Impact of Coal Production on Economic Growth in Indonesia

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List of Acronyms

BPS	Statistic Indonesia
ESDM	Ministry of Energy and Mineral Resources of Indonesia
GRDP	Gross Regional Domestic Product
HDI	Human Development Index
ISS	Institute of Social Studies
OPEC	The Organization of the Petroleum Exporting Countries
PUSDATIN	Centre for Data and Information Technology

Abstract

The main objective of this study is trying to reveal the impact of coal production on economic growth in Indonesia. This study will also provide the comparison of economic growth between coal producer's provinces with other provinces and try to find which one have more sustained growth. She result of the study shows that the impact of coal production on economic growth is relatively small, especially in the relation between coal production and employment. This study also find that coal-based economy relatively have similar growth performance with the economy that mainly depend on oil and gas.

Relevance to Development Studies

Most of study in resource curse area is focussed in comparison between countries. Only few studies were done in the province or district level. Moreover, the use of mineral production, especially coal production in this area is very limited. Therefore, it is important to use coal production as the main independent variable to give new nuance in resource curse study.

Keywords

Coal Production, Economic Growth, Natural Resource Curse, Resource Boom

Chapter 1 Introduction

1.1. Background of the Study

Natural resource curse is an interesting subject of study because of its contradictory. Most of resource rich countries which supposed to gain an advantages, found difficulties in maintaining sustainable economic growth. The rich natural resources countries is expected to gain high economic growth in the boom period and use the foreign exchange as a big push. Unfortunately, empirical study done by Sach and Warner (1999) in Latin America countries found that the economy of resource dependent countries in booming period do not run in the faster growth rate than the prior boom period. Moreover, Bolivia, Mexico and Venezuela did not enjoy higher level of per capita GDP during resource booms, and they suffer from slower growth rate in the post boom period (Sachs and Warner 1999: 64). Many other research also revealed similar thing; natural resource rich countries experienced slower growth in the long term compare to resource poor countries (Auty 1997, Isham et al. 2005, Van der Ploeg and Poelhekke 2009)

The main reason of the inability of natural resource based industry to support sustained economic growth is maybe because primary sector provide cyclical economic growth. Black et al. (2005) revealed that the impact of coal industry to local economy was highly fluctuate in 32 coal producer countries in US. They also confirm that the booming period of coal mining created slight positive impact to the economic growth, whereas the recession triggered by coal industry in declining period were far larger. Specifically, Black et al. estimated that for each 10 person hired in coal industry in booming period will produce 2 employment in other local sectors (construction, retail, and services). However other sectors will lost 3.5 workers in coal burst period when coal industry laid off 10 employees (2005: 473).

Interestingly, although coal will apparently evoke low economic growth, it has been known for a long time as the main source of energy in supporting economic development. Coal mining boom in UK during 18's century is closely related to Industrial Revolution. High energy demanded during the revolution from both domestic and manufacturing sector has triggered coal industry to increase its supply. British per capita consumption of coal reached 309.9 million pound sterling in 1860s, increased dramatically by nearly 500 per cent from 1700s (Clark 2001: 68). Coal was used in many aspect during industrial revolution in England. It heating up the houses, created high efficiency in iron industry and became the main fuel for steam engine, together (iron industry and steam engine) were the key element of industrialization in Britain (Ashton 1966).

Two centuries after the industrial revolution, coal is still become the main source of energy. Although most of the coal was burned in the power plant (more than 40% of world's electricity in 2013 is generated by coal (International Energy Agency 2014)), but the recent increasing demand of world coal is not only driven by high demand for electricity. Steel and cement industry also have consider-

able contribution in determining coal demand. Roughly 15 per cent of world's coal production is absorbed by steel manufacturer (World Coal Association 2014). Rapid development in developing countries also increases the demand of steel and cement for infrastructure, so it will also increases coal demand.

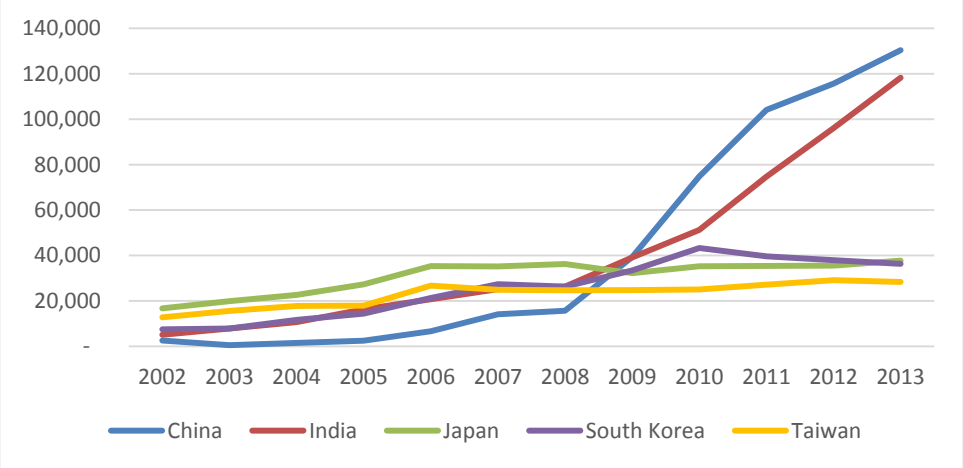
China and US as two global economic giant placed in the top of the list of coal consumer. Based on BP data in 2013, the combination of coal demand from both countries is remarkably high, accounted for 62.2 per cent of world consumption. But the main driven of high world coal consumption is China which…consume 1,925.3 MTOE (Million Tones Oil Equivalent) in 2013, more than half of coal consumption in the world (British Petroleum 2014). The faster the growth of China, the higher the demand of coal will be, since economic growth will request more coal to feed higher demand of electricity, steel, and cement.

Coal has become one of the most important commodity in the past, recent time, and might be will remain the main source of energy in the future. BP data in 2013 shows that coal has the largest proved reserve compare to oil and gas. With current rate of production, coal will still available as a source of energy for another 113 years, while other source of non-renewable energy such as oil and gas only accessible for around 53 and 55 years respectively (British Petroleum 2014). Based on this data, it is clear that coal will be the only source of non-renewable energy for the next 55 years.

The main reason behind the fact that coal being the most abundant of non-renewable energy source as well the main source of energy in the world is probably because coal is easier to explore, extract and transport. Since most of the coal stored in the second or third soil layer, it is more ease to find and mine coal. As comparison, gas and oil are located far underground or under sea bed with the range of tens of kilometre from surface. The easiness in finding coal reserve also make the machinery in coal mining is less developed than in oil and gas mining, then simpler technology will allow more people to enter the business. Increasing the production in coal industry is a matter of adding more equipment in extraction and transportation. Thus, the company can immediately response to the high demand of coal in the world.

The increasing of international coal consumption has made Indonesia lift his coal production. Indonesia has become the top coal exporter, followed by Australia and Russia in the second and the third place. In 2013, these countries exporting 474, 336, and 141 million tons respectively (Statistic Indonesia 2014, and World Coal Association 2014). Moreover, high coal export performance of Indonesian is likely driven by the increasing demand from China and India. From the figure 1, we can see that the Indonesian coal export to China and India hikes in 2008 and since that time, keep increasing in the massive rate. In 2013, 59 per cent of Indonesian coal export was absorbed by China and Indian market only. Interesting fact from figure 1 is that in 2008, when coal demand from Japan was declining, the demand from India and China was likely did not affected by global economic crisis.

Figure 1: Indonesian Coal Export by Top Five Major Destination Countries (thousand tons)



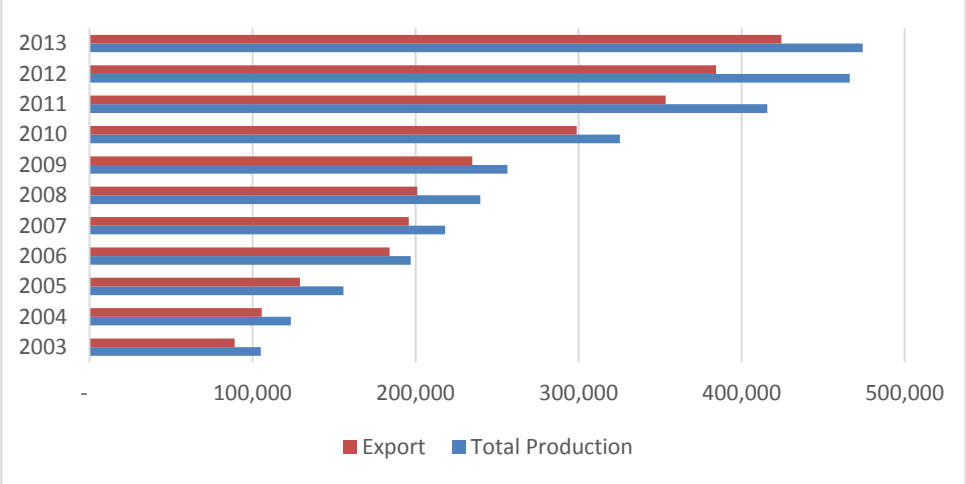
Source: Authors' construction based on data from Statistic Indonesia (2014)

There are many ambiguity in coal industry in Indonesia. On one hand, massive expansion of coal industry in Indonesia is expected able to boost local economic growth through direct and indirect effect. The direct effects of coal mining industry to the local economy by creating job opportunity can decrease unemployment, thus increase welfare of society. High rate of coal export also providing both central and local governments a huge amount of foreign exchange. Another direct effect of coal industry is increasing the income of both local and central government through taxes. The indirect effect of the industry is expected will make other sector such as services and construction growth faster.

On the other hand, the coal production rate in Indonesia is not in the sustainable level. Indonesia, which is only have 3.1 per cent of world's coal reserve, supply for 6.7 per cent of global demand (British Petroleum 2014). Another problem in is that the rate of coal depletion in Indonesia is faster than other main coal exporter countries. With the rate of coal production in 2013, Indonesian coal reserve will drain in 67 years, while other top coal exporter countries such as Australia, Russia and US will still be able to produce for around 160, 452, and 266 years respectively (British Petroleum 2014). The increasing trend of coal production is for sure will makes coal reserve in Indonesia depleted faster.

Moreover, Indonesian coal mining has been long time being an export oriented industry (figure 2). From 2003 until 2013, less than 20 percent of coal production was allocated for domestic market, and only around 11 per cent was absorbed by local industry in 2013. The inability of Indonesian domestic industry to increase its demand for coal also shows two possibilities. The first is that no clear regulation from government to support local industry that need coal as the production input. The second is may be because the development of local industry is very slow, hence creating small influence for the increasing of coal's demand.

Figure 2: Indonesian Coal Production and Export (thousand tons)



Source: Author's construction based on data from Statistic Indonesia (2014)

1.2. Problem Statement

High exporting rate of Indonesian coal production creates strong link between Indonesian coal industry and the global economy, thus resulting at least two potential problems. The first is creating an economy that is more vulnerable to economic shocks. Global crisis will hit the economy at provincial level harder than at the national level, since coal producer provinces have lower institutional capacity than central government. The second is that the coal dependent province will face difficulties to reach sustained growth. The inexistence of world institution similar with OPEC among coal producer countries will make coal price more volatile. There is possibility that in the declining period of business cycle, coal companies will push its production to keep the revenue from declining. This research then, will try to identify whether coal industry provide sustainable growth for coal-producer provinces.

1.3. Research Objectives and Questions

The main objective of this research is to identify the role of coal mining to the economic growth at province level. Then the **main question** in this research is: How big is the impact of coal production to the economic growth of coal-producer provinces in Indonesia?

