The Impact of Fossil Fuel Subsidies on Growth

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List of Acronyms

ASEN	Association of Southeast Asian Nations
BOE	Barrel of Oil Equivalent
CGE	Computable General Equilibrium
CPI	Consumer Price Index
FEM	Fixed Effect Model
GDP	Gross Domestic Product
IEA	International Energy Agency
IMF	International Monetary Fund
LMRC	Long Run Marginal Cost
LPG	Liquefied Petroleum Gas
MOPS	Mid Oil Plots Singapore Price
OECD	Organization for Economic Co-operation and Development
OPEC	Organization of the Petroleum Exporting Countries
REM	Random Effect Model
RON	Research Octane Number
USD	United States Dollar
VAT	Value Added Ta
WB	World Bank
WDI	World Development Indicator

Abstract

The main objective of this research is to examine the relationship between fossil fuel subsidies and growth. In order to achieve this objective, the research employs panel data analysis. However, due to the difficulties in obtaining the data about subsidies, the sample and the time frame have been selected based on the availability of the fossil fuel subsidies data. The sample consists of 37 countries, including Indonesia. Instead of the key variable (fossil fuel subsidies), the study also employs others determinants of growth as independent variables, namely openness (OPEN), gross capital formation (CF) and secondary school enrolment.

Many studies have been conducted to investigate the impact of subsidies on growth. However, by employing more recent data and better methods, this research focuses on the impact of fossil fuel (both in total and for each type of the fossil fuel energy) subsidies toward growth. The result of the regression confirmed that fossil fuel subsidies, coal subsidies, electricity and natural gas subsidies have negative and significant impact toward growth. However, the research found that oil subsidies are negative but not significant toward growth. The result on other explanatory variables shows that openness (OPEN) capital formation (CF) and gross secondary school enrolment (secgrt10) are positive and significant toward growth.

Relevance to Development Studies

Many countries still rely on fossil fuel energy to support economic growth. However, relying on fossil fuel energy is risky due to the volatility of energy price. Fossil fuel subsidies are being used to maintain the stability of the domestic price. Subsidies fill the gaps between the international and the domestic price. The trend shows that the amount of fossil fuel subsidies increase as the international price and the consumption increases. Subsidies distort the market signal and create inefficient allocation of resources. Furthermore, they hinder growth by affecting government budget. Huge amounts of subsidies depress government budgets. This research analyses the impact of subsidies toward growth.

Keywords

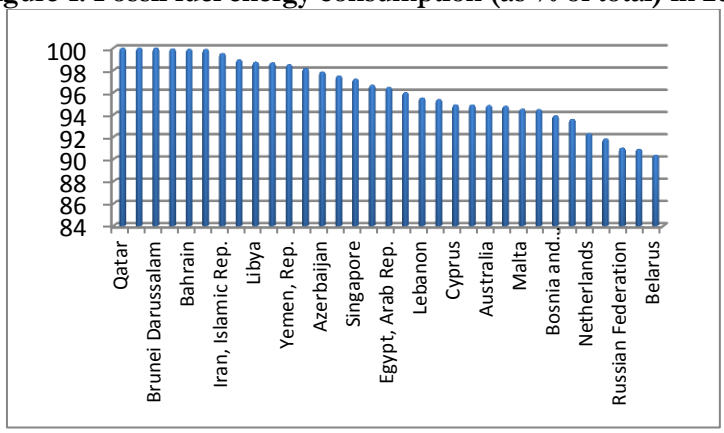
Subsidies, Growth, Energy, Fossil Fuel, Oil, Coal, Natural Gas, GDP

Chapter 1
Introduction

1.1 Background

In some countries, particularly in the Middle East countries, about 90% of their energy consumption is supplied by fossil fuel energy. Moreover, since 2001, about 80% of world total energy consumption comes from fossil fuel energy (The World Bank 2015). Although the development of other types of energy (such as wind, nuclear and solar energy) increase rapidly, the countries' dependency on fossil fuel energy remains high. For more detailed information about the amounts of fossil fuel energy consumption in some countries please refer to Figure 1 below,

Figure 1: Fossil fuel energy consumption (as % of total) in 2011



Source : The World Bank (2015) developed by the author

There are several reasons why some countries still rely on fossil fuel energy. One of the reasons is the presence of subsidies. Nwachukwu and Chike (2011) in the research in Nigeria found that there is strong relationship between demand on fossil fuel energy and subsidies. Subsidies made the domestic price of fossil fuel energy lower than its international price. Subsidies also made the price of other energy become uncompetitive compared to fossil fuel energy. This is supported by IEA (2010:572) which found that there is a clear link between low price of energy and high demand of energy.

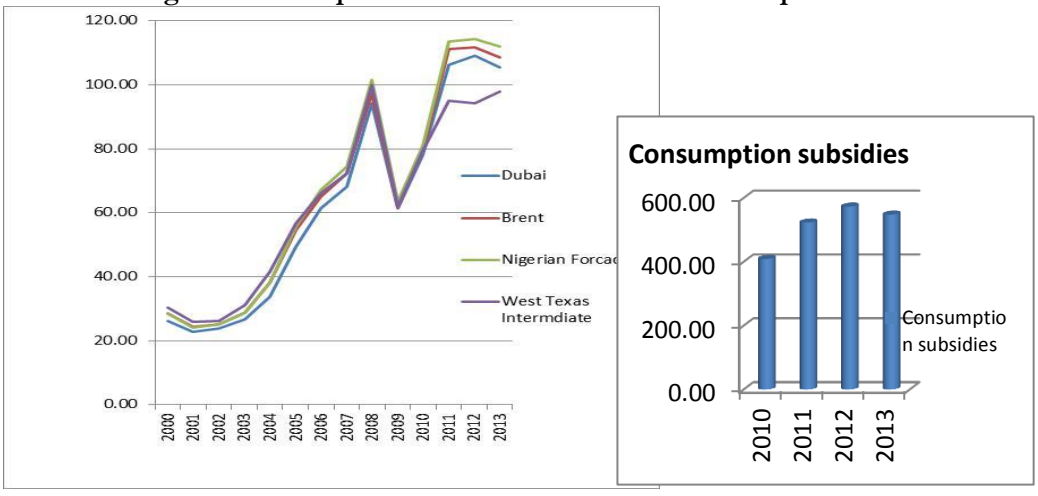
Subsidies influence the demand for fossil fuel energy in two ways. Firstly, Mourougane (2010:11) mentioned that subsidies stimulate over-consumption of subsidized energy which leads to inefficient use of energy. As a consequence, subsidies increase the tendency to import and depress the ability to export the energy (Mourougane 2010:11). Secondly, fossil fuel subsidies hinder the development of other types of energy including renewable energy. This is supported by Vagliasindi (2012:2) who said that energy subsidies distort the market price of energy and hinders the development of new energy. Fossil fuel subsidies decrease the budget available to develop other type of energy. Moreover, the low price of fossil fuel energy made people find difficulties to

shift their energy consumption to other type of energy which will creates barrier for energy diversification.

The high demand and reliance on fossil fuel energy creates several problems. One of the crucial problems is related to the energy reserve. Fossil fuels, such as coal and oil, are non-renewable so that massive consumption will accelerate depletion. The second problem is related to the volatility of fossil fuel energy particularly oil and petroleum products. The trend in the spot price of oil over a decade shows that the price of this commodity is very unstable. Dhawan and Jeske (2006) mentioned that increase in energy price leads to recession since 1973.

Moreover, the volatility of energy price affect the budget spends for subsidies. Increase in the world price of oil will be followed by increase in subsidies, unless the government adjust the domestic price. The recent data published by British Petroleum (2014) showed that the world price of oil increased into fourfold during the period from 2000 to 2013. Additionally, in 2012, the price reached a peak, whereby it hits USD 114.21/barrel for Nigeria Forcados (British Petroleum 2014). At the same period, the trend of subsidies (the global fossil fuel consumption subsidies) also increased. The data published by IEA shows that the world fossil fuel consumption subsidies reached USD 523 million in 2011 and rocketed into USD 573 million in 2012 when the world price of oil hit its peak (IEA 2015a). The amount of subsidies fell slightly in 2013 into USD 548 million, when the world price of oil started to decline (IEA 2015a). The increasing amount of subsidies has several negative impacts to the economy and depresses government budget (will be explained in the following chapter). Figure 2 illustrates the recent trend of world price of oil and subsidies.

Figure 2 : The Spot Price of Oil and Global Consumption Subsidies



Source : British Petroleum (2014) and IEA (2015a) developed by the author

Many researches have been done to provide better understanding about fossil fuel subsidies. Nonetheless, most discussions focused on the cost and benefit of subsidies while some others assessed the impact of subsidy reform. There

are several reasons to justify the presence of subsidies. First of all, low price of energy guarantee energy access for the poor. Moreover, by subsidising energy, the price of other commodities will be more affordable to the poor. Secondly, fossil fuel subsidies play an important role in supporting industrial development and boost investment. As Kahn and Mansur (2013) said that energy intensive industries are mostly concentrated in lower-electricity-price countries. Lastly, in some of oil exporting countries, subsidy is a tool to redistribute national wealth (IEA et al. 2010:571). As they earn much revenue from oil industries, some of the revenue flow back to the people in the form of subsidies.

However, there are some critics toward the presence of fossil fuel subsidies. Those who criticize it argue that fossil fuel subsidies bring negative impacts toward economy, and environment. Subsidies depress the government budget and decrease the budget available for infrastructure, which will hinder growth in the future. This argument is supported by some prior studies. Bulman et al. (2008: 14) on their research in Indonesia found that subsidies during the period of oil boom made government budget under pressure. The government of Indonesia for example, during the period of 2008, spent more than 25% of their budget for subsidies (Central Bank of Indonesia 2015). While some other countries, allocated up to one third of their government expenditure for subsidies.

Recent studies also show that the cost of subsidies outweighs its benefit and that the subsidies are wrongly targeted. The evidence shows that the rich are those who enjoy much the benefit of subsidies. Conducting research in Indonesia, Agustina et al. (2008) found that most of the subsidies went to the richest 20%. Similarly, Dartanto (2013:117) found that about 72% of oil subsidies had been enjoyed by the 30% highest income groups in the societies. In addition, El said and Leigh (2006:3) who conduct the research in Gabon found evidence that about one third of the subsidies belongs to the top 10% of the highest income. While the bottom 30% only received approximately 13% of the subsidies (El said and Leigh 2006:3).

This situation raises a call for subsidy reform, which aimed to eliminate the presence of fossil fuel subsidies. It was started in the Pittsburgh Summit Commitment in 2009 when some countries agreed to remove subsidies. While some other countries still mitigate the adverse impact of subsidy removal before deciding to phase out the subsidies. Some countries are in doubt to phase out subsidies since its cost and benefit is still unclear.

There are so many issues related to fossil fuel subsidies. However, this research will focus on the impact of fossil fuel subsidies toward economy especially on growth. Arze del Granado and Coady (2010) said that fossil fuel subsidies lead to budget deficit that will impede growth in the future. Some other studies said that subsidies is important to support growth and that the removal will dampen growth. Jiang and Lin (2014:418) found evidence that there was negative impact of subsidies removal on GDP and employment in the case of China. Employing CGE model, Abouleinein (2009:31) in the research in Egypt, calculated that the elimination of subsidies depressed annual GDP

growth by about 1.4% (from 5.6% to 4.14%) as compared to the reference period. Burniaux and Chateau (2011:12) by using CGE found that subsidy removal decrease GDP in oil exporting countries, but the decreases are compensated by the increase in the national welfare as a whole. In addition, they said that the impact of phasing out subsidies varied depending on the variable that is being subsidized (Burniaux et al. 2011). Conversely, Ellis (2010) found that subsidy removal influences GDP positively. However, Mourougane (2010) said that although subsidy removal is important for both the economy and the environment, the removal needs to be assessed more carefully in order to avoid public resistance.

As stated above, the main objective of this research is to investigate the impact of fossil fuel subsidies toward growth. Hence, the research will limit only to address this issue. We hope that the result of this study can be used to provide a better understanding about the relationship between fossil fuel subsidies and growth.

1.2 Problem Statement and Justification

In the fossil fuel dependence countries, fossil fuel energy plays important role to enhance productivity and boost economic growth. However, relying on fossil fuel energy is vulnerable due to the volatility of the international price, particularly oil. Hence, in these countries, the price of this energy becomes the most sensitive issues. In order to minimize the risk and stabilize the domestic price of energy (especially during the period of oil boom), the government introduce subsidy policy. Subsidy fills the gap between the domestic price and the international price and keeps the price lower than its international price.

However, some prior studies shows that subsidies hinder growth in the long term through its effects on government budget as mentioned by Clements et al. (2013) and Mourougane (2010). Putting Indonesia as one of the examples, the government of Indonesia spends about one third of their national budget for fossil fuel subsidies. In 1999 the amount of subsidies was just about 3%, but it surged up in 2000 (Central Bank of Indonesia 2015). Although the government tried to adjust the domestic price, the subsidies flew into above 18% in the late of 2013 (Central Bank of Indonesia 2015). Higher amount of subsidies depress the government budget and reduces the budget allocated for infrastructure and human capital. Declining budget for education harms the sustainability of growth in the future.

The on-going debate on the positive and negative impacts of fossil fuel subsidies has made this research relevant. Moreover, there is also a debate on the definition of the subsidies itself, especially about which intervention that can be categorized as a subsidy. Until now, there is no single agreed definition about fossil fuel subsidies which leads to inconsistency in the measurement process. Theoretically, in calculating subsidies, both producer and consumer subsidies should be included. But measuring producer subsidies is challenging because some of the subsidies are difficult to be measured in monetary term. As a result, this can understate the calculation of subsidies. Addressing this

issue, this research employs more recent and reliable data about fossil fuel subsidies which are taken from the IEA (International Energy Agency). Meanwhile, due to lack availability of the data, we conduct the research for the period of 2007 up to 2013.

Besides that, most of the research in the past was conducted by using CGE (Computable General Equilibrium) to analyse the impact of subsidies on several factor (see studies by Jiang and Lin (2014), Abouleinein (2009) and Dartanto (2013)). Since the research was based on simulation, the result of the studies was just a prediction. In order to obtain more precise results and provides better understanding about how subsidies influence growth, this research will employ panel data analysis. This research also extends the prior research by putting subsidies to other fossil fuel energy such as coal and natural gas. We believe that the result of this study can be used as a guideline for the policy makers in creating decision about subsidy reform.

1.3 Objective of the Study and Research Question

The main objective of the study is to analyse the relationship between subsidies and economic growth. Furthermore, within this study, we would like to investigate whether the impact of subsidies is similar to each country or not. This research will highlight some recent issues on subsidy reform. To achieve this objective, the whole research will be guided by these following questions,

a. The main research question:
    - What is the relationship between economic growth and fossil fuel subsidies?
b. The sub research question:
    - Is the impact of fossil fuel subsidies toward growth similar for each type of fossil fuel subsidies (oil, natural gas, electricity, coal)?
    - Is the impact of subsidies similar for the oil producing and non-oil producing countries?
    - Is similar impact of subsidies found in coal producing and non-coal producing countries. Furthermore, is the impact of the subsidies similar for natural gas producing and non-natural gas producing countries?

