Natural Resources and Economic Development: Cross-Country Experiences and Implications for Cambodia's Potential Oil and Gas Industry

by

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Chapter 1: Introduction

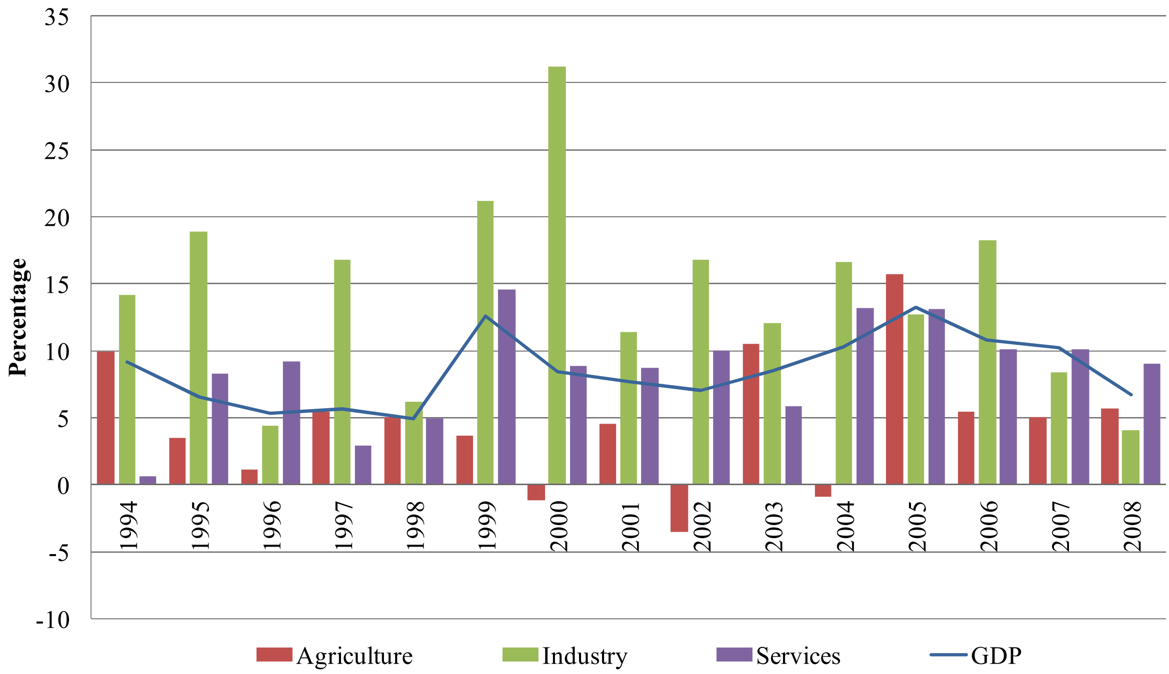
The oil and gas industry is a very sensitive topic in Cambodia. Since 2005, many international organizations, including the International Monetary Fund, the World Bank, and the United Nations Development Programme, have been actively involved in policy discussions and recommendations to provide technical assistance to the Royal Government of Cambodia (henceforth RGC). At the same time, the RGC and its private partners are also making a huge investment in oil and gas exploration in both offshore areas and the Tonle Sap Lake area.

Cambodia is still in the exploration stage. There are ideas that it is too early to put too much focus on the management of this industry or that more attention should be given to how to attract foreign investors to this industry. However, the experiences of resource-rich countries suggest otherwise. Due to the small amount of reserves that Cambodia is expected to have in its offshore area, advance planning and well-prepared policies can ensure that Cambodia enjoys the most benefits out of this opportunity to raise its economy to a higher level.

1.1 Cambodia's Economy

Cambodia had been enjoying quite strong economic growth before the world financial crisis reversed its trajectory in 2009. For the last decade and a half, its annual GDP growth has averaged about 8 per cent in Riels at 2000 constant prices (RGC, 2008). Four main contributors to Cambodia's GDP growth are the garment, tourism, construction, and rice sectors (see Figure 1-1). During this period, agriculture has gradually lost its share of GDP to industry, of which garment sector is the key player. In 2008, the agriculture, industry and services sectors account for 33%, 22%, and 45% of GDP, respectively (ADB, 2011).

Figure 1-1: GDP and Sectoral Growth Rates



Note: At constant 2000 prices

Source: Cambodia: Key Indicators by Asian Development Bank, 2011

Cambodia's economic growth can be explained by several main sources according to the National Institute of Statistics of Cambodia (NIS, 2008). Cambodia largely depends on foreign direct investment to foster the development of its garment sector. Tourist arrivals are also important in keeping Cambodia's services industry, especially the hotel and restaurant sectors, growing side by side with the garment sector. A gradual improvement in agricultural production and the recent rapid development of the construction sector are also two main reasons behind Cambodia's economic growth.

1.2 A New Source of National Income

Despite its favorable economic growth, Cambodia is about to face another historic golden opportunity (or threat) in the very near future, which brings this young economy into the spotlight of international stakeholders.

According to UNDP Cambodia (2006), Chevron announced in January 2005 Cambodia's first significant oil and gas discovery, bringing different perspectives to Cambodia's development prospects. It has been provisionally but conservatively estimated that there are around 400-500 million barrels of oil and three trillion cubic feet of gas lying in the four exploratory wells known as Block A, in addition to five other blocks that are at the exploration stage. With such an enormous amount of this black gold, Cambodia is expected to earn as much income or even more than the size of its total budget expenditures.

The economic implications of oil and gas extraction go far beyond government revenues from its royalty and taxes. Depending on how this new industry is managed, the oil and gas industry can prove significant and can act as a new main player in Cambodia's economic development.

1.3 Research Problem

1.3.1 The Potential Impacts of the Oil and Gas Industry

An economy has a very well connected system of different industrial activities such as agriculture, mining, manufacturing and services. A demand increase on one industrial activity has multiplier effects on other industries through their backward and forward linkages. Oil and gas extraction is no exception. Certain intermediate inputs from other industries are needed to make extraction feasible. It needs metals and cement from the manufacturing sector to make pipelines, wood and bamboo from the forestry sector to construct scaffoldings, insurance and finance services from services sector to support its administration work and so on. At the same time, the oil and gas sectors and supporting sectors also create added value through their use of primary inputs such as labor, capital, land and government services.

These sophisticated interactions can be represented by a simple input-output model first developed by Wassily Leontief. The change of one economic sector has multiplier effects on other sectors. Therefore, the extraction of oil and gas has the potential to contribute to further growth in other economic sectors and of the gross domestic product in general.

There are many possible ways of developing the oil and gas industry in Cambodia. The easiest and most convenient option is to export crude oil and raw gas to neighboring countries and other potential trading partners. It can greatly reduce management risks related to the high-tech refinery sector. In addition, this option is most suitable for a small amount of reserves that are not worth an expensive refinery. The government can earn revenues through royalty, shared profits, and taxes from the extraction. However, a limited contribution to Cambodia's national income is expected from this choice of development.

Alternatively, adding value to this oil and gas industry is a better way to make the most out of these underground resources. Building a refinery and generating electricity from this oil and gas industry seem to be two better choices of development in terms of the contribution it makes to Cambodia's economy. However, questions about feasibility and management practices require policy makers to study the costs and benefits of these development alternatives.