This research also have one **sub question** as follow:

a. How big is the differences of economic growth of the coal producer province compare to other province that do not highly depend on mining industry? Which one is grow faster?

b. Which one is providing better economic growth between coal producer provinces agricultural-based provinces or other mineral-based economy?

1.4. Hypothesis

The hypothesis proposed in this study is coal industry will give small contribution to the economic growth of coal-based province. Moreover, provinces that do not depend on mining will in average have higher economic growth compare to coal producer provinces. Coal-based economy is also suspected to have lower growth compare to other minerals economy.

1.5. Limitation of the Study

There are some limitations in this study. The first is that there is differences in the data provided by Ministry of Energy and Mineral Resources, Statistic Indonesia, and British Petroleum. Thus some of the data of coal production, presented in the figures will be slightly different.

1.6. The Organization of the Study

This study will be divided into six chapter. The organization of this research is as follow. First part of the study will provide the background. In the second chapter, this study will discuss literature review related with natural resource curse and the previous study about the relation between minerals production and economic growth. The third part of the study will discuss mainly about the summary of coal industry in Indonesia. In the fourth chapter, methodology of the research will be presented. The next part of this paper will provide both, quantitative analysis based on regression result and descriptive analysis based on stylized fact that presented. The conclusion is presented in the last part of this paper.

Chapter 2 Literature Review

2.1. Natural Resource Curse

Natural resource curse was largely observed by many researchers, but the result of the researches were vary. Many studies done by natural resource scholars found close relation between natural resource endowment and dependent countries with slow economic growth in the long term. With the growing number of study in the natural resource curse field,…there are more empirical findings which show that resource wealth countries tend to lost its potential to grow faster and more fragile to have conflict (Ross 2001: 328).

Contrary, the opponent of resource curse theory, argue that natural resource give more opportunity for the host countries become developed. Usually they laid their argument on the evidence which shows that many rich countries such as United Kingdom (UK), United States of America (US), Canada, Australia, and Norway were largely depend on natural resource in the past.

Comparing the economic growth between mineral and non-mineral economies of 79 developing countries in the year of 1970 and 1991, Davis (1995) found that in average, mineral economies outperform the economic growth of non-mineral based countries. In the period of 20 years, average GNP per capita of non-mineral economies were only increased by 4.8 times, lower than mineral economies which rose almost six fold (Davis 1995: 1773). Moreover, he believes that all countries will manage its natural resource in the best way. The natural resource-rich countries will created good policy to maximize its natural resource or even not to use the natural resource if they think that natural resource exploration will badly affected the economy. He also added that natural resource dependent countries such as Qatar, Saudi Arabia, and Nigeria enjoy better economic growth compare to non-mineral economy although they heavily depend on mineral for long period (see Davis 1995).

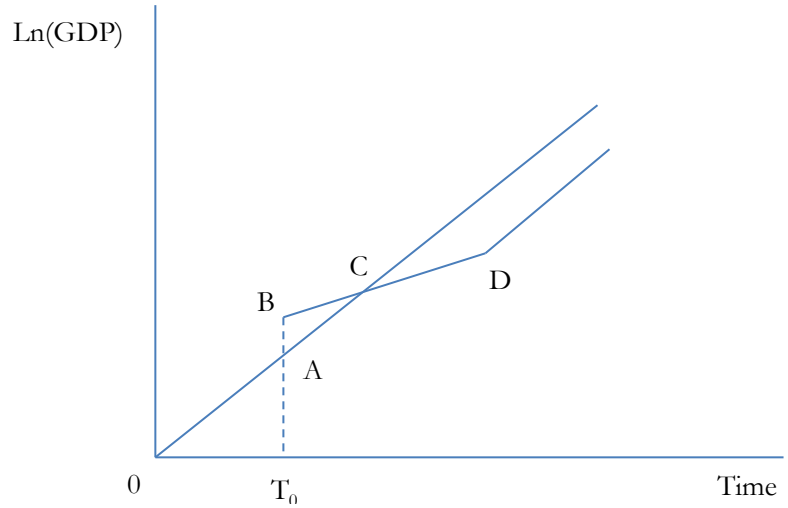
The main weakness of Davis (1995) research is that probably he is not comparing between mineral countries and manufacturing countries, instead between mining economies and agrarian economies. The non-mineral countries in Davis' research such as Egypt, Mexico, Sierra Leone, Jordan, Colombia, Malaysia, Zimbabwe, Morocco, and Brazil were still highly depended on agricultural product in mid 1980s (see Isham et al. 2005, table A-1). In this sense, we can clearly see that the hike of oil and mineral price during 1970s has provide windfall to mineral producer countries, then made them perform better than agricultural based economies.

In the middle of intensive debate about natural resource curse, we cannot refute that natural resource plays important role in economic growth. Either, with good or bad management, natural resource deliver economic progress to the host countries and societies, at least in the short term. Natural resource supposed to provides immediate source for economic growth; offer cheaper input for local industry, creates employment, and increases export performance. In the boom

period of natural resource extraction, the countries will gain instant economic growth from primary commodity export and high wages provided by natural resource sector. In addition, Davis and Tilton argue that natural resource reserve is an asset and there are no clear evidences show that mining is never give any contribution on economic growth (2005: 240).

Although natural resource provide positive impact on growth in short-run, but the result in the long-run might differ. In the long period, there are probability that the country will experienced resource curse, thus have lower gross national product (GNP) than it should be (illustrated in figure 3). Suppose there are two countries with similar economic growth from point 0 to A. Due to the increase of natural resource price of the discovery of new natural resource reserve, the country 2 experiencing natural resource boom at time 0. Then its economic growth and per capita gross domestic product (GDP) jump to point B. In the long period, if resource boom creates slower growth, country 1 will eventually surpass the economy of country 2 at point C.

Figure 3: Natural Resource Curse Illustration



Source: Sachs and Warner (1997)

The negative effect of natural resource on economic growth in the long run, generally was resulted through four main channels; Dutch disease, political economy, low government capacity (Gylfason 2001, Sachs and Warner 1997), and price volatility (Van der Ploeg and Poelhekke 2009).

Dutch disease is the condition when a countries experiences industrial degradation resulted by natural resource boom. In the Dutch disease study, the economic sector in a country is divided into two sector; tradable sector and non-tradable sector. Included in the tradable sector are natural resource sector and non-natural resource sector (manufacture and services). Furthermore, Krugman (1987) explained that natural resource boom will deteriorate non-natural resource sector because of the real exchange rate appreciation, then makes the industry lost its competitiveness. He also added that the worst scenario is when

the manufacturing sector unable to recover after natural resource boom period is over (1987). Thus, ties down the country to experience what Murshed (2004: 1) called as 'catastrophic growth failure'; a condition in a country when its per capita GDP is lower than the period prior to resource boom due to negative economic growth.

Political economy, as one of resource curse channel, has many forms, but in this research, political economy will be restricted as government behaviour and political preference. Included as government behaviour that linked to resource curse channel is the preference of the country to open its economy. Sachs and warner found that the relation between trade openness policy and natural resource intensity is similar with U shape (1997: 23). A country that have limited natural resource tend to have more trade. The trade openness then will decline together with the higher level of natural resource dependency. The reason is because the government does not want to experience Dutch disease, thus the government apply economic protection for its industry. The level of trade openness will again increases in the country which hold extremely large natural resource endowment and highly depend on natural resource. Sachs and Warner argue that the reason is because the government does not have any pressure to develop its industry (1997: 23). Other findings in the area of political economy, especially in the category of bad government behaviour are high rent seeking environment that force the most talented person become less productive (Murphy et al. 1991), overconfident of government about natural resource outlook thus not really focus to improve human capital (Gylfason 2001), and higher corruption index, which in return slowing down economic growth (Papyrakis and Gerlagh 2004).

Moreover, there are many studies linked natural resource curse with worse political inclination such as; less democratic regime (Ross 2001), the tendency if having powerful group to push the government to give kick back and higher fiscal transfer (Lane and Tornell 1996), and increased the tendency of the countries to have conflict (especially separatism in the oil dependent countries)(Ross 2004: 352). Although not in all cases that democracy provide better growth, but in general it is assumed that democracy will help the countries to grow faster. In democratic societies, all citizen are able to supervise government and give their opinion freely. In contrast, separatism movement and strong group which controlling government for own interest will jeopardize economic growth.

The centre of the debate about resource curse is probably in the scope of low government capacity. There is a group of researcher who believe that we cannot blame on natural resource for unsustainable economic growth, but the inability of the government to manage its natural endowment. Davis and Tilton argue that natural resource can be eliminated if the government have the ability to cope with rent-seeking behaviour and maximize the rent from natural resources to promote development (2005: 239). A rather extreme solution was proposed by Sala-i-Martin, and Subramanian (2003) to avoid the negative impact of poor government. They argue that the rent from natural resource is should be directly goes to the citizen, thus the government's quality will improve since they think and perform like the government in resource poor countries.

However, the solution from Sala-i Martin and Subramanian can creating new problem in the society. When the citizen directly receive the rent, it is true that the welfare will increase, but the productivity will drop. People will think that they do not need to work hard because they will regularly receive money from government. In the country level, total output of the country will decrease then slowing down economic growth.

Supporting Davis and Tilton (2005) argument, Mikesell conclude that the main factor that created resource curse is the ability of government in regulating natural endowment (1997: 197). There are contradictions in the relation of natural resource rich countries and existence of resource curse (Mikesell 1997: 192). Natural resource is supposed giving opportunity for the countries to instantly get foreign exchange, investment and knowledge transfer from abroad, intermediate input for industry, and of course history showed us that almost all developed countries was depend on natural resource extraction in the beginning of development (Mikesell 1997: 192).

The last main channel of resource curse is price volatility of primary product. Price volatility is believed as one of the most important feature in natural resource curse studies. Van der Ploeg and Poelhekke (2009) found that industrial countries grow better than the countries, which heavily depend on natural resource. Moreover, they have noted that the country which largely depend on primary product, such as mining and raw agricultural commodity, have lower growth performance compare to manufacturing-based country because the price of primary commodity is decreasing overtime and have high volatility (2009). In line with the argument, Jacks et al. (2011) studies has shown that the price of primary product is more fluctuated than manufacturing goods. From the finding, we can make further discussion regarding to the poor growth performance of primary goods based countries compare to manufacturing countries. Higher volatility is closely linked with greater risk and uncertainty. Thus, natural resource dependent countries will have difficulties in maintaining high economic growth in the long run.

Contrary, Davis and Tilton (2005: 237) claim that the declining price of raw commodities is because the application of new technology in mining industries that make them run with lower cost. They also added that, if the fall of production cost is higher than the price, then the countries will better off (2005: 237). It seems that Davis and Tilton forget to calculate the impact of minerals price declining to the host countries. Lower price means that the countries will get lesser rent, from taxes or royalties, for the same amount of mineral produced. Therefore, the country will get smaller amount of rent from the total of mineral reserve they had. In addition, value added from mining industry is very small compare to value added from manufacturing, especially when the countries exporting minerals as raw materials. For that reason, even if we assume that country will better off from efficient mining, it is still a lot better for the countries not to depend on natural resource.

Beside those four main channel of resource curse, there is new finding about the impact of natural resource on economic growth in developing countries. Differ-

ent type of natural resource provide different effect to the economy in the long term. Differentiated resource rich countries into three categories, Auty found that mineral resource countries have the worse growth performance compare to oil exporter countries and non-mineral resource rich countries in the period between 1960 and 1990 (1997: 652). He also revealed that oil exporter countries perform better among other types of resource rich countries (1997: 652).

Unfortunately, there are some ambiguities in Auty's (1997) study. He uses the number of cropland per capita as the measurement for resource endowment. As a result, he puts Indonesia and Colombia in the group of resource deficient countries. As discussed before, based on Isham et al. (2005, table A-1) Colombia and Indonesia were classified as resource dependent countries. Even though if then Indonesia and Colombia are excluded from the research will not change the result, but the conclusions would might be differ.