1.4 Practical Problem in Carrying Out the Research

This research will be conducted by relying on secondary data. Thus reliability and relevance are the biggest challenges in carrying out this research. However, we try to perform the research in compliance with ethical consideration, by obtaining the data from reliable and reputable institutions such as IEA (International Energy Agency), The World Bank, IMF and so on.

Moreover, we also find difficulties in obtaining some data, such as fossil fuel subsidies since not every country being transparent in reporting the amount of fossil fuel subsidies they provide. However in general, this research will not face any obstacle and difficulties.

1.5 Organization of the Paper

To achieve its objective and to get better understanding, the whole paper would be organized as follows: Chapter 1 will provide background of the research paper, which shows the recent trend of world fossil fuel and highlight the recent debates on fossil fuel subsidies. In addition, this chapter also contains the problem statement, the objective of the research, the obstacle in conducting the research and also the organization of the paper. The following chapter will consist of theorization and literature review. This chapter will provide some theory related to the topic and show some evidence obtained from prior research. The third chapter will provide an overview of the recent development of fossil fuel subsidies and will highlight several issues relating with subsidy reform. The fourth chapter will explain about the data and methodology used in this paper. In this part, we also describe about the model specification. Then, the next chapter will shows the result of the regression and provide interpretation of the result. Lastly, chapter sixth will provide conclusion of the whole discussion in this research paper. The conclusion will link the finding of the research to the related theory and existing literature.

Chapter 2
Theoretical Framework and Literature Review

2.1 Theoretical Background

2.1.1 Fossil fuel subsidies

Fossil fuel subsidy definition

Until now, there is no agreed definition about the term of 'fossil fuel subsidies'. As Steenblik (2003:101) contented that there is no universal definition of subsidies, but there is some similar concepts across each definition. Basically, subsidies are related with the reduction of price that should be paid by end consumers. Thus, with subsidy, the end consumer will pay for commodities in the lower price than the amount they are supposed to pay. IEA defines subsidies as

> Energy subsidies are any government action that lower the cost of energy production, raises the price received by energy producers or lower the price paid by energy consumers. (IEA 2010:570)

Meanwhile, Agustina et al. (2008:13) define fossil fuel subsidies as 'the difference between the regulated retail price and agreed benchmark price which is an estimated at the economic price'. As they conducted the research in Indonesia (the net importer countries), they use the international market price (Mid Oil Plots Singapore Price or MOPS) as the 'economic price'. Thus according to them, subsidies consist of MOPS and other factors (such as transportation cost) which they called adjustment factors.

In sum, the broad definition of subsidies should include both producer and consumer subsidies and includes any government action that influence the price of energy. However, due to some difficulties in measuring the government action intended to lower the price of energy, some research narrowed down the term of subsidies and only includes consumer or producers subsidies which can be measured in monetary term on the calculation. Meanwhile, OECD, IEA and WB on their joint report which was published in 2010 also narrowed down the definition. They calculate subsidies according to availability and measurability of the data. Lack of transparency is the biggest challenge in measuring subsidies.

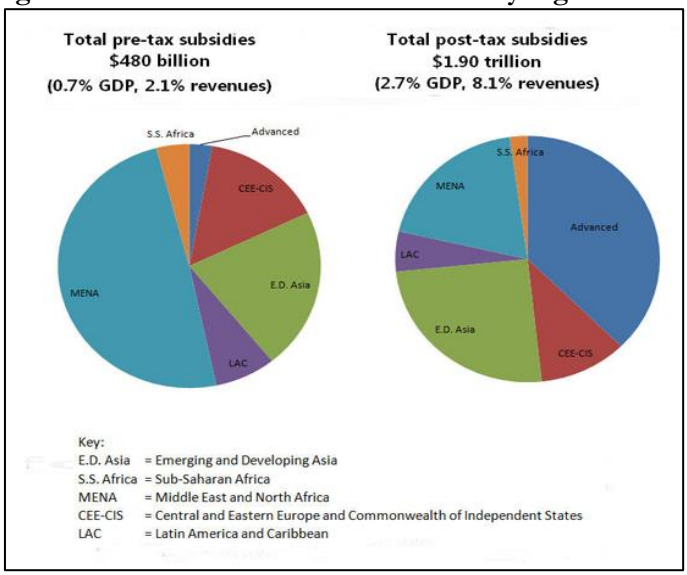
Types of subsidies

There are several ways to differentiates subsidies. IEA et al. (2010:6) mentioned that subsidies are usually categorized according to who gains the benefit (the producers or the consumer) and who gets the support (traditional fossil fuel or cleaner energy). According to who get the benefits, fossil fuel subsidies are divided into 2 types, the consumer subsidies and the producer subsidies.

Consumer subsidies are intended to reduce the price that should be paid by end consumers. They appeared in several forms such as coupon, discount, regulation or government intervention. This type of subsidies is mostly implemented by net importing countries. Recently, most countries in the world including some developing countries already have phased out this type of subsidies. However, this subsidy remains high in some countries, such as Indonesia. In Indonesia, the domestic price of energy is determined by the government. This price does not link with its international price and only change when the government adjust the domestic price.

Clements et al. (2013) on the IMF publication divided the consumer subsidies into pre-tax subsidies and post-tax subsidies. They calculated pre-tax subsidy as a difference between the price paid by the consumer and the reference price (International price). Meanwhile, post-tax subsidy is the sum of pre-tax subsidy and tax subsidy (tax subsidy arise when the tax applied for this energy is below its efficient level) (Clements et al. 2013). According to the Figure 3, the Middle East and North African countries were those who have bigger share of pre-tax subsidies. This is because most of them are oil producing countries. Meanwhile, the advanced countries were those who have larger proportion on post-tax subsidies.

Figure 3: Pre-tax and Post-tax subsidies by region in 2011



Source: IMF (2013)

The second type of subsidies, the producer subsidy is usually implemented to maintain or expand domestic supply. According to some literatures, producer subsidies can be both direct and indirect which take forms of loan guarantees, tax reduction, regulation, protections and others. This type of subsidies is mostly implemented by oil exporting countries and advanced economy. Producer subsidies are difficult to measure due to lack availability of the data. Hence, in some research, this type of subsidies is not included in the calculation of fossil fuel subsidies. Koplow et al. (2010:12) claimed that most of the recent studies understate the calculation of subsidies since they only take the difference between the domestic price and the reference price (price gap

approach). In general, the price gap approach is unable to capture the production subsidies, unless the effect appears in the short run. However, in most cases, the impact of producer subsidies does not appear in the short, but in the long term by affecting national energy structure (Koplow et al. 2010:12).

Some countries, particularly the oil exporting countries, applied both type of subsidies. For them, subsidies acted as a tool to redistribute national wealth. However, in general, producer subsides are high in the developed countries while the consumer subsidies are mostly in the developing countries. Aguilar (2009) mentioned that subsidies in the developing countries aimed to decline energy cost and support the industry by lowering both transportation and production costs. In contrast, the developed countries provide producers subsidies through 'complex scheme' such as through direct grant to oil producers and some 'preferential tax' in order to expand energy supply (Aguilar 2009:299).

Instead of above classifications, subsidies also can be categorized according to the channels used to deliver them. Please refer to table 1 below for more detailed information. Moreover, subsidies can also be differentiated into direct transfer (such as grants) and indirect transfer (regulation) (IEA 2010:570).

Table 1 Types of Energy

Types of energy subsidies according to IEA, OECD and the WB		
	Description	**Examples**
Trade instrument	Quotas, Technical restrictions, Tariffs	Tariffs on imported ethanol
Regulations	Price controls, Demand guarantees and, man	Gasoline price regulated at $0.03 per litre in Venezuela, Regulations that prioritise use of domestic coal for power
Tax breaks	Rebates or exemptions on royalties, duties, producer levies and general consumption taxes, Tax credits, Accelerated depreciation, allowances on equipment	Favourable tax deduction on oil and gas fields and coal deposits, Excise exemptions for fuel used in international air, rail or water transport
Credit	Low-interest or preferential rates on loasn to producers	Loan guarantees to finance new nuclear power plants
Direct financial transfer	Grants to producers or consumers	Home heating assistance programmes for the elderly and low income earners
Risk transfer	Limitation of financial liability	Limits on the energy industry's financial liability in the event of an accident
Energy-related services provided by government at less than full cost	Direct investment in energy infrastructure, Public research and development	Provision of seismic data for oil and gas exploration

Source: Adapted from table (19.1) published by IEA (2010: 571)

Why some countries still provide fossil fuel subsidies?

In most countries the underlying reason of providing fossil fuel subsidies is the social consideration. Mourougane (2010:5) on the research in Indonesia mentioned that the government of Indonesia provides oil subsidies particularly kerosene in order to help poor people to get access on energy. Maintaining energy price is important especially to manage the purchasing power of the poor. Low price of energy will lead to low price of other commodities (ceteris paribus).

The other reason of providing subsidies is to support industrial development, especially in the fossil fuel dependent countries. Subsidies protect industries from the high volatility of world price of oil. Low price of energy is also important to attract foreign investors. Subsidies provide incentive to increase investment particularly in the energy intensive industries such as in the metal and steel industries. Besides that, energy price is important to boost export. Low price of energy will lead to low production cost, which allow commodities to compete in the global market.

Summarizing the prior research on subsidies, IEA et al. (2010:8) mention that the underlying reason of providing subsidies is to alleviate poverty, enhancing domestic energy supply, supporting industrial development and employment, redistribute national wealth and protecting the environment. Moreover, they said that production subsidies are able to retain regional employment especially when the economy slowing down. Maintaining low price of energy will benefit both industries and employment in the difficult situation, such as in the period of oil boom.

Measuring fossil fuel subsidies

Measuring subsidies is the most challenging part in the research related to subsidies. As already discussed in the previous section, there is no single definition of subsidies which leads to inconsistencies in the measurement. Besides, some subsidies are attached implicitly and do not have direct impact to the domestic price in the short run. Lastly, some government interventions which affect the fossil fuel price are difficult to be measured in monetary term.

Theoretically there are several methods to determine the amount of subsidies paid by each country. However, the most common way to measure subsidies is by using price gap approach. The basic idea of employing this approach is by comparing the price of energy to its reference price. Some reputable institution (IEA, The World Bank and IMF) also uses this method to measure subsidies.

According to Jiang and Lin (2014), the basic formula of price gap approach is as follows,

- Measuring the amount of subsidies per litres/gallons:

$$\Delta P = Pr - Pc$$

- Calculating the total amount of subsidies in a given year

$$S = \Delta P \times E$$

Where,
ΔP= Price gap
Pr= Reference price /International price
Pc=Consumer price
S = Size of subsidy
E = Fossil fuel energy consumption

A relatively similar formula was also introduced by IEA (2015a) to calculate their consumer subsidies. The formula is as follows,

Subsidy = (Reference price - End-user price) × Units consumed

From those two formulas, if the difference between the reference price and end user price is negative, the difference represents taxes. Meanwhile if the difference is positive, the difference represents subsidies. As Coady (2006) said that the variance between the domestic price ('actual consumer price') and the reference price shows the presence of tax (if the domestic price higher than the international price) or subsidies (if the domestic price less than the international price).

Another difficulty in measuring subsidies is determining the reference price. There are several arguments concerning which price is suitable to be used as the reference price. According to Jiang and Lin (2014), the most suitable reference price for internationally traded energy product (petroleum and coal) is the international price which is adjusted for distribution and freight costs. For non-traded commodities, such as electricity, LMRC (long run marginal cost) which is adjusted by 'domestic electricity industry' is more suitable (Jiang and Lin, 2014). Additionally, Burniaux et al. (2011) mention that international price or 'border price' is commonly used as the reference price after adjusted for transport costs, distribution costs and countries 'specific taxes'.

Furthermore, to obtain a more accurate calculation, IEA (2015a) mentioned that different reference prices should be applied for the net importing countries and the net exporting countries. The reference price should be based on its 'import parity price' for the net importing countries and 'export parity price' for the next exporting countries.

The IEA defines 'import parity price' as

> The price of a product at the nearest international hub, adjusted for quality differences if necessary, plus the cost of freight and insurance to the net importer, plus the cost of internal distribution and marketing and any value-added tax (VAT) (IEA 2015a).

While 'export parity price' as

> The price of a product at the nearest international hub, adjusted for quality differences if necessary, minus the cost of freight and insurance back to the net exporter, plus the cost of internal distribution and marketing and any VAT (IEA 2015a).

In addition, for internationally traded commodities such as oil, natural gas and coal, the IEA uses the transportation costs which are based on the distance to adjust the reference price for each country. For oil energy, the distance is measured as if the shipping performed from the USA while for natural gas and coal the distance depends on the shipping documents (IEA 2015a). For non-traded commodities, such as electricity, the IEA mentioned that the best price for reference is the 'annual average-cost pricing' (IEA 2015a).

However, there are some weaknesses of price gap approach. This approach has a potential to underestimate the calculation of subsidies. This method failed to capture subsidies which do not have short term impact on the final price.

Thus, many literatures mention that price gap approach is more suitable to determine the amount of consumer subsidies rather than producer subsidies.

2.1.2 Economic growth

There are several theories proposed by economists to provide a better understanding about growth and the determinants of growth. Some of the well-known theories are the Harrod-Domar and the Solow Growth model.

According to the Harrod-Domar growth model, economic growth is determined by the degree of investment. The higher the degree of investment, the more likely a country will grow faster. As mentioned in the Todaro and Smith (2009:113), the rate of growth of GDP ($\Delta Y/Y$) under the Harrod-Domar model depends on both the net saving ratio (s) and the capital output ratio (k). In other words, it implies that without any government intervention, the more economy able to save and invest the higher the growth of GDP (Todaro and Smith 2009:113). However, if the 'capital to output' ratio is getting bigger, the growth will be lower. This model simplifies the importance of two other factors (labour and technological progress) which also influence growth. Labour is assumed to be excessive in the developing countries so that they can be employed easily. While technological progress is captured in the k in which technology is any factor which can decrease 'capital to output ratio'.

Recently, every government allocates some percentage of the national income to invest in the infrastructure. However, in some countries, the budgets are only sufficient to replace the impaired infrastructure. The budget is inadequate to boost economic growth and create new investment which will support growth (such as addition to infrastructure, factory, and public transportation). In order to expand investment, the government needs to either increase the revenue or reduce expenditure from unnecessary spending such as subsidy. Besides that, liberalization (openness) also plays important role in generating investment.

