CAUSAL ANALYSIS ON ENERGY CONSUMPTION AND ECONOMIC GROWTH : THE CASE OF MALAYSIA.

AIMI MAHIRAH BINTI ZAMZURI

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ABSTRACT

CAUSAL ANALYSIS ON ENERGY CONSUMPTION AND ECONOMIC GROWTH: THE CASE OF MALAYSIA, 1975-2008

By

Aimi Mahirah Binti Zamzuri

This study is aim to investigate relations cointegration for hydroelectric consumption, natural gas and Gross Domestic Product (GDP) in Malaysia during the periods of 1975 to 2008. The finding from normalized Equation result shows that, the variable of hydroelectric consumption and natural gas are cointegrating with GDP in a long-term and positive relationship existence between hydroelectric consumption and natural gas consumption toward GDP. The result of Granger causality based on VECM reveals there is unidirectional causality running from economic growth to hydroelectric consumption. It may implied that energy policies may be implemented with little adverse or no effects on economic growth. Other that, this research found, there is no causality in either direction between economic growth and natural gas consumption. It may implied that existing energy policy regarding the natural gas consumption regulation policies do not effect economic growth in Malaysia. The finding is useful in determining the energy consumption policies regarding hydroelectric and natural gas regulation policies which may effect the economic growth.
ABSTRAK

KAJIAN SEBAB-PENYEBAB TERHADAP PENGGUNAAN TENAGA DAN KELUARAN DALAM NEGARA DI MALAYSIA: 1975-2008

Oleh
Aimi Mahirah Binti Zamzuri

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CHAPTER ONE

INTRODUCTION

1.1 Introduction

Energy consumption plays a key and crucial role in the process of economic growth. At the same time, energy consumption patterns in every country are significantly affected by energy prices. Energy use has been associated with population growth and the expansion of urban centers. Energy use also is a key to industrialization and the development of industrial and infrastructural facilities. Roads and transportation and factory networks are among the most energy intensive of these facilities. Energy use is a necessary input to economic growth and is also a function of growth.

Energy has been defined as both a consumer good and an intermediate good (Pierce, 1986). As a consumer good, at the early stages of economic growth, it is possible that consumers will demand and consume more energy as soon as they can acquire the means to do so. As an intermediate good, the demand for energy is a derived demand, input factor demand derived from demand for the final product being produced. The traditional argument is not that energy is merely consumption good, but that it is an essential input into technological advancement. The substitution of machines and other forms of capital for human labor is an integral
part of the process of economic development that requires energy inputs. Thus, one can view the consumption of large amounts of energy as either a cause or a symptom of economic growth.
1.2 Definition of Terms

1.2.1 Gross Domestic Product (GDP)

Economic growth is generally described in terms of the ability of a country to produce more goods and services from one year to another. This concept of economic growth is captured in the evaluation of the gross domestic product (GDP) growth of a country. The GDP represents the total market value, expressed in specific national currency, of all final goods and services produced within a country over a certain period. The GDP calculated each year, known as the nominal GDP, is often adjusted for inflation to account for changes in price levels over time, yielding the real GDP. The real GDP is then divided by the population to obtain real GDP/capita. This real GDP/capita has been used to compare standards of living between countries. Thus, another interpretation of economic growth is the ability to increase real GDP/capita over time. Producing goods and services requires the use of energy inputs. The goal of society is to use energy wisely and efficiently because energy resources are scarce or limited. Energy consumption known as the intensity of energy use refers to the amount of energy required to produce a unit of output (GDP). Thus, the energy-GDP ratio is a measure and indication of energy consumption.
1.2.2 Energy and Hydroelectricity

Electricity actually is a secondary source or knows as energy carrier. Meaning that, we get electricity from the conversion of the other sources of energy such as coal, nuclear, hydro or solar energy. Whereas hydroelectricity energy refer to electric power produced from generators driven by water turbines that convert the potential energy in falling or fast-flowing water to mechanical and play an important role in supplying the world’s electricity. In 1996, nearly 13 trillion kilowatt-hour of electricity were generated worldwide, which is almost one-fifth of this electricity were produced by hydroelectricity (Doman, n.a).