1.3.2 Natural Resources and Economic Development

A short-term impact study on the oil and gas industry in Cambodia has to be complemented with the poor long-term experiences of many natural resource-rich countries, which show that proper management is required to truly realize the blessing of natural resources.

Since the 1970s, on average some resource-rich countries have been growing more slowly than their resource-poor (manufacturing-led) counterparts. Countries rich in natural resources started off being wealthier than those poor in natural resources, but this ranking was reversed in the 1990s. By 1993, the term "resource curse" had been coined (Karl, 1997). From the past and the current experiences of many resource-cursed countries, it is clear that these resources do not come without a cost. Furthermore, though this black gold will certainly bring large inflows of income into its host country, it cannot ensure a sustainable economic development without effective revenue management and investment policies. There are cases of resource-rich countries such as Angola, Nigeria, and other countries in various regions that have experienced so-called "growth without development".

It is justifiable to claim that natural resources can be two-edged, depending on the management of host countries. However, empirical studies on the impacts of natural resources show mixed results. While more previous research, especially those Sachs-Warner-sided works, often claimed the existence of the natural resource curse, they are constantly being criticized for having inappropriate methodologies that yielded biased results. Thus, it is unreasonable to conclude that natural resource abundance is negatively related to development. The oil and gas industry in Cambodia deserves a fair judgment in terms of its impacts on economic development.

1.4 Research Objectives and Methodologies

Based on the discussion of these research problems, this dissertation has three main objectives:

1. Project the potential impacts of the offshore oil and gas industry on Cambodia's economy: gross domestic product, income to factors of production, and government revenues.
2. Investigate the relationship between natural resources and economic development through a cross-country study and macroeconomic comparison of resource-rich countries that have experienced "resource curse" with those that have experienced "resource blessing".
3. Survey the development policies and management practices of resource-rich countries to make policy recommendations for mining and petroleum industries in Cambodia

The projection of the potential impacts of the oil and gas industry on Cambodia's economy uses the input-output analysis. Different percentage simulations are used because the initial estimates are not the official or final data released by the government of Cambodia or the exploration companies. In addition, the preliminary estimations are still under highly uncertainty because of the complex geology of Cambodia's reservoirs, which requires further exploration activities by drilling wells in all the blocks in the offshore area. Hence, to properly study the impacts of the oil and gas industry, it is more reasonable to set a range of production-reserve success rates.

To achieve the second objective, a cross-country investigation employs the common conditional convergence growth model. Furthermore, this study develops its estimation techniques by integrating methodological developments in the literature to avoid common mistakes that lead to a misinterpretation of the relationship between natural resources and economic development. More importantly, this study finds that there is a conditional rather than an absolute relationship.

For the comparison between resource-cursed and resource-blessed countries, macroeconomic models are built for two countries: Norway and Nigeria. They are chosen not only because of their similar natural resource abundance, but also because of their contrasting experiences in reaping the benefits from their natural endowments. The two macroeconomic models illustrate the divergent experiences of the impacts of the resource sector on their respective economies.

To achieve the third objective, this study surveys and discusses varied research on country experiences in the management policies and practices of the mining and petroleum industries. Finally, policy recommendations are given based on Cambodia's macroeconomic and institutional environment.

1.5 Dissertation Structure

This dissertation has seven chapters. **Chapter 1** discusses the significance, objectives and methodologies of this research. In addition, it introduces the general background of Cambodia's economic structure and the magnitude of its oil and gas industry.

Chapter 2 estimates the potential of the offshore oil and gas industry in Cambodia. This chapter shows the impacts of this industry on gross domestic product, the contribution to national income, employment creation and government revenues. It also discusses the impacts on both upstream and downstream sectors. Given the challenges of oil and gas industry, this chapter provides a precaution and a reasonable anticipation on the future of this industry.

Chapter 3 surveys the literature on the link between natural resources and economic growth. This chapter initially shows the resource curse findings by many researchers. Resource-rich countries, on both theoretical and empirical bases, are found to have grown slower than resource-poor countries. However, as some researchers argue, resource-curse findings are plagued with several methodological mistakes. The measurements of natural resources, sensitivity to the time period used, and endogeneity problems have complicated the cross-country findings of the resource curse. Finally, there is a general trend that posits that the relationship of natural resources and economic growth is conditional upon the macroeconomic and politico-economic channels of the resource-rich countries.

Based on a comprehensive literature, **Chapter 4** re-investigates the relationship between natural resources and economic growth. This chapter draws upon the methodological improvements in the literature and uses two important measurements of the macroeconomic and political environments to study the conditional relationship between natural resources and economic growth. The findings of this chapter yield a breakthrough explanation to this controversial relationship. The measurements of natural resources do not influence the findings of the resource curse while different time periods used provide contradictory results. However, the important conclusion in this chapter is that only resource-rich countries with good macroeconomic and political environments have been blessed by their natural wealth. On the other hand, other resource-rich countries without sufficient macro-economic and political conditions, if not cursed, have not benefited from their advantages.

Chapter 5 emphasizes the divergent experiences between resource-cursed and resource-blessed countries by comparing the macroeconomic impacts of resource exports on domestic economies. Nigeria and Norway both are rich in natural resources, particularly oil and gas, yet after four decades of extraction, Norway has substantially increased its standard of living while Nigeria's is not much higher than before petroleum extraction. Nigeria's unfortunate experiences with natural resources are the results of both poor fiscal and monetary policies. The dominance of the resource sector, the inefficient and forceful public investment, and the low domestic absorptive capacity all have contributed to the crowding out of private investment in the agriculture and manufacturing sectors. The fixed exchange rate before 1986 and its collapse afterwards have pushed the Nigerian Central Bank to pursue a strong monetary expansion that has led to rapid inflation and loss of currency confidence. This further depresses private investment in the non-resource tradable sector.

Based on the discussion and the findings from the previous chapters, **Chapter 6** discusses good management and policy practices to ensure that resource-rich countries can gain maximum benefits from their natural resources. This chapter looks at various experiences of both resource-blessed and resource-cursed countries and gives policy recommendations to new and potential resource-rich countries including Cambodia.

Chapter 7 summarizes the findings from the main chapters and conducts a SWOT analysis on the future oil and gas industry in Cambodia. Finally, this chapter draws a conclusion about the future of oil and gas industry in Cambodia. What is the potential of the oil and gas industry in Cambodia? In addition, what should Cambodia do to escape the resource curse and reap maximum benefits from its potential natural resources?

Chapter 2: The Potential of Offshore Oil and Gas Industry in Cambodia

2.1 Introduction

Cambodia’s GDP growth is currently fueled by the garment, tourism, construction and rice sectors. However, Cambodia is about to face a golden opportunity in the very near future. In 2005, Chevron announced Cambodia’s first significant oil and gas discovery, bringing different perspectives to Cambodia’s development prospects.

Many international organizations, including the International Monetary Fund, the World Bank, and the United Nations Development Programme have been actively involved in policy discussions and recommendations to provide technical assistance to the Royal Government of Cambodia. At the same time, the RGC and its private partners are also making a huge investment in oil and gas exploration in both the offshore area and the Tonle Sap Lake area.

