of, $\hat{\beta}$.

Sobel test holds assumption that the sample size is large and the sampling distribution of indirect effect is normally distributed. However, the use of the normal distribution for the Sobel test is questioned as the sampling distribution of the indirect effect may not be normal but symmetrical especially when the samples are small (Bollen & Stine, 1990). The distribution of indirect effect is usually positively skewed and thus, the symmetric confidence interval that is based on the normality assumption will result in underpowered tests of mediation. Due to these problems, MacKinnon et al. (2002) argues against the adoption of normal distribution to assess the significance and they suggested an alternative approach that similarly requires a table of critical values to assess the significance, which is the bootstrap approach. In this regard, our group has decided to use the bootstrap test as an alternative for our study.

Bootstrap test is an increasingly popular non-parametric method for the testing of indirect effect with the estimation of the standard error. It estimates the population distribution with the use of the information of a number of resamples from the sample. In other words, it is based on the random sampling with replacement. Bootstrapping treats the given sample as the population. According to Mooney and Duval (1993), the bootstrap procedures are described as below: -

1. Construct the empirical probability distribution from the sample with probability of 1/n for each observation, where n represents the sample size.
2. Draw random sample with replacement from the empirical probability distribution. The observation drawn randomly will remain in the pool so that it has the possibility of being drawn again. This step is repeated until n observations are achieved.
3. Calculate the statistic of interest, which is the standard error ($\hat{\sigma}$) of indirect effect from the resample.
4. Repeat the second and third steps for at least 50-200 times (B) while estimating the standard error and at least 1000 times while constructing the confidence intervals (Efron & Tibshirani, 1985).
5. Eventually, construct the probability distribution from all of the resampled estimates with probability of 1/B for each standard error. The distribution constructed is the bootstrapped estimate of the sampling distribution of the standard error.

The constructed probability distribution is the basis to make the inferences. The standard deviation of the distribution is the bootstrapped standard error of the indirect effect. The sampling distribution of the standard error can be used for confidence intervals calculation. If zero is outside of the confidence interval, the null hypothesis will be rejected. The indirect effect is interpreted as being different from zero.

The simplest nonparametric bootstrap confidence interval is the percentile interval. No invalid parameter values can be included in the interval (Carpenter & Bithell, 2000). The key features of this percentile interval are that it makes use of a transformation to normality automatically. Its simplicity is also the attraction. However, the coverage error is notable as the distribution of the estimated standard deviation is not nearly symmetric and is biased. This is because the justification of percentile bootstrap is based on the existence of the monotone transformation (g) of the standard deviation. Thus, bias-corrected percentile interval is introduced as the modified interval after simple adjustment is made to overcome the shortcomings of percentile interval (Bollen & Stine, 1990). As the bias-corrected percentile interval is more powerful after the adjustment, we have decided to use this confidence interval in our study.

3.3.1.5 Homogeneity of the Regression

The no-interaction assumption which is the homogeneity of regression has always been described as necessary for the causal inference in mediation analysis. The homogeneity of regression indicates that the effect of the mediator (M) on the dependent variable (Y) being invariant across the value of independent variable (X). In the present study, it is important to ensure that the effect of mediators on economic growth does not depend on education. If there is violation in the assumption where X and M interact in the model of Y, the association between M and Y will not be accurately characterized and thus it is not sensible to estimate the indirect effect.

Chapter 4: Data Analysis

4.0 Introduction

This chapter focuses on the interpretation of the empirical results obtained by conducting the analysis and tests discussed in Chapter 3. Descriptive statistics for each of the variables will be first presented to understand the basic features of the data. Then, it will be continued with the result of total effect model which describes the total effect of each education level and its significance on economic growth. In order to interpret the direct and indirect effect of education obtained from mediation analysis, the result of the homogeneity test will be first shown to confirm that there is no interaction between education and each of the mediators. Once the violation in the assumption is rejected, comparison between the direct and indirect effect of each education level together with their significance and relationship will be discussed in the next section.

The results of the descriptive statistics are shown in section 4.1, followed by the results of total effect model in section 4.2. Section 4.3 presents the outcome of homogeneity of the regression, whereas section 4.4, 4.5 and 4.6 present the output of direct effect, indirect effect and comparison between these two effects respectively.

4.1 Descriptive Statistics

Table 4.1 shows minimum, maximum, mean, standard deviation, skewness and kurtosis for the data of each variable. The values of minimum and maximum tell the range of the data, whereas mean shows their average value over the years. Standard deviation explains the variability while skewness together with kurtosis measure the normality of the data

Table 4.1 Descriptive Statistics

Variables	Minimum	Maximum	Mean	Standard Deviation	Skewness	Kurtosis
lnGDPPC	8.41	10.38	9.42	0.63	-0.10	-1.24
PRI	92.69	102.74	95.97	2.44	1.14	1.29
SEC	52.97	72.03	61.90	6.27	0.04	-1.69
TER	4.74	37.20	19.85	11.54	0.09	-1.63
UNEM	2.40	7.40	3.99	1.37	1.56	1.56
FER	1.98	3.68	2.90	0.64	-0.28	-1.67
lnTECH	11.77	13.87	12.64	0.57	0.17	-0.41

According to Table 4.1, average GDP per capita in Malaysia was 9.42% between 1984 and 2012. By taking the natural logarithm of GDP per capita, we can see the percentage change, which is the growth rate rather than the absolute value change in the economic growth. The 1986 recession had given the poorest economic growth in Malaysia with performance of only 8.41% whereas the year of 2012 showed the best economic performance. After taking natural logarithm, we can see a low variability in the data of GDP per capita evidenced by small standard deviation.

On the other hand, average enrollment rate of primary, secondary and tertiary education were 95.97%, 61.90% and 19.85% respectively. It is not surprising that the enrollment rate of primary education was the highest since primary education was announced as compulsory officially in 2003. Although secondary education has not made compulsory until today, it is believed that free education for both primary and secondary level given by the government is one of the reason which encouraged more than half of the relevant population to enroll in secondary education. Tertiary enrollment rate showed considerable volatility evidenced by the highest value of standard deviation. However, it implies that there are more and more people enrolled in tertiary education with evidence of 4.47% in 1984 to 37.20% in 2012.

The unemployment rate in Malaysia is 3.99% on average with the highest rate in 1986 recession and lowest in 1997. While the average fertility rate of woman in Malaysia was 2.9 with highest rate of 3.68 in 1984 and lowest rate of 1.98 in 2012. Besides, research and development (R&D) expenditure in Malaysia was 12.64% on average over the period of 1984 to 2012. This R&D expenditure increased over the years from lowest of 11.77% in 1984 to highest of 13.87% in 2012. The variation of the data for these three mediators was small which is shown by the small value of standard deviation.

Table 4.1 also shows that the skewness and kurtosis of each variable were ranged between ±2.0. While Gonyea et al. (2003) claimed that the range for the skewness and kurtosis value to be accepted as normally distributed fall between ±1.0, Geroge and Mallery (2006) argued that the values between ±2.0 are also acceptable depending on the application of researcher. Since our study employed non-parametric test which is bootstrapping approach for accessing the indirect effect, normality assumption is not imposed in our study.

4.2 Total Effect Model

Table 4.2 Total Effect Model

Variable	Coefficient	Std. Error	t-statistic (p-value)
Primary Education	0.0367	0.0107	3.4142 (0.0022)***
Secondary Education	-0.0426	0.0095	-4.4876 (0.0001)***
Tertiary Education	0.0707	0.0049	14.2844 (0.0000)***
R^2 = 0.9653, F-statistics = 232.0017, P-value = 0.0000			

Note: *, ** and *** denote statistical significance at the 0.10, 0.05 and 0.01 levels respectively.

Table 4.2 shows the results of the total effect of the levels of education on economic growth. As mentioned in the earlier chapter, total effect model is a model of the economic growth as the function of all levels of education without mediators.