Another confusion in Auty's research is that he putted Indonesia and Colombia in the same group with China and South Korea. If his purposes is to emphasis on the impact of cropland deficiency on the development in the resource dependent countries, he probably should replace China and South Korea with other countries, which have dependency on natural resource as well as limited cropland. Moreover, by removing China and South Korea, the research will have clearer criteria of resource dependent and manufacturing countries. Hence, he may be able to make new conclusion; the limited cropland is the reason behind the good growth performance of several resource dependent countries.

With a slightly different natural resource criteria, Woolcock et al. (2001) found similar result with Auty's (1997) research. They make three commodity categorisations based on who produced natural resource. Woolcock et al. found that diffuse[1] natural resource economies resulted better average growth rate compared with the countries which mainly exporting point-sourced[2] resource and coffee/cocoa[3] (2001: 84). They also proved that manufacturing countries got the best growth performance. Contrary, point-sourced and coffee/cocoa based economies experienced sluggish growth rate (2001: 84).

Improving their previous research, Woolcock together with Isham identify the impact of four different type of main export commodities (manufacturing, diffuse, point-source, and coffee/cocoa) on economic growth channels. Isham et al. (2005) pointed out that coffee and cocoa index and point-source index have negative and significant impact on political stability, government effectiveness, and absence of corruption with coffee and cocoa economy provide higher nega-

[1] Diffuse economies is the countries which mainly exporting agricultural raw materials and foods. It is called diffuse because it is produced by peasant and involve many people and families, thus the household got the biggest rent.

[2] Point-sourced is the countries that produce fuels and minerals as the main export commodities. Named as point-sourced because only few people enjoy the rent (usually is the owner of the company).

[3] Coffee/cocoa are separated because it can be produced by peasant farmers or plantations

tive effect (2005: 156). The other two indexes have different sign with insignificant impact. Specifically, diffuse economy provided negative impact and manufacturing economy had positive impact on those three institutional criteria (Isham et al. 2005: 156).

Using similar natural resource categories with Woolcock et al. (2001) and Isham et al. (2005), but Murshed (2004) only focused on democracy as the main channel of economic growth. He proved that point-resourced type countries have the worse growth performance criteria compared with other type of economy. Using several regression method, he only discovered contradictory fact when he employed random effect model. In this model, he surprisingly found that the impact of point-source type economy on democracy is better that diffuse economy (2004: 23).

Stijns (2005) found various result about the relation between natural resource reserve and economic growth. He divided natural resource into four categories namely, land, oil and gas, coal, and minerals. He revealed that only land that have negative relation to all of economic growth criteria; Politics, Economic Policy, Investment, Education, and positively related to Dutch disease. The findings of Stijns study in term of land endowment is similar with Auty (1997), that high land per capita will slowing growth rate. Unlike land, the other three categories (oil and gas, coal, and minerals) have mixture result. Oil and gas has positive impact on economic policy, investment, and education, but creating Dutch disease and have unclear relation with politics. Coal endowment positively influenced political infrastructure, economic policy, and investment, however did not show vibrant relation with education and Dutch disease. Finally, minerals only promoted economic policy and investment and have mixed relation with politics, education, and Dutch disease (see Stijns 2005).

2.2. Mineral Production and Economic Growth

Most of research about resource curse were done in the country level and usually use primary commodities export as the proxy of resource dependent and use natural resource reserve data as resource endowment. Only few studies try to explore the relation between natural resource production and economic growth. Nonetheless, Stijns claim that it is very useful to make differentiation in natural resource study by using the data of production, primary export commodities, and natural resource reserve (2005: 111).

Did the study in 33 countries in New Mexico, United States, Peach and Starbuck (2011) concluded that oil and gas production only have small effect on facilitating economic growth. In the study, they use income, employment, and population as a proxy of economic growth. The most highlighted point in Peach and Starbuck study is that they use census year because they employ population as one of growth criteria. Consequently, they used data of the year 1960, 1970, 1980, 1990, and 2000. Moreover, they also use real value of oil and gas production as their main independent variable (Peach and Starbuck 2011).

Replicating the work of Peach and Starbuck (2011), Reyes (2012) utilized a rather similar variables. Focusing the study in 1,925 countries in twenty six coal producer states, he used median household income of year 2005-2009 and per capita income in 2009 as independent variable of income. For other dependent variables, he used median number of employment and median number of population of year 2005-2009. Together with the coefficient of variation coal production, average coal production between 2000 and 2009 is used as the main independent variable. To know whether oil and gas production have any impact to economic growth, he employed dummy variable for oil/gas producing countries (Reyes 2012).

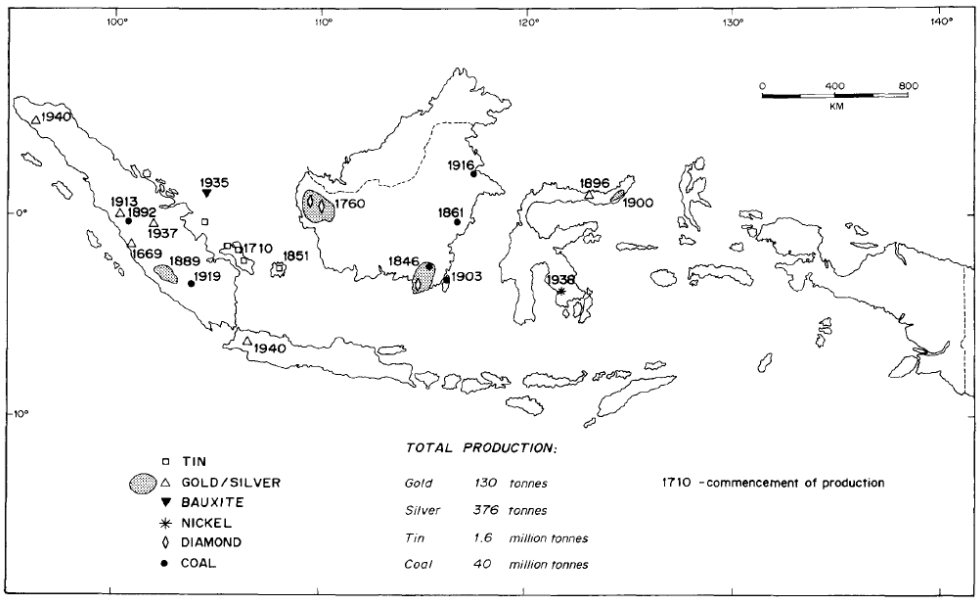
The following points can be brought out of Reyes' (2012) work. In average, coal production variation provide negative and significant impact on per capita income (Reyes 2012: 30). It means that when production are highly fluctuated because of price volatility or unstable demand, income will be hampered. Another important finding is that coal production definitely creating positive effect on all of growth variables; namely population, income per capita, median household income, and employment (Reyes 2012: 30). Positive sign of coal production is probably because of coal industry in US in 2009 was at the peak level. The real coal price was keep increasing since 2001, while coal production was hiked from roughly 400 million short tons in 1963 to nearly 1,200 million short tons in 2009 (see Reyes 2012, figure 2 and 8).

Chapter 3 Summary of Coal Industry in Indonesia

3.1. The Foster of Indonesian Coal Industry

Indonesia has been depended on natural resource for long period. Before being the main coal producer in the world, Indonesia was member of OPEC and relatively a major oil exporter. Similar with oil and gas mining, coal industry in Indonesia in early independent year was a result of acquisition of Netherlands' companies. Coal production in Indonesia has been stared since 1846 in the Mahakam Coal Field, East Kalimantan (see map 1). In Sumatera Island, the first discovery of coal is in Ombilin, West Sumatera in 1868 and the production started in 1891, followed by the production in Bukit Asam area in South Sumatera in 1919 (van Leeuwen 1994: 33). Both of coal mining in West Sumatera and South Sumatera was operated by the Netherlands Indies Government. The production of coal in Indonesia during colonialization era reached its peak with production rate of 2 million tons in 1941 (see van Leeuwen 1994).

Map 1: Mineral Production Centres in Indonesia pre-1949



Source: van Leeuwen (1994: 15)

Due to the World War II and the discovery of cheap oil and gas in Indonesia facing bleak times during 1970s. Coal production from three government owned mines (Ombilin, Bukit Asam, and Mahakam) was plumed to less than 200 thousand tons in early 1970s (van Leeuwen 1994). Moreover, new coal exploration done by RTZ/CRRA between 1973 and 1975 also by Shell Mijnbouw from 1973 to 1978 in Sumatera was disappointing because of uneconomically feasible (van Leeuwen 1994). As a final point, the government shutdown Mahakam mine in 1971, also considered to close Ombilin and Bukit Asam in 1973 (Sigit 1980 and 1988a, as cited from van Leeuwen 1994: 34).

Need more than four decades for Indonesia to reach its coal production rate as in 1941. One decades after Indonesian government announced new energy policy in 1976, which is emphasis on energy diversification, coal production in Indonesia finally break the lifetime coal production rate record. In 1986, total of coal production in Indonesia reach 2.6 million tons, increased 600 hundred tons from previous year (British Petroleum 2014). Coal production Indonesia until the end of 1980s is likely only come from Ombilin and Bukit Asam area, since coal extraction was mainly driven by government owned company, PT. Bukit Asam, the owner of two coal sites in West Sumatera and South Sumatera.

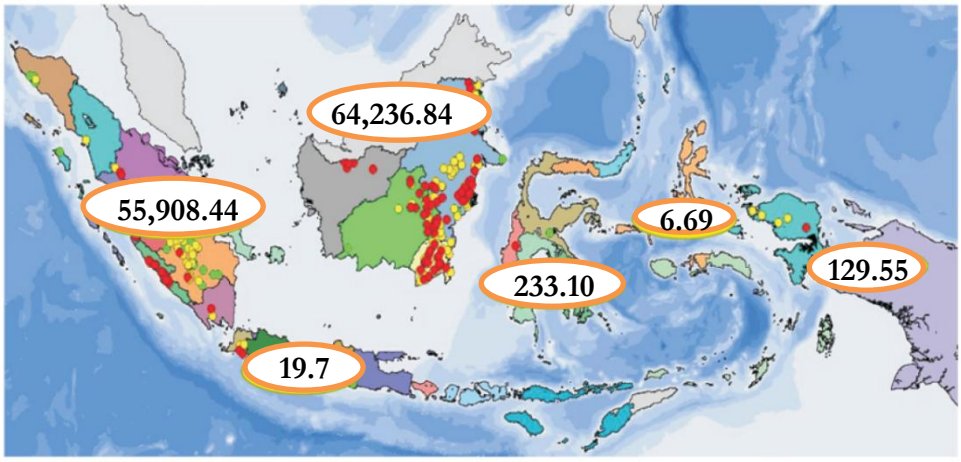
After abandoned by the government in 1971, coal project in Kalimantan was stared again by PT. Arutmin Indonesia, which signed an agreement with Indonesian government in 1981 to do coal exploration in South Kalimantan (van Leeuwen 1994). Up to early 1990s all coal exploration were done in Kalimantan by private companies. The first coal production by private companies, namely PT. Arutmin Indonesia, in South Kalimantan in 1988 marked the raise of Indonesian coal industry. One year later, PT. Kaltim Prima Coal started its production in East Kalimantan. Thereafter, eight private coal companies had started its production by 1993 (see van Leeuwen 1994) and more companies started its exploration and production in Kalimantan then make coal production in Indonesia increased very fast.