The second theory, the Solow neoclassical growth model is basically the expansion of the Harrod–Domar growth model by explicitly adding labour and technology in the model (Todaro and Smith 2009:128). The basic equation of the Solow growth model is as follow

$$Y= K^{\alpha}(AL)^{1-\alpha}$$

In which Y represent GDP, K is the capital (include all physical capital), L is labour and A is the productivity of labour. Commonly, K is measured by using the share of capital over GDP. Under the Solow growth model, growth is determined by 3 factors, which are the increase in labour (both number and quality), capital and technology. The quality of labour can be enhanced through education and increasing health quality, while capital can be expanded by using saving and investment (Todaro and Smith 2009:129).

In general, an increase in population growth will result in an increase of the labour force. Since labour play a significant role in stimulating economic

growth, the increase in population growth will lead to a higher economic growth. However, this depends on the quality of the labour; whether they are productive or not. Besides that, Todaro and Smith (2009:143) mentioned that the impact of population growth depends on how the economy is able to hire the labour and how much additional labour will benefit the economy. Barro (1991) said that the initial level of human capital contributed positively to the growth rate of GDP per capita. Similarly, Romer (1990) also found that human capital is important to influence 'the rate of growth', but the quantity of labour (as proxies by the number of population) is insufficient to accelerate growth.

Meanwhile, capital accumulation is the percentage of income which is saved and invested to generate future income (Todaro and Smith 2009:142). Capital as denoted by K, includes any investment, such as land, physical equipment, and factory. In some literature, K is measured by using saving ratio over GDP or capital formation over GDP. According to De Long and Summers (1991), the number of machinery and equipment investment is positively related with economic growth. On the research for the period of 1960-1985 they found that 1 per cent increase in the GDP per capita which is invested for equipment increased the GDP for about 1/3%.

Since capital is important to generate growth, saving plays an important role particularly in the closed economy, whereby capital does not flow from one country to another. A country which has higher saving ratio will grow faster. In the open economies, countries do not depend solely from internal financing since capital can flow easily between countries in the form of FDI, loan or aids. Thus, the degree of openness also plays important role to generate higher economic growth. Instead of facilitating capital flow, Todaro and Smith (2009:129) said that openness provides a better access to foreign ideas and technology, which will accelerate the development of technology in the country. Moreover, through engaging in trading activities, country is able to expand their export market. Market expansion enhances the demand of local product which stimulates the development of manufacturing industries particularly for exports commodities (Todaro and Smith 2009:76).

2.2 Literature Review

2.2.1 Political economy of subsidies

Instead of social consideration, the other reason to retain subsidies is political consideration. Energy price is the most sensitive issues in the societies. Any attempt to adjust the price will face public protest and resistance. Thus, in order to manage their political constellation and make their voters happy, the government tends to retain the budget for subsidies and control the domestic price of subsidy (Victor 2009). This situation commonly occurred in developing countries who implement consumer subsidies. In the countries which implement producer subsidies, the motivation of retaining subsidies is to obtain political donation and support from oil companies. The donation is important to fund future election (Victor 2009:7).

Thus, it is not surprising that only several countries shows their commitment to Pittsburgh declaration and agree to phase out subsidies. Besides that, they are also uncertain about the real impacts of subsidy removal on both the economy and societies. Although much research has been done to investigate the impacts of fossil fuel subsidies on the economy, especially growth, the results of those studies are varied, no single conclusion can be derived. The positive view of why government maintain fossil fuel subsides has been written by Victor (2009) who said that the governments still maintain the budget for subsidies since they do not have better policy. Subsidy is the easiest way to protect the poor and industries from the negative impact of oil boom. Subsidies will protect them in the shorter period.

However, reducing subsidies is the best policy according to some research. The cost of subsidies is suffered by the whole economy but the benefit only flows to small parts of the societies. Conducting research in China, Jiang and Lin (2014:11) found that subsidies have greater benefit on high income households rather than the low income households. Meanwhile, Arze del Granado and Coady (2010:13) mentioned that subsidy is a 'costly approach', since most of the benefit goes to the rich. They found that the high income gets the benefit of fuel subsidies 6 times higher than the poor.

Phasing out subsidies is difficult policy to undertake. Many countries failed to phase out subsidies. Massive protest and public resistant were the factors behind the failure. Victor (2009) said that political economy factors are the main cause of the failure in subsidies reform. Brazil becomes one of several countries who succeed in eliminating subsidies. Pearce and von Finckenstein (2002) said that the best time to phase out subsidies is in the period of crisis (such as monetary crisis or a regime collapse). Other said that communication strategy and compensation program is the key success of phasing out subsidies. Conducting research in Indonesia, Beaton and Lonton (2010) found that opposition to subsidy reform in Indonesia declines when the government launch welfare programme at the same time.

2.2.2 Fossil fuel subsidies and growth

The impact of fossil fuel subsidies toward growth can be either positive or negative. Theoretically, subsidies lead to overconsumption of energy (Morgan 2007). Inefficient use of the resources brings negative impact on GDP performance (a proxy to measure growth). Looking from energy efficiency, Morgan (2007) said that subsidies influence GDP through its impact on resources allocation. Hannesson (2009) mentioned that growth in energy consumption decreases GDP. Additionally, Lee and Chang (2008:3) said that the impact of energy consumption appeared in the long run.

Some prior research provides empirical evidence that subsidy brings negative impact toward growth. In the oil producing countries, subsidies decrease revenue gathered from oil production activities, in which the revenue is important to finance growth (Birol 1995). Moreover, Clements et al. (2013) mentioned that energy subsidies bring negative impacts toward growth through

several channels, especially by affecting fiscal balance, public debt and decrease investment in the energy sector. Jiang and Lin (2014:411) claimed that subsidies create some 'fiscal burden' on budgets, distorting market signal, escalate energy consumption and lead to higher CO2 emission. Mourougane (2010) mentioned that energy subsidies decrease the government ability to invest in the infrastructure and production sector which will hinder growth in the future. This argument also supported by Arze del Granado and Coady (2010) and Hannesson (2009) who contend that increase in the demand of energy due to subsidy will impede growth in the future.

On the contrary, lower energy price has some positive impact toward growth in the shorter term. Firstly, subsidy minimizes the risk faced by industries under the volatility of international energy price. Secondly, subsidies provide protection for the infant industries under the difficult situation. Moreover, Bohringer (1996) mentioned that fossil fuel subsidies reduce cost of energy which benefit some industries and strengthen their competitiveness. Lastly, as the consumers pay less for energy, subsidies contributes to enhance domestic saving.

Thus we can imply that there is a dilemma about subsidies. Retaining subsidy creates severe impacts on government budget, which potentially impede growth. On the other side, removing subsidies also bring adverse impact to the economy. Subsidy removals slow down economic activity. They also influence employment particularly in the period of oil shock. Lin and Li (2012) found that subsidies removal influence national competiveness. By using CGE, Abouleinein (2009), in the case of Egypt, also finds evidence that elimination of subsidies depressed annual GDP growth, from 5.6% to 4.14% (decreased about 1.4% compared to the reference period). Jiang and Lin (2014) noticed that subsidy removal creates negative impacts on the macro economic conditions, particularly GDP and employment. Contra evidence obtained from Ellis (2010) who found that subsidy removal influences GDP positively at a rate of 0.1% up to 0.7% in both OECD and Non-OECD countries.

In general, there is no single conclusion of whether fossil fuel subsidies will bring positive or negative impact on growth (as measured by GDP and GDP/Capita). Moreover, the prior studies also show contra results on the relationship between fossil fuel subsidies and resource allocation.

2.2.3 Other determinant of growth

As mentioned in Todaro and Smith (2009:142), there are 3 main determinants of economic growth. They are capital accumulation, human capital and technological progress. Barguellil et al. (2013:137) on their research found that openness to international trade and physical capital also influences growth. Conducting research in China, Liang and Yu (2014: 3) found that fixed asset investment, government spending, total net exports, labour force and Consumer Price Index (CPI) contribute significantly to the increase in growth.

Many literatures confirmed that capital accumulation has positive relationship with growth. Capital is important to enhance national productivity. Hussin and Saidin (2012:119) found that capital as proxies by using gross capital formation has significant contribution toward growth in Asian-4 countries (Malaysia, Thailand, Philippines and Indonesia). This is supported by Liang and Yu (2014) which found that capital (proxies by fixed asset investment) also has positive impact toward growth. Obtaining the similar finding, Dao (2012) found empirical evidence that gross capital formation (gross capital formation as percentage of GDP) is important toward growth. Recent research by Ogun (2014) also found that plenty of capital has positive relationship toward growth.

In addition to capital, according to Solow growth model, labour also plays an essential role in promoting growth. Commonly, growth of the labour force is associated with the growth of population. This assumed that labour increase as the population increases. Dao (2012) found that population growth is positively affect economic growth. Ogun (2014) on the research in Africa obtain evidence that labour supply is positively support economic growth. However, this is not only depends on the quantity of labour but also the quality.

Observing other determinants of growth, Hussin and Saidin (2012) found empirical evidence that openness also significantly influences growth in Indonesia. However, he failed to find evidence that openness also play important roles in Malaysia, Philippines and Thailand. Similarly, Chen and Feng (2000) also found that openness to international trade has significant role in promoting economic growth.

Education also plays an important role towards growth. Education enhances productivity through improving the quality of labour. Moreover, education facilitates the advent of new ideas, science and technology which are important to accelerate growth in the future. Conducting the research in China, Chen and Feng (2000) found that higher education had a positive link toward growth. Underline the importance of human capital on growth, Chen and Feng (2000) said that 'knowledge-driven' growth is important to stimulate growth. On their research, they use higher education as proxy of education because primary education is compulsory so that variation is low. Barro (1991) also found that initial human capital (in which he used school enrolment rates at the period of 1960) had positive relationship toward growth. Barro (1991) and Chen and Feng (2000) said that countries which had higher stock of human capital are growing faster.

Growth also can be dampening by several factors. Chen and Feng (2000) found that inflation has negative impact toward growth. They said that inflation dampen China's economy. Ogun (2014) in the research on Africa also found that inflation hinder growth. Moreover, he also mentions that policy distortion, conflict and debt are some hindrance of growth.

Chapter 3
Overview and recent development of subsidies

3.1. Global fossil fuel subsidies

3.1.1 Fossil fuel at glance

As already explained in the previous section, in most developing countries, fossil fuel energy plays important role in the economy. These types of energy were being used widely in the household, industry, transportation and power plant. There are several types of fossil fuels energy; however the most commonly used are coal, petroleum and natural gas. Each country has its own preference on using fossil fuel. Taking Indonesia and China for an example, Indonesia relies heavily on oil while China depends on coal as the energy source.

Most of fossil fuel energies are internationally traded, thus the price of these commodities supposed to be relatively similar in every country. If there is a difference, it is only due to transportation cost. However the data published by the World Bank (2015) shows that the domestic price of fossil fuel (especially gasoline and diesel fuel) varied widely. Davis (2013) said that the wide variation of fuel price (especially oil product) is surprising since this commodity is traded actively all over the world, which made the 'opportunity cost' is relatively similar. Difference in the freight costs and refinery costs only explained a few of the price divergence, while the biggest difference was merely caused by the presence of subsidies and taxes (Davis, 2013).

Table 2: Pump Price of Gasoline and Diesel Fuel

Pump price for diesel fuel (US$/liter)

Top lowest price

No	Country	2008	Country	2010	Country	2012
1	Venezuela, RB	0.01	Venezuela, R	0.011	Venezuela, RB	0.011
2	Iran, Islamic Rep.	0.03	Iran, Islamic	0.016	Saudi Arabia	0.067
3	Saudi Arabia	0.09	Saudi Arabia	0.067	Libya	0.1

Top highest price

No	Country	2008	Country	2010	Country	2012
1	Malawi	1.67	Greece	1.78	United Kingdom	2.27
2	Slovak Republic	1.68	Denmark	1.79	Turkey	2.33
3	Israel	1.7	Sweden	1.82	Norway	2.35

Pump price for gasoline fuel (US$/liter)

Top lowest price

No	Country	2008	Country	2010	Country	2012
1	Venezuela, R	0.02	Venezuela, R	0.023	Venezuela, R	0.023
2	Iran, Islamic	0.1	Iran, Islamic	0.097	Libya	0.12
3	Libya	0.14	Saudi Arabia	0.16	Saudi Arabia	0.16

Top highest price

No	Country	2008	Country	2010	Country	2012
1	Monaco	1.64	Finland	1.94	Eritrea	2.49
2	Malta	1.66	France	1.98	Norway	2.53
3	Cuba	1.67	Denmark	2	Turkey	2.54

Source : The World Bank (2015) developed by the author

A further investigation on the variation in the domestic energy price, this research finds link between low prices of energy with the presence of subsidies. The data published by IEA shows that countries who have low price of both gasoline and diesel fuel, also have high amount of subsidies. Here subsidies refer only to consumer subsidies. As shown in the table 2, Venezuela is a

country which has the lowest pump price for both gasoline and diesel fuel since 2008 up to 2012. According to IEA calculation, Venezuela has high average subsidisation rate amounted into 92.7%, (equal to 1252.8 subsidy$/person and 10.2% of its GDP). Oil subsidies deserve the highest proportion of the subsidies compare to other types of fossil fuel energy. Some other countries such as Iran, Saudi Arabia and Libya which has low price of gasoline and diesel fuel also have high rate of subsidies (please refer to table 3 for more detailed information). Thus, the data imply that subsidies contribute to the existence of low price of energy.

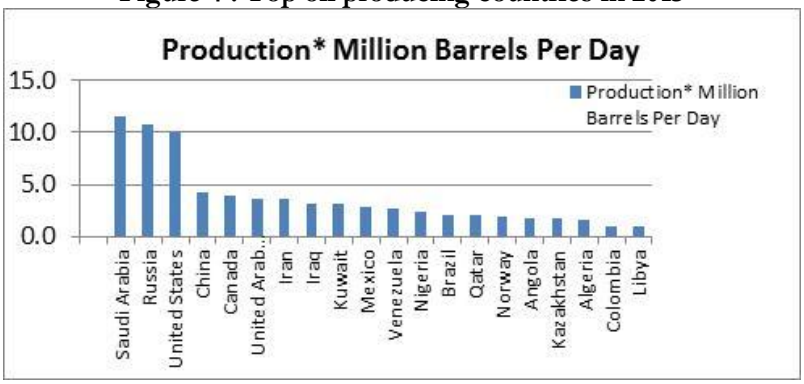
Table 3 Fossil Fuel Consumption Subsidies (Billion $) 2013

Country	average subsidisation rate	Subsidy $/person	Total Subsidi as share of GDP
Venezuela	92.70%	1252.8	10.20%
Qatar	78.50%	2853.2	3.10%
Kuwait	78.40%	2721.2	4.90%
Algeria	77.50%	550.7	10.10%
SaudiArabia	77.30%	2155.1	8.30%
Iran	77.10%	1083.2	22.90%
Libya	76.70%	1209	11.10%
Turkmenistar	65.70%	1593.4	20.60%
UAE	65.00%	2378	5.60%
Egypt	61.20%	364.1	11.00%
Uzbekistan	58.70%	406.1	21.70%
Iraq	53.30%	413.20	6.00%
Ecuador	51.20%	364.9	6.10%

Source: IEA (2015a)

Trying to look from a different angle, most of the countries which have the low pump price of both gasoline and diesel fuel is oil producing countries. Venezuela, Iran, Saudi Arabia and Libya are some of the example. Taking Venezuela for example, Venezuela is one of the biggest oil producing countries in the world (please refer to figure 4). Besides that, the data published by the British Petroleum (2014) shows that Venezuela has the highest amount of proved oil reserves, which is amounted about 298.3 thousands million barrel in the end of 2013 or equal to about 17.7% of total world proved reserves (British petroleum 2014).