According to the results, primary, secondary and tertiary education are significant to the economic growth at $\alpha = 1\%$. As the coefficient of primary education is 0.0367 which shows its positive relationship with economic growth, it indicates that for each one percentage point increase in primary enrollment rate, economic growth on average will increase by 3.67%, holding other variables constant. The result is similar to the study done by Lau et al. (1991) and Judson (1996) where primary schooling has positive and significant impact towards the economy growth.

Moreover, the coefficient of secondary education is -0.0426, indicating a negative relationship with economic growth. Thus, the economic growth on average will decrease by 4.24% when there is 1% point increase in secondary enrollment rate. Matsushita, Siddique and Giles (2006) also acquired similar result in their research and stated that it is not unexpected as the secondary school enrollment will delay the students' entrance to the labor market and their contribution towards economic growth. Moreover, according to the descriptive statistic of our research, the mean of the secondary education gives value of 61.90% which shows more than half of the relevant population is enrolled into secondary schools. This shows that many students have delayed entering into the labor market due to their education. However, the secondary enrollment only dampens growth of the economy in short to medium term. They will eventually benefit the economic growth in the long term as the quality of labor is improved where more skills are acquired to increase the productivity and help boost the economy.

On the other hand, the tertiary education is positively related to the economic growth as the results show a value of 0.0707 for its coefficient. When tertiary education goes up by one percentage point, on average, the level of economic growth will go up by 7.07%, holding other variables constant. The result is supported by Loening (2005) where tertiary education is important as it is significant to the contribution of economy growth.

Overall, by simply comparing the coefficients, we can conclude that the total effect of tertiary education was the highest, followed by secondary and primary. However, since the focus of this project is to analyze how the total effect of each education levels is split into the direct and indirect effects, more detailed explanation will be given in the next section. Additionally, the result shows that the overall model is a good model as its R^2 is 0.9653. Theoretically, the higher the R^2, the better the model fits with the data. It indicates that 96.53% of the variation of GDP per capita is being explained by the variation of primary, secondary and tertiary education. In addition, the p-value of the overall model is 0.0000 which explains the significance of overall model at $\alpha = 0.01$.

4.3 Homogeneity of Regression Test

Before proceeding to mediation analysis which assesses the direct and indirect effect of education on economic growth, the testing of the homogeneity of the regression has been carried out. It is to ensure that the assumption of homogeneity is not violated where the mediators (unemployment, fertility and technology) has no relationship with the independent variables (primary, secondary and tertiary education). When there is evidence of interaction mediation, the analysis should not be used (Preacher & Hayes, 2014).

Table 4.3 Homogeneity of Regression Test

	F-Test Statistics (p-values)
Education × Unemployment	1.0225 (0.4048)
Education × Fertility	2.2246 (0.1185)
Education × Technology	2.1194 (0.1315)

Note: Education = Primary, Secondary and Tertiary Education

4.3.1 Education with Unemployment

H_0: Primary, secondary and tertiary education does not interact with unemployment

H_1: Primary, secondary and tertiary education does interact with unemployment

As shown in Table 4.3, the p-values for unemployment is 0.4048 which is greater than 0.10 significance level. The null hypothesis is thus not rejected. There is significant evidence that unemployment has no relationship with primary, secondary and tertiary education.

4.3.2 Education with Fertility

H_0: Primary, secondary and tertiary education does not interact with fertility

H_1: Primary, secondary and tertiary education does interact with fertility

According to Table 4.3, fertility does not have any interaction with the independent variables which are primary, secondary and tertiary education as the p-value of 0.1185 is larger than α at 0.10. Therefore, the null hypothesis is not rejected. There is significant evidence that fertility has no relationship with primary, secondary and tertiary education.

4.3.3 Education with Technology

H_0 : Primary, secondary and tertiary education does not interact with technology

H_1 : Primary, secondary and tertiary education does interact with technology

Table 4.3 shows that technology has no interaction with primary, secondary and tertiary education. This is due to the p-value of 0.1385 which is larger than 90% confidence interval. Hence, the null hypothesis is not rejected and demonstrates that there is no relationship between technology and education.

The non-significant p-value of the homogeneity of regression test in the result ensures that the mediation analysis can be carried on. As the effect of the mediators does not depend on the independent variables, the direct and indirect effects of primary, secondary and tertiary education on Malaysia's GDP can be interpreted.

4.4 Direct Effect Model

Table 4.4 Direct Effect Model

Variable	**Coefficient**	**Std. Error**	**t-statistic (p-value)**
Unemployment	-0.0602	0.0166	-3.6236(0.0015)***
Fertility	-0.3069	0.1012	-3.0322(0.0061)***
Technology	0.3758	0.0754	4.9855(0.0001)***
Primary	0.0107	0.0070	1.5238(0.1418)
Secondary	-0.0148	0.0055	-2.6705(0.0140)**
Tertiary	0.0204	0.0072	2.8272(0.0098)***
R^2 = 0.9967, F-statistic = 544.8680, P-value =0.0000			

Note: *, ** and *** denote statistical significance at the 0.10, 0.05 and 0.01 levels respectively.

Table 4.4 shows the results of the direct effect model of education on economic growth, this model represents the part of the exposure effect of education which is not mediated by the mediators. In the other words, it shows the effect of different education levels on the economic growth without going through the three mediators which are unemployment, fertility and technology innovation.

4.4.1 Direct Effect of Primary Education

According to the output shown in Table 4.4, an increased in 1% point of primary enrollment rate will directly foster the GDP per capita by 1.07% on average. In order to determine whether the mediation process is fully mediated or partially mediated, significance of the direct effect is the important indicator. From the direct effect model, we noticed that the p-value of primary education is 0.1418 which is greater than the 0.10 significance level. Thus, the null hypothesis of the coefficient which is equal to zero should not be rejected. The insignificance of primary education in explaining economic growth after controlling the mediators implies that the direct effect of primary education is insignificant. This result is similar with Sieng and Yussof (2014) where there is a positive sign of coefficient for primary education but is insignificant in relation to the economic growth. This may due to the fact that primary school education is compulsory in Malaysia, so it does not directly affect the economic growth as compared to secondary and tertiary education. As a result, the effect of primary education on economic growth is entirely through the indirect effect and it is said to be fully, completely or perfectly mediated by the three mediators.

4.4.2 Direct Effect of Secondary Education

Other than that, based on the result from the direct effects model of secondary education, 1% point increase in secondary enrollment rate corresponds to a direct decrease in GDP per capita by 1.48%. Since the p-value of secondary education is 0.0140, it rejects the null hypothesis which indicates that the direct effect is insignificance at 5% level of significance. In other words, we can conclude that the negative effect of secondary education is statistically significant in the direct model. According to Section 30 of the Education Act of 1996, secondary education in Malaysia had been made free of charge by government and thus, increasing in the secondary enrollment rate simply implies greater extent of government funding. Since secondary education in Malaysia has not officially made compulsory, students are freely to leave school before completing their study.

The study of Wanyonyi (2004) suggested that the school dropout rate was high despite the freeness of education. This is demonstrated by Patel (2014) that the number of student dropout from secondary school in Malaysia reaches into the thousands. As a result, such non-compulsory secondary education causes the money funding by government to be wasted on the students who finally dropout and thus directly reduces economic growth. Since secondary education remains significant in the direct effect model, this suggests that unemployment, fertility and technology partially mediated the influence of secondary education on economic growth.

4.4.3 Direct Effect of Tertiary Education

For direct effect of tertiary education, there is positive relationship between tertiary education and economic growth. It shows that an increase in 1% point of tertiary enrollment rate, on average, the GDP per capita will be increased by 2.04%. On the other hand, the p-value of the tertiary education is 0.0098 which is smaller than the significance level of 1% indicating that tertiary education is statistically significant. The finding was not surprising as Malaysia has become one of the countries that have a very high proportion of international students pursuing their higher education with an increase of over 16% annually (The Sun Daily, 2015). Consequently, it directly boosted the economic growth through the spending of those foreign students on Malaysian economy. Since the direct effect of tertiary education remains significance, we can conclude that unemployment, fertility and technology partially mediated the influence of tertiary education on economic growth.