Intensive coal exploration during 1980s in Kalimantan has resulted the discovery of large coal reserve in East Kalimantan and South Kalimantan. Similar with gold rush in US and Australia that attracted many people to hunt for gold, the new found of large coal reserve in Kalimantan also attracted many companies to engage in the business. From 1991 to 1992, no less than 21 local companies submitted a proposal to get coal concessions (van Leeuwen 1994: 38). Based on that fact, it is not surprising that Kalimantan become the largest coal producer region.

3.2. Recent Condition of Indonesian Coal Industry

Although coal reserve in the past was only founded in Sumatera and Kalimantan Island, but in fact coal scattered across Indonesia. Based on the latest geological survey, coal was discovered in 21 provinces in Indonesia. All of big islands have coal deposit, and Maluku is become the only small island with coal resource in it. Kalimantan Island is estimated to have the largest deposits with 53.28 per cent of national reserve (map 2). The second largest coal resources founded in Sumatera with 55.9 trillion tons or 46.37 per cent of Indonesia reserve. Relatively big coal deposit also discovered in Sulawesi and Papua during the survey. No less than 129.55 million tons coal resources found in Papua, while Sulawesi estimated to have twice the number of Papua's coal deposit.

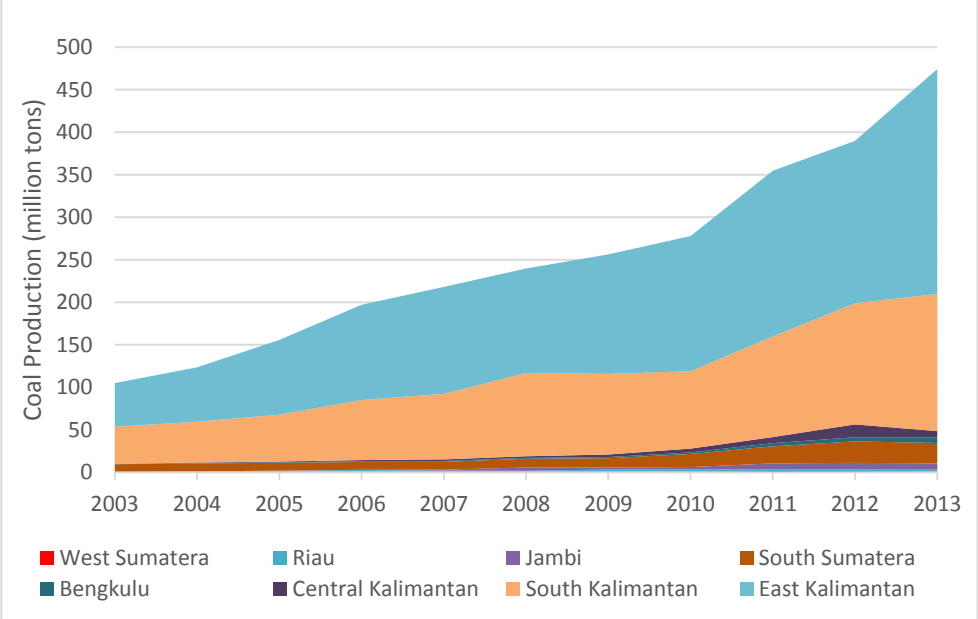
Map 2: Coal Resources in Indonesia per 1 January 2013 (million tons)



Source: Author's construction (basic map taken from Pusdatin ESDM (2010))

From figure 4, we can see that the latest position of coal industry in Indonesia is not very different with 1990s. Coal production in Indonesia is still largely determined by both South Kalimantan and East Kalimantan. In 2013, East Kalimantan accounted for 56 per cent of Indonesian coal production, while South Kalimantan had a 34 per cent share of national. Coal mining in Central Kalimantan is relatively newly developed. Coal production in Central Kalimantan just started in 2004 and reaching its peak in 2012 with the production of 15.15 million tons, before plummeted by 50 per cent in 2013. In aggregate production share of coal production in Kalimantan to national from 2003 onward is in steady rate, around 90 per cent of national production.

Figure 4: Coal Production by Province



Source: Author's construction based on data from ESDM (2015)

Unlike Kalimantan, the development of coal industry in five provinces in Sumatera was relatively stagnant. Coal production in one of the oldest coal mining in West Sumatera (Ombilin) is very low, roughly only reached 1 million tons in the last five years. The condition is probably because Ombilin site is an underground mine, thus very expensive to expand it. For that reason, more profitable option for PT. Bukit Asam is to push the coal production from its open pit coal mining in South Sumatera. The other provinces in Sumatera, such as Jambi and Bengkulu only show relatively high growth in production since the raise of world coal price in 2011 to reached 7.45 million and 6.76 million tons respectively in 2013. Similar with West Sumatera, coal production in Riau Province is in steady rate, only about two million tons per annum. The reason is may be because Riau is an oil rich province; therefore, the province government is not really concern in developing coal industry.

More detailed figure of Indonesian coal deposit is presented in table 1. While resources is a rough estimation, reserve is more reliable data and closer to actual deposit in the field. East Kalimantan have the largest coal reserve, followed by South Sumatera. Coal reserve in both province is slightly different, with 14 trillion and 12 trillion respectively. With quite similar coal reserves, South Sumatera supposed to have equal production rate with East Kalimantan. The massive coal exploration in Kalimantan in the past is probably being the reason of the high concentration of coal mining in Kalimantan. Only two out of ten largest (in term of reserve owned) coal company operated in South Sumatera, and the rest of it in Kalimantan (see appendix 8). The other reason is probably because Kalimantan has many large rivers, thus make the transportation of coal will be cheaper and much easier. In contrast, coal transportation in Sumatra is largely depend on railway or road, thus make the coal mining in Sumatera become more expensive. From the appendix 8, we also can see that Kalimantan is already crowded with coal mining, while South Sumatera relatively not much exploited.

Fast expansion of coal industry in Indonesia brings not only positive impact but also negative effect. The positive impacts that are expected from coal mining primary comes from royalties and taxes, creating job opportunities and increasing investment. On the other hand, in the interest of pursuing revenue, the local government oftentimes easily issued the license for investor to run coal mining. The adverse selection behavior of local government, and moral hazard of small coal companies, resulted many ex coal pit were abandoned without reclamation. With most coal is produced in Kalimantan, it is predicted that Kalimantan will face the biggest problem.

In the decentralization era, the inability of central government to control mining contract signed by local government has creating many problems. Local government very often do not earnestly examine Environmental Impact Analysis (EIA) document. Thus creating serious environmental problem and worsen the health of people live near the mining. In many cases, the mining location is overlapping with other mines. Many of small companies also do not pay royalties and taxes to the government because lack of supervision from local government.

To address the issue in mineral exploration, also to create more value added to Indonesian economy, government passed law number 4 of 2009 about mineral and coal mining. As mandated by law, government must change and verified all of old mining contract that previously issued by local government into the new format of mining license. As a result, Ministry of Energy and Mineral Resource are able to register 10,809 mining license, of which more than 35 per cent of it is coal mining licenses (Nasarudin 2013: 7). Nasarudin added that after verification, the Ministry found that 1.338 coal exploration license and 897 production license are clear and clean (2013: 7). Unfortunately, from 897 clean and clear coal mining in the production phase, only a quarter that already pay royalties per 25 February 2015 (Ministry of Energy and Mineral Resources 2015).

Table 1: Coal Resources and Reserves in Indonesia per 1 January 2013 (in million)

No.	Province	Resources	Reserves
1	Banten	18.80	
2	West Java		4.00
3	Central Java	0.82	
4	East Java	0.08	
5	Nangroe Aceh Darussalam	450.64	
6	North Sumatera	27.22	
7	Riau	1,810.51	689.23
8	West Sumatera	795.52	158.43
9	Bengkulu	192.07	18.95
10	Jambi	2,223.42	323.89
11	South Sumatera	50,301.27	12,104.24
12	Lampung	107.89	
13	West Kalimantan	491.30	
14	Central Kalimantan	3,755.78	559.05
15	South Kalimantan	12,587.29	3,488.02
16	East Kalimantan	47,402.47	14,015.22
17	South Sulawesi	231.12	0.12
18	Central Sulawesi	1.98	
19	North Maluku	6.69	
20	West Irian Jaya	126.48	
21	Papua	3.07	
Total		**120,534.42**	**31,361.15**

Source: Pusdatin ESDM (2014)

Chapter 4 Research Methodology and Data

4.1. Methodology

There are two analysis will be use in this study. Primarily I will use quantitative analysis to gauge the impact of coal production on the economic growth. The econometric model proposed in this paper is mainly taken from previous research, especially Peach and Starbuck (2011) and Reyes (2012). To give more vibrant investigation, I will also use descriptive analysis in the latter part of discussions. When econometric model is used to know the impact of coal production on economic growth, graphical analysis will be employed to present further discussion about the growth performance between coal base provinces and non-mineral based provinces within the island.

This paper employ similar dependent variables as Peach and Starbuck's (2011) research; employment and per capita household expenditure. Little adjustment is taken to change the variable of income per capita used by Peach and Starbucks into household expenditure. The reason is because different approach taken by Statistic in Indonesia (BPS). Most of Indonesian people do not comfortable to answer the question related to their income when they participating in the survey, thus BPS make an alternative method to measure the money owned by household. Although income and expenditure are might be different in term of value, the objective is the same; capturing economic growth. It is largely known that usually expenditure is smaller than income, however there is possibility that expenditure will be higher than income when someone have loan or credit. However, in some cases per capita expenditure expected able to show economic growth better. Especially in the booming period, when people tend to be more consumptive.

As the second dependent variable, this research use number of employment. The relation between employment and economic growth is as follow. Economic growth will created more job opportunity, which makes more people are employed. As a result, employment will also increase. When economic growth, the demand for all product will increase, thus more employer will be hire to increase the production rate. Contrary, in the declining period, companies will reduce its production rate by shrinking the number of workers.

Different with Peach and Starbuck (2011) and Reyes (2012), this will not use population as the third dependent variable, but research only use per capita household expenditure and employment as dependent variables. The assumption is that because Indonesia has large supply of worker. Thus the employment demanded by coal mining also by other sectors related to coal industry will be fulfilled by the region within the province. Furthermore, coal is capital intensive industry and do not need many worker when they want to increase their production.

The main independent variable in this paper is coal production. The increase of coal production expected to give positive or negative impact on employment

and household expenditure. Higher coal production will not only increase coal companies' requirement for employment, but also trigger other sector to develop. Thus creating more job opportunity. Conversely, if natural resource exist, then coal production will hamper economic growth. Higher coal production will decrease employment via Dutch disease channel that impede other sector, then reduce the employment rate. Additionally, household expenditure will be contracted because unequally distributed income. Rent seeking behaviour will only benefited small group of people and created poverty for the rest of society.

There are three control variables in this paper, namely initial year of per capita gross regional domestic product (GRDP), percentage of population who make health complain, and high school participation rate in the base year. Initial GRDP is expected to have negative sign. The negative sign of initial GRDP shows convergence (Murshed et al. 2015: 6)…between the province which have high and low GRDP per capita. The employment rate in the provinces with high GRDP is expected to be higher than in the provinces with lower GRDP. When per capita GRDP is high, the demand for services and construction sector will be higher, thus there will be more people will be hired. Household expenditure in rich provinces also expected to be higher than in the poor provinces. With higher household expenditure and developed tertiary sectors, the growth of employment and household expenditure in rich province will be in the slower pace.

Health complaining rate is anticipated to have negative relation with employment, but positively increase expenditure. High rate of health complaining will decrease the ability of a person to work, then will decrease his or her productivity. In the worst case, the person who too often skipped from work will be fired. In larger scale, this condition may choke employment rate. Moreover, the explanation between healths complain and expenditure is as follow. In developing countries, still less people have health insurance. The government also unable to provide social safety system to assure the citizen health care. In this case, when the citizen have health problem, they will solely depend on their own money to pay doctor or the medicine. Hence, health complaining is expected to have positive relation with household expenditure.

