THE IMPACT OF CLIMATE ON ECONOMIC GROWTH IN MALAYSIA

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This project is submitted in partial fulfillment of the requirements for the degree of
Bachelor of Economics with Honours

(Industrial Economics)

Faculty of Economics and Business

UNIVERSITY MALAYSIA SARAWAK

2015

Statement of Originality

The work described in this Final Year Project, Entitled

"The impact of climate on economic growth in Malaysia"

is to the best of the author's knowledge that of the author except where due reference
is made.

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ABSTRACT

THE IMPACT OF CLIMATE ON ECONOMIC GROWTH IN MALAYSIA

by

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The study investigate the relationship between climate change and economic growth in Malaysia. The selected dependent variable is GDP (current LCU) while independent variables are Precipitation, Temperature and Arable land as well. The objective of this study is to assess the relationship between precipitation, temperature and arable land, which statistically significant to the GDP (current LCU). This study uses the annually time series data of GDP (current LCU), Precipitation (mm), Temperature (°C) and Arable land (% of land used) from year 1983 to 2013. The methodologies that been employed in this study include the Augmented Dickey-Fuller (ADF) unit root test, Dickey-Fuller GLS (DF-GLS) unit root test, the Johansen-Juselius Cointegration test, Vector Error Correction Model (VECM) test, the Variance Decomposition (VDC) test and the Impulse Response Function (IRF) test. The empirical results implies that there is one cointegrating vectors between variables, which indicate that there is a unidirectional causality relationship between Precipitation, Temperature and Arable land towards GDP (current LCU) in long term. Furthermore, the Precipitation appears to be the most exogenous variable and Temperature appears to be the most endogenous variable at the 50 year horizon period. The IRF test concluded that majorities of the model are able to recover back within 5 years when response over time of a variable caused by the shock of another variable. Several policies have been recommended in this study that may be carried out by the Malaysian government to solve the currecncy climate crisis that may eventually be absorbed into the economic growth of Malaysia.

ABSTRAK

KESAN IKLIM TERHADAP PERTUMBUHAN EKONOMI MALAYSIA

Oleh

TAY GUAN PUAY

Kajian ini mengkaji hubungan antara perubahan iklim dan pertumbuhan ekonomi di Malaysia. Pembolehubah bersandar dipilih KDNK (LCU semasa) manakala pembolehubah bebas adalah Air hujan, suhu dan tanah pertanian juga. Kajian ini bertujuan untuk menilai hubungan antara hujan (mm) , suhu (˚C) dan tanah pertanian (% daripada tanah yang digunakan) ,yang statistik yang signifikan kepada KDNK (LCU semasa) dengan menggunakan data tahunan yang mengrakumi tempoh diantara tahun 1983 dan 2013. Metodologi yang telah digunakan dalam kajian ini termasuk Augmented Dickey-Fuller (ADF) unit ujian akar, Dickey-Fuller GLS (DF-GLS) ujian unit akar, ujian Johansen-Juselius cointegrasi, Vektor Pembetulan Ralat Model (VECM) ujian, Varian penguraian (VDC) ujian dan Impulse Respons Fungsi (IRF) ujian. Keputusan empirikal menunjukkan bahawa terdapat satu vektor cointegrating antara pembolehubah, yang menunjukkan bahawa terdapat hubungan sebab dan akibat yang satu arah antara Pemendakan, Suhu dan tanah pertanian kepada KDNK (LCU semasa) dalam jangka panjang. Tambahan pula, Pemendakan kelihatan pembolehubah yang paling eksogen dan Suhu kelihatan pembolehubah yang paling dalaman pada tempoh ufuk 50 tahun. Ujian IRF membuat kesimpulan bahawa majoriti model yang dapat memulihkan kembali dalam tempoh 5 tahun apabila sambutan dari masa ke masa bagi pembolehubah yang disebabkan oleh kejutan pembolehubah lain. Beberapa dasar telah disarankan dalam kajian ini yang boleh dilakukan oleh kerajaan Malaysia untuk menyelesaikan krisis iklim currecncy yang mungkin akhirnya diserap ke dalam pertumbuhan ekonomi Malaysia.