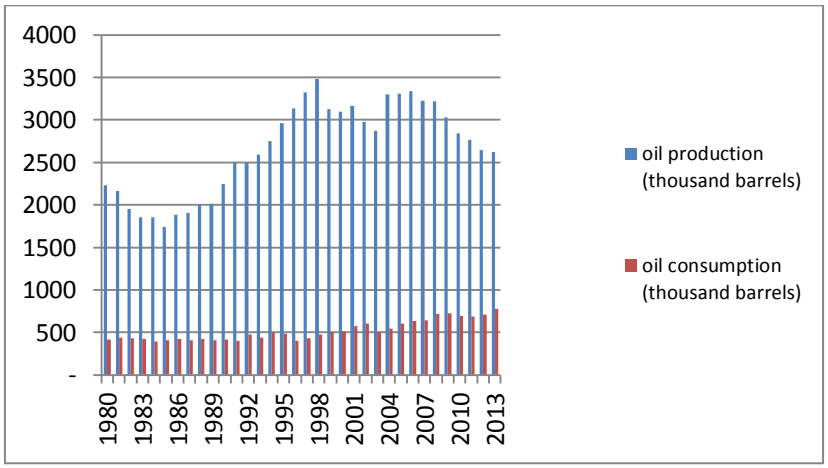
Figure 4 : Top oil producing countries in 2013



Source: The British Petroleum (2014) developed by the author

For the energy producing countries, providing subsidies will not bring negative impact as high as in the non-energy producing countries. For them, increase in the demand of subsidies in the period of oil boom will be net off by the gain obtained from oil export activities. Moreover, in the case of Venezuela, the production of oil is far above the domestic demand (see figure 5). However the trend shows that the demand of energy increases while the production decreases. Hence, they have to reduce their dependency on fossil fuel energy particularly oil since this energy will be depleted rapidly along with the increase in the oil consumption.

Figure 5 : The trend of oil production and oil consumption in Venezuela



Source: British Petroleum (2014) developed by the author

In sum, energy is necessarily needed to support growth. Low price of energy is important to support industrial activities and guarantee the access of energy for the poor. However, subsidies have some negative impacts. For the producing countries, subsidies will decrease the revenue generated from energy production activities. While for non-energy producing countries, subsidies will dampen government budget.

3.1.2 Call for energy reform and the benefit of removing subsidies

It was started during Pittsburgh summit in 2009 when some countries commits to conduct energy reform, one of which is to eliminate any kind of subsidies, particularly energy subsidies. However, only a few countries commit with the result of the Pittsburgh summit. Energy subsidies were already phased out in the developed countries but the amount of subsidies remains high in some developing countries. Some countries still mitigate the adverse impact of subsidies removal. Please refer to figure 6 for the more detailed information about recent development on the energy subsidies.

There are some benefits of removing subsidies for fossil fuel energy. Firstly, removing subsidies will increase energy security and give incentive to develop other source of energy (renewable energy such as wind, solar and so on). Secondly, subsidies removal are important to decrease pollution especially air pollution and carbon emission. Lastly, higher price of energy will decrease the demand of fossil fuel energy and decline extraction of the resources.

Furthermore, removing subsidies will potentially increase the macroeconomic condition, and promote long term and sustainable.

However, removing subsidies is not as easy as we ever thought. In some countries, the removal lead to public protests and in the extreme cases it leads to riots. Mourougane (2010) mentioned that phasing out subsidies will benefit both the economy and the environment but it will lead to opposition. Some attempt to phase out subsidies got resistance from the people as shown in Egypt, Indonesia and Nigeria. Thus, she suggests that the government needs to carefully undertake the policy and communicate it first to the societies before execute it (Mourougane 2010).

Figure 6 : Recent Development in Energy Subsidies

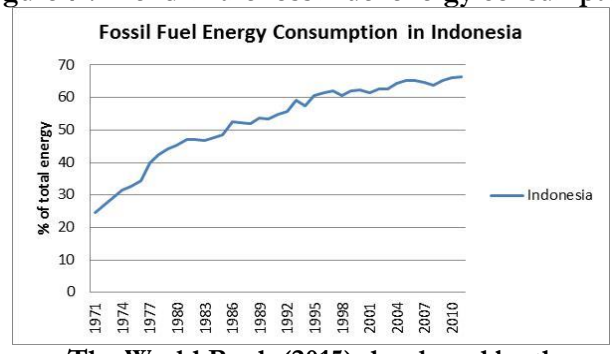
Recent development in the energy subsidies												
Countries	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14
Angola									gasoline and diesel price increase25%			
Argentina				Announce to reduce 20% of subsidies to natural gas, both for commercial and residential users								
Bahrain	Plan to increase the price of diesel 200% in 2017											
Bangladesh	cut the budget for subsidies into 67% in order to meet IMF loan condition											
China				New pricing mechanism for NG								
Ecuador					Electricity price increase by $0,.02							
Egypt							Increase the price of 92 and 80 octan gasoline by 41 % and					
Ghana							Increase the pump price of both gasoline and diesel about 22%					
India				Plan to increase natural gas price 200% (but delayed)								
Indonesia	Increase the price of LPG by			Increase electricity tariff					Increase the price of LPG about 23%			
Iran				Gasoline price increase 75%, NG 40% and diesel 32%								
Kuwait									Diesel fuel subsidies reduced and			
Malaysia	Electricity tarif increased by 15%				Natural gas price increase by about 26%					Increase gasoline price by		
Mexico	Increase both gasoline and diesel fuel to catch up international price											
Morocco	Gasoline and fuel oil subsidies eliminated					Cost of diesel increase						
Myanmar	new electricity tariff introduced											
Nepal			Increase gasoline , diesel, kerosene & aviation fuel price						New pricing scheme which matched to			
Nigeria						Held discussion to		Increase NG price for power generation and				
Oman					Announce to gradually decline fuel subsidies esp gasoline							
Russia	Plan to increase natural gas price on july 2015 (4.8%) and july (4.9%)											
Sudan	Since september 2013 gasoline increase by 68% while diesel increase by 75% and LPG 66%											
Thailand								Increase gasoline price and diesel price		Increase natural gas price		
Tunisia					Increase gasoline price by 6.3%							
Turkmenistan		Increase the price for household natural gas										
Ukraine				Increase natural gas price for industry								
Uzbekistan							Increase diesel price by 11.7%					
Yemen							Increase gasoline price by 60% and diesel price by 95%		Subsidies restored due to public protest			

Source : customized from IEA (2015a)

3.2 Fossil fuel subsidies in Indonesia

Indonesia is one of the countries who rely much on the use of fossil fuel as the main source of energy. The statistic shows that the trend on the energy consumption increases since the last four decades (please see Figure 7). High amount of fossil fuel energy consumption is mostly due to the increase in the demands side and lack development of the alternative energy.

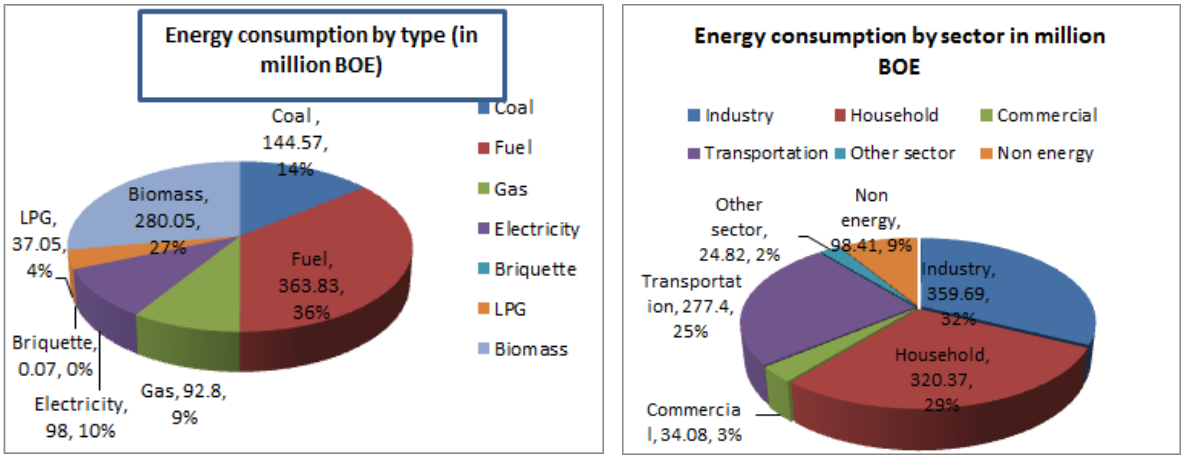
Figure 7 : Trend in the fossil fuel energy consumption



Source : The World Bank (2015) developed by the author

Among all types of energy, fuels (kerosene, gasoline and diesel fuel) are the most consumed energy in Indonesia (see figure 8). This energy is consumed massively both by the household and the industry. However, the industry consumes slightly above the household. Moreover, due to lack of infrastructure and public transportation, people rely on gasoline and diesel fuel to travel from one place to another place. Thus, about 25% of the energy is absorbed by the transportation sector in 2012.

Figure 8 : Energy consumption by type and sector in 2012



Source : Ministry of energy and mineral resources republic Indonesia (2012) developed by the author.

Although both household and industry are the major consumers of fossil fuel energy, the types of energy being used is different. In the past, most of the household rely on kerosene and LPG to support their domestic activities. However, in 2006 the government issued new policy to convert the use of kerosene into LPG. This policy aimed to decrease the demand of kerosene. The government gradually increases the price of kerosene while distributing the subsidized LPG. Although the policy was introduced since 2006, according to the table below, the effect was appeared in 2008. In 2008 the use of LPG is nearly doubled than it was in 2007.

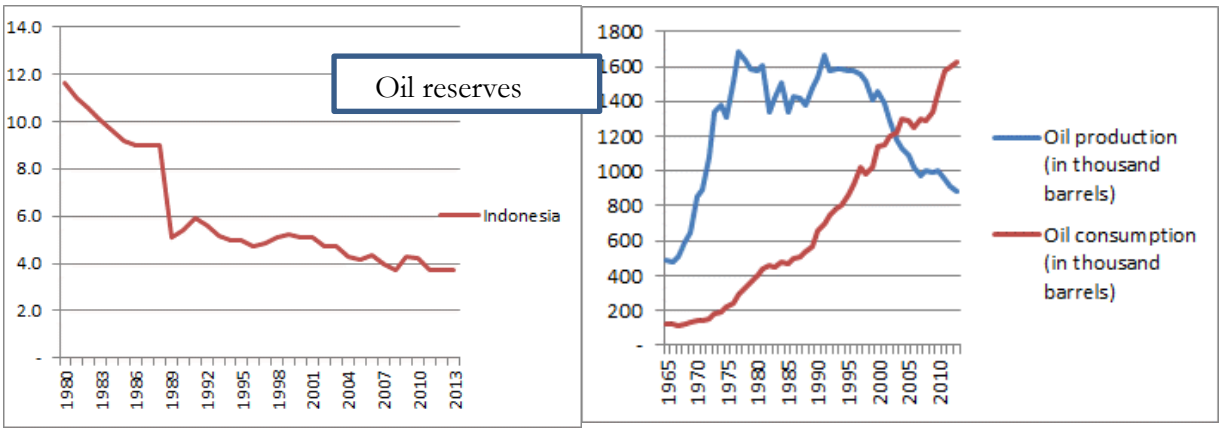
Table 4 : Share of energy consumption in the household sectors

Year	Biomass	Gas	Kerosene	LPG	Electricity
	Thousand Ton	MMSCF	Kilo Liter	Thousand Ton	GWh
2000	90,783	449	10,665,049	696	30,563
2001	92,399	487	10,515,453	724	33,340
2002	94,201	535	9,997,862	748	33,994
2003	95,904	553	10,061,787	823	35,753
2004	97,230	691	10,141,412	798	38,588
2005	97,788	693	9,733,831	704	41,184
2006	99,302	711	8,580,829	788	43,753
2007	100,795	737	8,474,054	979	47,325
2008	101,068	729	6,764,523	1,592	50,184
2009	101,510	722	4,091,982	2,671	54,945
2010	99,619	751	2,436,009	3,564	59,825
2011	103,542	635	1,699,298	4,144	65,112
2012	103,823	748	1,183,525	4,824	72,133
2013	104,115	681	1,079,100	5,377	77,211

Source : Ministry of energy and mineral resources republic Indonesia (2014)

Unlike in the period of 1980's when Indonesia obtained benefit from oil boom. Since the beginning of 1990's the oil production decreased while the consumption is continued to increase (see figure 9). Agustina et al. (2008) mention that although the world price of oil increased massively the government revenue gathered from oil and gas decreased since 2001. Besides that, the amount of reserves being discovered also decreased due to lack of exploration activities and difficulties in finding new reserves. Having limited amount of proved oil reserves, low production activities and increase in demand for oil product, Indonesia becomes net importing countries. In 2008, Indonesia announced to temporarily terminate its membership in OPEC.

Figure 9 : The graphic of oil reserves, oil production and consumption

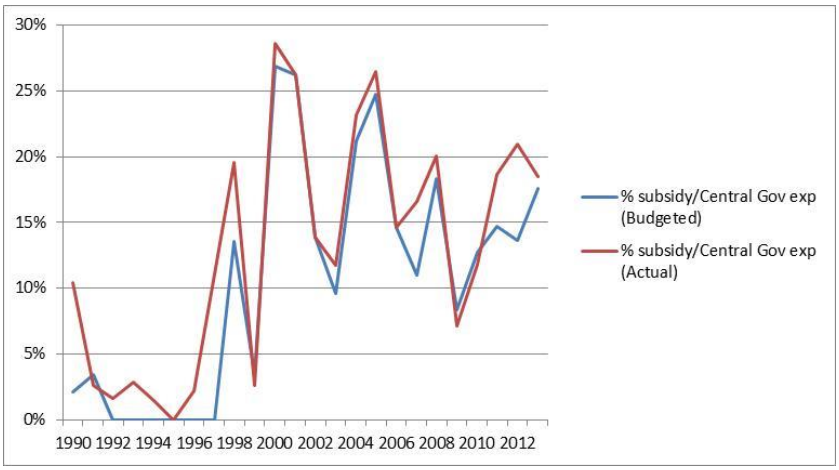


Source : British Petroleum (2014) developed by the author.