Generally, education is expected to have positive impact on economic growth, thus will enter the equation with positive sign. Nevertheless, education is not instantly push economic growth. It need sometime for education to positively influence the economy. For that reason, this research will use initial year of high school participation rate. The lagged time of 11 years is assumed good enough to measure the impact of education on growth. The high school students in 2003, now is expected to reach managerial level. Thus give high value added to the economy.

Based on argumentation presented above, followed econometric model is proposed for this research:

$$\ln(empl_{it}) = \alpha + \beta_1 \ln(coal_{it}) + \beta_2 \ln(pcgrdpbase_{it0}) + \beta_3 healthcompl_{it} + \beta_4 educbase_{it0} + year_t + \varepsilon_{it}$$

$$\ln(hhexp_{it}) = \alpha + \beta_1 \ln(coal_{it}) + \beta_2 \ln(pcgdrpbase_{it0}) + \beta_3 healthcompl_{it} + \beta_4 educbase_{it0} + year_t + \varepsilon_{it}$$

Where α represent the intercept parameter estimation, β_1 to β_4 represent the slope parameter estimates, and ε represent the error term. Since health complaining and initial high school participation rate is in percentage form, it is necessary to transform the other variable into growth form. For that reason, number of employment, per capita household expenditure, coal production, and per capita GRDP use natural logarithm. Further explanation for each variable is as follow:

empl	: Number of employment
hhexp	: Per capita Household expenditure
coal	: Volume of coal production
pcgrdpbase	: Initial Gross regional domestic product per capita at province level
healthcompl	: Percentage of population who make health complaining
educbase	: Initial High school participation rate
year	: Dummy year variable
i	: Provinces (1, 2, 3, …, 8)
t	: Year (2003-2013)

4.2. Data Source

This research will use secondary data in annual basis for eleven years from 2003 to 2013. There are eight coal producer province in this research namely; East Kalimantan, South Kalimantan, Central Kalimantan, West Sumatera, Riau, Bengkulu, Jambi, and South Sumatera. The data of coal production for each provinces is obtained from Ministry of Energy and Mineral Resources (ESDM), except for West Sumatera and South Sumatera, due to the data limitation form ESDM. The data of coal production for West Sumatera and South Sumatera is compiled from Annual Report of PT. Bukit Asam, Province in Figures, and ESDM. Moreover, the data of annual household expenditure per capita, number of employment, GRDP per capita, initial high school participation rate, and health complaining rate is collected from Statistic Indonesia (BPS).

Chapter 5 Result and Discussions

5.1. Econometric Analysis

In this part, we will try to reveal the impact of coal production on economic growth of eight coal producer provinces. The interpretation for estimation result will be presented to make it easier to understand. In this sub chapter, I will also try to investigate and give further explanation for the regression result.

Before do regression for two proposed econometric models, it is important to run Hausman test to investigate whether random effect or fixed effect model is the best for the analysis. If the result is significant, thus the best method for analysing the data is by Fixed Effect Model. In contrast, if the result is insignificant, the regression result will not have any systematic differences between random effect and fixed effect model.

The Hausman test result for two equation presented in previous chapter is different. In the first model there is no systematic differences between random effect and fixed effect model (see appendix 1). Hence, there will be no big differences in the regression result for both model. The Hausman test for the first model is consistent with the result. From the table 2, we can see that the variable which is omitted in fixed effect model is not significant in random effect model analysis.

Unfortunately, the Hausman test for the second model is inconsistent. Although the result of the test for the second model is significant (see appendix 1), meaning that Fixed Effect Model is the best method, the regression result show that random effect model provide higher R^2 and more significant variable. From the econometric analysis presented in the table 3, we can see that Initial per capita GRDP and initial high school participation rate are omitted from fixed effect analysis. Thus, with two omitted variables, we cannot clearly know whether fixed effect or random effect estimation is the best method. For that reason, both method in the second model will be discussed.

In general, the estimation result from the first model is disappointing. The R^2 is very low. Only 2 per cent of variation of number of employment can be explained by the model. Moreover, The only significant variables in the first model is coal production, and the other variable do not show significant impact on employment.

From table 2, we also can see that the findings is in line with the result of Reyes' (2012) work, which found that coal production has positive impact on employment. However the impact is very small. In average, if coal industry in Indonesia increasing its production rate by 10 per cent, the employment rate will only increase by 0.79 percentage point. There are 1,358 coal companies in Indonesia that have production license, and 2,528 coal companies with exploration license. With the increasing trend of coal production, these large and small companies

supposed to absorb massive number of employment. This condition shows that coal industry in Indonesia is highly capital intensive. As a result, when the company increase its production, they only absorb few workers.

Even though the other variable is not significant, the variable enter the model with correct sign, except health complaining rate. The negative sign of initial per capita GRDP show that in the province with higher initial GRDP, the employment growth rate is smaller than the province with lower initial GRDP. Initial high school participation rate also have positive impact on employment, though it is very small.

Table 2. Summary of Estimation Result between Number of Employment and Coal Production

Dependent Variable: log number of employment		
Independent Variables	**FE**	**RE**
Log Coal production	0.0791535** (0.0167309)	0.0789808*** (0.0169135Z
Log Initial Per capita GRDP	-	-0.1744986 (0.4417874)
Health complaining rate	0.0008473 (0.0005766)	0.0008507 (0.0005853)
Initial high school participation rate	-	0.0061864 (0.0192548)
Constant	12.97836*** (0.2547094)	14.15882*** (3.647679)
Observations	85	85
R-squared	0.0264	0.0206

Standard errors in parentheses ***p<0.001, **p<0.05, *P<0.1
Source: Author's calculation using Stata

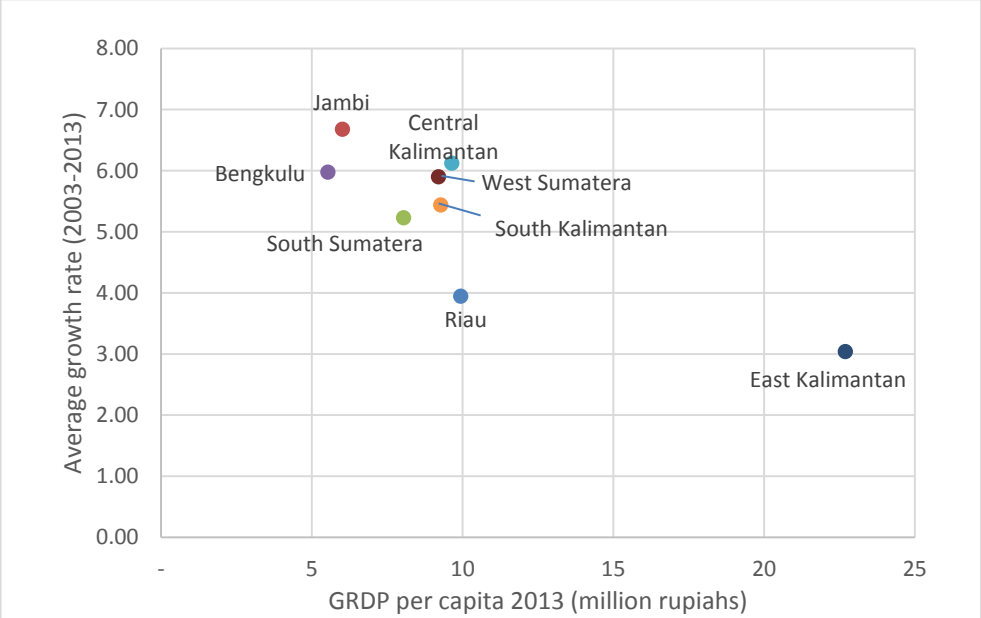
The estimation result for the second model (see table 3) is much better that the first model. The Second model is able to capture 50 per cent of variation which influence household expenditure, and all of proposed variable shows significant result. Since overall R^2 in the Random effect model is better than in the fixed effect model, I will mainly discuss the result from random effect method.

The finding in the second model also corresponding the research of Reyes (2012). Coal production significantly increase household expenditure. The coefficient is relatively high. With the increase of 10 per cent of coal production, households will be able to raise their expenditure by 2.7 per cent. This finding is also strongly support the argument that coal mining is capital intensive industry. With little impact on employment, but has fairly high impact on household expenditure, coal mining created bad income distribution.

Similar with the study of Sachs and Warner (1997: 27), the second model also confirm the convergence between rich and poor province. The negative sign in regression shows that household expenditure in lower per capita GRDP base

grow faster during the period of observation, between 2003 and 2013. The convergence founded in this study also…corroborated neoclassic study about conditional convergence (Sachs and Warner 1997: 27). We can also see in the figure 5 than convergence is occur between coal producer provinces. East Kalimantan, the province with highest per capita GDRP have the lowest average growth rate in the last decades. Whereas Jambi and Bengkulu as the poorer provinces show relatively high average growth rate.

Figure 5: Average Growth Performance of Eight Coal Producer Provinces



Source: Author's construction based on data from BPS (2015)

Different with the first model, health complaining rate in the second model is significant. Household expenditure is negatively affected by health complaining rate. The reason is probably because most of Indonesian people are working in informal sector, thus they not covered by health insurance. Indonesia have two government owned company for health insurance. Although there are national security system in Indonesia, it just implemented in 2014. Consequently, prior the implementation of national security system, most of Indonesian will depend on its own money to get health assistance.

Initial high school participation rate as expected has positive impact on household expenditure. In average, 10 per cent increase of high school participation rate will increase household expenditure in the next decades by 0.5 percent. The impact of high school participation rate to household expenditure is relatively moderate. Average high school participation rate has increased by 13 percent from around 50 per cent in 2003 in the last decade. Then, further investigation is important to know the impact of the increasing rate of high school participation to Indonesian economy in the future.

Table 3. Summary of Estimation Result between Household Expenditure and Coal Production

Dependent Variable: log household expenditure		
Independent Variables	**FE**	**RE**
Log Coal production	0.3623401** (0.0758898)	0.2686687*** (0.0452883)
Log Per capita GRDP base	-	-0.8418014** (0.3252305)
Health complaining rate	0.0090419** (0.0018545)	0.011504*** (0.001476)
Initial high school participation rate	-	0.0568555*** (0.0123223)
Constant	7.051977*** (1.158821)	12.71489*** (2.159524)
Observations	85	85
R-squared	0.2093	0.5001

Standard errors in parentheses ***p<0.001, **p<0.05, *P<0.1
Source: Author's calculation using Stata

I also conduct econometric analysis to know time fixed effect. Unfortunately, the result is mostly not significant (showed in appendix 4 to 7). The estimation result of time fixed effect surprisingly contradict previous estimation presented above. However, I still believe that coal production have positive impact on economic growth due to insignificant result showed by time fixed effect. The only time fixed effect regression that provide significant result is in the analysis of second model which employ household expenditure as the dependent variable. In the random effect model, two variables are significant, viz. initial per capita GRDP and health complaining rate (appendix 6). In the fixed effect model, health complaining rate become the only variable that significant.