Certainly, the recent initial estimates of the oil and gas industry in Cambodia are good news for the future development of this country, which is in need of both domestic fuel sources and investment capital. However, what is known about this new industry is very limited and subject to further information to be released by contractors who are given rights to explore potential blocks in both offshore and onshore areas. The production stage has been delayed constantly without specific reasons. Coupled with the lack of knowledge about its economic potential, interest in the oil and gas industry is fading, which may lead to public negligence. It is important to have a proper projection on the potential of the future oil and gas industry in Cambodia so that various stakeholders can shape their expectations appropriately.

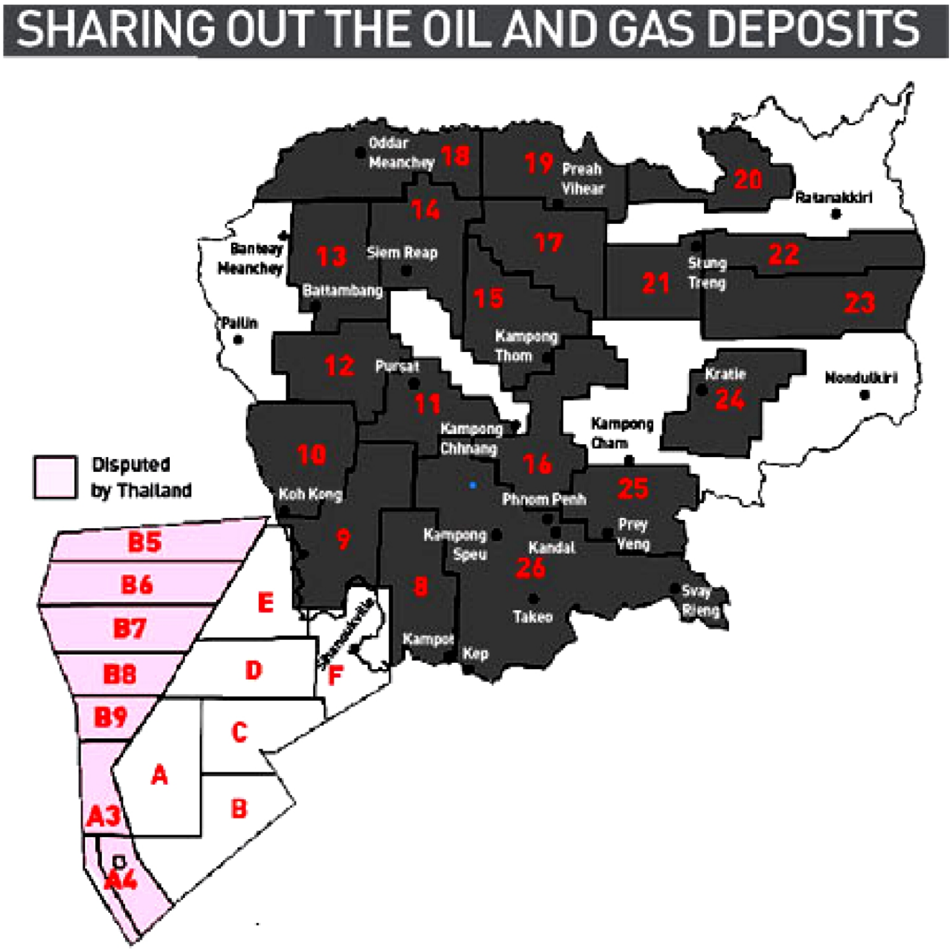
The objective of this chapter is to make an educated estimate on the potential of the offshore oil and natural gas industry in the future.

This chapter is organized in the following way. Section 2.2 gives an overview of the current situation of the petroleum industry in Cambodia. Section 2.3 discusses some challenges for this industry. Section 2.4 describes the objective and the methodology used in this study. Section 2.5 describes and discusses the simulation results, and Section 2.6 concludes the discussion.

2.2 The Current Situation of the Oil and Gas Industry in Cambodia

Oil and gas activities in Cambodia are still at the exploration stage despite five decades of very slow progress and constant delays (Lim, 2006). The history of oil and gas exploration in Cambodia dates back to the early 1960s when Polish geologists conducted geological and structural mapping and found some oil seeps and outcrops. From 1972 to 1974, Elf and Esso conducted the first offshore operation by drilling three wells, but everything came to a halt during the Khmer Rouge regime from 1975 to 1979. Later in the late 1980s, a co-venture by Cambodian and Russian geoscientists went through a series of explorations in both offshore and onshore areas. Because of this study, offshore and onshore areas were divided into various blocks (see Figure 2-1). Three regions remain un-delineated; one is on the western border with Thailand, another in the far northwest, and the other is an area stretching around Block 24.

Figure 2-1: Cambodia's Oil and Gas Blocks



Source: Cambodia National Petroleum Authority (CNPA)

According to UNDP Cambodia (2006), it has been provisionally but conservatively estimated that there is a significant amount of oil and natural gas resources, lying in the four exploratory wells of Block A. Having drilled many wells in this block by 2005, Chevron confirmed that it might contain as much as 500 million barrels of recoverable oil and 3 trillion cubic feet of gas. Block A is not the only block that has potential oil and gas reserves. In 2007, the Chinese CPHL Company completed its seismic survey of the 360 square kilometers of Block D and concluded that the total reserve could be as much as 227 million barrels of oil and 496 billion cubic feet of gas (May & Mullins, 2010). Together with other blocks in the

37,000 square kilometers, there may be as much as two billion barrels of oil and 10 trillion cubic feet of gas (UNDP, 2006). The area of overlapping claims also has potential according to previous survey and exploration results. Furthermore, oil and gas resources in adjacent areas in the Gulf of Thailand, which are being extracted, add more optimism that oil and gas reserves in the Overlapping Claims Area can be quite large. The 27,000 square kilometers have been estimated to contain up to 11 trillion cubic feet of natural gas and underdetermined quantities of condensate and oil according to some estimations (A. A. Robinson, n.d.).

These initial estimates are still uncertain until further results are released by companies exploring these blocks, especially Blocks B, C, E, and F. Nevertheless, to some extent these estimates can act as a benchmark to forecast the potential impacts on Cambodia's economy during the production stage.

Production of these newly found resources has been postponed repeatedly without specific explanations. One reason is the complex geography of Block A; the reserves are dispersed rather than in one core field (Reuters, 2008). However, it is suspected that there is disagreement over revenue sharing between the government and US energy giant Chevron (AFP, 2010). The oil and gas industry involves many phases of development; one report from the Economic of Institute of Cambodia (2008) described 22 phases of technical petroleum operations. The first 13 phases belong to the exploration stage; 14 to 19, development stage; and 20 to 22, production stage. Each phase may take years to be completed because many activities need to be completed.

In 2008, Chevron of Block A was at the early stage of development planning, probably phase 14 or phase 15. Until the phase 20 of the production stage, it may take up to four years. Therefore, originally 2012 was projected as the year Cambodia's first oil production would start, as the Prime Minister set it as the deadline for Chevron, which completed the environmental impact assessment for development in March 2012 (Weinland, 2012a). However, in July 2012 Chevron once again surprised the public by announcing that the production stage of Block A would be postponed until 2016 (Weinland, 2012b). At the same time, Block D remains silent despite its initially estimated 227 million barrels of recoverable oil reserves and 496 billion cubic feet of natural gas. Other offshore and onshore blocks are still at the early stage of exploration while the overlapping claims area with Thailand will take years to develop, and only if the two countries agree on any model of oil and gas sharing.