Malaysia has substantial hydroelectric resources. The hydropower potential is estimated at 29,000 megawatt, of which only 2,000 megawatt is currently utilized. Whist developing hydroelectricity is capital intensive and often involves social economic issues. There are many benefits for using hydro as resources to produce electricity. First, hydropower is a renewable resource compared to oil, natural gas and coal which their reserves may be depleted over time. Second, hydro resources are indigenous. A country that has developed its hydroelectric resources does not have to depend on other nations for its electricity, and hydroelectricity also secures a country’s access to energy supplies. Third, hydroelectricity is friendly environmentally. Which is it does not emit greenhouse gases, and hydroelectric dams can be used to control flood, divert water for irrigation purposes and improve navigation on river (Doman, n.a). Additionally, in the longer term, electricity from
hydro is cheap and cost will not be affected by the changing fuel price which is determined by international market forces in which we as a country has little to say. These are among some of the reasons why the government decided to implement the Bakun project having capacity of 2,400 megawatt.

In Malaysia, there is 17’s existing dam, which is Air Itam dam, Babagon dam, Bakun dam, Batang Ai dam, Beris dam, Batu dam, Chenderoh dam, Hulu Terengganu hydroelectric Project dam, Kenyir dam, Klang Gate dam, Mengkuang dam, Murum dam, Pedu Lake, Pergau dam, Teluk Bahang Dam, Tenom Pangi dam, Temenggor dam and Sultan Mahmud Power Station.

The Bakun dam is a largest dam in Asia outside of China. It is located in Sarawak, on the Balui River, a tributary of the resource of the Rajang River and some sixty kilometers west of Belaga. It’s expected to generate 2400 megawatts of electricity once it competed. The purpose of this dam project is to meet growing demand for electricity. However, most of this demand is lie in Peninsular Malaysia but not East Malaysia demanded, where 30 percent of this hydroelectric generated may use for Sarawak demanded and the other 70 percent may piped to the Peninsular Malaysia. The Bakun hydroelectric project will involve the construction of a 205 meter high rock filled concrete dam creating a reservoir of 695 km. this reservoir is small compared with some of the hydroelectric power stations such as the 5,800 km
for the 2,400 megawatts Aswan Dam, 4,500 km for the 1,500 megawatts Kariba Dam in Zambia and 1,500 for the 850 megawatts Akosomb Dam in Ghana¹.

However, hydroelectric also have its disadvantages. Hydroelectric dams typically require a great deal of land resources. In conventional hydroelectric projects, a dam typically is built to create a reservoir that will hold the large amounts of water needed to produce power. Further, constructing a hydroelectric dam may harm the ecosystem and effect the population surrounding a hydro project such as disrupting the flow of a river for fish population and other animal and plant species. Another potential problem for hydroelectricity is the possibility of electricity supply disruptions. A severe drought can mean that there will not be enough water to operate a hydroelectric facility. Nation with very high dependence on the hydroelectric resources may find themselves a struggling with electricity shortages in the form of black-outs.

1.2.3 Natural Gas

Natural gas is a primary resource. It refer to a mixture of hydrocarbon gases that occurs with petroleum deposits, principally methane together with varying quantities of ethane, propane, butane, and other gases, and is used as a fuel and in the manufacture of organic compounds. Natural gas has thousands of uses; it can use for

cooking, heating, air conditioning and power a variety of other useful appliances. In the industrial sector, natural gas is often used as a raw material for products such as hydrogen, fertilizers and plastics. It is also commonly used as an energy source for food processing, glass making and even steel fabrication. It is also widely used to produce electricity via co-generation (Gas Malaysia, 2009).