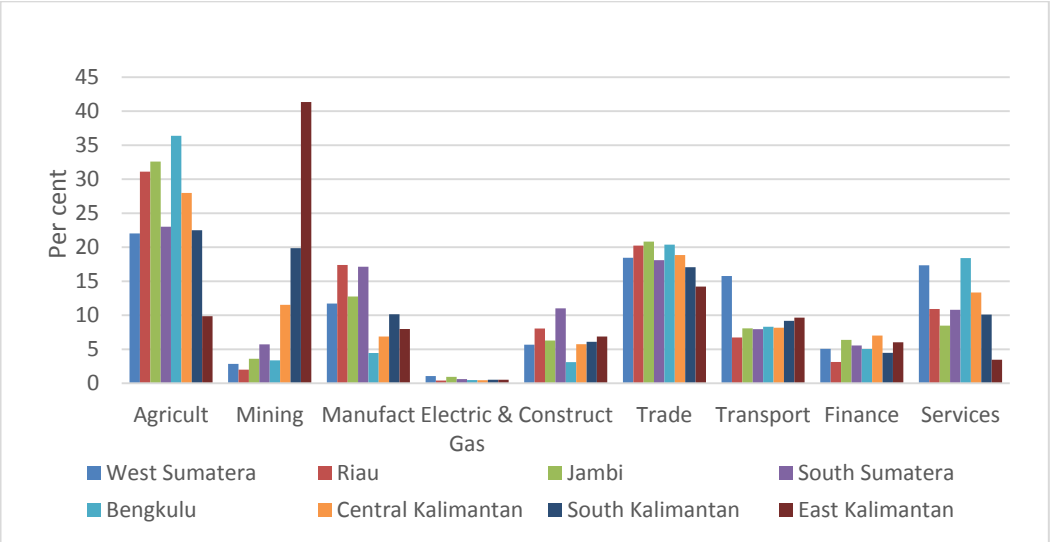
5.2. Descriptive Analysis

The second part of this chapter, will be used to answer sub question of this research. Graphical analysis will be employed to make the comparison easier. By analysing the growth performance between coal producer countries, also between coal producer provinces and non-mineral based provinces within the same island, hopefully will help us to get deeper understanding about economic growth phenomena in Indonesia.

Figure 6 to show distribution of GRDP by sector for eight coal producer province. The data is presented without oil and gas, so that can give clearer view about the economic condition in the provinces, since Riau and East Kalimantan is the main producer of oil and gas. Previously we already discuss that South Kalimantan and East Kalimantan is the main coal producer in Indonesia, and 90 per cent national coal production are came from both province. However, the low rate of industrialization in South Kalimantan and East Kalimantan (displayed by low share of manufacturing sector to GRDP) show that both prov-

inces do not use the revenue from coal as a Big Push. Furthermore, figure 6 also show that East Kalimantan is largely depended on Coal industry. More than 40 per cent of its GDP is came from mining sector, which is only producing coal. The other coal producer provinces in Sumatera, although do not depend on mining, but most of their economy is generated by agricultural sector.

Figure 6: Distribution of GRDP by Sector 2013 (without oil and gas)

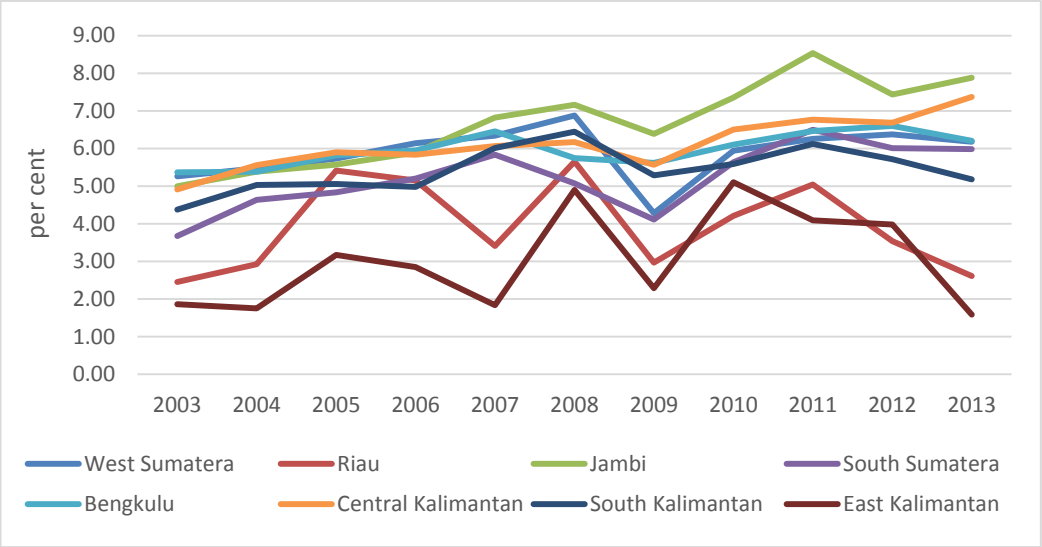


Source: Author's construction based on data from BPS (2015)

To know whether provinces which depend on mining sector have slower growth compare to agricultural based province, economic growth comparison is presented (figure 7). Deeper analysis revealed that Riau is also fundamentally depended on mining sector, especially from oil and gas. Without oil and gas, the contribution of mining sector to Riau's GDP is only 2 per cent. But, if we added oil and gas to the counting, the figures will radically changing. The contribution of mining sector to Riau's GDP with oil and gas is 43.65 per cent, higher than of which in East Kalimantan.

After knowing the exact figures of Riau Economy, we can examine and comparing growth performance of eight coal producer provinces. Riau and East Kalimantan surely have more volatile economic growth compare to the other. High dependency of both provinces to mining sector might be is the reason behind this cases. If it is true, then this study found similar fact with the work of Woolcock et al. (2001) and Isham et al. (2005). The provinces which depend on mining will have more volatile growth and in average have slower growth rate compare with agricultural-based provinces. The explanation for South Kalimantan is that even though he is the second largest coal producer, but the share of mining sector to overall economy is only 20 per cent. Still lower than the share from agricultural sector which account for around 23 per cent.

Figure 7. Economic Growth of Coal Producer Provinces



Source: Author's construction based on data from BPS (2015)

Jambi and Central Kalimantan show impressive economic growth, specifically from 2009 onward. The booster of economic growth of both provinces is likely came from large investment in coal industry. Coal production in Jambi jump from only 2.5 million tons in 2010 to 7.08 million tons in 2011. Similarly, Central Kalimantan also experienced coal production hikes to 7.12 tons in 2011 from only 4.5 tons in 2010. Central Kalimantan and Jambi just started their coal production in 2004 and 2005 respectively. If we borrow the meaning of resource boom d from Sachs and Warner[4] (1997: 6), then we can conclude that Central Kalimantan and Jambi is in coal boom period.

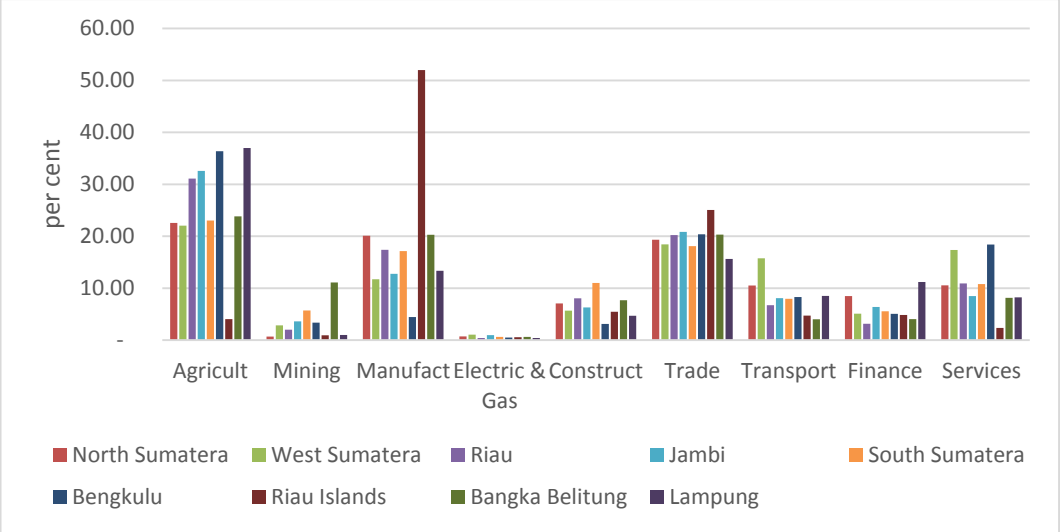
To complete the analysis in this chapter, finally we will discuss the growth performance of coal producer provinces compare to other provinces within in the same island. It is important to compare growth performance of the province within an island because the provinces in the same island usually have similar characteristics. Moreover, make comparison between provinces in in one island to other islands will little bit difficult, since different island will have different kind of natural resources. Java for example is largely known as poor-resources countries and already become the centre of Indonesian economic growth. Each of big island in Indonesia also have different culture, which make more difficult to have an even comparison. Another reason is that the development of infrastructure that still have large inequality, with the eastern part of Indonesia is less developed. Better infrastructure is assumed will give better economic growth.

In Sumatra, Riau Islands become the only provinces that large manufacturing industries (see figure 8). Manufacture sector in Riau Islands contributed to more than 50 per cent of GDP. The flourishing argument in the natural curse studies

[4] Coal boom according to Sachs and Warner can be caused by two occurrence, first is caused by resource discovery, and the second is due to trade improvement.

is that manufacturing countries usually has better growth performance. Conversely, Riau Islands do not show the same pattern with recent studies. Experiencing the highest and more stable economic growth up to 2007, Riau Island is suffering the most during economic crisis in 2008 (see figure 9). Riau Islands has a centre of industrial area in Batam Island which is established to compete with high technology manufacture in Singapore. Industrial goods produced in Batam is mostly for export market, thus global crisis in 2008 hardly struck Riau Islands' economy. One of the privilege of manufacturing based economy is that it can recover faster than agricultural based economy or mineral based economy. Riau, that largely depend on oil and gas, also hit by the crisis hardly, and has never been recovered until now.

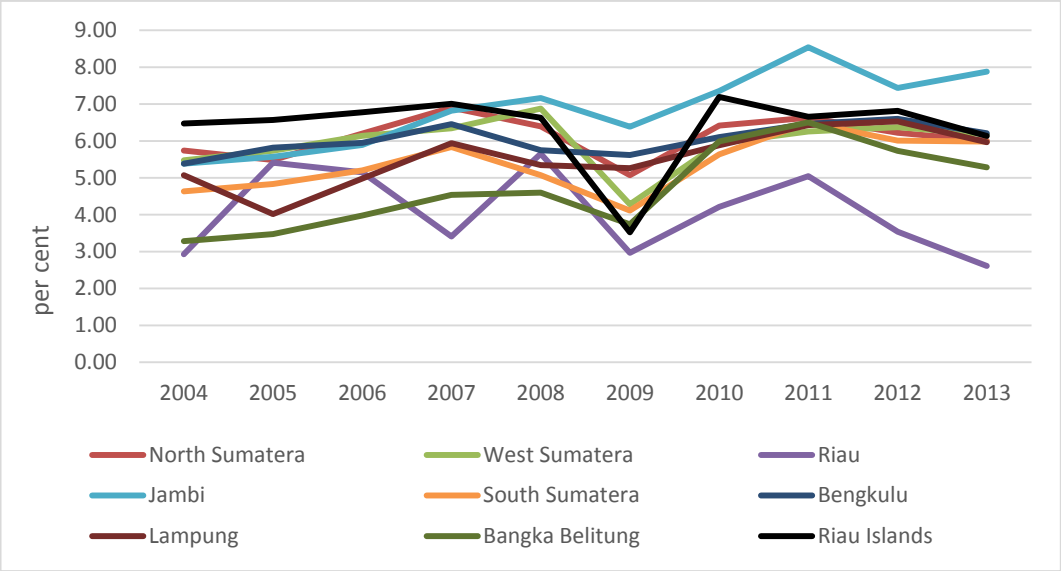
Figure 8. Distribution of GRDP Provinces in Sumatera by Sector in 2013 (without oil and gas)



Source: Author's construction based on data from BPS (2015)

Figure 9. Economic Growth of Provinces in Sumatera[5]

[5] The data is presented from 2004 because Riau Islands just established as new province in 2003, thus the data of economic growth only available from 2004.