Overall, the results suggest that unemployment, fertility and technology innovation fully mediated the effect of primary education while partially mediated the effect of secondary and tertiary education on economic growth. According to Rucker, Preacher, Tormala, and Petty (2011), because of the high dependence on the sample size for the partial and full mediation concept, it is suggested that this concept may not be applied with the modern statistical approaches while the significance and magnitude of the indirect effects should be more focused instead of direct effect.

4.5 Indirect Effect of Education in GDP

Table 4.5 Indirect effect of Education in GDP

	Education's Effect on Each Mediators	Mediators' effect on GDP	Indirect effect of Education on GDP
Primary			
Unemployment	-0.2202**	-0.0602***	0.0133**
Fertility	-0.0240*	-0.3069***	0.0074
Technology	0.0143	0.3758***	0.0054
Secondary			
Unemployment	0.2017**	-0.0602***	-0.0121**
Fertility	0.0107	-0.3069***	-0.0033
Technology	-0.0330**	0.3758***	-0.0124**
Tertiary			
Unemployment	-0.1544***	-0.0602***	0.0093**
Fertility	-0.0580***	-0.3069***	0.0178***
Technology	0.0616***	0.3758***	0.0232***

Note: *, ** and *** denote statistical significance at the 0.10, 0.05 and 0.01 levels respectively.

Table 4.5 summarizes the indirect effect of different education levels on the economic growth through the mediation variables. The second column represents the effect of primary, secondary and tertiary education on the mediators which are unemployment, fertility and technology whereas the third column represents the effect of each mediator on the economic growth. The multiplication of second column and third column results in the indirect effect of educations on economic growth which is in the fourth column. Positive sign in the indirect effect of educations on economic growth indicates that there is positive relationship between education levels and economic growth, vice versa.

As the significance of indirect effects depends on the bootstrap confidence interval, different tests are being carried out at 99%, 95% and 90% confidence interval. At 99% confidence interval, if the indirect effect is significant in which zero is not included in the interval, we can conclude that the effect is significant at $\alpha = 0.01$. Likewise, the indirect effect is significant at $\alpha = 0.05$ when zero is not included in the 95% confidence interval and the indirect effect is significant $\alpha = 0.10$ when zero is not included in the interval at 90% confidence interval.

4.5.1 Indirect Effect of Primary Education

According to Table 4.5, the result shows that when there is 1% point increase in primary enrollment rate, the economic growth will increase by 1.32% through the reduction of unemployment. The significant positive relationship between primary education and economic growth through unemployment is supported by the human capital theory (Nickell, 1979). As an individual have further qualifications and higher education with the chance to obtain more skills, there will be lesser chance that he or she will quit a job or be made redundant their employer. This shows that education helps lower unemployment that eventually boosts the economic growth.

Moreover, when there is 1% point increase in primary enrollment rate, the economic growth will increase by 0.74% through the lowering of fertility rates which shows a positive relationship between primary education and economic growth through fertility. According to Weil (2009), the higher the education level, the lower the fertility rate which in turns reduces the population of the country. In another words this raises the economic growth since there will be sufficient resources for the country to serve the small population and increase its wealth. However, this indirect effect could not be explained in Malaysia due to the insignificance of the effect of primary education on fertility rate as shown in Table 4.5. The result is similar with Tan and Haines (1984) where they conducted a cross-national study and failed to find any relationship between primary enrollment and fertility as significant impact are not likely to be found with only small amounts of primary education.

In addition, the economic growth will increase by 0.54 % through increasing the technology innovation when there is 1% point increase in primary enrollment rate. The New Growth Theory by Romer (1968) and Lucas (1988) support this statement by having consistent positive relationship result that education has positive contribution towards technology development through highly skilled human capital which eventually boosts the economic growth. Unfortunately, the effect of primary education through technology on economic growth is statistically insignificant in Malaysia as shown in the result. The result is logical as person with solely primary education was not enough for technology innovation in which Sieng and Yussof (2014) supported the statement by claiming that economic growth is boosted by higher level of education but not primary level education.

In short, the primary education gives the largest effect to the economic growth through unemployment as the other mediator variables which are fertility and technology, the indirect effect is found to be insignificant.

4.5.2 Indirect Effect of Secondary Education

Meanwhile, the computed result shows the indirect effect of secondary education is significantly negative related to the economic growth through unemployment, which 1% point increase in secondary enrollment rate will result in 1.12% decrease in economic growth through increasing unemployment rate. According to the study conducted by Matsushita, Siddique and Giles (2006), the findings show that increasing of the enrollment in secondary education will give unfavorable impacts towards the economic growth of Australia through unemployment as people are delayed to labor market and thus reducing the productivity for economic growth. The study explains the negative relationship of the result in Table 4.5.

Next, secondary education has also negatively affected the economic growth indirectly through fertility rate. That is, 1% point increase in the secondary enrollment rate will decrease the economic growth by 0.33% through increasing the fertility rate.

This negative relationship is supported by Gronqvist and Hall (2013) where they stated that the role of secondary education was meant to prevent early childbearing among the younger ages. However, the benefit and importance of education which are not fully understood by the society which result in the increase of young new mothers in the society that in turns lowers the economic growth. In our study, the negative relationship of secondary education on economic growth through fertility is found to be insignificant in Malaysia. As the research done by Mohd, Adibah and Haliza (2015) revealed that besides the lacking of education, there are many significant risk factors for teenage pregnancy in Malaysia such as poverty. This is evidenced by Hayward (2011) where the author found that teenage pregnancy is significantly associated with higher rates of poverty. These findings suggested that secondary education in Malaysia might not be the significant reason in explaining the raising of fertility rate which reveals the insignificant effect shown in Table 4.5.

As for the indirect effect of secondary education through technology innovation, it is found that there is a significantly negative relationship where the economic growth will decrease by 1.24% when there is an increase in 1% point of secondary enrollment rate. The result was not unexpected since the dropout rate of secondary education in Malaysia was increasing over the years which had been mentioned in the previous section. This implied that the increasing in the secondary enrollment rate does not reflect any rise in the skilled human capital that would make them apply and innovate new technologies for economic growth. In fact, rising in the dropout rate of secondary school students in Malaysia not only suggested that there will have no rising in the R&D by secondary educated person, but also reduces the R&D funding for higher education since a portion of the fund has to be used to support the free secondary education.

Overall, the indirect effect of secondary education through fertility is shown to be insignificant towards economic growth. Thus, by simply comparing between unemployment and technology, the negative effect of secondary education on economic growth is higher through lowering the technology innovation than increasing unemployment.

4.5.3 Indirect Effect of Tertiary Education

Apart from that, tertiary education has shown results that are within our expectation. Tertiary enrollment shows significantly positive relationship with the economic growth through unemployment. When there is 1% point increase in tertiary enrollment rate, the economic growth will increase by 0.93% through the lowering of unemployment. According to Blinova, Bylina and Rusanovskiy (2015) and Snieska, Valodkiene, Daunoriene, Draksaite (2015), tertiary education is coherently the factor that causes decrease in unemployment levels and increase in employment creation to support the growth of economic. This shows that tertiary education is much more essential for the growth of economic through employment rate.

Next, the significantly positive relationship is also found between the tertiary education and economic growth through fertility. When there is 1% point increase in tertiary enrollment rate, it will result in 1.78% increase in the economic growth through lowering the fertility rate. In the research done by Piotrowski and Tong (2015), the fertility is considered as an opportunity cost for economic growth as the newlyweds who obtained tertiary education in this era are less likely to give birth but to contribute in the expansion of the economy.