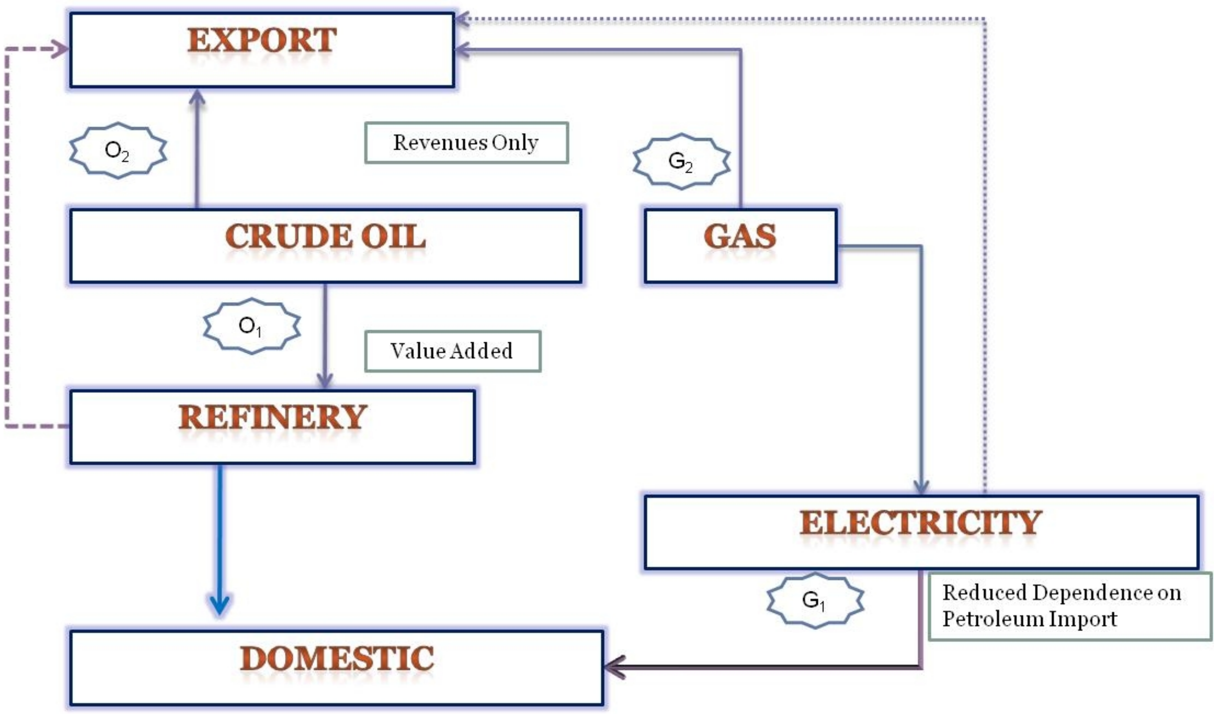
2.3 The Challenges of the Oil and Gas Industry in Cambodia

2.3.1 Development Options

Cambodia is yet to publish any finalized development policy for the oil and gas industry. Several options are still open for discussions, depending on the commerciality and size of the reserves. There are four specific development options under the consideration of the Cambodian National Petroleum Authority (CNPA). They were summarized by H.E. Mr. Ho Vichet, the vice chairman of the CNPA, in a public presentation (Ho, 2010).

The four development options for the oil and gas industry present different benefits and challenges to Cambodia's economy (see Figure 2-2). O_1 represents the development option of building a refinery. O_2, in contrast, assumes that crude oil should be exported to the international market. G_1 is the option that Cambodia desires most among all the development options for natural gas. Using natural gas to generate electricity through power plants provides the most benefits, given that Cambodia is in dire need of more accessible and cheaper electricity. Otherwise, natural gas will have to be exported to Thailand through existing pipelines in the Gulf of Thailand, which is option G_2.

Figure 2-2: Oil and Gas Industry Development Options



Source: Author's conceptualization based on Ho, 2010

Downstream development options O_1 and G_1 can reduce Cambodia's total dependence on imported petroleum products from neighboring countries, which could prove significant for development in several ways. One is the national security of Cambodia and the predictability of fuel supplies. Most of Cambodia's imported petroleum products originate from the Middle East countries, a region with highly politically driven petroleum policies. With its own capacity to generate electricity and refined petroleum products, especially diesel, gasoline, liquefied petroleum gas and fuel oil, Cambodia could reduce the risks of insufficient supply of petroleum products and sudden price increases by making its own petroleum policies. In addition, a refinery and a natural-gas-based electricity plant could bring added value and employment to Cambodia's economy to some extent.

On the other hand, the downstream development of crude oil and raw gas presents several significant challenges. One, of course, is the size of Cambodia's oil and gas reserves. The economies of scale are everything when it comes to refining. In the case of oil, for example, there are fixed costs associated with a refinery. Hydro-treating and other processes must be in place, which requires a huge initial investment. Furthermore, the cost per unit size increases with an increasing overall size of the processing unit with a power of only 0.6 (World Bank, 2008). That is, if a 15,000 bpd unit costs 150 million US dollars to construct, a 30,000 bpd unit will not double the cost; yet it will increase it to only 227 million US dollars.

On top of the economies of scale, refining crude oil has to match the different mix of demands for petroleum products. The use of petroleum products has been changing over time as global trends shift from one type of fuel to another for economic, environmental and political reasons. This can cause a shortage of some products and a surplus of others. In addition, compliance with fuel specifications set by governments can make refining processes more costly. The regulations regarding gasoline's volatility and the amount of sulfur, metals and aromatics can easily cost a refinery a fortune to meet.

Crude oil has a wide market and can be sold directly or through traders to refineries. Similarly, natural gas can be connected to Thailand through existing gas pipelines in the region. Exporting crude oil and raw gas, therefore, is an easier option. The government, in this case, is concerned only with revenue management and spending policies.

2.3.2 Uncertainties in Reserves Accounting

There is no definitive estimation of Cambodia's offshore oil and gas reserves, including the overlapping claims area with Thailand. So far, only Block A and Block D have been found to hold significant resources with specific figures. Table 2-1 provides the initial estimates of all the possible resources lying under Cambodia's offshore areas. Roughly, there are 2,000 million barrels of oil and 15,500 billion cubic feet of natural gas, assuming that a 50-50 production-sharing agreement is reached in the OCA.

Table 2-1: Initial Estimates of Cambodia's Oil and Gas Resources[1]

	Oil (in million barrels)	Gas (billion cubic feet)
Block A	500	3,000
Block D	227	496
Other offshore blocks	1,273	6,504
OCA blocks	-	5,500
Total	**2,000**	**15,500**

Source: Various sources including UNDP, 2006, May and Mullins, 2010, and A. A. Robinson, n.d.