ACKNOWLEDGEMENT

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CHAPTER 1

INTRODUCTION

1.0 Introduction

Climate change has become the single biggest environmental and humanitarian crisis of our time (*Climate Institute*, 2010). Climate change is a complicated phenomenon because its hard to predict the full-scale impact[1]. Recently, scientist have learned more about the interaction between climate change and planet or our communities. Most of the scientist agree that certain consequences are likely to occur if current trends continue as usual[2]. Climate change is affects our economy, health and communities in diverse way. The inconsistent of climate change will lead to a degradation in economic growth. Besides, the changes of weather such as the increased in temperature and reduced in air quality and precipitation have negative impact towards our health and communities. Scientist warn that if we fail to aggresive take action to curb the climate change, the results will be disastrous (*Climate Institute, 2010*).

Scientists have found that carbon dioxide emission or temperature is the main factor that causing the environmental degradation or climate change[3]. Carbon dioxide is the primary greenhouse gas emitted through human activities like combustion of fossil fuels that include coal, natural gas, and oil for energy and transportation, electricity and industry. Carbon dioxide is naturally present in the atmosphere as part

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[1] Definition obtained from http://www.nrdc.org/
[2] Defined from http://www.nrdc.org/
[3] Definition obtained from
http://wwf.panda.org/who_we_are/wwf_offices/malaysia/environmental_problems_malaysia/

of the Earth's carbon cycle (*United States Environmental Protection Agency, 2014*). Carbon cycle is altered by human activities by adding more carbon dioxide to the atmosphere and by influencing the ability of natural sinks. The higher the carbon content in the fossil fuel or inefficient the burning process is, generally the more carbon dioxide that is produced while temperature will increased. The warmer temperature and the absence of winter frosts will leads to sustainability lower the long-term economic growth in developing nations (*Massachusetts Institute of Technology*, 2012). This happened because of higher temperature hurt economic production such as slowing down worker productivity, commerce and perhaps even capital investment. Inversely, the higher temperature benefits in cooler countries. This is because the warmer temperature will increase the economic production such as increased worker productivity due to comfortable weather. Dell, Jones and Olken (2011) found that temperature has statisticaly significant affect the condition of economic growth in poor countries. Their study stated that "an increase in annual average temperature by 1 degree centigrade corresponded to a 1.39 percent drop in per-capita gross domestic product" which had a huge effect to economic growth (p.75).

There are some other factors that causes the climate change such as precipitation and land reform. Precipitation is the primary mechanism for transport water from the atmosphere to the surface of the earth[4]. The most common forms of precipitation is water rainfall. Precipitation is naturally present through hydrological cycle. The hydrological cycle begins with evaporation from the surface of the ocean or land before redistributes the water vapor to locations where it forms cloud, and then returns to the surface as precipitation. The changes in precipitation causes climate change and

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[4] Definition retrieved from http://ww2010.atmos.uiuc.edu/%28Gh%29/guides/mtr/hyd/prcp.rxml

affect the economic growth significantly. The increasing in precipitation will induce a region's susceptibility to a variety of factors such as flooding, rate of soil erosion, mass movement of land and soil moisture availability (*Climate Institute, 2010*). These variety of factors are able to affect the key economic components of gross domestic product such as agricultural productivity, land values, and an area's habitability (*Intergovernmental Panel on Climate Change*, 2007). As stated in Nearing et al (2005), the decreasing in soil moisture leads to reduced downward movement of water and less replenishment of groudwater supplies.

Futhermore, land reform is also a factor that caused climate change. Land reform define as purposive change in the way in which agricultural land is held or owned and it also known as deforestation. The increasing world population had increased the demand for a place-to-stay. Thus, many forest had been cleared out to construct the cities to provide for housing. This will directly and adversely affect the economic growth leading to reduced oxygen output while rising the greenhouse effect. Deforestation occurs primarily due to urban expansion and burning the plant crops. The activity of deforestation helps in filtering the carbon dioxide in the atmosphere and provide the oxygen during photosynthesis.