Lastly, tertiary education is statistically significant to economic growth through technology innovation as well. 1% point increase in tertiary enrollment rate will contribute to 2.32% increase in economic growth by having technology innovation. From the study of Kruss, McGrath, Petersen, Gastrow (2015), the authors highlighted the importance of the intersection of tertiary education in technological innovation in terms of production and global development and strongly suggested for heavy investment in tertiary education which supports the positive relationship between tertiary education and economic growth through technology innovation.

By comparing among the positive relationship of tertiary education through unemployment, fertility and technology, the indirect effects through technology is the highest as it gives the highest magnitude which is 0.0232.

4.6 Comparison between Direct Effect and Indirect Effect

Table 4.6 : Total Effects, Direct Effect and Indirect Effect of Education on Economic Growth

	Coefficient		
	Primary	Secondary	Tertiary
Direct effect	**0.0107**	**-0.0148****	**0.0204*****
Indirect effect			
Unemployment	0.0133**	-0.0121**	0.0093**
Fertility	0.0074	-0.0033	0.0178***
Technology	0.0054	-0.0124**	0.0232***
Total Indirect effects	**0.0261**	**-0.0278**	**0.0503**
Total effects	**0.0368*****	**-0.0426*****	**0.0707*****

Note: *, ** and *** denote statistical significance at the 0.10, 0.05 and 0.01 levels respectively.

Table 4.6 shows the results of total effects, direct effects and indirect effects of three levels of education on economic growth. In the total effects model, the model included only the causal variables (primary, secondary and tertiary education) and the outcome variable (economic growth). From the results generated for the total effects model, primary, secondary and tertiary education is statistically significant at 1% significance level. However, when unemployment, fertility rate and technology were included among the predictors in the direct effect model, the results have changed in which only two out of the three levels of education is statistically significant at 5% significance level. The result of the direct effect and indirect effects will be further discussed in the following.

The direct effect model shows the part of the exposure effect which is not mediated by the mediators. Whereas, the indirect effect will capture the part of the exposure effect which is mediated by the mediators. As we can see in Table 4.6, the results showed that education has the largest effect on economic growth through indirect effects as compared to the direct effect.

Firstly, based on the result shown in the direct effect model, the direct effect of primary education on economic growth is statistically insignificant in Malaysia. Due to the insignificance of the variable, the direct effect of education on economic growth is equal to zero instead of 1.07%. While for the total indirect effects, primary enrollment on average has an effect of 2.61% in increasing the GDP per capita through unemployment, fertility and technology. However, based on the significance of the three mediators, only unemployment is statistically significant at 95% confidence interval since zero is excluded in the interval. Fertility and technology are statistically insignificant based on the result in Table 4.6. Therefore, it implies that the actual indirect effect of primary enrollment rate on GDP per capita after deducting the insignificant indirect effects is equal to 1.33% only through lowering the unemployment rate. In short, we can conclude that the impact of primary education on economic growth is larger through the indirect effect as 1.33% is greater than the direct effect of zero.

Other than that, the result from the direct effects model of secondary education suggested that 1% point increase in secondary enrollment rate corresponds to a decrease in GDP per capita by 1.48%. While looking at the indirect effects, the result showed that 1% point increase in secondary enrollment corresponds to a decrease in GDP per capita by 2.78% through unemployment, fertility and technology. However, after taking into account the significance of the three mediators, the actual indirect effects of secondary enrollment on GDP per capita are only 2.45%. By simply comparing the magnitude, we can conclude that the actual indirect effect of secondary education on economic growth is 2.45% through unemployment and technology and it is higher than the direct effect of 1.48%.

Moreover, the result also shows that the indirect effects have larger effects on economic growth through the three mediators in tertiary education. All the three mediators are statistically significant in tertiary education at confidence interval of 90% and 95%. From the result, we can see that every 1% point increase in tertiary enrollment will boost the GDP per capita directly by 2.04% and indirectly by 5.03% through unemployment, fertility and technology innovation. Obviously, the indirect effect of tertiary education on economic growth is higher than its direct effect by 2.99%. As expected, higher levels of economic growth were associated with the influence of tertiary education in lowering down the unemployment and fertility rate as well as increasing the levels of technology innovation which resulted in higher indirect effect of tertiary education on economic growth.

In short, it is clearly shown that the effect of different levels of education on economic growth is higher in indirect effect compared to direct effect. In other words, the contribution of education to economic growth is larger through unemployment, fertility and technology. Besides, as discussed in the earlier parts, we should focus more on the indirect effect of different levels of education on economic growth instead of direct effect. Thus, it can be concluded that indirect effect is more important in analyzing the effect of different levels of education on economic growth.

Chapter 5: Discussion, Conclusion and Implications

5.0 Introduction

This chapter consists of four sections in which the summary of the entire empirical study will first be presented. The findings of this study suggested that, excluding secondary education, both primary and tertiary educations have significant positive effects on economic growth in Malaysia. This happens through various mediators such as unemployment, fertility rate and technology innovation. Also, the following sections would include the policies implication, limitations of the study as well as the recommendations for future research.

5.1 Summary

The empirical tests that we have conducted in this study consist of mediation analysis and homogeneity of regression test, whereby mediation analysis is the main test of the entire study. The aim of this test is to identify whether the mediating variables (unemployment, fertility rate and technology innovation) will transmit the effect of independent variables (primary education, secondary education and tertiary education) to the dependent variable (economic growth).

The testing of homogeneity of regression must be first carried out before conducting mediation analysis. This is to ensure that there is no significant relationship between the mediators and independent variables. Otherwise, the assumption of homogeneity will be violated and the interpretation on the outcome of mediation analysis should not be validated. According to the outcome of homogeneity test, all the p-values is greater than the significant level of 0.10, thereby we accept the null hypothesis and conclude that the mediators have no relationship with the independent variables.

With the evidence of the homogeneity of regression, mediation analysis can be conducted and the total, direct and indirect effect could be interpreted. The total effect model is a model with economic growth as a function of all levels of education without any mediator. By referring to the results, all levels of education are significant to economic growth and the total effect of tertiary education is the highest among the education levels. Primary education showed a positive relationship with economic growth, whereby the result has fulfilled our expectation and evidenced in the study of Mankiw et al. (2003) in which schooling in primary level has given a positive impact to the economy growth. In contrast, the secondary education showed a negative relationship with economic growth. The computed result is in opposition to the studies done by the previous researchers such as Judson (1996), Barro and Sala-i-Martin (1995), Adawo (2011) as well as Shaihani, Harisb, Ismaila and Saida (2011) in Chapter 2. This could be happened due to the latency period of students entering into workforce as explained in previous chapter. However, it is suggested that the rising in secondary enrollments may result in higher continuation of students in pursuing pre-tertiary education, which believed to provide greater positive influences on economic growth in the long run (Matsushita, Siddique & Giles, 2006). This is evidenced by the greatest positive effects of tertiary education on economic growth found in this study, which also achieved the initial expectation on the importance of tertiary education in boosting the economy (Loening, 2005). As a result, it is believed that the net outcome of the contrary influence between secondary and tertiary education would be positive and large on economic growth.

The direct effect model measures the degree of which the economic growth changes when education enrollments increases while the mediators remain unchanged. From the generated output, the direct effect of primary education indicated an insignificant relationship in explaining economic growth. This result is as expected since Education Act of 1996 explained that primary education is compulsory in Malaysia. Hence, it does not affect the economic growth directly. On the other hand, the negative effect of secondary education is statistically significant in the direct effect model. Since secondary education has yet to be compulsory, students are able to discontinue their study without restrictions by law of education (Patel, 2014).

As government had completely subsidized the secondary education fees, this resulted in a waste of funding to the students who drop out from school. Lastly, tertiary education showed positively significant direct relationship to economy. As the number of international students enrolling in tertiary education in Malaysia has been increasing over the years, it directly boosted economy through the expenditure of foreign students in our country. This can be proven by Verbik and Lasanowski (2007), where 55000 or 2% of total foreign students in the world enrolled in Malaysia.