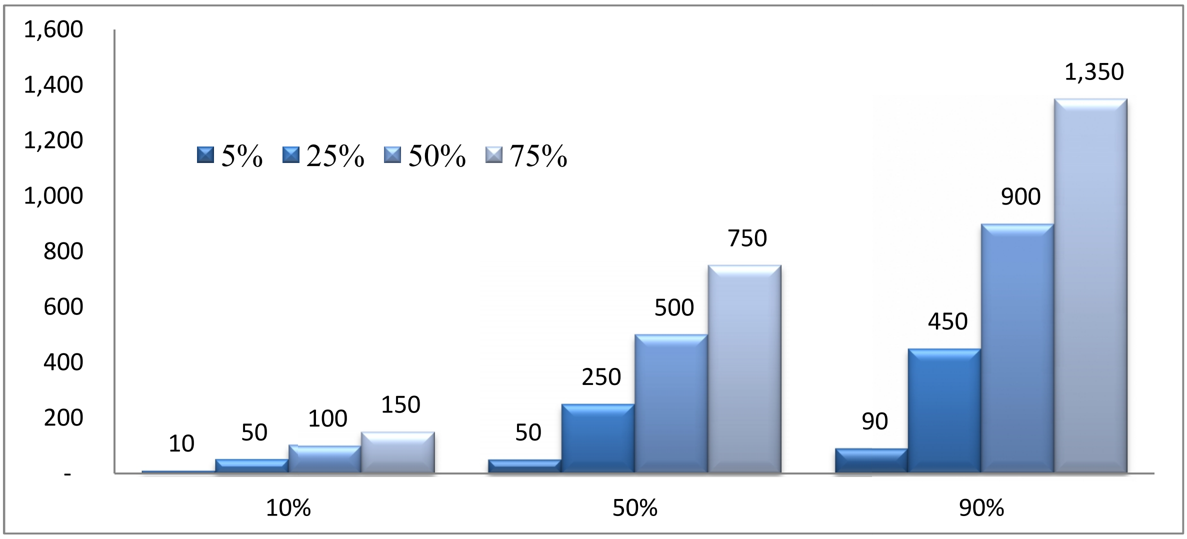
However, there are always uncertainties in estimating oil and gas reserves and in accounting for all the recovery factors associated with their extraction. One of the greatest uncertainties is geologic factors. Well drilling data can only directly measure a small portion of the reservoir while the rest is inferred by seismic data. There can be small faults and sand channel boundaries that can negatively influence the estimated data. In fact, in the oil and gas industry, recoverable reserves are linked to the amount of resources-in-place through a recovery factor, which may range from 5 to 75 per cent depending on many technical aspects

[1] Resources and reserves are similar terms referring to the stock of total oil and natural gas under the ground. The former is the more uncertain estimate and the latter is more commonly used to estimate a country's richness in oil and natural gas.

of their reservoirs (EIC, 2008). Furthermore, the extent of the resources-in-place is subject to the degrees of probability. Resources thought to be in place are considered proven, probable, or possible depending on whether it has a 90 per cent, 50 per cent, or 10 per cent confidence level of being present. In the same way, oil and gas reserves are considered either proven, probable, or possible recoverable reserves if there is a corresponding chance of recovery of 90 per cent, 50 per cent, or 10 per cent respectively.

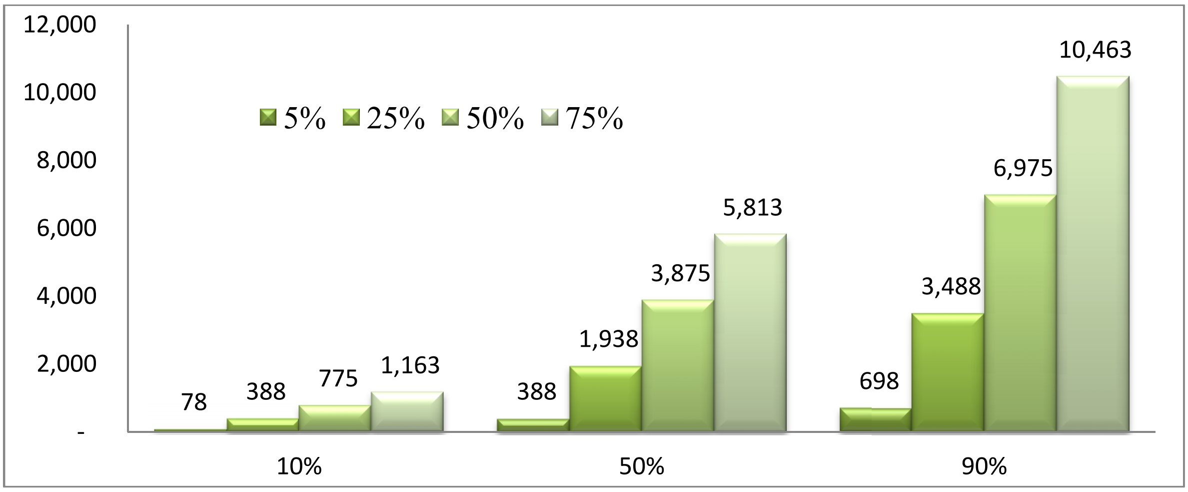
In short, the recovery factor may range from 5 to 75 per cent while there is a probability of 10, 50 and 90 per cent of initial estimated resources to be found. Therefore, Cambodia's offshore oil reserve may ultimately range from as low as 10 million barrels with a probability of 10 per cent and a recovery factor of 5 per cent to as high as 1,350 million barrels at 90 and 75 per cent (see Figure 2-3 and Figure 2-4). Being neither optimistic nor pessimistic, if average-case scenarios are taken, Cambodia should expect from 250 to 750 million barrels of oil lying under its offshore area. Similarly, natural gas should also be estimated with the same standard, taking account of the recovery factor and the probability. The worst-case scenario with the recovery factor of 5 per cent and 10 per cent probability puts the estimated reserve of natural gas at only 78 billion cubic feet while the best-case scenario is equal to 10,463 billion cubic feet. Again, in average-case scenarios, Cambodia should expect from two trillion cubic feet to four trillion cubic feet of natural gas.

Figure 2-3: Oil Reserve Re-estimation (Unit: million barrels)



Source: Author's calculation by recovery factor and probability based on various sources including UNDP, 2006, May and Mullins, 2010, and A. A. Robinson, n.d.

Figure 2-4: Natural Gas Reserve Re-estimation (Unit: billion cubic feet)



Source: Source: Author's calculation by recovery factor and probability based on various sources including UNDP, 2006, May & Mullins, 2010, and A. A. Robinson, n.d.

2.3.3 Managing Public Expectations

The above discussion on the uncertainty of the estimated amount of oil and gas resources is an important reminder that any projection of the amount of future reserves is highly subject to change. So far, only a few reports, such as the UNDP paper (2006) and the IMF report (Davies, Ntamatungiro, & Luengnaruemitchai, 2007), have put concrete figures to the oil and gas revenues, reserves and production year, yet with their own particular assumptions. Thus, it is misleading when the media quote directly from these reports without full understanding or elaboration of the assumptions behind those figures. This can lead to inflated expectations at first and despair later if the significance of the oil and gas industry is not as high as expected. This can pose several important problems, such as difficulties in development planning, social mistrust, and economic downturns (EIC, 2008).

It should be noted that the two main expectations from this potential new industry are employment and a decrease in gasoline price. Oil and gas production and refining do not provide many jobs due to their high-capital and high-tech characteristics. Moreover, not many Cambodian workers will have sufficient skills for this industry. Petroleum companies may bring qualified technicians from abroad unless there is an agreement that local employees should be trained. Even if a refinery is built, only 220 workers are required at an 88,000 bpd refinery and 820 at a 340,000 bpd refinery (World Bank, 2008).