In contrast, economic growth is defined as increase the value market of goods and services that produced by economy over time. An increasing of percent rate in Gross Domestic Product (GDP) or Real Gross Domestic Product (RGDP) is measured by economic growth. Based on the history, improvements in economic growth and development is affected by the condition of environment. For instance, Malaysia faced environmental degradation in year 2005, which is the water resources are depleting and put up with the recurrent haze (*Vision for A Sustainable World*, 2014). The sparking forest fire in year 2005 cause degradation in weather which produced

haze, but does it affect economic growth and development? In this scenario, it is interesting to find out whether environmental preservation and economic growth & development can coincide or not.

There are many researches on the relationship between environmental and economic growth. It is important to investigate the inetraction between environmental preservations and economic growth because it will able to generate reliable policies to reduce environmental crisis while make improvement in economic growth. Based on the findings, the government can comfirm which environmental variable significantly affects the condition of economic growth and the knowledge to manage the problems of environmental crisis. Climate change can identify with the changes in economic conditions and help estimate the future performance in economic growth and development (Choi, Heshmati & Cho, 2010). Environmental improvements will come as a natural effect stringent environmental policies via innovation, compliance, increase resource efficiency and improved technologies (Ekborn & Dahberg, 2008). When the functions of the natural environment are seriouly impaired, economic growth can slow down or even be negative due to the inconsistent air quality control, water-quality control, hazardous waste disposal, solid waste management and management of toxic substances from industrial production. Besides, some researcher state that pollution may directly decrease output and quality of life by decreasing productivity of man-made capital and labour (Borhan, Ahmed & Hitam, 2013). However, as stated by Akram (2012), economic growth is negatively affected by changes in temperature, precipitation and population growth whereas urbanization and human development stimulates economic growth. Furthermore, a small portion of excess income is allocated for environmental problems during the early stage of economic development due to the GDP per capita increases and exceeds a certain

threshold (Choi, Heshmati & Cho, 2010). Last but not least, the reults of the research can be a reference to the government in implementing policies in managing the environmental preservations progress.

Basically, the previous study shows that both economic growth and development are influenced by the climate change. As found by Brown and Lall (2006), rainfall or precipitation is statistically significance to economic growth and development. The effect of water rainfall could have a deleterious impact towards large segments of human society (Brown & Lall, 2006). In the research of Barriors, Bertinelli and Strobl (2003), rainfall had a significant effect on economic growth in Africa, but not for other developing countries. The results from Dell et.al. (2012) documented that temperature have negative impact on economic growth and development which the decreasing in the degree of temperature leads to an increasing in GDP per capita and exceeds the certain threshold. In addition, Walker (1993) examine that land reforms is a necessary outcome of economic development and have statiscally sigficance results. The study concluded that climate change have negative impact towards economic growth in developing countries (Odusola & Abidoye, 2007). In a nutshell, this study intends to investigate the relationship of climate change on economic growth and development in Malaysia.

In terms of methodology, this study employed unit root tests which consists of Augmented Dickey Fuller test to analyze the stationary of the time series of data. The finding of the unit root tests show that all the time series data are stationary and integrated order 1. In contrast, the relationship between climate change and economic growth & development is determine by using Johansen and Juselius cointegration test. It use to prove the existence of long run equilibrium relationship between variables. Last but not least, the VECM Granger Causality test and Granger causality test will be

used to investigate the short run causality between the climate change and economic growth & development.

There are three environmental variables consisting of Temperature, water rainfall and land reforms are obtained in the study. The data for the variable obtained for the period of 30 year. The data period from 1983 to 2013 year has been selected in the study. Data was collected from Worldbank.

1.1 Background of the Study

Malaysia

Malaysia is a federal constitutional monarchy located in Southeast Asia. It consists of thirteen states and three federal territories. Malaysia is divided into two similarly sized region which consists of Peninsular Malaysia and East Malaysia.

The environmental record in Malaysia define as relatively positve. Malaysia has enjoyed one of the least polluted urban environments in Asia. Malaysia hold tropical rainforest as well as peat swamp forest and become one of the world's favorite for travel enthusiasts.and rainforests. However, in recent years, the massive industrial development had increase in urbanisation and vehicles use. This situation leads growing of air pollution due to both stationary industry emissions and vehicles exhaust in industrial and urban areas. Besides, Malaysia also faces environmental problems such as pollution of inland and marine waters, problems of deforestation, soil and coastal erosion, water pollution and the problem of water disposal.