The indirect effect model shows the effect of different education levels on the economic growth through various mediators such as unemployment, fertility rate and technology innovation. Among the three mediators, only unemployment is significant in transmitting the positive effect of primary education to economic growth. As primary education is fundamental in obtaining higher qualification and skills, people with primary education seldom quit their job and thus lowering the unemployment rate and boosted the economic growth (Hanushek, 2004). In contrast, the indirect effects of primary education through fertility and technology innovation are found to be insignificant in this study. This is because a small amount of primary educations is not sufficient to raise awareness in lowering fertility (Tan & Haines, 1984) or generating new technology innovation (Sieng & Yussof, 2014).

For the indirect effect of secondary education, it shows that secondary education is statistically negatively related to economic growth through increasing the unemployment rate as well as lowering the technological innovation, which is beyond our initial expectation. It is explained that as people delay their participations in labor market, unemployment rate increases and thereby reducing growth (Matsushita, Siddique & Giles, 2006). Besides, increasing in secondary education withdrawal rate also provided reason for the unfavorable impacts on technology innovation, leading to a drop in economic growth. While the unemployment rate and technology innovation are significant mediators, the indirect effect of secondary education through fertility is statistically negatively related yet insignificant to economic growth. This is because there might be other reasons such as poverty instead of education attainments that causes the increase in the fertility rate of Malaysia.

Lastly, the indirect effects of tertiary education have met our initial expectation, whereby unemployment, fertility rate and technology innovation are significant mediators to tertiary education. In other words, tertiary education is significant to boost economic growth through lowering unemployment and fertility rate together in generating new technology innovation. The findings are supported by Bureau Labor Statistics (BLS, 2011) whereby the researchers found that tertiary education is essential in enhancing the employment opportunities. In addition, Barror (2013), Klasen (2002) and Brander and Dowrick (1994) also found an identical result in which tertiary education would reduce the fertility rate of a woman while Romer (1990) and Psacharopoulous (1984) found that economic growth could be improved through having new technology innovation generated by higher education level.

5.2 Policy Implications of the study

5.2.1 Policies on Tertiary Education

This study found that the tertiary education is significantly positively related to the economic growth through its direct and indirect effects. Thus, the Malaysian government should emphasize on the tertiary education in order to boost the economic growth.

As mentioned in Chapter 1, the government has been investing high levels of expenditure on education in Malaysia but there is evidence that the fund is not efficiently allocated. According to Loh (2016), the budget allocated for Public Services Department (JPA) has been reduced to RM1,661 million which is RM278 million lower than the previous year. This decision by government may be an effort to allocate educational funds efficiently but most Malaysians assume that government decided to sacrifice education due to the weakening of economy. Thus, understanding the budget revision is thereby important before making any conclusions.

As the Budget 2016 was revised, the government announced that the JPA scholarships are divided into 4 scholarship programmes. The first programme is the Special Engineering Programme for 200 students who intend to pursue higher education in Japan, Korea, Germany and France while the second programme, Bursary Graduate Programme will be for 744 students who are going to pursue undergraduate studies in local public and private universities. Besides, 8000 JPA scholarships will also be given at local public and private universities. In addition, the National Scholarship Programme will only be prepared for the top 20 Sijil Pelajaran Malaysia students to further their education at leading universities in the world (The Star, 2016). This transformation shows that there is a drastic reduction in the overseas JPA scholarships. Recently, JPA scholarships are decided to be given in the form of loans but the conversion can be done based on three different loan agreement mechanisms (Portal Rasmi Pembangunan Modal Insan [e-SILA], 2016).

Firstly, the graduates who work in the civil service upon graduate can be exempted from paying back the loan in which the loan is said to be converted into scholarship. Secondly, the graduates will only need to pay back 50% of the loan when they decide to work with any government linked companies (GLC) in Malaysia. Otherwise, graduates who do not wish to work in civil service or any GLS will be required to pay back the full amount of loan.

According to Welfare, Family and Women Development Minister, Datuk Fatimah Abdullah, it is true that the decision regarding JPA scholarship may be due to the weakening economy in Malaysia. Such decision would reduce the burden of the government especially for the reduction in oversea scholarships as the current exchange rate of ringgit compared to other currencies is not in Malaysia's favor (Balakrishnan, 2016). However, it cannot be denied that such changes in JPA scholarships will also help government allocate the funds efficiently where the expenditure will result in output growth. Previously, JPA scholars have their freedom after graduating in which they can continue to pursue their dreams abroad. This policy is unfavorable to economy as JPA scholars are not required to return and contribute to Malaysia which resulted in the inefficient use of educational expenditure.

It is suggested that even if JPA does not have job postings for the scholars, the students should at least contribute to the country for six years or repay the government (JPA scholarship bond-free for young Malaysians, 2011). Therefore, with the transformation of this policy, the scholarship programmes are now mostly offered for local university students together with the requirements to work in the civil service in order to be exempted from repaying the loan. This clearly shows a better allocation for the funds offered to the higher education students. By requiring them to work in Malaysia, the output growth of the country will be increased. As a result, instead of sacrificing education, the revision in the policy in fact suggested an efficient allocation of educational funds which may boost the Malaysian economy in the future.

On the other hand, over the years, only students who completed their studies and obtained First Class Honours are eligible for repayment exemption from PTPTN loan (Perbadanan Tabung Pendidikan Tinggi Nasional [PTPTN], 2013). In order to encourage higher enrollment into tertiary education, it is recommended that government may offer a chance of getting 50% discount on the PTPTN loan for students with Second Class Honours. Interviews can be conducted to such students who applied for the 50% discount in the loan repayment. Students' academic performance should not be judged based on result alone as there are students with average academic performance yet has well developed practical skills. They deserve to be assisted financially in their tertiary education as well. Besides, such policy will also motivate students who are unable to score in their Sijil Pelajaran Malaysia (SPM) and failed to be rewarded JPA scholarships to continue to enroll in tertiary education. This may provide a second chance and encourage them to study harder in their tertiary education in order to acquire at least 50% waive of PTPTN loan.

5.2.2 Policies on Primary and Secondary Education

The research also concludes that primary education has significant positive relationship with economic growth through its indirect effect by lowering the unemployment rate. Since Malaysia has already been giving free education for primary education and making it compulsory for everyone, the government can proceed into making better policies for secondary education.

The secondary education in the study shows its significant negative relationship with economic growth. It is explained that the upper secondary school students have delayed entering into the labor market and decreased the economy growth. According to Ministry of Education Malaysia (2013), the Ministry will make secondary education compulsory for all by year 2015 as it is going to bring Malaysia in line with the international standards on years of compulsory education. However, there is not any official announcement by the Ministry despite being in year 2016. Furthermore, this policy seems to be contradicting with the result in the study as secondary school gives significant negative effect to the education and making the secondary education compulsory would further delay their participation in the labor force. Nonetheless, it is suggested that the government should accomplish such policy to make both lower and upper secondary education compulsory. This will result in the growth of secondary completion rate where it will increase students' continuation of studies into pre-tertiary courses like Foundation, STPM, Matriculation and so on (Matsushita et al., 2006). As a consequence, this can increase the enrollment for tertiary education which will have greater contributions to the economy growth of Malaysia in the long run.

5.3 Limitations of the Study

Every research has its own limitations that will influence their study. Likewise, there are a few limitations and shortcomings that we have found in our study throughout the whole research process.

One of the significant problems that we faced in our research is the issue of missing data. We have adopted primary, secondary and tertiary school enrollment rate as the independent variables in our study to represent the different levels of education with time periods ranging from 1984 to 2012. However, the data available during these periods are found to be incomplete. Despite our effort to fill up the missing data from different data sources, the complete set of data for primary and tertiary school enrollment rate was still unavailable and there are still missing data in few of the years. In order to deal with this problem, the current study adopted averaging method to fill up the missing values. Averaging method was selected in the current study as it is simple to calculate, able to maintain our sample size and it is more efficient compared to the method of case deletion (Schafer & Graham, 2002). Despite its simplicity, this averaging method is found to be an unfavorable method to solve the missing data problem due to its reduction of variability in the data which causes the standard errors to be underestimated while test statistic is being overestimated (Soley-Bori, 2013). According to Baraldi and Enders (2010), since the averaging method is unable to capture the variability of the data, it will lead to bias mean estimates which might influence the findings of the study.