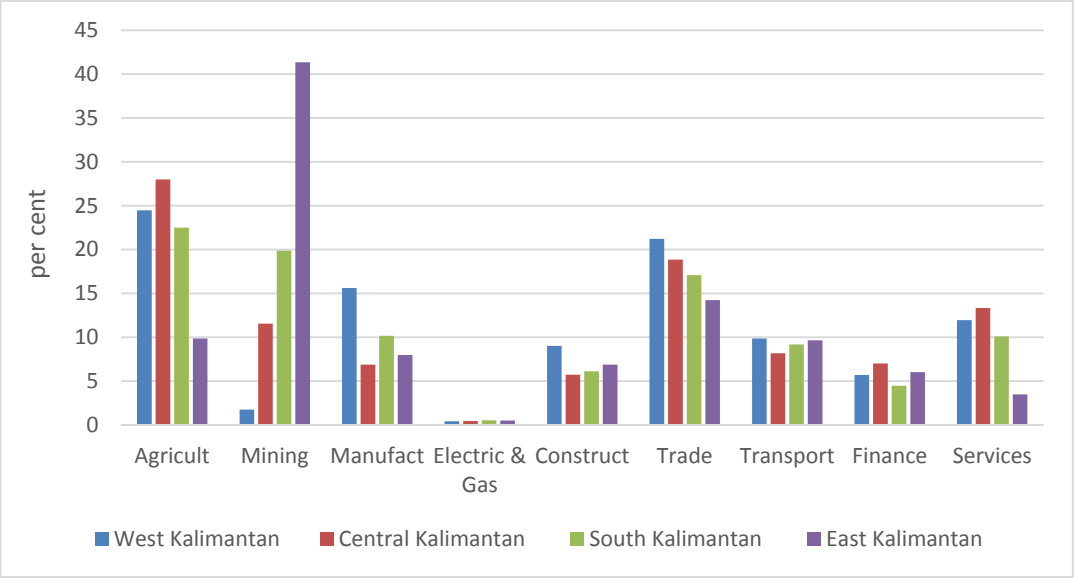


Source: Author's construction based on data from BPS (2015)

There is an interesting fact from the economy of Sumatera, although in 2004 the economic growth for each provinces is differ, but latter they grow in the same pace (except for Jambi and Riau). Similar growth rate show that the economy in Sumatera is being interlinked. With high economic integration, it seems that the specialization in manufacturing is not really the case to provide high economic growth. Economic diversification also an important factor that can provide sustainable economic growth.

The econometric analysis in this study revealed that coal production in Indonesia only have small impact to the economy. This findings is in line with previous research from van der Ploeg and Poelhekke (2009) which revealed that the price volatility will make mineral economy become unstable and provide slow economic growth. Further investigation from the stylized fact presented in figure 11 also show that the economy of East Kalimantan is the most unstable due to high economic dependency on coal mining.

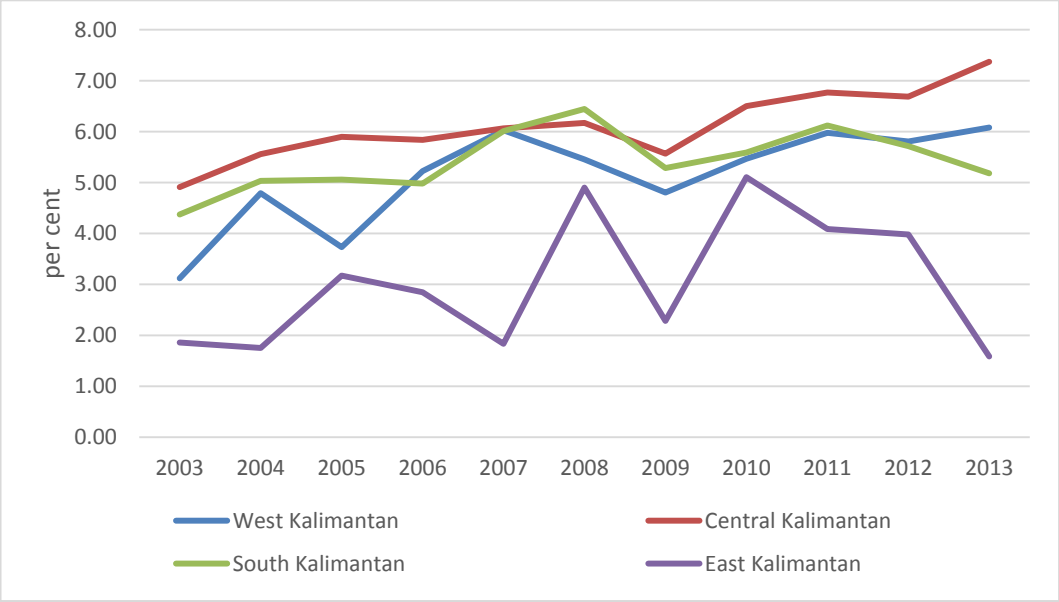
Figure 10. Distribution of GRDP Provinces in Kalimantan by Sector 2013 (without oil and gas)



Source: Author's construction based on data from BPS (2015)

If we look closer to the figure 11, we will find that economy of bot major coal producer, South Kalimantan and East Kalimantan are constantly in a declining growth period since 2011. The declining of growth performance of South Kalimantan and East Kalimantan is likely show that the coal mining in both area is already on the peak. Unlike factory that can increase its production in almost unlimited number, mining sector have many limitation in increasing the productivity. Thus the economic growth will in the slow pace in the peak period.

Figure 11. Economic Growth of Provinces in Kalimantan



Source: Author's construction based on data from BPS (2015)

The economy of West Kalimantan, which highly depend on agricultural goods show moderate growth which raged from 3 per cent in 2003 as the lowest growth rate, and keep increasing to reach 6 per cent in 2013. The economy of Central Kalimantan shows the most steady economic growth in Kalimantan. When the other economy hit by crisis in 2004, Central Kalimantan economy seems unaffected. Coal boom in Central Kalimantan is might the only reason for the good performance of his economic growth.

Chapter 6 Conclusion

To conclude with, there are five findings in this paper. The first is that coal production in Indonesia have positive impact on economic growth. Although coal production significantly affected economic growth, the impact is very small. Specifically, coal production is likely not helping the economy to absorb many employment, thus the welfare created from coal industry is not well distributed to all citizen. The second findings is that similar with previous study, coal depended province have the worse economic growth performance. Moreover, there are not many differences in term of growth performance between the economy that mainly depend on coal with oil and gas based economy. The next findings is that this study found similar fact with the study of Woolcock et al. (2001) and Isham et al. (2005); in average the growth performance of mineral based economy is worse than agricultural economy and manufacturing-based economy. The comparison between agricultural economy and manufacturing economy cannot be done since the economy of the provinces in Sumatera show the similar growth rate in 2013.

The fourth finding in this study is relatively new and will might give new perspective in the natural resource curse study. As shown by Riau Islands' economy, manufacturing based economy is not always been the best option in reaching sustained economic growth. Although Riau Islands' economy are able to recover from global crisis, but other economy in Sumatera is better in maintain economic growth during the crisis. A more balanced economic structure is probably the key to be resistant to economic crisis. Finally, it is suspected that Jambi and Central Kalimantan experiencing coal booming. The economy in both province shows remarkable growth in the last five years, and being the best compare to the others.

Appendices

Appendix 1. Hausman Test

1A. Hausman test result: Employment as dependent variable

	Coefficients (b) fixed	(B) .	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
lcoal	.0791535	.0789808	.0001727	.0005293
healthcompl	.0008473	.0008507	-3.45e-06	.0000153

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(2) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 0.24
Prob>chi2 = 0.8877

1B. Hausman test result: Eousehold expenditure as independent model

	Coefficients (b) fixed	(B) .	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
lcoal	.3623401	.2686687	.0936714	.0231709
healthcompl	.0090419	.011504	-.0024621	.0006769

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(2) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 16.99
Prob>chi2 = 0.0002

Appendix 2. Estimation result: Employment as dependent variable

```
Random-effects GLS regression                   Number of obs      =        85
Group variable: id                              Number of groups   =         8

R-sq:  within  = 0.4425                         Obs per group: min =         9
       between = 0.0072                                        avg =      10.6
       overall = 0.0206                                        max =        11

                                                Wald chi2(4)       =    274.76
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000

                                    (Std. Err. adjusted for 8 clusters in id)
------------------------------------------------------------------------------
             |               Robust
      lempl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lcoal |   .0789808   .0169135     4.67   0.000      .045831    .1121306
 lpcgrdpbase |  -.1744986   .4417874    -0.39   0.693    -1.040386    .6913887
 healthcompl |   .0008507   .0005853     1.45   0.146    -.0002964    .0019979
    educbase |   .0061864   .0192548     0.32   0.748    -.0315523    .0439251
       _cons |   14.15882   3.647679     3.88   0.000     7.009506    21.30814
-------------+----------------------------------------------------------------
     sigma_u |  .66913309
     sigma_e |  .07772421
         rho |  .98668727   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

```
Fixed-effects (within) regression               Number of obs      =        85
Group variable: id                              Number of groups   =         8

R-sq:  within  = 0.4425                         Obs per group: min =         9
       between = 0.0154                                        avg =      10.6
       overall = 0.0264                                        max =        11

                                                F(2,7)             =     16.71
corr(u_i, Xb)  = -0.2115                        Prob > F           =    0.0022

                                    (Std. Err. adjusted for 8 clusters in id)
------------------------------------------------------------------------------
             |               Robust
      lempl |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lcoal |   .0791535   .0167309     4.73   0.002     .0395911    .1187158
 lpcgrdpbase |          0  (omitted)
 healthcompl |   .0008473   .0005766     1.47   0.185    -.0005161    .0022107
    educbase |          0  (omitted)
       _cons |   12.97836   .2547094    50.95   0.000     12.37607    13.58065
-------------+----------------------------------------------------------------
     sigma_u |  .46048165
     sigma_e |  .07772421
         rho |  .97229948   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

Appendix 3. Estimation result: Household expenditure as dependent variable

```
Random-effects GLS regression                   Number of obs      =        85
Group variable: id                              Number of groups   =         8

R-sq:  within  = 0.6672                         Obs per group: min =         9
       between = 0.3145                                        avg =      10.6
       overall = 0.5001                                        max =        11

                                                Wald chi2(4)       =    116.68
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000

                                    (Std. Err. adjusted for 8 clusters in id)
```

lhhexp	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
lcoal	.2686687	.0452883	5.93	0.000	.1799054	.3574321
lpcgrdpbase	-.8418014	.3252305	-2.59	0.010	-1.479241	-.2043613
healthcompl	.011504	.001476	7.79	0.000	.008611	.014397
educbase	.0568555	.0123223	4.61	0.000	.0327042	.0810068
_cons	12.71489	2.159524	5.89	0.000	8.482304	16.94748
sigma_u	.125311					
sigma_e	.24615569					
rho	.20581625	(fraction of variance due to u_i)				

```
Fixed-effects (within) regression               Number of obs      =        85
Group variable: id                              Number of groups   =         8

R-sq:  within  = 0.6811                         Obs per group: min =         9
       between = 0.1190                                        avg =      10.6
       overall = 0.2093                                        max =        11

                                                F(2,7)             =     39.29
corr(u_i, Xb)  = -0.8679                        Prob > F           =    0.0002

                                    (Std. Err. adjusted for 8 clusters in id)
```

lhhexp	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
lcoal	.3623401	.0758898	4.77	0.002	.1828892	.541791
lpcgrdpbase	0	(omitted)				
healthcompl	.0090419	.0018545	4.88	0.002	.0046566	.0134272
educbase	0	(omitted)				
_cons	7.051977	1.158821	6.09	0.000	4.311801	9.792153
sigma_u	.68760628					
sigma_e	.24615569					
rho	.88640197	(fraction of variance due to u_i)				