Natural gas is the cleanest burning fossil fuel due to combustion process for natural gas is almost perfect; very few by products are emitted into the atmosphere as pollutants. Because of natural gas burns cleanly, it doesn't leave behind any unpleasant soot, ash, or odors. Other that natural gas is reliable which the pipeline system is can't be easily damaged by weather or affected by weather conditions. In contrast, oil must be trucked to the customer's location, and truck deliveries are susceptible to weather conditions. From an environmental point of view, natural gas is also advantageous because it produces the least amount of carbon dioxide (CO₂) greenhouse per unit of energy generated (Olah, Geopert and Prakash, 2004).

However, there also have disadvantages of using natural gas. Moving large amounts of natural gas by pipeline is relatively easy, but the process is not adaptable from remote locations far from consumer markets. For intercontinental transport, across oceans, natural gas is usually liquefied to yield natural gas (LNG). This process is, however, energy-intensive, and requires specially designed and highly expensive tankers that keep natural gas at or below its boiling point (-162°C) in highly insulated (Olah, et. al. 2004). Other than that, natural gas can also be
dangerous. In 1994, the explosion of LNG storage plant in Cleveland, Ohio, killed 128 peoples and injured several hundreds. In 2003, 27 peoples killed in the explosion of natural gas liquefaction plant in Algeria. A study by Sandia National Laboratory found that an explosion from a LNG tanker leak could result major injuries and significant damage up to 500 meter away from leak, while people up to 2 kilometer away would suffer second-degree burns. Besides accidents, LNG facilities and tankers are also potential targets for terrorists. For these reasons, LNG terminals are usually would not welcomed near major cities or population centers and increasingly located off-shore (Olah, et. al. 2004).
1.3 The Trend of Malaysia Gross Domestic Product

Figure 1: The Trend of Malaysia's Gross Domestic Product, 1975-2008

![Graph showing the trend of Malaysia's GDP from 1975 to 2008.]

Sources: IMF, country report, various issues.

Figure 1 above shows the trend of Malaysia Gross Domestic Product (GDP) starting from 1975 to 2008. Based on the movement of trend, Malaysia's GDP has been increasing since 1975 to 1984, but at slow movement. To be more specific, this increment is occur after the period of the Malaysia economic slumped by great recessions in 1975. The reason is largely encouraged by trade policies pursued by successive Malaysian governments to diversify its economy particularly in the expansion of manufacturing sector.¹

Nevertheless, the Malaysian economic growth momentum was not sustained in 1985 due to economic recessions or stagnation, mainly as a result of the decline in

¹ For detail, see Third Malaysia Plan 1976-1980
manufacturing and mining output and high unemployment\textsuperscript{3}. The Malaysian recovery during that period is focused on the export of manufacturing to generate growth. After that period of recession, the Malaysian economy increased steadily and period between 1990 and 1997 has been viewed as the golden age due to impressive performance and remarkable economic development before Asian financial crisis took effect.

In year 1997, Malaysia was among the five most affected countries by the Asian financial crisis with the floatation of the Thai baht. The financial crisis subsequently spread to the regional economies, including Malaysia. The Asian financial crisis had place inflationary pressure to the Malaysia's economic and GDP registered a negative growth rate of 7.5\% in 1998, while per capital income contracted by over 1.8\% during the crisis period. As a recovery for the crisis, the Malaysian government as a result began to undertake measures to strengthen the economy. The measures were aimed at stabilizing the ringgit, resorting market confidence, containing inflationary pressure, improving the external position, tightening prudential requirements in the financial system and providing adequate support to low income and poor households\textsuperscript{4}.

In the mid 1998, the policy shifted towards easing the monetary policy and providing a fiscal stimulus in order to resuscitate the economy. After the crisis, Malaysian economy has shown an increasing trend from 1999 to 2000. However, the increased trend has been affected by global economic slowdown in 2001 causing the

\textsuperscript{3} For detail see Fourth Malaysia Plan 1981-1985.