Secondly, the data available for school enrollment rate is only up to year 2012. As a consequence, we are unable to study the relationship between education and economic growth based on recent data. It is believed that recent data might be more useful in describing the current situation of the relationship between education and economic growth.

Last but not least, the adoption of school enrollment rate as our measurement for education is also suggested to be one of the limitations in current study as school enrollment rate is not a good proxy to represent the education. Based on our major findings, we found an inconsistent result in which there is a negative relationship between secondary school enrollment rate and economic growth. As we have discussed in Chapter 4, the unfavorable result was probably due to the fact that secondary education is non-compulsory in Malaysia that resulted in a high dropout rate.

Since education is free of charge by the government, this high dropout rate will cause the money funding by the government to be wasted. Therefore, it can be concluded that the effect of school enrollment rate as a proxy for education could not be analyzed accurately since school enrollment is unable to capture the real effect of education contributed on economic growth.

5.4 Recommendations for Future Research

The findings and limitations of the current study discussed earlier suggested that it can be further extended and enhanced in several areas. First and foremost, since the data of primary and tertiary enrollment rates in some of the years was unavailable and the averaging method employed in current study to deal with the problem of missing data is proven to be weak, it is suggested that new proxy such as completion rate by level of education should be considered. New proxy rather than new approach of handling the missing data is recommended as we realized that the school enrollment rate was unable to explain the indirect effect of education attainment on economic growth clearly since it does not imply the accumulation of human capital. This is evidenced by the unfavorable result shown by secondary school enrollment rate. It is important to know the effect of education attainment on economic growth based on completion rate so that the question on the necessity to make secondary education compulsory in Malaysia could be addressed properly. However, such secondary data might not be completed in various databases and future researcher might be required to collect primary data for the benefit of it.

Another possibility for future studies would be an empirical study focusing on the effect of higher education on economic growth since current study revealed favorable effect of tertiary education but only in a general way. It is suggested that an empirical comparison study especially between the effects of public and private universities may provide an in-depth analysis of the impact of higher education on economic growth, which can lead to an accurate evaluation of higher educational policies.

Other than that, future extension of current study could cover the benchmarking of the overall education performance with those of the developing countries that have similar stage of economic development as Malaysia. One of the developing countries suggested for benchmarking would be Thailand since various sources adapted in previous chapter showed that the education performance of Malaysia is still lagging behind Thailand. The primary objective of this benchmarking study is to recognize the areas that lead to the poorer performance of education in Malaysia when compared to Thailand, so that appropriate policies to accomplish improvements in such areas could be identified accordingly.

REFERENCES

Abbas, Q. (2001). Endogenous Growth and Human Capital: A Comparative Study of Pakistan and Sri Lanka. *The Pakistan Development Review, 40*(4), 987-1007.

Abdullah, A. (2012). Economic Growth and its determinants: A longitudinal and a cross-regional analysis. *Journal of Economics and Sustainable Development, 3*(1), 20-31.

Abdullah, A. J. (2013). Education and economic growth in Malaysia: The issues of education data. *Procedia Economics and Finance*, *7*, 65-72.

Adawo, M. A. (2011). Has education (human capital) contributed to the economic growth of Nigeria. *Journal of Economics and International Finance, 3*(1), 46-58.

Awad, A., Halid, N., & Yussof, I. (2013). The impact of human capital on economic growth: the case of selected Arab countries. *Jurnal Antarabangsa Kajian Asia Barat, 5*(2), 79-96.

Babalola, Y. A. (2012). The impact of corporate social responsibility on firms' profitability in Nigeria. *European Journal of Economics, Finance and administrative sciences*, *45*(1), 39-50.

Babatunde, M. A. & Adefabi, R. A. (2005, November 1-2). *Long run relationship between education and economic growth in Nigeria: Evidence from the Johansen's cointegration approach*. Paper presented at the Regional Conference on Education in West Africa: Constraints and Opportunities Dakar, Senegal. Retrieved from http://www.saga.cornell.edu/saga/educconf/babatunde.pdf

Balakrishnan, N. (2016, February 26). You now have to pay back your JPA scholarships if you don't want to work in civil service. *Says.* Retrieved from http://says.com/my/news/jpa-scholarships-converted-into-loans-starting-2016

Baraldi, A. N., & Enders, C. K. (2010). An introduction to modern missing data analyses. *Journal of School Psychology*, *48*(1), 5-37.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality & Social Psychology, 51*, 1173-1182.

Barro, R. J. & Sala-i-Martin, X. (1995). *Economic growth*. New York, United States: McGraw-Hill.

Barro, R. J. (1991). A cross-country study of growth, saving and government. *NBER Working Paper,* 5994.

Barro, R. J. (2013). Education and economic growth. *Annals of Economics and Finance*, *14*(2), 277-304.

Bassanini, A., Scarpetta, S., & Hemmings, P. (2001). Economic growth: the role of policies and institutions. Panel data evidence from OECD countries. *OECD Economics Department Working Paper,* 283.

Bassetti, T. (2007). Education and poverty in a Solow growth model. *JEL Working Paper*, E13I2O4.

Becker, G. S., Murphy, K. M., & Tamura, R. (1994). Human capital, fertility, and economic Growth. *NBER Working Paper*, 11239.

Benhabib, J. & Spiegel, M. (1994). The Role of Labour in Economic Development: Evidence from Cross-Country Data. *Journal of Monetary Economics, 34*, 143-173.

Benos, N., & Zotou, S. (2014). Education and Economic Growth: A Meta-Regression Analysis. *World Development, 64*, 669-689.

Bils, M., & Klenow, P. J. (2000). Does schooling cause growth? *The American Economic Review*, *90*(5), 1160-1183.

Blinova, T., Bylina, S., & Rusanovskiy, V. (2015). Vocational education in the system of determinants of reducing youth unemployment. *Procedia – Social and Behavioral Sciences, 214*, 526-534.

Bollen, K. A., & Stine, R. (1990). Direct and indirect effects: Classical and bootstrap estimates of variability. *Sociological Methodology, 20*, 115-140.

Brander, J. A., & Dowrick, S. (1994). The role of fertility and population in economic growth. *Journal of Population Economics, 7*(1), 1-25.

Bureau of Labor Statistics. (2011, April 8). *College Enrollment and Work Activity of 2010 High School Graduates*. Retrieved from http://www.bls.gov/news.release/archives/hsgec_04082011.pdf

Carpenter, J., & Bithell, J. (2000). Bootstrap confidence intervals: when, which, what? A practical guide for medical statisticians. *Statistics in Medicine, 19*, 1141 - 1164.

Chu, M. M. (2014, February 27). Malaysia's population is not 28 million anymore. *Says*. Retrieved from http://says.com/my/news/malaysia-population-hits-30-million-on-27-feb-2014

Clark, N. (2014, December 2). Education in Malaysia. *World Education News & Reviews*. Retrieved http://wenr.wes.org/2014/12/education-in-malaysia/

Cobb, C. W., & Douglas, P. H. (1928). A theory of production. *American Economic Review, 18*, 139-165.

Cokluk, O., & Kayri, M. (2011). The Effects of Methods of Imputation for Missing Values on the Validity and Reliability of Scales. *Educational Sciences: Theory and Practice, 11*(1), 303-309.

Cole, J. (2009). *Great American University*. New York: Public Affairs.

Dahlin, B. G. (2002). The Impact of Education on Economic Growth. *Theory, Finding, and Policy Implications. Duke University.*

Doppelt, R. (2012). Skill flows: A theory of human capital and unemployment. *New York University Working Paper*, 062712.

Dowrick, S. (2003). Ideas and education: Level or growth effects? *NBER Working Paper*, 9709.