Figure 1.1: GDP growth rate (%) from year 1983 to 2013 in Malaysia
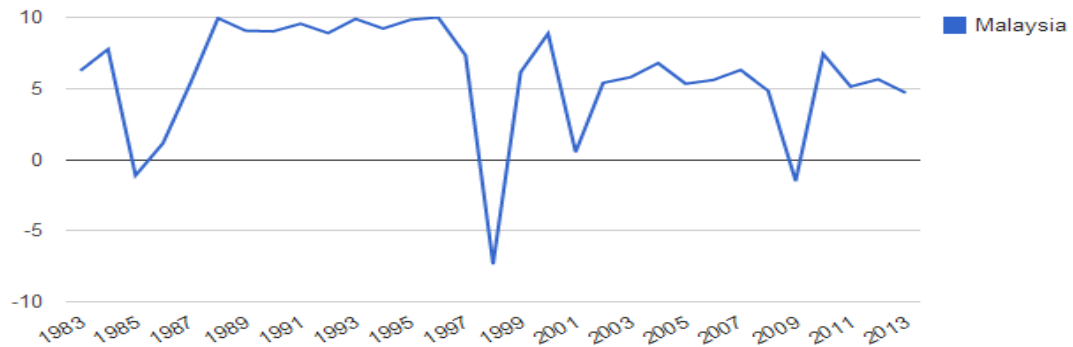
Source: World Bank Indicator, 2014.

The figure 1.1 shows that GDP has consistent growth from year 1985 to 1987. In year 1997, Malaysia economy was negative perception because of the collapse of the Thailand economy (*Asian Development Bank Institute*, 2014). International rating agencies had failed to consider underlying risks in the Thailand economy. This perception effects their assessment of Malaysia while leading in decrease of the ringgit exchange rate. However, Malaysia able to control the environmental crisis before year 2007. The GDP have showed a slightly drop from year 2012 to year 2013. In year 2013, Malaysia was tightly in a cloud of record-breaking haze pollution. The haze caused by Sumatra, Indonesia to open burning and clear land for agriculture. The large amounts of carbon dioxide emissions from the burning of carbon-rich peatland and forrests had causes climate change. It leads to a decreasing in GDP growth rate because of temperature increase and been recorded the worst haze crisis year in history since there are norm during "haze season" every year start from 1980s.

Figure 1.2: Average Precipitation from year 1983 to 2013 in Malaysia
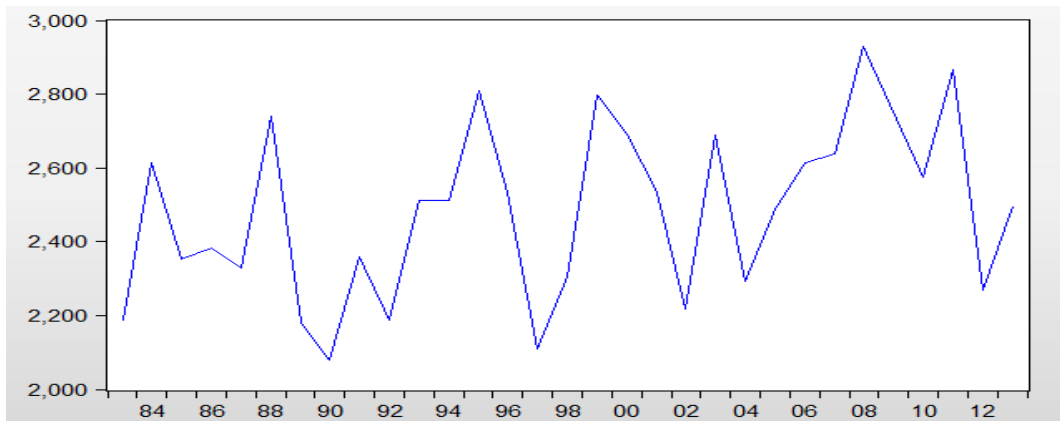
In contrast, climate change will induce a higher incidence of flooding that change in condition of precipitation. The future changes in weather condition will affect different regions in different ways (*Intergovernmental Panel on Climate Change*, 2001). Precipitation will decrease in high latitude regions when there is an increasing in temperature. This would causes a water crisis among agriculture. Since 1990s, Selangor was headed impending water crisis (*Intergovernmental Panel on Climate Change*, 2001). It could be solve if there is another water treatment plant was built to process raw water and support the state heavy usage . As a result, inconsistent of precipitation in developing countries will be at risk and indirectly give a negative impact towards GDP growth rate.