Gasoline price decrease is another expectation that is not realistic. The world market has exclusive rights to determine gasoline and petroleum product prices. Unless the government of Cambodia is willing to subsidize prices of petroleum products, little can be done against the force of the world market. It is important to ensure that the public are informed through reliable channels about the challenges of the oil and gas industry; otherwise, unrealistic expectations can either pressure the government to choose wrong policies or lead to public negligence towards this industry. Neither are good for public participation in the industry.

2.3.4 The Natural Resource Curse

The last but most important risk of the oil and natural gas industry in Cambodia is the curse of natural resources. Management of natural resource production and the revenue spending of many resource-rich countries in recent history has proven that natural resources have a complicated relationship with economic development. Numerous theoretical and empirical studies have found that there is a negative relationship between natural resource dependence and economic growth (Gylfason, 2001; Sachs & Warner, 1995, 1997, 2001). In other words, resource-rich countries have grown more slowly than resource-poor countries. This challenge is discussed in the following chapters.

2.4 Research Objective and Methodology

Having discussed the challenges of the oil and gas industry, this study considers the management of public expectations very important. It is the objective of this study to make an educated guess about the potential of this industry so that the public understands the magnitude of its windfall, and expectations can be managed appropriately.

2.4.1 Input-Output Model

This study makes a short-term projection of the impacts of the oil and gas industry on Cambodia's economy by using the input-output model. As a prerequisite, there must be an input-output table for the Cambodian economy. There is no official input-output table for Cambodia. However, recently a Cambodian researcher has unofficially built two tables for Cambodia's economy in 2003 and 2008 (Oum, 2007). Due to the unavailability of extensive survey data on the structure of Cambodia's economy, Oum used the tables of Vietnam and

Thailand obtained from the Global Trade Analysis Project (GTAP). The main sources of data for Cambodia are from the Economic Institute of Cambodia, the Cambodian National Institute of Statistics, the National Bank of Cambodia, the World Bank, the IMF, and other institutions.

The 2008 Input-Output Table for Cambodia has 22 aggregated sectors. The crude petroleum sector and petroleum refining sectors are new in Cambodia's economic structure. Therefore, this study uses the technical coefficient matrix of Thailand's crude petroleum sector and petroleum refineries sector in 2005 and adds them to Cambodia's technical coefficient matrix as N+1 and N+2 sectors (refer to Miller & Blair, 2009, pp. 636–637).

2.4.2 Study Areas

Direct, indirect and induced effects are studied based on this 2008 table to project all possible impacts of this new industry on other sectors in the economy. This impact study will make a projection on job creation and eight areas of income distribution, including gross value added, skilled wages, unskilled wages, capital, land, taxes, tariffs, and leakages to imports. Table 2-2 shows nine study areas to understand the impacts of the oil and gas industry in Cambodia. All of them are per one million US dollars.

Forestry, Fishery, OthCrops, and Livestock sectors have the highest value added while ElecGasWater, BasFabMetlPrd, and FoodBevTbaco sectors have the smallest value added per one million US dollars of output. On average, the value added of Cambodia's sectors is around 46.8 per cent of total output. Unskilled labor in OthCrops, Livestock, Fishery, and Paddy sectors receive the highest wages per one million US dollars of output. Skilled labor receives the highest share of value added in the service sectors. The capital share in value added is high in the Forestry, HotelRest, and Trade sectors while people who own land receive value added from 15 per cent to 30 per cent of total output in agricultural sectors. Government tax has the highest share of value added in Forestry and ChemRubPlas sectors while the tariff is highest in ChemRubPlas and OthManuf sectors due to the high concentration of imported products in these two sectors.

Imports per one million US dollars of output are very high in sectors 10 to 13. The ChemRubPlas sector's imports are explained by both high intermediate and consumers' imported petroleum products. OthManuf sector has high imports per one million US dollars of output mainly due to imported consumer products such as electronic equipment, machinery, vehicles, and transport equipment.

Lastly, employment per output is highest in Paddy, OthCrops, and Livestock sectors followed by Trade sector while ElecGasWater and RealEstBus sectors employ the fewest workers per one million US dollars of output. Any interpretation of the number of jobs per one million US dollars of output should be done with reservation for two reasons. One is that employment may not be subject to linear estimation as in the case of output and gross value added. In other words, if one million US dollars of output on average creates 484 jobs, 10 million US dollars of output may not create 10 times more jobs, since workers can increase their productivity because of the economies of scale or the change in management structure. The other limitation in employment interpretation is intrinsic to Cambodia's prevalent under-employment problem. This is especially true in more traditional sectors such as agricultural sectors. When there is a stronger demand for input from these sectors, workers in these sectors can work more hours instead of increasing the number of new jobs.

Table 2-2: Value Added, Employment, and Import (per one million US$)

US$ 1 million	GVA	Unskilled	Skilled	Capital	Land	Tax	Tariff	Job	Import
1 Paddy	0.434	0.264	0.001	0.020	0.146	0.003	0.000		0.003
2 OthCrops	0.840	0.638	0.001	0.024	0.176	0.001	0.002	2053	0.108
3 Livestock	0.830	0.560	0.002	0.032	0.235	0.001	0.000		0.001
4 Forestry	0.998	0.063	0.000	0.777	0.119	0.038	0.000	262	0.000
5 Fishery	0.959	0.366	0.001	0.298	0.291	0.003	0.000	649	0.000
6 Mining	0.398	0.105	0.016	0.216	0.054	0.008	0.000	367	0.000
7 FoodBevTbaco	0.105	0.030	0.006	0.059	0.000	0.011	0.010		0.137
8 TCF	0.279	0.077	0.011	0.182	0.000	0.009	0.014		0.695
9 WoodPaperPrt	0.332	0.032	0.005	0.279	0.000	0.016	0.002		0.158
10 ChemRubPlas	0.221	0.043	0.010	0.131	0.000	0.037	0.513	152	3.739
11 NonMetlMin	0.240	0.041	0.007	0.183	0.000	0.008	0.016		1.219
12 BasFabMtlPrd	0.097	0.023	0.004	0.068	0.000	0.002	0.102		1.311
13 OthManuf	0.234	0.047	0.008	0.171	0.000	0.008	0.523		4.894
14 ElecGasWater	0.087	0.010	0.005	0.069	0.000	0.003	0.001	50	0.051
15 Construction	0.497	0.138	0.025	0.321	0.000	0.013	0.000	347	0.024
16 Trade	0.786	0.216	0.045	0.509	0.000	0.015	0.000	1532	0.003
17 TranspComm	0.429	0.035	0.009	0.380	0.000	0.006	0.004	195	0.141
18 HotelRest	0.786	0.216	0.045	0.509	0.000	0.015	0.001	197	0.080
19 Finance	0.404	0.029	0.022	0.335	0.000	0.018	0.000	164	0.021
20 RealEstBus	0.270	0.060	0.045	0.157	0.000	0.008	0.002	40	0.126
21 PubAdmin	0.477	0.080	0.122	0.276	0.000	0.000	0.000	240	0.014
22 OtherServ	0.593	0.061	0.044	0.470	0.000	0.019	0.000	528	0.005
Average	**0.468**	**0.142**	**0.020**	**0.248**	**0.046**	**0.011**	**0.054**	**484**	**0.579**