As a net importing country, matching the domestic price with the international price is important. For several years the government determines the domestic price of fuel and electricity tariff. However, the price is far below its international price and sometime does not link with the international price. Subsidy is provided to fill the gap between the domestic price and the international price. The amount of subsidies is increase as the world price and the demand for energy increase.

Subsidies then become a serious problem in Indonesia, subsidies depressed government budget. The data provided by Central Bank of Indonesia (2015) shows that in the last two decades, the government allocates around 15%-30% of the government spending for subsidy (see Figure 10). In some periods such as in 2001 and 2013 the actual subsidies exceed the budgeted subsidy; that lead to budget deficit. In order to phase out subsidies, the government pursue LPG conversion programs and gradually adjusts the price of gasoline (RON 88) and diesel fuel. Adjusting the domestic price is not an easy way and public resistant is the strongest barrier.

Figure 10 : Subsidy as % of Government Budget



Source : Central Bank of Indonesia(2015) developed by the author

Chapter 4
Data and Methodology

4.1 Data

In order to analyse the impact of fossil fuel subsidies on growth, we use panel data sets. The secondary data employed in this research were taken from several reliable sources such as IEA, British Petroleum and The World Bank. The data for fossil fuel consumption subsidies were taken from the IEA and spanned from the period of 2007 to 2013.

The IEA calculate subsidies by using price gap approach. They compare the domestic price with the reference price. Basically, we can use our own calculation to measure the amount of subsidies. However, due to some limitation, this research use the secondary data provided by IEA. Difficulties in determining the reference price is one of the reasons. The data about subsidies provided by IEA capture oil subsidies, coal subsidies, electricity subsidies and natural gas subsidies. However, the data are only available for certain countries. Hence, the selection of countries and time coverage is depend on the availability of the data about subsidies. Please refer to the table 5 for the list of sample.

Table 5 : List of Sample

1	Algeria	11	India	21	Nigeria	31	Thailand
2	Angola	12	Indonesia	22	Pakistan	32	Turkmenistan
3	Argentina	13	Iraq	23	China	33	Ukraine
4	Azerbaijan	14	Iran, Islamic Rep.	24	Peru	34	United Arab Emirates
5	Bangladesh	15	Kazakhstan	25	Philippines	35	Uzbekistan
6	Brunei Darussalam	16	Korea, Rep.	26	Qatar	36	Venezuela, RB
7	Colombia	17	Kuwait	27	Russian Federation	37	Vietnam
8	Ecuador	18	Libya	28	Saudi Arabia		
9	Egypt, Arab Rep.	19	Malaysia	29	South Africa		
10	El Salvador	20	Mexico	30	Sri Lanka		

The data about GDP per capita, Export/GDP and Import/GDP (which being used to measure openness) are taken from the World Bank. Here we use GDP per capita PPP (at constant 2011 international US dollars). The data for other explanatory variables (such as secondary school enrolment, and gross capital formation) are also taken from the World Development Indicator published by the World Bank.

4.2 Modelling framework

Prior studies on growth show that there are several factors which contribute to economic growth. Chen and Feng (2000:4) mentioned that investment, human capital, international trade and inflation are influence growth. While some other research found that demographic factor such as population and population growth also influence economic growth.

Another research on growth which conducted by Hussin and Saidin (2012) found that fixed capital formation has positively influence growth. Similar finding proposed by Dao (2012) on their research in the developing countries which found that share of gross capital formation on GDP has positive relationship with economic growth.

Furthermore, Hussin and Saidin (2012) on their research in ASEAN countries found that openness contributes significantly to growth in Indonesia. In addition, Frankel and Rose (2002) on their research found that openness to trade positively stimulate economic growth.

Based on prior research and finding, we try to develop model that will be used in this research. Since this research will examine the impact of fossil fuel subsidies, we add subsidies variable (FFsubs, Oilsubs, NGsubs, Coalsubs, Elecsubs) in the model. Thus we proposed empirical equation modelled as follow,

To measure the impact of fossil fuel gdp in total on growth

$$(\text{Growth})_{it} = \alpha_0 + \alpha_1 (\text{OPEN})_{it} + \alpha_2(\text{FFsubs})_{it} + \alpha_3 CF + \alpha_4 (\text{secgrt10})_{it} + \varepsilon_{it}$$

To measure the impact of oil subsidies on growth

$$(\text{Growth})_{it} = \alpha_0 + \alpha_1(\text{OPEN})_{it} + \alpha_2(\text{Oilsubs})_{it} + \alpha_3 CF + \alpha_4 (\text{secgrt10})_{it} + \varepsilon_{it}$$

To measure the impact of fossil fuel based-electricity subsidies on growth

$$(\text{Growth})_{it} = \alpha_0 + \alpha_1(\text{OPEN})_{it} + \alpha_2(\text{Elecsubs})_{it} + \alpha_3 CF + \alpha_4 (\text{secgrt10})_{it} + \varepsilon_{it}$$

To measure the impact of natural gas subsidies on growth

$$(\text{Growth})_{it} = \alpha_0 + \alpha_1(\text{OPEN})_{it} + \alpha_2(\text{NGsubs})_{it} + \alpha_3 CF + \alpha_4 (\text{secgrt10})_{it} + \varepsilon_{it}$$

To measure the impact of coal subsidies on growth

$$(\text{Growth})_{it} = \alpha_0 + \alpha_1(\text{OPEN})_{it} + \alpha_2(\text{Coalsubs})_{it} + \alpha_3 CF + \alpha_4 (\text{secgrt10})_{it} + \varepsilon_{it}$$

Where

Growth = Economic growth (in %), which measured by using formula,

$$\text{Growth} = \left[\frac{GDP_t - GDP_{t-10}}{GDP_{t-10}} X100\right]:10$$

GDP_t is GDP per capita PPP (constant 2011 international US dollar) at time t. While, GDP_{t-10} is GDP per capita PPP (constant 2011 international US dollar) at time t-10 (initial period)

OPEN = Average of the degree of openness during the period of t until t-10 (in %). Conventionally the degree of openness is measured by using (X+M)/Y.

FFsubs = Total fossil fuel subsidies measured as a share of GDP (in %)

Oilsubs = Oil subsidies as a share of GDP (in %)

Elecsubs = Electricity subsidies as a share of GDP (in %)

Coalsubs = Coal subsidies as a share of GDP (in %)

NGsubs = Natural gas subsidies as a share of GDP (in %)

CF = Gross capital formation during the period (% of GDP)
Secgrt10 = Enrolment in the secondary school (% gross) in the initial period

4.3 Data definition

The dependent variable in this study is Growth in which calculated by using formula as explained above. The explanatory variable consist of several independent variables such as openness, fossil fuel subsidies (coal subsidies, oil subsidies, electricity subsidies and natural gas subsidies), gross capital formation as percentage of GDP, and secondary school enrolment.

Growth

This research use economic growth as the dependent variable. Here Growth refers to economic growth which defined as the growth rate of GDP per capita over certain periods. Hussin and Saidin (2012:122) also use growth rate of GDP as a proxy of economic growth. In this research, Growth is calculated using this formula,

$$\text{Growth} = [\frac{GDP_t - GDP_{t-10}}{GDP_{t-10}} X100]:10$$

In which GDPt represents GDP per capita PPP at time t (in constant international 2011 US dollar), while GDPt10 is GDP per capita PPP at time t-10 (also in constant international 2011 US dollars). The data for GDP per capita were taken form WDI published by the World Bank. The World Bank (2015) defines GDP per capita PPP as the GDP per capita which is converted into international dollar by using PPP or 'purchasing power parity rates'. Meanwhile, they define GDP as total of gross value added produced by resident producers after added by any taxes and subsidies which excluded from the product's value (The World Ban, 2015). They do not include both depreciation on assets and depletion of natural resource in the calculation.

Openness

Hussin and Saidin (2012:122) defined openness as the degree of the economy interacts with other countries (the rest of the world). Commonly openness measured by using this formula

Opennes = (total export + total import)/GDP

Here we suspect that the more open the economy, the higher the economic growth (the relationship between openness and growth is positive).

Fossil fuel subsidies (coal subsidies, oil subsidies, electricity subsidies and natural gas subsidies)

In this research, the subsidies (fossil fuel subsidies, coal subsidies, oil subsidies, electricity subsidies and natural gas subsidies) are measured as a share of GDP. The data about subsidies were taken from IEA. According to prior studies, the relationship between fossil fuel subsidies and growth can be either positive or negative.

Gross capital formation as percentage of GDP

Previously, the World Bank named gross capital formation as gross domestic investment. Gross capital formation consists of addition of fixed assets and net changes in the level of inventories. Addition of fixed asset is include land improvements, purchase of equipment purchases and soon. While change in the level of inventories includes inventories and 'work in progress goods'. Dao (2012) found that capital formation has positive impact on growth. Thus we expect the relationship between gross capital formation and growth is positive.

Secondary school enrolment

Gross secondary school enrolment also calculated as total enrolment in secondary education without considering age. The models use secondary school enrolment at the beginning of the period (secgrt10) as an independent variable. As well as productive population, we hypothesize that secondary school enrolment will have positive relationship with economic growth.

Table 6 Summary of the dependent variables and expected sign

Variable	Definition	Expected Sign	Source
OPEN	The degree of openness during the period of t until t-10. Conventionally calculated using (X+M)/Y	Positive	Own calculation by using data from The World Bank
FFsubs	Total fossil fuel subsidies as share of GDP (%)	Negative	Own calculation by using data from IEA
Oilsubs	Oil subsidies as a share of GDP (%)	Negative	Own calculation by using data from IEA
Coalsubs	Coal subsidies as a share of GDP (%)	Negative	Own calculation by using data from IEA
Ngsubs	Natural gas subsidies as a share of GDP (%)	Negative	Own calculation by using data from IEA
Elecsubs	Electricity subsidies as a share of GDP (%)	Negative	Own calculation by using data from IEA
CF	Gross capital formation during the period (% of GDP)	Positive	World Development Indicator published by The World Bank
secgrt10	Enrolment in the secondary school (% gross) in the initial period	Positive	World Development Indicator published by The World Bank

4.4 Data presentation and analysis

This research will be conducted by using some economic analysis in order to determine the relationship between the dependent and independent variables.

Basically there are several types of data analysis, the times series and panel data. However, since this research employs data in many different countries, the research will prefer to use panel data approach. Commonly, panel data applied when two sets of data, which are cross-sectional data and time series data, are combined.

There are several advantages of using panel data approach. Baltagi (1995) mentioned that by using panel data, there is huge information can be generated from the data. Gujarati (2003) mentioned that through panel data, the sample can be expanded. Besides that, the quality of the data is much higher and there is least possibility of co-linearity problem occurred (Baltagi 1995). This is supported by Gujarati (2003) which mention that combination of time series and cross section data provide better information. Lastly, panel data is more suitable to analyses complex behaviour. All in all, the major advantage of using panel data is the possibility of allowing unobserved heterogeneity, so that omitted variables can be solved.

There are several types of panel data approach, but the most noticeable is the fixed effect model (FEM) and the random effect model (FEM). This research will perform Hausman test to check which model is suitable, whether the fixed effect model or the random effect model.

Chapter 5
Finding and Analysis

5.1 Summary of the Descriptive Statistic

The aim of this research is to examine the relationship between fossil fuel subsidies and economic growth, both in total and for each type of fossil fuel energy (Oil, Coal, Natural Gas and Electricity). In order to meet the objective, this research is conducted using panel data analysis. Since there are difficulties in obtaining the data about subsidies, the sample selection is based on the availability of the data about fossil fuel subsidies that has been published by the IEA. Hence, the sample only consists of 37 countries which spanned from the period of 2007 up to 2013. The descriptive statistic of the independent variable (Growth) and the dependent variables are presented in the Table 7.

Table 7 : Descriptive Statistic

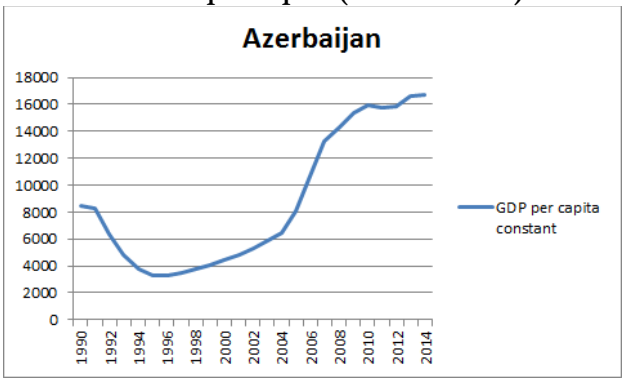
Variable	Obs	Mean	Std. Dev.	Min	Max
Growth	164	4.59	4.02	-0.95	27.96
OPEN	164	82.19	39.37	34.11	223.93
FFsubs	164	3.97	5.47	0.00	35.01
Oilsubs	164	1.74	2.44	0.00	12.78
Elecsubs	164	0.99	1.16	0.00	6.00
NGsubs	164	1.21	3.83	0.00	28.31
Coalsubs	164	0.03	0.14	0.00	1.38
X	164	9.66	23.11	0.00	140.45
Y	164	100.69	790.54	0.00	9476.53
z	164	33.69	113.98	0.00	751.60
CF	164	24.52	8.31	11.30	49.29
secgrt10	164	71.35	22.09	12.98	114.87

As shown in the table, Growth variable (which represents growth in GDP per capita based on PPP at constant 2011 international USD) varies widely, spanning from -4.76 % to 27.96%. The formula to calculate Growth is already explained in the previous chapter (Chapter 4). Based on our calculation, Brunei Darussalam is a country which has minimum growth rate, with average -0.95% during the period of 2003-2013. In 2003, the GDP per capita of Brunei Darussalam was USD 76,736.7, while in 2013 the GDP per capita was only about USD 69,474.2. Brunei Darussalam is small country in South East Asia which has one of the highest GDP per capita in this area. However, since their economy is highly supported by oil industries, oil revenue becomes the main contributor on GDP. On the contrary, our calculation shows that Azerbaijan is the country which has the highest economic growth. For more detailed information about the trend in the GDP per capita (in constant PPP) in Azerbaijan, please refer to the figure 11.

Besides that, the data also shows that Bangladesh is the country which has the lowest value of GDP per capita (in constant PPP). In 2008, their GDP was only about US$ 2,264.891. Meanwhile, Qatar has the top values of GDP per

capita during the observation period. In 2011, their GDP per capita (in constant PPP was amounting to about US$ 133,733.9.

Figure 11: Trend GDP per capita (constant PPP) in Azerbaijan



Sources: The World Bank (2015) developed by the author

The mean value of variable OPEN (which measures the average value of the degree of openness during the period of t-10 up to t in each country) is 82.19. From the descriptive statistics, no country has 0 value of OPEN, which implies that all countries in the sample are open country. Conventionally, the degree of openness is measured by using the sum of export and import over a capita in a given period. Hence, a country which actively engages in exports imports activities will be considered to be an open country. According to our calculation, Malaysia has the highest degree of openness. The average value of OPEN from the period of 1997 up to 2007 is 223.93. Meanwhile, Argentina was found to be the least open country. In 2007, our calculation shows that country's average openness (as calculated by using sum of export and import per GDP) was only 34.1067.