Figure 1.3: Annual Temperature (˚C) from year 1983 to 2013 in Malaysia
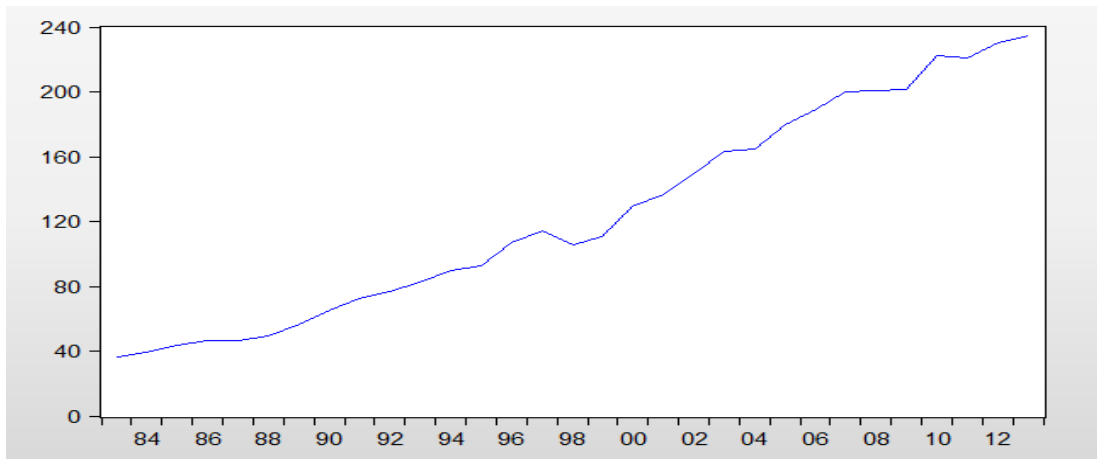
The figure above showed annual temperature which measure in degree celcius from year 1983 to 2013 in Malaysia. Malaysia temperature is kept increased throughout the year. Although there are decreased in some years, but it still remain high and unstable. In year 1997, there had been the worst haze in Malaysia due to farmers regularly burn scurb and forest to clear land during dry season for agriculture purpose (*Climate Institue*, 2010). Furthermore, the poor air quality in the Malaysian capital city of Kuala Lumpur occur since 2005 (*WWF Global*, 2015). The haze is keep increased until the health officials advised citizens to stay at home with doors closed while some schools were closed to keep children from being exosed to the haze. In short, the unsloved temperature crisis in developing nations will be burden not just the country economic performance, but also the mortality rate due to the worst haze condition.

Figure 1.4: Arable land (% of land used) from year 1983 to 2013 in Malaysia
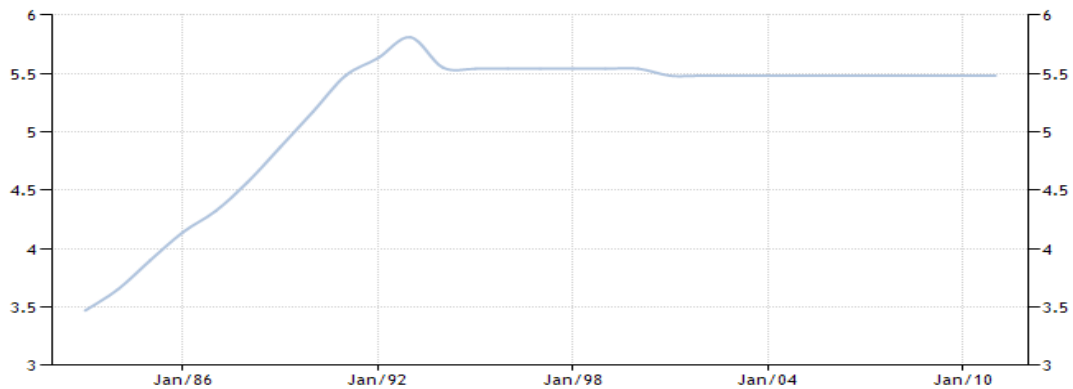
Source: World Bank Indicator, 2014