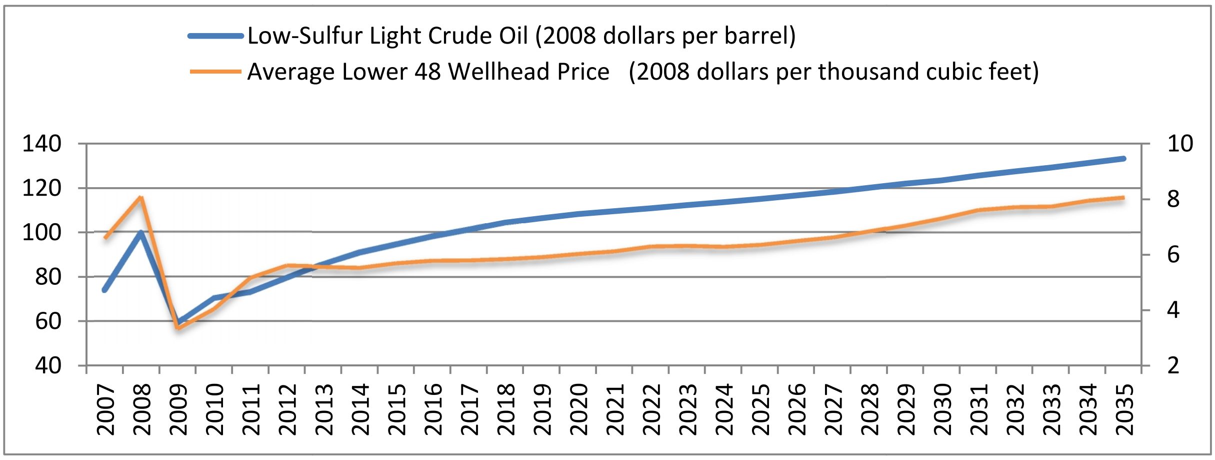
Source: Author based on the 2008 input-output table and the employment data from IMF, 2009

2.4.3 Forecasts of Prices and Costs

The potential impacts of the oil and gas industry in Cambodia cannot be projected without another set of assumptions: the forecasts of prices and costs. Throughout the history of the oil and gas industry, real prices have been on an upward trend, which is understandable considering the forces of demand and supply in the market. Nevertheless, there are times when prices drop. In an industry characterized by wild fluctuations, there is the saying “up like a rocket, down like a feather” to explain the prices of crude and refined petroleum products. Prices can jump up like a rocket in a fortnight mainly due to political reasons and war, but they drop slowly mainly due to economic recessions.

Despite the sharp price drop of crude oil in 2008 in response to the global economic recession, the International Energy Agency (2010) projected a 36 per cent increase in primary energy demands between 2008 and 2035, while production of crude oil may peak at 86 million barrels per day just before 2020. Therefore, prices of crude oil, natural gas, and other primary energy fuels are expected to rise gradually. Similarly, the Energy Information Administration of the US also projects that the era of cheap oil and gas is over (EIA, 2010). After the price drop in 2008 and 2009 due to the recession, the prices of both crude oil and natural gas in the US will gradually rise to and keep rising above their pre-crisis level (see Figure 2-5).

Figure 2-5: 2007-2035 Projections of Prices of Crude Oil and Natural Gas



Note: Low-Sulfur Light Crude Oil Weighted is the average price delivered to U.S. refiners. Wellhead price is the value at the mouth of the well.

Source: EIA, 2010

For the sake of studying the impacts of the oil and gas industry in Cambodia, assumptions must be made in terms of prices and costs. In addition, conservative assumptions should be employed to avoid over-estimation of any effects of this new industry on

Cambodia's economy. Therefore, for this analysis, the price of oil is assumed at 60 US dollars per barrel and the price of natural gas is 5 US dollars per thousand cubic feet. The cost of producing one barrel of oil is 25 US dollars and the cost of producing natural gas is assumed at 4 US dollars per thousand cubic feet.

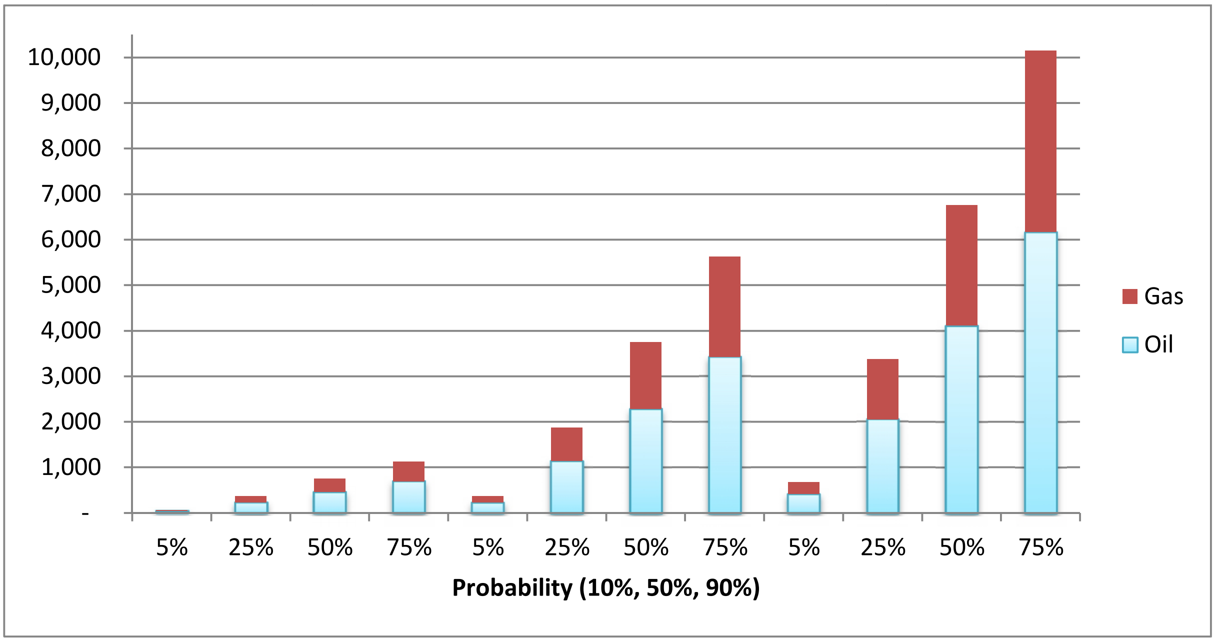
2.5 Simulation Results

2.5.1 Upstream Impacts of the Oil and Gas Industry

This study assumes that the life span of this industry is 20 years. In the upstream sector, oil and gas production can be for either the export market or the domestic downstream market, if commercially viable. Either way will present similar impacts on Cambodia's economy through industrial linkages with other sectors.