Stepping further to the subsidies variables, the minimum value of fossil fuel subsidies as a share of GDP (FFsubs) is 0 (close to 0) while the maximum value is 35.01%. Uzbekistan has the highest percentage of fossil fuel subsidies (as a share of GDP) which amounted up to 35.01% in 2009. Some countries, such as Korea have a relatively small amount of fossil fuel subsidy compared to their GDP, so that when the subsidy is divided by GDP, the ratio become close to zero. Most of the time, oil is the most subsidized fossil fuel energy. The mean value of Oilsubs (oil subsidy as a share of GDP) is about 1.74 %, and ranges from 0% to 12.78%. Iran is the country which allocated the largest amount of oil subsidies as a share of GDP. Natural gas energy is the second largest subsidized fossil fuel energy with average subsidy is 1.21%. Conversely, coal is typically the least subsidized energy.

Instead of subsidy variables and OPEN, there are some others explanatory variables included in the model. They are secgrt10 (secondary school enrolment, gross % at the initial period or t-10), and CF (Capital formation). The mean value of secgrt10 is relatively high, about 71.35%. However there is a wider gap in the percentage of gross enrolment in secondary school as shown by the minimum value (12.97%) and the maximum value (114.87%). Angola has the lowest percentage of gross enrolment in secondary school, in which the enrolment ranges from 12% up 18%. In contrast, Kuwait has the highest

enrolment, with the average enrolment during the period of 1997 to 2003 above 100%. According to the World Bank (2015), gross enrolment in secondary school (which measures the total enrolment in secondary school without considering age) can exceed 100% since it include both under-aged and over-aged students.

The mean value of CF (which represents average gross capital formation as % of GDP) is 24.52% while the minimum and maximum values are 11.29% and 49.28% respectively. Based on our sample, Iraq is the country which has the lowest share of capital formation compared to others countries. In average the percentage of capital formation as a share of GDP is below 20%. However, China has the highest percentage of CF, with the value of CF above 40%.

5.2 Fossil fuel subsidies on growth

In this research the relationship between growth (dependent variable) and the independent variables is estimated by using panel estimation models. There are three panel estimation models employed, namely pooled model, fixed effect model (FEM) and Random Effect model (REM). Below is the result of the regression,

Table 8 : Regression result 1

	Pooled				Fixed				Random			
Growth	Coef.	Std. Err.	t	P>t	Coef.	Std. Err.	t	P>t	Coef.	Std. Err.	z	P>z
OPEN	0.011819	0.00731	1.62	0.108	0.047396	0.014784	3.21	0.002***	0.03938	0.012693	3.1	0.002***
FFsubs	0.036422	0.052216	0.7	0.486	-0.0944	0.048362	-1.95	0.053*	-0.08662	0.046121	-1.88	0.06*
CF	0.200533	0.03468	5.78	0.000***	0.175563	0.029616	5.93	0.000***	0.174178	0.028691	6.07	0.000***
secgrt10	-0.03944	0.012923	-3.05	0.003***	0.04169	0.021759	1.92	0.058*	0.025513	0.019235	1.33	0.185
_cons	1.371769	1.527826	0.9	0.371	-6.21006	2.100838	-2.96	0.004	-3.69712	2.057859	-1.8	0.072
No Obs				164				164				164
Prob > F				0				0				0.0001
R-squared				0.2205								
Adj R-squared				0.2009								
R-sq: within =								0.2794				0.2755
between =								0.2794				0.0321
overall =								0.0349				0.0625

Chow Test		
Prob > F	0.0000	(Prob > F)<Alpha 0,05 Reject H0, accept fixed effect

Hausman Test		
Prob > Chi2	0.4068	(Prob > Chi2) > Alpha 0,05 Accept H0, Different in coefficient is not systematic, then use random effect

From the pooled regression we can see that the R-Squared is 22.05%, while the Adjusted R-Squares is 20.09 The R-squared shows that about 22% variation of growth can be explained by the model. In order to determine which model is more suitable, we perform both Chow test and Hausman test.

The Chow test indicates that (FEM) is more preferable than pooled regression. While the Hausman test indicates that the REM is more appropriate than the fixed effect model (FEM). According to the random effect model, three variables are significant. They are OPEN (the degree of openness), FFsubs

(fossil fuel subsidie as a share of GDP) and CF (capital formation). OPEN and CF are significant at alpha 1%, while FFsubs is significant at alpha 10%. The coefficient of these variables is positive except for FFsubs.

The negative coefficient of FFsubs shows that fossil fuel subsidies create a negative impact on economic growth. The coefficient implies that 1 unit increase in FFsubs will decrease Growth by 0.086 units (ceteris paribus). The result is in line with Jiang and Lin (2014), Clements et al. (2013) and Arze del Granado and Coady (2010) who claim that the presence of subsidies depresses government budgets and creates hindrances on growth. Meanwhile, Mourougane (2010) found that energy subsidies decrease government ability to invest in the infrastructure and productive sectors which will hinder growth in the future. Looking from energy efficiency, Morgan (2007) said that subsidies influence GDP through its impact on resources allocation. This view is supported by Hannesson (2009) who found that growth in energy consumption decreases GDP. Additionally, Lee and Chang (2008:3) said that the impact of energy consumption appeared in the long run.

This research provides empirical evidence that fossil fuel energy will hinder growth. Hence phasing out subsidies becomes necessary action that should be undertaken by the government. Simulating the impact of subsidy removal and growth by using CGE, Ellis (2010) found that subsidy removal increases GDP by 0.1% to 0.7% in both OECD and Non-OECD countries.

In order to provide a deeper analysis, the research performs further regression to determine the impact of subsidies (on each type of fossil fuel energy) towards growth. Furthermore, we investigate whether the impact is similar or not for the energy producing and non-energy producing countries.

5.2.1 Oil subsidies on growth

Oil subsidies have the largest share on the total fossil fuel subsidies. Hence, we need to investigate further to what extent oil subsidies affect growth. In order to assess the relationship between growth and oil subsidies, we perform similar methods, using Pooled, Fixed effect model (FEM) and Random effect model (REM). The result of the regression is summarized as follows.

Table 9: Regression result 2

	Pooled				Fixed				Random			
Growth	Coef.	Std. Err.	t	P>t	Coef.	Std. Err.	t	P>t	Coef.	Std. Err.	z	P>z
OPEN	0.010704	0.007083	1.51	0.133	0.044615	0.01502	2.97	0.004***	0.037526	0.012803	2.93	0.003***
Oilsubs	-0.37133	0.112928	-3.29	0.001***	0.009063	0.080536	0.11	0.911	-0.00293	0.078145	-0.04	0.97
CF	0.199981	0.033589	5.95	0.000***	0.169969	0.029985	5.67	0.000***	0.169517	0.029118	5.82	0.000***
secgrt10	-0.04316	0.012469	-3.46	0.001***	0.042628	0.022132	1.93	0.056*	0.024401	0.019449	1.25	0.21
_cons	2.532128	1.512105	1.67	0.096	-6.30161	2.136257	-2.9	0.004	-3.7452	2.063818	-1.81	0.07*
No Obs				164				164				0
Prob > F				0				0				0.0003
R-squared				0.2679								
Adj R-squared				0.2495								
R-sq: within =								0.2579				0.2531
between =								0.0192				0.033
overall =								0.0337				0.0683

Chow Test		
Prob > F	0.0000	(Prob > F)<Alpha 0,05 Reject H0, accept fixed effect

Hausman Test		
Prob > Chi2	0.2216	(Prob > Chi2) > Alpha 0,05 Accept H0, Different in coefficient is not systematic, then use random effect

Table 9 summarizes the result of the regression by using pooled, FEM and REM. However, the Hausman test suggests that the random effect model is the most appropriate model. Unlike the previous regression, the results of the regression under REM show that growth only can be explained by OPEN (significant at alpha 1%) and CF (significant at alpha1%). As shown in the table, both variables (CF and OPEN) have positive impact toward growth.

This regression failed to capture the impact of oil subsidies on growth. As shown in the table above, Oilsubs (oil subsidy as a percentage of GDP) is insignificant towards growth although the coefficient is negative (-0.0029). This result failed to support prior research conducted by Jiang and Lin (2014) and Clements et al. (2013) which found that fossil fuel subsidies (including oil subsidies) bring negative impact toward growth.

As discussed previously, the world price of oil is highly fluctuated which often makes subsidy policy risky. The amount of subsidies that should be prepared depends on the gap between the domestic price and the international price. As the gap getting wider, the subsidies increase and depress government budget. Hence, matching the domestic price of oil (particularly gasoline and diesel fuel) with its international price is important in order to minimize the risk. Theoretically, the negative impact of oil subsidies will be greater in the non-oil producing countries, since they do not get any benefit from the oil boom. In the oil-producing countries, the huge amount of subsidies needed during the period of oil boom can be net off by the revenue gathered from oil production.

Tracing back to the data, most of the countries which provide huge amount of oil subsidies are oil producing countries. They are Turkmenistan, Iraq, Egypt, Venezuela, Iran, Saudi Arabia and Libya. Saudi Arabia is one of the largest oil producing countries, which contributes to about 13.1% of world total oil production (British Petroleum 2014). In oil producing countries, subsidies act as a tool to redistribute national income which is generated from oil production (IEA et al. 2010: 8). Birol (1995) stated that in oil exporting countries, governments use their energy endowment for the advantage of the people, particularly the poor.

However, in the long term, even for oil producing countries, subsidies impede growth. Subsidies erode the benefit obtained from the increase in the world price of oil. On the contrary, when the world price of oil decline, the oil revenue decreases and creates balance payment problem (Birol 1995). Meanwhile, for non-oil producing countries, the impact will be greater during a

period of oil boom. Lower energy prices create obstacle for the development of other energies and impede energy diversification programs. Relying only on petroleum products is harmful since they are not a renewable energy source and massive consumption will accelerate the rate of depletion.

In order to provide a better understanding of how subsidies will influence growth in oil producing and non-oil producing countries, this research performed another regression by putting 1 additional variable namely X. X is calculated by multiplying oil subsidies as a share of GDP and oil production per capita. Hence X is the interaction between oil subsidies and oil production in the oil producing countries. As discussed earlier, in oil producing countries, the negative impact of subsidies on growth will be offset by the gain obtained from oil revenue particularly in the period of oil boom. Hence we expected that X would have a positive sign. The result of the regression is as follows.

Table 10: Regression result 3

	Pooled				Fixed				Random			
Growth	Coef.	Std. Err.	t	P>t	Coef.	Std. Err.	t	P>t	Coef.	Std. Err.	z	P>z
OPEN	0.012212	0.007147	1.71	0.089*	0.044893	0.015059	2.98	0.003***	0.037565	0.012846	2.92	0.003***
Oilsubs	-0.31801	0.119091	-2.67	0.008***	-0.00735	0.084445	-0.09	0.931	-0.00585	0.081906	-0.07	0.943
X	-0.01887	0.013713	-1.38	0.171	0.009133	0.013809	0.66	0.51	0.001671	0.013233	0.13	0.9
CF	0.191041	0.034119	5.6	0.000***	0.171375	0.030127	5.69	0.000***	0.169815	0.029287	5.8	0.000***
secgrt10	-0.03564	0.013582	-2.62	0.01**	0.042999	0.022188	1.94	0.055*	0.024416	0.019524	1.25	0.211
_cons	2.180197	1.529411	1.43	0.156	-6.44513	2.151976	-2.99	0.003	-3.76818	2.073986	-1.82	0.069
No Obs				164				164				164
Prob > F				0				0				0
R-squared				0.2766								
Adj R-squared				0.2537								
R-sq: within =								0.2605				0.254
between =								0.0136				0.0314
overall =								0.0245				0.0654

Chow Test		
Prob > F	0.0000	(Prob > F)<Alpha 0,05 Reject H0, accept fixed effect

Hausman Test		
Prob > Chi2	0.2400	(Prob > Chi2) > Alpha 0,05 Accept H0, Different in coefficient is not systematic, then use random effect

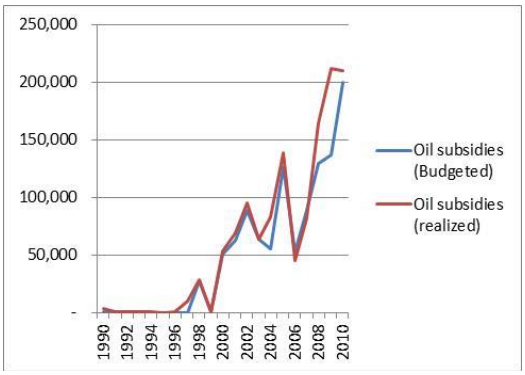
As well as in the prior regression, the Hausman test reveals that the random effect model (REM) is the most appropriate model. Under the REM, growth can be explained by only 2 variables which are OPEN (the degree of openness) and CF (capital formation). Similar to the previous result, the impact of Oilsubs (oil subsidies as a share of GDP) on growth is negative but insignificant. The coefficient is slightly bigger; in which 1 unit increase in Oilsubs will dampen growth by 0.0058 units (assumed other remain constant). However, X, which is added into the model to see the interaction between oil subsidies and oil production, is positive but also not significant. Although it is not significant, the direction of X toward growth is interesting for analysis. This regression failed to find evidence about how the interaction between subsidies and oil production influence growth. The result of the regression is unable to support prior research by Birol (1995). Conducting a study in oil exporting countries (Iran, Nigeria and Algeria), Birol (1995) argued that,

subsidies lead to inefficient use of energy which decreases government revenue from oil. The oil revenue is important to support growth in oil producing countries (Birol 1995).

Oil subsidies in Indonesia

In Indonesia, oil (including oil products) is the highest subsidized energy. Fuel price is not determined by market mechanisms and thus are not linked with international price (Dartanto 2013). Otherwise, the government sets up the retail price of fuel. Starting in 1998, the price of energy hiked due to the depreciation of IDR following the severe monetary crisis. Increases in fuel prices led to a riot in 1998. In order to lower the price, the government decided to allocate more subsidies. The budget allocated for subsidies dropped in 1999, but it increased afterwards (following the increase in the world price of oil) and has stayed above 50 trillion since 2000. This amounts to about 11%-22% of total budgeted government expenditure.