Malaysia kept implement palm oil plantation to increase GDP growth rate (*The Malaysia Palm Oil Cluster Final Report*, 2011) . Malaysia was the largest leading producer of palm oil until year 2006 before it was overtaken by Indonesia, primarily due to constraints on further land expansion of palm plantations. The increase of palm oil production has been driven by strong global demand for oil and fats. Oil palm plantation known as prevalent feature of the Malaysian landscape. This industry has become a major contributor to the country's export eanings. However, the expansion of land for palm oil plantation caused low land tropical forest which are ecologically sensitive habitats. Tropical forest acts as the lung of the Earth to help in filtering the carbon dioxide and provide the oxygen during the photosynthesis. Therefore, the decreasing of tropical forest will leads to a rise in temperature or carbon dioxide emissions. It would indirectly causes a downturn in GDP growth rate. Recently, evidence shows that people have graduated from the consumption of highly starcy food to the consumption of more proteinous food, fruits and vegetables (Olaniyi, Abdullah, Ramli & Sood, 2012). The sizes of agricultural land use for production of different agricultural crops such as fruits and vegetables is affected by

the changes of consumer taste. Subsequent change in tastes due to increased per capita income resulted to a change in agricultural land use in favor of highly rewarding and better-demanded crops like fruits and vegetables, thus causing agricultural land use dynamics (Olaniyi et.al., 2012).

1.2 Motivation of Study

       The factors that motivated this study on the interaction between climate change and economic growth in Malaysia is due to the previous studies that focuses on identified effect on economic growth from developed countries. The additional information regarding Malaysia environmental will provide in the findings of study. It will increase the understanding and knowledge among public towards Malaysia environmental. However, there were less studies determine more than two effect of climate change on economic growth in developing countries.

1.3 Problem Statement

The relationship of climate change which are temperature, precipitation and arable land with economic growth has become significant recently. There are similar research done by several reserachers such as Korea, China and Japan (Choi et. al., 2010), poor countries (Dell et.al., 2011), India (Besley & Burgess, 1998), Africa (Barriorset.al., 2003), and Iran (Asadikia, Oyarhossein, Saleh, Rafiee & Zare, 2009). However, a majority of the research were conducted in developed countries, which may not be reflective of developing economies, including Malaysia. The findings from the previous studies are mixed. Therefore, its offer a reason to investigate whether there is any significant relationship of air quality, precipitation, land reforms and economic growth in Malaysia.

This study will enchance knowledge of the studies about the short run and long run effect of several climate change towards economic growth. Perhaps the relevance of climate change will be clearer in relations to economic growth. Recently, Malaysia climate change is in fluctuating trends. Thus, this research may become a recommendation for government in policymaking in order to solve the currency problem.

1.4 Objectives of the Study

1.4.1 General Objective

The main objective of the study is to investigate the effects of climate change on economic growth.

1.4.2 Specific Objective

i. To investigate the relationship between temperature and economic growth.

ii. To investigate the relationship between precipitation and economic growth.

iii. To investigate the relationship between land reforms and economic growth.

1.5 Significance of the Study

The study examines the effects of climate change on economic growth to the developing countries are intends to provide a clear understanding regarding the effect of temperature, precipitation and land reforms towards economic growth. Besides, the policy makers are able to find out with the best solution or adaption in order to investigate the effects of the climate change in the developing countries to minimize the degradation of environmental that would give a negative impact on economic growth. To the extent that developing countries are able to manage the economic growth while the impacts of climate change is expected to be more serious in future. Thus, it is important to do a research on condition of environmental in developing countries.