Echevarria, D. G. (2009). *The contribution of higher education to economic development in a globalized environment* (Doctoral dissertation, Florida International University). Retrieved from http://gradworks.umi.com/33/77/3377919.html

Education Act 1996. (2006, January 1). Retrieved from http://planipolis.iiep.unesco.org/upload/Malaysia/Malaysia_Education_Act_1996.pdf

Efron, B., & Tibshirani, R. (1985). The bootstrap method for assessing statistical accuracy. *Behaviormetrika, 12*(17), 1-35.

Filho, M. B., Silva, R. G., & Diniz, E. M. (2005). The empirics of the Solow growth model: Long-term evidence. *Journal of Applied Economics, 8*(1), 31-51.

Földvári, P., & Leeuwen, B. V. (2009). An alternative interpretation of 'average years of education' in growth regressions. *Applied Economics Letters, 16*(9), 945-949.

Francis, B. & S. Iyare (2006). Education and development in the Caribbean: A cointegration and causality Approach. *Economics Bulletin, 15*(2), 1-13.

Free Malaysia Today. (2011, May 16). *JPA scholarship bond-free for young Malaysians*. Retrieved on http://www.freemalaysiatoday.com/category/opinion/2011/05/16/jpa-scholarship-bond-free-for-young-malaysians/

Garrouste, C., Kozovska, K., & Perez, E. A. (2010). Education and Long-Term Unemployment. *MPRA Paper, 25073.*

George, D., & Mallery, P. (2006). *SPSS for Windows step by step. A simple guide and reference, 13.0 update* (6th ed.). New York: Allyn and Bacon.

Glewwe, P., Maïga, E., & Zheng, H. (2014). The contribution of education to economic growth: A review of the evidence, with special attention and on application to Sub-Saharan Africa. *Journal of World Development, 59*, 379-393.

Gonyea, R. M., Kish, K., Kuh, G. D., Muthiah, R., & Thomas, A. (2003). *College Student Experiences Questionnaire: Norms for the fourth edition*. Bloomington, IN: Indiana University Center for Postsecondary Research, Policy and Planning.

Grönqvist, H., & Hall, C. (2013). Education policy and early fertility: Lessons from an expansion of upper secondary schooling. *Economics of Education Review, 37*, 13-33.

Guisan, M. C., Aguayo. E., & Exposito, P. (2001). Economic growth and cycles: cross-country models of education, industry and fertility and international comparison. *Applied Econometrics and International Development, 1*(1), 3-37.

Gupta, M. R., & Chakraborty, B. (2006). Human capital accumulation and endogenous growth in a dual economy. *Hitotsubashi Journal of Economics*, 47(2), 169-195.

Hanushek, E. A. (2004). Economic analysis of school quality. *Paper commissioned for the EFA Global Monitoring Report 2005, The Quality Imperative.*

Hayward, G. (2011). Teenage pregnancy and its health implications. *International Journal of Public Health Research Special Issues, 11*, 100-102.

Higher Education in Malaysia. (2014). *List of Universities in Malaysia.* Retrieved from http://www.etawau.com/edu/IndexUniversity.htm

Jalil, A., & Idrees, M. (2013). Modeling the impact of education on the economic growth: evidence from aggregated and disaggregated time series data of Pakistan. *Economic Modelling, 31*, 383-388.

Judson, R. (1996). *Do Low Human Capital Coefficients Make Sense? A Puzzle and Some Answers*. United States: Division of Research and Statistics, Division of Monetary Affairs, Federal Reserve Board.

Judson, R. (2002). Measuring human capital like physical capital: what does it tell us? *Bulletin of Economic Research*, *54*(3), 209-231.

Kalaitzidakis, P., Mamuneas, T. P., Savvides, A., & Stengos, T. (2001). Measures of human capital and nonlinearities in economic growth. *Journal of Economic Growth*, *6*(3), 229-254.

Keller, K. R. I. (2006). Education expansion, expenditure per student and the effects on Growth in Asia. *Global Economic Review, 32*, 21-42.

Klasen, S. (2002). Low schooling for girls, slower growth for all? Cross-country evidence on the effect of gender inequality in education on economic development. *The World Bank Economic Review*, *16*(3), 345-373.

Koba, K. (2014). *How is monthly jobs report compiled? CNBC explains.* Retrieved from http://www.cnbc.com/id/44451664

Krueger, A. B. & Lindahl, M. (2001). Education for growth: Why and for whom? *Journal of Economic Literature, 39*(4), 1101-1136.

Kruss, G., McGrath, S., Petersen, I., & Gastrow, M. (2015). Higher education and economic development: The importance of building technological capabilities. *International Journal of Educational Development, 43*, 22-31.

Latham, C. (2013). *What is gross domestic product and why is it important?* Retrieved from http://metro.co.uk/2013/04/25/what-is-gross-domestic-product-and-why-is-it-important-3666096/

Lau, L. J., Jamison, D. T., & Louat, F. F. (1991). Education and productivity in developing countries: An aggregate production function approach. *World Development Report,* 612.

Le, T., Gibson, J., & Oxley, L. (2005). Measures of human capital: A review of the literature. *New Zealand Treasury Working* Paper, 05*/10*.

Levine, L. (2013). Economic growth and the unemployment rate. Congressional Research Service.

Loening, J. L. (2005). Effects of primary, secondary and tertiary Education: Evidence from Guatemala. *Policy Research Working Paper*, 3610.

Loening, J. L. (2005). Estimating human and physical capital stock in data-scare environments: A methodological note and application to Guatemala. *International Journal of Applied Econometrics and Quantitative Studies, 2*(1), 89-114.

Loh, S. (2016, January 28). 5 ways budget 2016 will affect college & university students. *Edu Advisor*. Retrieved from https://eduadvisor.my/articles/budget-2016-impact-college-university-students/

Lucas, R. (1988). On the mechanics of economic development. *Journal of Monetary Economics, 22*(1), 3-42.

MacKinnon, D. P., Lockwood, C. M., Hoffman, J. M., West, S. G., & Sheets, V. (2002). A comparison of methods to test mediation and other intervening variable effects. *Psychological Methods, 7*, 83-104.

Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A contribution to the empirics of economic growth. *Quarterly Journal of Economics, 107*(2), 407-437.

Matsushita, S., Siddique, A., & Giles, M. (2006). Education and economic growth: A case study of Australia. *Review of Applied Economics, 2*(1), 117-127.

McMahon, W. W. (1984). The relation of education and R&D to productivity growth. *Journal Economics of Education Review, 3*(4), 299-313.

Melike, B., Melda, O., Seçkin, S., & Elçin, A. (2005). Determinants of human capital theory, growth and brain drain; An econometric analysis for 77 countries. *Applied Econometrics and International Development, 5*(2), 109-140.

Mercan, M., & Sezer, S. (2014). The Effect of Education Expenditure on Economic Growth: The Case of Turkey. *Procedia-Social and Behavioral Sciences*, *109*, 925-930.

Ministry of Education Malaysia. (2013). *Malaysia education blueprint 2013-2025 (Preschool to post-secondary education)*. Putrajaya, Malaysia: Author.

Ministry of Education Malaysia. (2015). *Malaysia education blueprint 2015-2025 (Higher education)*. Putrajaya, Malaysia: Author.

Mitra, D. (2011). *Pennsylvania's best investment: The social and economic benefits of public education*. State College, PA: Pennsylvania State University.

Mohd, A. M., Adibah, H. I., & Haliza, G. (2015). A review of teenage pregnancy research in Malaysia. *The Medical Journal of Malaysia, 70*(4), 214-219.

Mondschean, T., & Oppenheimer, M. (2011). Regional long-term and short-term unemployment and education in transition: The case of Poland. *The Journal of Economic Asymmetries, 8*(2), 23-48.

Mooney, C. Z., & Duval, R. D. (1993). *Bootstrapping: A nonparametric approach to statistical inference.* California, United States: Sage Publications.