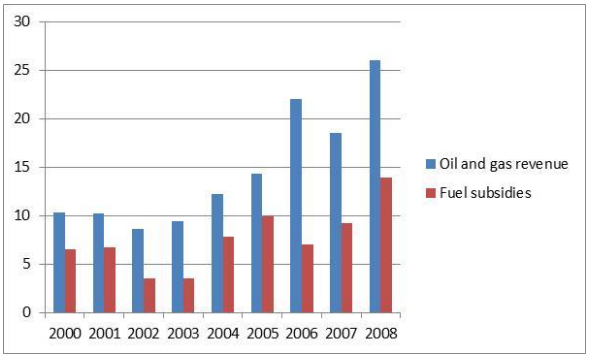
Figure 12: Budgeted and Realized Oil subsidies in Indonesia (In billion IDR)



Source : Central Bank of Indonesia (2015) developed by the author

In the case of Indonesia, subsidies deter the government's ability to enhance economic growth. Subsidies decrease the budget allocated for infrastructure and human capital (Dartanto 2013). As an oil producing country, about half of the revenue from oil goes to subsidies (Please refer to figure 13). The presence of subsidies for gasoline and diesel fuels also leads to monopoly practices. Pertamina (National Oil Company) becomes the only company that is authorized to sell subsidized fuel. However, less competition influences their performance. This situation also hinders investment in the energy sector, since other companies will find it difficult to enter the energy industry. Furthermore, subsidies hinder the development of public transportation and create traffic congestion. Lastly, subsidies lead to smuggling, as many gallons of subsidized fuel are illegally traded to neighbouring countries (Bulman et al. 2008).

Figure 13: Indonesia oil & gas revenue and subsidies (In US$ billion)



Source: Agustina et al. (2008:3) developed by the author

According to Dartanto (2013), phasing out subsidies is necessary action that should be carried out by the Indonesian government. He argued that without new discovery, the oil reserve in Indonesia will only last for about 15-20 more years. In Indonesia, fuel subsidies are wrongly targeted. Since the subsidy is given for each litre of fuel consumed, those who consume most are those who get the higher benefit of subsidies (Mourougane 2010).

Several attempts have been made by the government to phase out subsidies. In 2002, the government announced that they would to link the domestic price of fuel with the international price. This was followed by their policy to increase the domestic price in early 2003. However, as this policy was poorly communicated, public protests arose (Mourougane 2010). After that, in 2005, the government reduced the amount of subsidies by increasing the price of diesel fuel and kerosene. The budget saved from phasing out subsidies is distributed to the poor households in the form of direct transfer (monthly cash transfer). Furthermore, again in 2008, the government increased the price of gasoline and diesel fuel. As well as in 2005, the government accompanied it with compensation program called *Bantuan Langsung Tunai* by providing cash transfers to the poor households.

Instead of adjusting the domestic price of fuels (kerosene, diesel fuel and gasoline), the government also launched some other program. Starting in 2006, in order to eliminate the use of kerosene in the domestic activities, the government pursued the conversion from kerosene to LPG. The government distributed the stove and LPG cylinders for free to every household. Moreover, the government also provided subsidies for the small LPG cylinder (the green-colour cylinder).

5.2.2 Electricity subsidies on growth

As we know, in some countries, the majority of the electricity is generated using fossil fuel energy. However, using fossil fuel energy to generate electricity is both costly and risky, since the price of the energy fluctuates. The table below describes the relationship between electricity subsidies and growth.

Table 11 : Regression Result 4

	Pooled				Fixed				Random			
Growth	Coef.	Std. Err.	t	P>t	Coef.	Std. Err.	t	P>t	Coef.	Std. Err.	z	P>z
OPEN	0.011797	0.00728	1.62	0.107	0.04687	0.01476	3.18	0.002***	0.039337	0.01269	3.1	0.002***
Elecsubs	0.319503	0.254945	1.25	0.212	-0.28968	0.147692	-1.96	0.052*	-0.27161	0.145587	-1.87	0.062*
CF	0.204248	0.034733	5.88	0.000***	0.171983	0.029498	5.83	0.000***	0.170999	0.02862	5.97	0.000***
secgrt10	-0.04321	0.013375	-3.23	0.002***	0.044031	0.021757	2.02	0.045**	0.027179	0.019259	1.41	0.158
_cons	1.379335	1.519242	0.91	0.365	-6.33388	2.099831	-3.02	0.003	-3.81959	2.054187	-1.86	0.063
No Obs				164				164				164
Prob > F				0				0				0
R-squared				0.2258								
Adj R-squared				0.2063								
R-sq: within =								0.2797				0.2757
between =								0.0179				0.0283
overall =								0.0339				0.0625

Chow Test		
Prob > F	0.0000	(Prob > F)<Alpha 0,05 Reject H0, accept fixed effect

Hausman Test		
Prob > Chi2	0.3400	(Prob > Chi2) > Alpha 0,05 Accept H0, Different in coefficient is not systematic, then use random effect

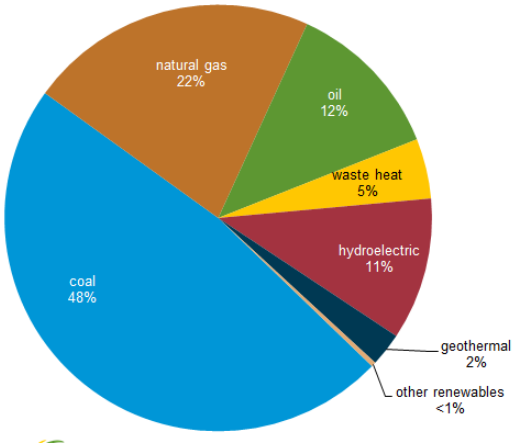
The R-squared in the pooled regression shows that 22.58% of the variation in growth can be explained by the variables. Under pooled regression, 2 variables (CF and secgrt10) are significant. To determine which model is more suitable, the Chow test and the Hausman test are performed in this research. The results of the tests suggest that the random effect model is the most suitable model.

The random effect model shows that Growth can be explained by OPEN, Elecsubs and CF. OPEN and CF have positive impact toward Growth. The coefficients suggest that 1 unit increase in OPEN and CF increase growth by 0.039 units and 0.17 units respectively (assumed other remain constant). Meanwhile, the coefficient of Elecsubs is negative which implies that increases in Elecsubs (electricity subsidy as a share of GDP) will decrease growth.

Electricity subsidies in Indonesia

In Indonesia, electricity deserves the second largest share of energy subsidies. In 2012, about 44% of the electricity was generated using coal (see figure 14). PLN (National Electricity Company) is the only provider of electricity in the country. However, as the demand of electricity outweighs supply, electricity shortages which are followed by blackout become the major issues. Sufficient supply of electricity is important to support growth since most of the industries rely on electricity for production activities.

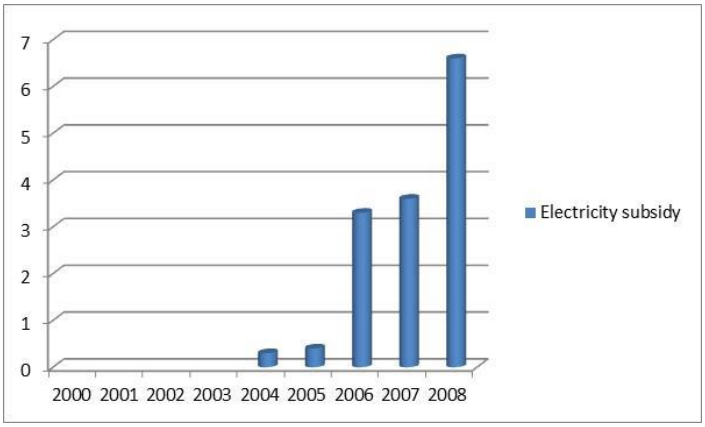
Figure 14 : Indonesian electricity generation by source in 2012



Source: IEA (2015b)

In Indonesia, electricity tariffs are determined by the government. PLN as the only supplier does not have the right to set the price. The government provides subsidies to close the gap between the electricity tariff and production costs. The amount of electricity subsidies increased rapidly by tenfold in 2006 (see figure 15). However, unlike in the oil subsidies, there are some difficulties in providing a deeper analysis of electricity subsidies due to limited sources.

Figure 15 : Electricity subsidies



Source : Agustina et al. (2008:3) developed by the author

As well as oil subsidies, the government of Indonesia planned to phase out electricity subsidies. In 2010, the government of Indonesia announced they would to increase the electricity tariff for both households (10%) and industries (10-15%). In Indonesia, electricity subsidies deter the development of new electricity generation. As the tariff is set below the market price, PLN was forced to obtain losses during their production activities. This situation creates barrier for them to invest and enhance their capacity (Beaton and Lonton 2010).

5.2.3 Natural gas subsidies on growth

As conducted previously, this research also performs pooled regression, random effect regression and the fixed effect regression to investigate the impact of natural gas subsidies on growth. In most industrialized countries, natural gas is being used massively as the main source of energy in the industry. However, in some countries, natural gas is being used for the household (heating system) and for commercial use only.

Table 12 : Regression Result 5

Growth	Coef.	Std. Err.	t	P>t	Coef.	Std. Err.	t	P>t	Coef.	Std. Err.	z	P>z
OPEN	0.012262	0.00716	1.71	0.089*	0.045368	0.014724	3.08	0.003***	0.037883	0.012677	2.99	0.003***
NGsubs	0.196022	0.073545	2.67	0.008***	-0.17159	0.087283	-1.97	0.051*	-0.14314	0.081817	-1.75	0.08*
CF	0.201871	0.033971	5.94	0.000***	0.176479	0.029655	5.95	0.000***	0.174192	0.028795	6.05	0.000***
secgrt10	-0.04495	0.012774	-3.52	0.001***	0.036244	0.022001	1.65	0.102	0.022053	0.019338	1.14	0.254
_cons	1.602269	1.493583	1.07	0.285	-5.84373	2.113489	-2.76	0.007	-3.52117	2.061873	-1.71	0.088
No Obs				164				164				164
Prob > F				0				0				0
R-squared				0.2516								
Adj R-squared				0.2327								
R-sq: within =								0.2797				0.2761
between =								0.0154				0.0238
overall =								0.0285				0.0523

Chow Test		
Prob > F	0.0000	(Prob > F)<Alpha 0,05 Reject H0, accept fixed effect

Hausman Test		
Prob > Chi2	0.2385	(Prob > Chi2) > Alpha 0,05 Accept H0, Different in coefficient is not systematic, then use random effect

The Chow test and Hausman test results suggest that the random effect model is the most appropriate model. The results under random effect model show that OPEN, NGsubs and CF are significant toward Growth. OPEN and CF are significant at 1% while NGsubs is significant at 10%. However, unlike OPEN and CF which bring positive impacts toward Growth, NGsubs has negative impact toward Growth. The coefficient of NGsubs reveals that 1 unit increase in NGsubs will decrease growth by 0.143 units (ceteris paribus).

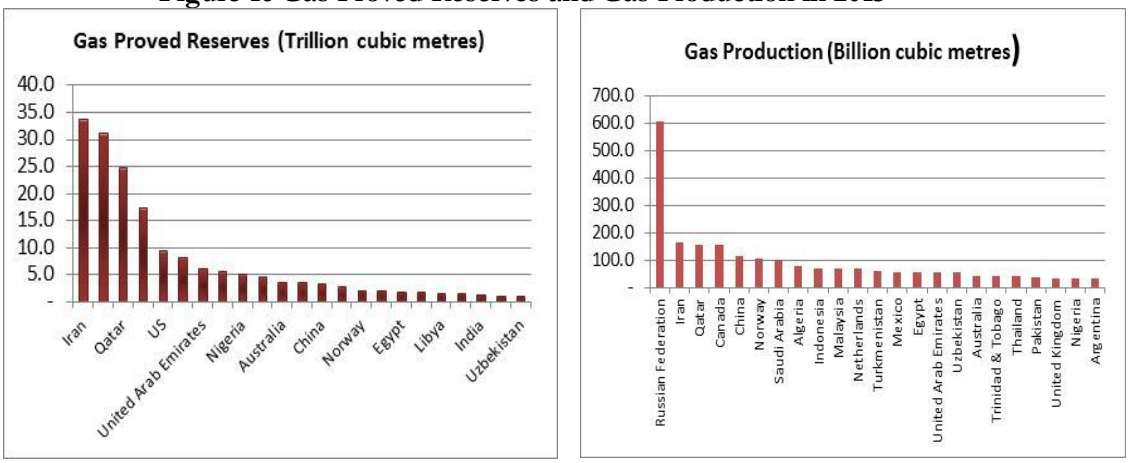
The result is in line with prior studies (see Jiang and Lin (2014) and Clements et al. (2013)). However, this research provides contra evidence with Heidari et al. (2013) which found that natural gas price is statistically insignificant to affect growth. As already discussed in the previous chapter, subsidies hinder growth in several ways, one of them is by pursuing inefficient use of energy. Consumer subsidies lead to lower energy prices, which tend to increase the demand of the energy. As the demand increase, the amount of subsidies that should be provided will also increase. This will depress government budget. Besides that, in most countries (such as in Iran), natural gas is being consumed by the household, which is a non-productive sector.

From the data published by the IEA, countries which have high amount of natural gas subsidies (subsidies as a share of GDP) are Uzbekistan, Turkmenistan and Iran with average subsidization for the period of 2007-2013 is 25.13%, 14.94% and 6.56% respectively. While some other countries have moderate levels of natural gas subsidies, they are Pakistan, Azerbaijan, Bangladesh and Egypt with the average subsidization around 1%-3%.

Most of the countries which has high rate of natural gas subsidies are natural gas producing countries. Iran, Uzbekistan, Turkmenistan are some of the example. However some other countries, such as Indonesia, which have huge amounts of natural gas production, do not provide subsidies for natural gas energy. Indonesia has abundant resources of natural gas, but the domestic consumption is relatively low. Since the domestic consumption is dominated by the industry and power plants, the government does not provide a subsidy for natural gas.

Compared to Russia, which has the largest natural gas production in the world, the amount of subsidy provided by Iran is around 20 times bigger. The data published by IEA shows that in 2013, the amount of subsidies (as a share of GDP) provided by Russia was just about 1.06%. Iran has the second largest proved natural gas reserves in the world, which amount to about 1.193 trillion cubic feet in 2014 (IEA 2015b) and the first largest natural gas proved reserves in 2013. However, the production of natural gas is relatively low. In 2013, Iran produced only 166.6 billion cubic meters of natural gas which amounts to about 4.9% of world total natural gas production (please refer to the figure below).

Figure 16 Gas Proved Reserves and Gas Production in 2013

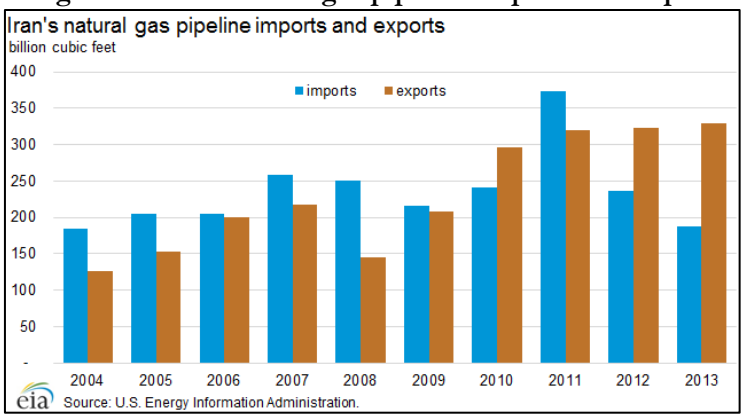


Source : British Petroleum (2014) developed by the author

There are several factors which influence the low production of natural gas in Iran. Heidari et al. (2013) said that economic sanction is one of the factors. Economic sanction deters the ability of Iran's government to generate foreign investment. Moreover, Iran has difficulty in exploiting their natural gas resources since most of them are located in the sea (Heidari et al. 2013).