Appendix 4. Estimation result of random effect model with time dummies (employment as dependent variable)

```
Random-effects GLS regression                   Number of obs      =        85
Group variable: id                              Number of groups   =         8

R-sq:  within  = 0.7724                         Obs per group: min =         9
       between = 0.0176                                        avg =      10.6
       overall = 0.0567                                        max =        11

                                                Wald chi2(7)       =         .
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =         .

                                                (Std. Err. adjusted for 8 clusters in id)
```

lempl	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
lcoal	-.014373	.0240929	-0.60	0.551	-.0615943	.0328483
lpcgrdpbase	.2383153	.378524	0.63	0.529	-.503578	.9802087
healthcompl	-.0021011	.0030686	-0.68	0.494	-.0081154	.0039132
educbase	-.010824	.0215245	-0.50	0.615	-.0530112	.0313633
year	.0739389	.1294885	0.57	0.568	-.1798539	.3277318
y1	.4061685	1.112528	0.37	0.715	-1.774346	2.586683
y2	.3454797	.9824716	0.35	0.725	-1.580129	2.271089
y3	.3126519	.8841083	0.35	0.724	-1.420169	2.045472
y4	.2263741	.7473579	0.30	0.762	-1.23842	1.691169
y5	.1889326	.6191024	0.31	0.760	-1.024486	1.402351
y6	.1756729	.5070677	0.35	0.729	-.8181615	1.169507
y7	.1225641	.380485	0.32	0.747	-.6231728	.868301
y8	.1144144	.2642619	0.43	0.665	-.4035294	.6323582
y9	.0869429	.1286287	0.68	0.499	-.1651648	.3390506
y10	0	(omitted)				
y11	0	(omitted)				
_cons	-135.6288	259.9423	-0.52	0.602	-645.1064	373.8487
sigma_u	.47063861					
sigma_e	.05334345					
rho	.98731638	(fraction of variance due to u_i)				

Appendix 5. Estimation result of fixed effect model with time dummies (employment as dependent variable)

```
Fixed-effects (within) regression               Number of obs      =        85
Group variable: id                              Number of groups   =         8

R-sq:  within  = 0.7724                         Obs per group: min =         9
       between = 0.0353                                        avg =      10.6
       overall = 0.0147                                        max =        11

                                                F(7,7)             =         .
corr(u_i, Xb)  = -0.0901                        Prob > F           =         .

                                              (Std. Err. adjusted for 8 clusters in id)
```

lempl	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
lcoal	-.0144059	.0234295	-0.61	0.558	-.069808	.0409961
lpcgrdpbase	0	(omitted)				
healthcompl	-.0020957	.0030084	-0.70	0.509	-.0092094	.0050181
educbase	0	(omitted)				
year	.033317	.0183739	1.81	0.113	-.0101303	.0767643
y1	0	(omitted)				
y2	-.0199508	.0358173	-0.56	0.595	-.1046452	.0647435
y3	-.0121612	.0230582	-0.53	0.614	-.0666851	.0423628
y4	-.0578085	.0463073	-1.25	0.252	-.1673079	.0516909
y5	-.0546366	.0551222	-0.99	0.355	-.1849799	.0757068
y6	-.0272797	.0514348	-0.53	0.612	-.1489038	.0943443
y7	-.0397641	.0655253	-0.61	0.563	-.1947069	.1151786
y8	-.0072836	.0709994	-0.10	0.921	-.1751705	.1606033
y9	.005905	.092603	0.06	0.951	-.2130663	.2248762
y10	-.0404052	.1091111	-0.37	0.722	-.298412	.2176016
y11	0	(omitted)				
_cons	-52.35548	36.57498	-1.43	0.195	-138.8416	34.1306
sigma_u	.46061874					
sigma_e	.05334345					
rho	.98676594	(fraction of variance due to u_i)				

Appendix 6. Estimation result of random effect model with time dummies (household expenditure as dependent variable)

```
Random-effects GLS regression                   Number of obs      =        85
Group variable: id                              Number of groups   =         8

R-sq:  within  = 0.9672                         Obs per group: min =         9
       between = 0.8101                                        avg =      10.6
       overall = 0.9442                                        max =        11

                                                Wald chi2(8)       =         .
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =         .

                                              (Std. Err. adjusted for 8 clusters in id)
```

lhhexp	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
lcoal	-.0182205	.0268399	-0.68	0.497	-.0708257	.0343848
lpcgrdpbase	.4328043	.0897572	4.82	0.000	.2568834	.6087251
healthcompl	.0070856	.002338	3.03	0.002	.0025033	.011668
educbase	.0054107	.0053046	1.02	0.308	-.0049862	.0158076
year	-.2050467	.1059734	-1.93	0.053	-.4127507	.0026574
y1	-2.957054	1.020463	-2.90	0.004	-4.957124	-.956984
y2	-2.694555	.9083369	-2.97	0.003	-4.474862	-.9142471
y3	-2.46556	.8005259	-3.08	0.002	-4.034562	-.8965577
y4	-2.091833	.667942	-3.13	0.002	-3.400975	-.7826907
y5	-1.661641	.5509667	-3.02	0.003	-2.741516	-.5817664
y6	-1.389564	.4448124	-3.12	0.002	-2.261381	-.5177481
y7	-1.091437	.3390633	-3.22	0.001	-1.755989	-.4268849
y8	-.7329421	.2267921	-3.23	0.001	-1.177447	-.2884377
y9	-.3065908	.1063324	-2.88	0.004	-.5149986	-.0981831
y10	0	(omitted)				
y11	0	(omitted)				
_cons	422.1053	212.832	1.98	0.047	4.962196	839.2483
sigma_u	.09948385					
sigma_e	.08469637					
rho	.57977383	(fraction of variance due to u_i)				

Appendix 7. Estimation result of fixed effect model with time dummies (household expenditure as dependent variable)

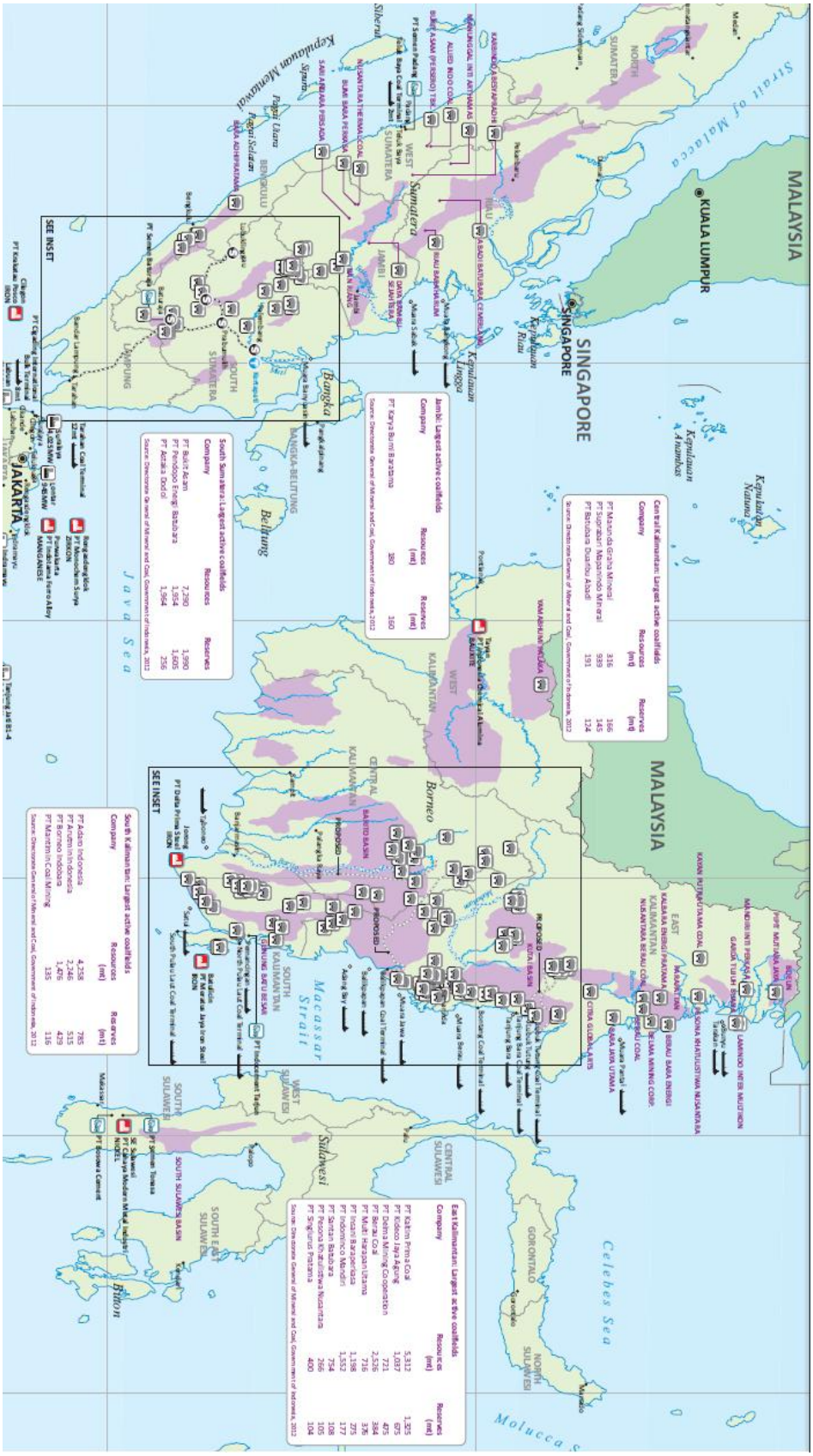
```
Fixed-effects (within) regression               Number of obs      =         85
Group variable: id                              Number of groups   =          8

R-sq:  within  = 0.9673                         Obs per group: min =          9
       between = 0.1122                                        avg =       10.6
       overall = 0.7539                                        max =         11

                                                F(7,7)             =          .
corr(u_i, Xb)  = -0.0928                        Prob > F           =          .

                                              (Std. Err. adjusted for 8 clusters in id)
------------------------------------------------------------------------------
             |               Robust
      lhhexp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lcoal |  -.0263115    .033358    -0.79   0.456    -.1051907    .0525677
 lpcgrdpbase |          0  (omitted)
 healthcompl |   .0074904   .0023776     3.15   0.016     .0018682    .0131125
    educbase |          0  (omitted)
        year |   .0902838   .0075181    12.01   0.000     .0725063    .1080612
          y1 |          0  (omitted)
          y2 |  -.0303046   .0233483    -1.30   0.235    -.0855145    .0249054
          y3 |  -.0989679   .0446549    -2.22   0.062      -.20456    .0066241
          y4 |  -.0190043   .0647909    -0.29   0.778    -.1722104    .1342019
          y5 |   .1163941   .0633827     1.84   0.109    -.0334821    .2662703
          y6 |   .0938369   .0697238     1.35   0.220    -.0710336    .2587074
          y7 |   .0974273   .0733463     1.33   0.226     -.076009    .2708637
          y8 |   .1626825   .0810086     2.01   0.085    -.0288724    .3542373
          y9 |   .2987067   .1004443     2.97   0.021     .0611936    .5362198
         y10 |   .3117618   .1034658     3.01   0.020     .0671041    .5564194
         y11 |          0  (omitted)
       _cons |  -168.2424   14.78287   -11.38   0.000    -203.1983   -133.2865
-------------+----------------------------------------------------------------
     sigma_u |  .22105185
     sigma_e |  .08469637
         rho |  .87198771   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

Appendix 8. Map of Coal Mining in Indonesia



Source: Fuller and Bush (2014)

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