Nelson, R. R., & Phelps, E. S. (1996). Investment in humans, technological diffusion and economic growth. *The American Economic Review, 56*(1/2), 69-75.

Nickell, S. (1979). Education and lifetime patterns of unemployment. *Journal of Political Economy, 87*(5), 117-131.

Page, J. (1994). The East Asian miracle: four lessons for development policy. *NBER Microeconomics Annual 1994, 9*, 219-282.

Papageorgiou, C. (2003). Distinguishing between the effects of primary and post-primary education on economic growth. *Review of Development Economics, 7*(4), 622–635.

Patel, T. (2014). Dropping out of school in Malaysia: What we know and what needs to be done. *Policy Ideas, 14*, 1-16.

Perbadanan Tabung Pendidikan Tinggi Nasional. (2013). *Repayment Exemption*. Retrieved from http://www.ptptn.gov.my/web/english/repayment-exemption

Petrakis P. & Stamatakis, D. (2002). Growth and educational levels: A competitive Analysis. *Review of Economics Education, 21,* 513–521.

Piotrowski, M., & Tong, Y. (2016). Education and fertility decline in China during transitional times: A cohort approach. *Social Science Research, 55,* 94-110.

Pirim, Z., Owings, W. A., & Kaplan, L. S. (2014). The Long-Term Impact of Educational and Health Spending on Unemployment Rates. *European Journal of Economic and Political Studies, 7*, 46-45.

Portal Rasmi Pembangunan Modal Insan. (2016). Pengumuman Model Baharu Penajaan JPA. Retrieved from http://esilav2.jpa.gov.my/esila_new/index.php.

Poulsen, T. B. (2004). The impact of education on growth – Is education positively related to the growth rate? (Master dissertation, Aarhus University, Aarhus, Denmark). Retrieved from http://www.thbp.dk/thbp/final_thesis.pdf

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*, 879-891.

Preacher, K. J., & Hayes, A. F. (2014). Statistical mediation analysis with a multicategorical independent variable. *British Journal of Mathematical and Statistical Psychology, 67,* 451-470.

Preacher, K. J., Rucker, D. D., & Hayes, A. F. (2007). Assessing moderated Mediation hypotheses: Theory, methods, and prescriptions. *Multivariate Behavioral Research, 42,* 185-227.

Pritchett, L. (2001). Where has all the education gone? *The World Bank Economic Review, 15*(3), 367-391.

Psacharopoulos, G., & Schultz, T. W. (1984). *The contribution of education to economic growth: International comparisons*. Washington, DC: World Bank.

Romer, D. (2000). *Advanced macroeconomics* (2nd ed.). New York, United States: McGraw-Hill

Romer, P. M. (1986). Increasing returns and long-run growth. *Journal of Political Economy, 94*(5), 1002-1037.

Romer, P. M. (1990). Capital, labor, and productivity. *Brookings papers on economic activity*. Microeconomics, *1990,* 337-367.

Rucker, D. D., Preacher, K. J., Tormala, Z. L., & Petty, R. E. (2011). Mediation Analysis in Social Psychology: Current Practices and New Recommendations. *Social and Personality Psychology Compass, 5*(6), 359-371.

Russell, I. J., Crofford, L. J., Leon, T., Cappelleri, J. C., Bushmakin, A. G., Whalen, E., Barrett, J. A., and Sadosky, A. (2009). The effects of pregabalin on sleep disturbance symptoms among individuals with fibromyalgia syndrome. *Sleep Medicine, 10,* 604-610.

Sachs, J. D., & Warner, A. M. (1995). Economic reform and the process of global integration. *Brookings Papers on Economic Activity, 25,* 1-95.

Schafer, J. L., & Graham, J. W. (2002). Missing Data: Our View of the State of the Art. *Psychological Methods, 7*(2), 147-177.

Schündeln, M., & Playforth, J. (2014). Private versus social returns to human capital: Education and economic growth in India. *Journal of European Economic Review, 66,* 266-283.

Self, S. & Grabowski, R. (2004). Does education at all levels cause growth? India, a case study. *Economics of Education Review, 23,* 47-55.

Shaihani, M., Harisb, A., Ismaila, N., & Saida, R. (2011). Long run and short run effects on education levels: case in Malaysia. *International Journal of Economic Research, 2*(6), 77-87.

Sieng, L. W., & Yussof, I. (2014). Human Capital Accumulation and Economic Growth in Malaysia – Investigating the Long Run Nexus. *Jurnal Ekonomi Malaysia*, *48*(1), 155-165.

Snieska, V., Valdokiene, G., Daunoriene, A., & Draksaite, A. (2015). Education and unemployment in European union economic cycles. *Procedia – Social and Behavioral Sciences, 213*, 211-216.

Sobel, M. E. (1982). Asymptotic confidence intervals for indirect effects in structural equation models. *Sociological Methodology*, *12*, 290-312.

Soley-Bori, M. (2013). Dealing with missing data: Key assumptions and methods for applied analysis. *Technical Report*, 4.

Solow, R. M. (1956). A contribution to the theory of economic growth. *The Quarterly Journal of Economics, 70*(1), 65-94.

Sterlacchini, A. (2008). R&D, higher education and regional growth: Uneven linkages among European regions. *Journal of Research Policy, 37*(6), 1096-1107.

Stern, D. (2004). Economic growth and energy. *Encyclopedia of Energy, 2*, 35-78.

Study Malaysia. (2015, March 14). The Malaysian higher education system- An overview. *Study Malaysia*. Retrieved from https://www.studymalaysia.com/education/higher-education-in-malaysia/the-malaysian-higher-education-system-an-overview

Tan, B. H. (2008). *Cobb-Douglas production function*. Berlin, Germany: Jamador.

Tan, J. P., & Haines, M. (1984). Schooling and Demand for Children: Historical Perspectives. *World Bank staff working papers*, 697.

Tehrani, M. A. (2014). *An analysis of education impact on Malaysia economic growth from 1985 to 2010* (Master dissertation, Asia e University, Kuala Lumpur, Malaysia). Retrieved from http://eprints.aeu.edu.my/1796/

Terzo, G. (2016). *What is the importance of GDP?* Retrieved from http://www.wisegeek.com/what-is-the-importance-of-gdp.htm#

Testa, M. R. (2014). On the positive correlation between education and fertility intentions in Europe: Individual- and country-level evidence. *Journal of Advances in Life Course Research, 21,* 28-42.

The Star. (2016, January 28). *Budget 2016 Revision: Four JPA Sponsorship Programmes to go on.* Retrieved from http://www.thestar.com.my/news/nation/2016/01/28/budget-2016-revision-four-jpa-scholarship-programmes-to-continue/

The Sun Daily. (2015, January 29). *Malaysia has one of highest proportions of international students pursuing higher education.* Retrieved from http://www.thesundaily.my/news/1314991

Tsai, C. L., Hung, M. C., & Harriott, K. (2010). Human capital composition and economic growth. *Social Indicators Research*, *99*(1), 41-59.

Universitas 21. (2014). *Malaysia's ranking in the U21 report*. Retrieved from http://www.myedureview.com/

Van Leeuwen, B. (2007). *Human capital economic growth in India, Indonesia, and Japan: a quantitative analysis, 1890-2000*. Netherlands, Box Press Shop.

Vasile, B., & Camelia, B. (2013). Drivers of knowledge economy in the Eu'S developing countries. *Annals-Economy Series*, *2*, 10-15.

Verbik, L., & Lasanowski, V. (2007). International student mobility: Patterns and trends. *The Observatory on Borderless Higher Education report*, United Kingdom.

Wanyonyi, W. (2004). *A study of the factors affecting the implementation of free Primary Education in Nairobi province* (Master's thesis). University of Nairobi, Kenya.

Weil, N. D. (2009). *Economic growth* (3rd ed.). United States: Pearson Education Limited 2013.

Woessmann, L. (2014). The Economic Case for Education. *EENEE Analytical Report*, 20.