\textsuperscript{4} For more detail see Seventh Malaysia Plan 1996-2000.
GDP increase at an average of 2 percent and slowly picked up. In year 2003, the Malaysian GDP records an impressive performance and remarkable growth as shown by the increasing trend with an average of 6.0 percent. The Malaysian economic performance continuous increasing until year 2008.

As conclusion, the changes in Malaysian economy growth are clearly represented by the fluctuation of the trend of Malaysian GDP since 1970 to 2008.
1.4 The Trend of Malaysia Hydroelectricity

Figure 2: The Trend of Malaysia’s Hydroelectric Consumption in Malaysia
(1980-2008)

![Graph showing the trend of Malaysia's hydroelectric consumption from 1980 to 2008.]

Sources: Energy Information Administration, EIA (2009)

Figure 2 show the Malaysia hydroelectricity performance for period 1980 until 2008. In 1980, Malaysia hydroelectricity consumption is 1.7 terawatt-hour. These amounts increased to 4.1 terawatt-hours or grow at 58.54 percent in 1986 and recorded a positive performance until 1989 where increased to 5.3 terawatt-hours or grow at 29.27 percent as compared to 1986. However on 1990 the consumption of hydroelectric decreased to 4 terawatt-hours and constant at 4.4 terawatt-hours in 1991 and 1992. These decreases occurred due to some distortion at power stations. In 1993, hydroelectricity consumption recorded a little growth, which is increased to 4.9 terawatt-hour or increase of 0.5 terawatt hours compared with 1992. However, in 1994, total hydroelectricity consumption was recorded at 6.5 terawatt-hours or
growth at 32.65 percent compared to 11.36 percent in 1993 and little reduction in 1995 which reduce to 0.3 terawatt-hours. This acceleration is due to increase in demands from all sectors especially industrial sectors. In 1996 until and 1997, the amount of demand was decrease to 5.2 and 3.5 terawatt-hours respectively due to economic crisis that Malaysia faced. In 1998 until 2008, the hydroelectricity consumption as electricity supply recorded a positive growth, where 4.9, 6.4, 5.8, 6.7 and 6.8 terawatt-hours for 1998, 2002, 2004, 2007 and 2008 respectively. These increments were largely contributed by the manufacturing activity, which was supported by increase in exports and strong domestic demand (National Energy Balance 2007).
1.5 The Trend of Malaysia Natural Gas Consumption

Figure 3: Natural Gas Consumption in Malaysia (1980-2008)

Figure 3 shows the Malaysia natural gas performance from 1980 to 2008. Roughly, natural gas performance is increasing for every year. In year 1980, the demand of natural gas as energy resources is 56 billion cubic per feet (bcf) and this amount was increased 21 bcf or 27 percent in three year which is on 1983. From 1983 until 1986, the demand for natural gas has steadily increased to 279 bcf which is gross 45 percent compared from 1980 to 1983. This positive acceleration of natural gas consumption due to increasing demands from all sectors especially industrial sectors and increased of investment on industrial sector. However, in 1989 the amount of natural gas consumption has increasing in decreasing amount, which is increase only at 18.39 bcf compared in 1983 which is increased 202 bcf. In 1992,
total natural gas consumption recorded 388 bcf, which is increased 90.64 cubic per feet or 30 percent gross from 1989 and 1992. Whereas in 1995, 1998, 2001 and 2004, the total natural gas consumption has positively increased which is 96.87 bcf, 129.96 bcf, 280.75 bcf and 264.33 bcf respectively. However, in 2007, natural gas consumption has little decreased which decrease about 24.72 bcf or 2.81 percent compared in year 2004. However, in 2008 the amount has increased to 927.87 bcf or increases about 73.24 bcf. As inferred, the positive growth of natural gas consumption for very year occur due to it price is cheaper than oil price.