In Iran, natural gas is the main source of energy. The data provided by IEA (2015b) shows that 67% of the country's electricity were generated by natural gas. Meanwhile, Heidari et al. (2013) contend that the biggest consumers of natural gas are the household and the commercial sector. Economic sanctions depress the production and development of natural gas in Iran, and as a result Iran has become an importer of natural gas (see figure below).

Figure 17 : Iran natural gas pipeline imports and export



Source : IEA (2015b)

Although since 2012 the Iran natural gas exports outweigh its import, Iran has a long experience of being a net importer country for natural gas. For net importing countries, providing subsidies depressed government budget since revenue obtained from exporting activities eroded by the liability to provide subsidies. However, the impact is expected to be smaller when compared to others countries that do not produce natural gas.

In order to provide a deeper analysis, we perform another regression to distinguish the impact of subsidies in natural gas producing countries and non-producing countries. Variable z is added in the previous regression. z is the interaction term between natural gas subsidies and natural gas production, which is calculated by multiplying the amount of subsidies and production of natural gas. The result of the regression is as follows,

Table 13 : Regression Result 6

Growth	Coef.	Std. Err.	t	P>t	Coef.	Std. Err.	t	P>t	Coef.	Std. Err.	z	P>z
OPEN	0.01356	0.007125	1.9	0.059	0.045261	0.01477	3.06	0.003***	0.038118	0.012674	3.01	0.003***
NGsubs	0.320248	0.096136	3.33	0.001***	-0.11408	0.148892	-0.77	0.445	-0.03293	0.131126	-0.25	0.802
z	-0.00645	0.003255	-1.98	0.049**	-0.00213	0.004468	-0.48	0.634	-0.00425	0.003947	-1.08	0.282
CF	0.210442	0.03394	6.2	0.000***	0.176715	0.029749	5.94	0.000***	0.175309	0.028789	6.09	0.000***
secgrt10	-0.04179	0.012758	-3.28	0.001***	0.036929	0.022115	1.67	0.097*	0.023577	0.019378	1.22	0.224
_cons	1.12671	1.499365	0.75	0.453	-5.88752	2.121925	-2.77	0.006	-3.64051	2.06441	-1.76	0.078
No Obs				164				164				164
Prob > F				0				0				0
R-squared				0.2697								
Adj R-squared				0.2466								
R-sq: within =								0.281				0.2761
between =								0.0201				0.0375
overall =								0.0332				0.0663

Chow Test		
Prob > F	0.0000	(Prob > F)<Alpha 0,05 Reject H0, accept fixed effect

Hausman Test		
Prob > Chi2	0.4231	(Prob > Chi2) > Alpha 0,05 Accept H0, Different in coefficient is not systematic, then use random effect

Similar with prior regression, the Hausman and Chow test reveals that the random effect model is the most appropriate model. However, in these regression NGsubs becomes not significant although the sign is negative. Meanwhile, the variable z (which added to the regression investigate the interaction between natural gas production and subsidies) is also not significant. The random effect model infers that Growth can only be explained by two variables namely OPEN and CF (both significant at alpha 1%). As well as in other regressions, the coefficients of OPEN and CF are positive.

5.2.4 Coal subsidies on growth

Similar methods were applied to measure the relationship between coal subsidies and growth. Below is the result of the regression,

Table 14 : Regression Result 7

	Pooled				Fixed				Random			
Growth	Coef.	Std. Err.	t	P>t	Coef.	Std. Err.	t	P>t	Coef.	Std. Err.	z	P>z
OPEN	0.009717	0.007266	1.34	0.183	0.040032	0.014147	2.83	0.005***	0.034878	0.01229	2.84	0.005***
Coalsubs	4.195028	1.973322	2.13	0.035**	-2.41545	0.609057	-3.97	0.000***	-2.38263	0.607216	-3.92	0.000***
CF	0.194144	0.034328	5.66	0.000***	0.147457	0.028805	5.12	0.000**	0.148627	0.027986	5.31	0.000***
secgrt10	-0.04221	0.012758	-3.31	0.001***	0.048156	0.020867	2.31	0.023**	0.030997	0.018624	1.66	0.096*
_cons	1.929494	1.520803	1.27	0.206	-5.68635	2.016817	-2.82	0.006	-3.42199	2.002478	-1.71	0.087
No Obs				164				164				164
Prob > F				0				0				0
R-squared				0.2397								
Adj R-squared				0.2206								
R-sq: within =								0.3396				0.3358
between =								0.0107				0.0202
overall =								0.0151				0.0369

Chow Test		
Prob > F	0.0000	(Prob > F)<Alpha 0,05 Reject H0, accept fixed effect

Hausman Test		
Prob > Chi2	0.0548	(Prob > Chi2) > Alpha 0,05 Accept H0, Different in coefficient is not systematic, then use random effect

The Hausman test indicates that the random effect model (REM) is the most appropriate model. Under REM, growth can be explained by 4 variables in the model, namely OPEN, Coalsubs, CF and secgrt10. The sign of the coefficient of the variables is positive toward Growth, except for Coalsubs. The coefficient of Coalsubs reveals that 1 unit increase in the coal subsidies will decrease growth by 2.38 units.

According to the data provided by IEA (2015b), coal is the least subsidized energy. In our sample, Kazakhstan has the largest share of coal subsidies over GDP, which from 2007 up to 2013, amounted to 0.48% in average. Thailand (0.167%) and China (0.0303%) were in the second and third place respectively. This ratio is small compared to other types of energy, particularly oil and natural gas. However, as well as with other types of fossil fuel energy, the impact of coal subsidies on growth is negative. This means that increases in the coal subsidies will deteriorate economic growth.

Coal is mostly consumed by productive sector, particularly industry and power plant sectors. A lower price of coal is important to support the industry and decrease the production cost of goods and services. However, rapid industrialization influences the demand for energy (including coal). As the demand grows, the budget needed to subsidize coal increases. Therefore, we suspect that Coalsubs will have a negative impact on growth. Taking Kazakhstan (which has the largest share of Coalsubs) as an example, coal is highly subsidized in the country. As one of the ten largest coal producing countries, coal has become the country's main source of energy (amounting to about 63% of total energy consumption) (IEA, 2015b). Here, coal is being used massively in the industry particularly in the mining and smelting industries (IEA, 2015b).

From the data on coal subsidies, most of the countries which provide huge amounts of subsidies are coal producing country. Kazakhstan and China are two goods examples. Although China is the world's largest coal producing country, the amount of subsidy (coal subsidies as a share of GDP) is far below Kazakhstan. In China, coal energy is mostly consumed by the productive sectors. About 50% of coal is consumed by the power plant sector, 41% by the industry and only about 9% goes to the household (IEA 2015b). However, rapid industry in China has led to higher demand on energy, particularly coal. As the demand increases and domestic production is unable to meet the demand, import activities have increased. In 2009, China became a net coal importer (IEA 2015b).

Not all coal producing countries provide coal subsidies. Indonesia is one example. The government of Indonesia only provides subsidies for oil and electricity. Coal has becomes the third major source of energy in the country, amounting to about 20% of total energy consumption (IEA 2015b). In Indonesia, coal is mostly consumed by power plants. Even though the demand of coal for electricity generation increased massively, the supply of coal is still far above its demand (IEA 2015b).

As discussed previously, subsidies can bring both negative and positive impacts on growth. Subsidies influence growth in a positive way when subsidies enhance productivity. The ability of subsidies to reduce production costs will attract more investment and enhance national competitiveness. However, subsidies have the potential to hinder growth in the long term. Subsidies accelerate the rate of depletion and threaten energy security. Additionally, as the demand of coal increases, subsidies will increase greatly. The revenue

obtained from coal production will be reduced by the obligation to provide subsidies.

Going further to mitigate the impact of the subsidies in coal producing and non-coal producing countries, we performed other regression. Variable Y (interaction between coal subsidies and coal production) which was obtained by multiplying coal subsidies (as a share of GDP per capita) and coal production were added to the regression. Below is the result,

Table 15 : Regression Result 8

Growth	Coef.	Std. Err.	t	P>t	Coef.	Std. Err.	t	P>t	Coef.	Std. Err.	z	P>z
OPEN	0.010065	0.007294	1.38	0.17	0.039449	0.014145	2.79	0.006***	0.034521	0.012292	2.81	0.005***
Coalsubs	2.287782	3.327195	0.69	0.493	-3.09429	0.868547	-3.56	0.001***	-3.05533	0.865782	-3.53	0.000***
Y	0.000427	0.000599	0.71	0.477	0.000148	0.000136	1.1	0.275	0.000147	0.000135	1.09	0.277
CF	0.195099	0.034407	5.67	0.000***	0.146616	0.028793	5.09	0.000***	0.147879	0.027956	5.29	0.000***
secgrt10	-0.04237	0.01278	-3.32	0.001***	0.049107	0.020868	2.35	0.02**	0.031889	0.018626	1.71	0.087*
_cons	1.897705	1.523816	1.25	0.215	-5.68227	2.015234	-2.82	0.006	-3.43169	2.003288	-1.71	0.087
No Obs				164				164				164
Prob > F				0				0				0
R-squared				0.2422								
Adj R-squared				0.2182								
R-sq: within =								0.3458				0.3421
between =								0.0102				0.0196
overall =								0.0144				0.0359

Chow Test		
Prob > F	0.0000	(Prob > F)<Alpha 0,05 Reject H0, accept fixed effect

Hausman Test		
Prob > Chi2	0.3537	(Prob > Chi2) > Alpha 0,05 Accept H0, Different in coefficient is not systematic, then use random effect

The Hausman test suggests that random effect model is the most appropriate model. According to this model, Growth can be explained by OPEN, Coalsubs (coal subsidy as a share of GDP), secgrt10 and CF. As well as in the prior regression, Coalsubs is negative and significant toward Growth. However, we failed to find evidence that Y (the interaction between coal subsidies and coal production) influences Growth. The coefficient of Y is positive but not significant. Meanwhile, after adding Y, the coefficient of Coalsubs is slightly bigger compared to the previous one, in which 1 unit increase in Coalsubs will decrease Growth by 3.05 units (ceteris paribus).

5.2.5 The impact of other explanatory variables toward growth

In this research we suspected that other explanatory variables would have a positive relationship toward growth. An increase in the openness (OPEN), capital formation (CF), and gross secondary school enrolment (secgrt10) was expected to increase growth.

The research found empirical evidence that capital formation (CF) is positive and significant toward growth as shown in all regression (regression 1 up to 8).

The results are in line with Hussin and Saidin (2012:119) and Dao (2012) who found that capital (as proxies by using gross capital formation) has a significant contribution toward growth. Liang and Yu (2014) and Ogun (2014) also found that capital abundance has a positive relationship toward growth.

Openness is expected to have positive impact toward growth, since the degree of openness facilitates the flow of capital and technology which are important to boost growth. Similar to CF, OPEN (the degree of openness) is also positive and significant toward growth as shown in the regression 1 into 8. This result is consistent with Hussin and Saidin (2012) who found empirical evidence that openness has significant impact on growth in Indonesia. Besides that, the results are also in line with Chen and Feng (2000) who found that openness stimulates economic growth.

Meanwhile, secgrt10 is only positive and significant in the regression 7 and 8. In other regression, the coefficient of secgrt10 is positive but not significant. The result on secgrt10 is also consistent with Chen and Feng (2000) who found that higher education has a positive link toward growth. Barro (1991) also stated that initial human capital is important to support growth. In addition Barro (1991) and Chen and Feng (2000) contend that the higher the levels of the human capital the more likely country will grow faster.

Conclusion

This research aimed to find empirical evidence about the relationship between fossil fuel subsidies (both in total and in each types of fossil fuel energy) and economic growth. In order to provide better analysis, this research also try to investigate whether the impact of subsidies is similar or not in the producing and non-producing countries.

In order to meet the objective, this research employs panel data analysis. The sample is picked up based on the availability of the fossil fuel subsidies data which published by IEA. There are 37 countries included in the sample. This research rely on secondary data, the data of subsidies is obtained from the IEA. The data about oil, coal and natural gas production are obtained from the British Petroleum while the rest of the data is generated from the World Bank.

The result of the regression found that fossil fuel subsidies (in total), electricity subsidies, coal subsidies and natural gas subsidies have negative impact toward growth. However, the research failed to find empirical evidence that oil subsidies influence growth. The regression suggests that Oilsubs is negative but not significant toward Growth. The negative sign of subsidies variables (FFsubs, Oilsubs, Coalsubs, NGsubs, and Elecsubs) toward growth are consistent with some prior research which says that subsidies impede growth through several ways, particularly by affecting energy demand and government budget.

Morgan (2007) and Hannesson (2009) said that subsidies influence GDP through its impact on resources allocation. Lower price of energy (which caused by the presence of subsidies) tends to enhance the demand of fossil fuel energy. As the demand increase, the amount of subsidies should be prepared will also increase. This is supported by Jiang and Lin (2014), Clements et al. (2013) and Arze del Granado and Coady (2010) which mentioned that subsidies depress government budget and hinder growth. These cases occur in some countries, such as in Indonesia, in which the government spent about one third of the government budget for subsidies. In Indonesia, fossil fuel subsidies decrease the budget available for other sector. As stated by Mourougane (2010), energy subsidies decrease the ability of the government to invest in the infrastructure and production which will hinder growth in the future.

Hence, subsidy removal is the necessary action that should be taken by the government since subsidies bring negative impact toward growth. In Indonesia, the government tries to adjust the domestic price of fossil fuel (particularly gasoline, diesel fuel and kerosene) and promote energy conversion program in order to decrease the amounts of fossil fuel subsidies.Ellis (2010) found that subsidy removal increases GDP by 0.1% up to 0.7% in both OECD and Non-OECD countries. However, phasing out subsidies is not easy, good planning and communication is the key success to phase out subsidies.

This research also found empirical evidence that capital formation (CF), openness (OPEN) and gross secondary school enrolment (secgrt10) are positive and significant toward growth. This result on CF is agreed with Hussin and Saidin (2012) and Dao (2012) who found that gross capital formation has positive impact growth. Liang and Yu (2014) and Ogun (2014) also found that capital has positive relationship toward growth. The result on openness variable (OPEN) is also consistent with Hussin and Saidin (2012) and Chen and Feng (2000). In addition, the result on secgrt10 (in regression 7 and 8) also consistent with Chen and Feng (2000) and Barro (1991) who found that initial human capital has positive relationship toward growth. They also said that countries which had higher degree of human capital will grow faster.

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