Figure 2-6 below provides the whole picture of the total effects of the oil and gas industry on Cambodia's economy through direct, indirect, and induced effects. Annually, the total effects on the economy of oil and gas production can be as small as 46 million US dollars and as large as 10 billion US dollars in terms of total output. With a probability of 10 per cent (which means only 10 per cent of initial estimates can be found), the total effects of the oil and gas industry can be 75, 376, 752 and 1,127 million US dollars with the recovery factors of 5, 25, 50 and 75 per cent, respectively. Assuming 50 per cent probability, total output produced and induced by oil and gas industry can range from 376 to 5,637 million US dollars. If 90 per cent of initial estimates can be found, total output will range from 676 to 10,147 million US dollars annually.

Figure 2-6: Total Effects on Total Output (million US$)



Note: Recovery factor is from 5% to 75%. The first 4 columns correspond to the 10% probability; the subsequent 4 columns, 50%, and the last 4 columns, 90%.

Source: Author's calculation based on the 2008 input-output table

Total output and GDP contribution can be related through the value added as shown in Table 2-2. Taking the worst-case scenario of oil production only (with a probability of 10 per cent and a recovery factor of 5 per cent), annually oil production is worth around 21.5 million US dollars through its own output and 5.6 million US dollars through linkages with other sectors (see Table 2-3). Capital owners are expected to gain more than 60 per cent of total value added. Wages are paid 26 per cent. Interestingly, government's tax on oil and gas sector can be around 14 per cent of the total value added, which is much higher than in other sectors in the economy. Under this worst-case scenario, around 6,739 jobs can be created, not counting direct jobs in the oil and gas sector itself. Imports, on the other hand, are expected to increase by 6.7 million US dollars. The strongest import flow will be in the OthManuf Sector, which is about 70 per cent of total import increase.

Table 2-3: Impacts of Oil Production on the Economy

Million US$	GVA	Unskilled	Skilled	Capital	Land	Tax	Tariff	Employment	Import
1 Paddy	0.4	0.2	0.0	0.0	0.1	0.0	0.0		0.0
2 OthCrops	0.4	0.3	0.0	0.0	0.1	0.0	0.0	3,430	0.0
3 Livestock	0.3	0.2	0.0	0.0	0.1	0.0	0.0		0.0
4 Forestry	0.3	0.0	0.0	0.2	0.0	0.0	0.0	77	0.0
5 Fishery	0.4	0.2	0.0	0.1	0.1	0.0	0.0	272	0.0
6 Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15	0.0
7 FoodBevTbaco	0.2	0.1	0.0	0.1	0.0	0.0	0.0		0.2
8 TCF	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.1
9 WoodPaperPrt	0.1	0.0	0.0	0.1	0.0	0.0	0.0		0.0
10 ChemRubPlas	0.0	0.0	0.0	0.0	0.0	0.0	0.1	516	0.4
11 NonMetlMin	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.1
12 BasFabMtlPrd	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.2
13 OthManuf	0.2	0.0	0.0	0.2	0.0	0.0	0.5		4.9
14 ElecGasWater	0.1	0.0	0.0	0.0	0.0	0.0	0.0	32	0.0
15 Construction	0.1	0.0	0.0	0.1	0.0	0.0	0.0	63	0.0
16 Trade	0.7	0.2	0.0	0.4	0.0	0.0	0.0	1,274	0.0
17 TranspComm	0.4	0.0	0.0	0.4	0.0	0.0	0.0	191	0.1
18 HotelRest	0.1	0.0	0.0	0.0	0.0	0.0	0.0	17	0.0
19 Finance	0.1	0.0	0.0	0.1	0.0	0.0	0.0	57	0.0
20 RealEstBus	1.0	0.2	0.2	0.6	0.0	0.0	0.0	154	0.5
21 PubAdmin	0.2	0.0	0.1	0.1	0.0	0.0	0.0	99	0.0
22 OtherServ	0.6	0.1	0.0	0.5	0.0	0.0	0.0	542	0.0
OilCoal&NG	21.5	5.2		12.9		3.4	0.0	-	0.0
Total	27.1	7.1		16.4		3.5	0.6	6,739	6.7
Oil: Worst Case Scenario with 10% Level and 5% Recovery Factor									

Source: Author's calculation based on the 2008 input-output table

Table 2-4 and Table 2-5 give all possible magnitudes of economic contribution of the oil and gas industry. Under the worst-case scenario, oil and gas production is not significant at all to Cambodia’s economy. Only around 0.6 per cent of GVA can be created by this new industry. Employment created indirectly through linkages with other sectors is only 0.1 per cent of the total labor force. However, government tax can be increased by 3.9 per cent.

In the best-case scenario, which is very rare in the oil and gas business, the economic contribution from oil and gas production is very significant for Cambodia's economy. Under this scenario, 90 per cent of initial estimates can be found and 75 per cent can be recovered. If this is true, linkage effects on other sectors from the oil and gas industry alone can be 18.5 per cent of gross value added. In addition, to supply input for oil and gas industry, all sectors in Cambodia will have to employ roughly 1.5 million workers or 17.9 per cent of the total labor force in 2007. On the negative side, imports can be expected to increase by 1,480.7 million US dollars or by 24.2 per cent to supply input to all sectors. More importantly, economic impacts from the direct output of oil and gas industry are enormous. Under this scenario, gross value added from direct output of oil and gas industry is equal to 4,774.4 million US dollars or 71.3 per cent of GVA, 20 per cent and 60 per cent of which are labor share and capital share, respectively. Government tax is around 20 per cent of GVA created by the direct output of the oil and gas industry, which is about five times bigger than the government's 2008 tax revenues.

However, a more realistic scenario is a 50 per cent probability and a 25 per cent recovery factor. Under this scenario, the direct, indirect and induced effects of the oil and gas industry can generate around 1,114 million US dollars or 16.6 per cent of GVA annually. Tax revenues from both the petroleum sector and other sectors are equal to the size of the government's tax revenues in the 2008 table[2]. In addition, 277,265 new jobs, or 3.3 per cent

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[2] This direct tax revenue estimation from this input-output analysis is complicated by the fact that Thailand employs different Profit Sharing Contracts from Cambodia. The estimation of government revenues is more accurate in the following section.

of the 2007 labor force, can be created by all sectors through linkage effects of the oil and gas industry. Imported products, on the other hand, are expected to increase by 274.2 million US dollars or 4.5 per cent of 2008 imports.

Table 2-4: Direct Effect of Oil and Gas Industry

New Industry Effect (Million US$)		GVA	Wage	Capital	Tax
Worst Case Scenario with 10% confidence level and 5% recovery factor	Oil	21.5	5.2	12.9	3.4
	Gas	13.9	3.3	8.4	2.2
	Total	**35.4**	**8.5**	**21.3**	**5.6**
	Percentage	**0.5%**	**0.4%**	**0.6%**	**3.8%**
Average Case Scenario 50% confidence level and 25% recovery factor	Oil	537.2	129.1	323.2	84.9
	Gas	346.9	83.4	208.8	54.8
	Total	**884.2**	**212.5**	**532.0**	**139.7**
	Percentage	**13.2%**	**9.0%**	**14.7%**	**94.6%**
Best Case Scenario 90% confidence level and 75% recovery factor	Oil	2,900.9	697.2	1,745.4	458.3
	Gas	1,873.5	450.3	1,127.3	296.0
	Total	**4,774.4**	**1,147.5**	**2,872.7**	**754.2**
	Percentage	**71.3%**	**48.4%**	**79.2%**	**510.7%**

Source: Author's calculation based on the 2008 input-output table

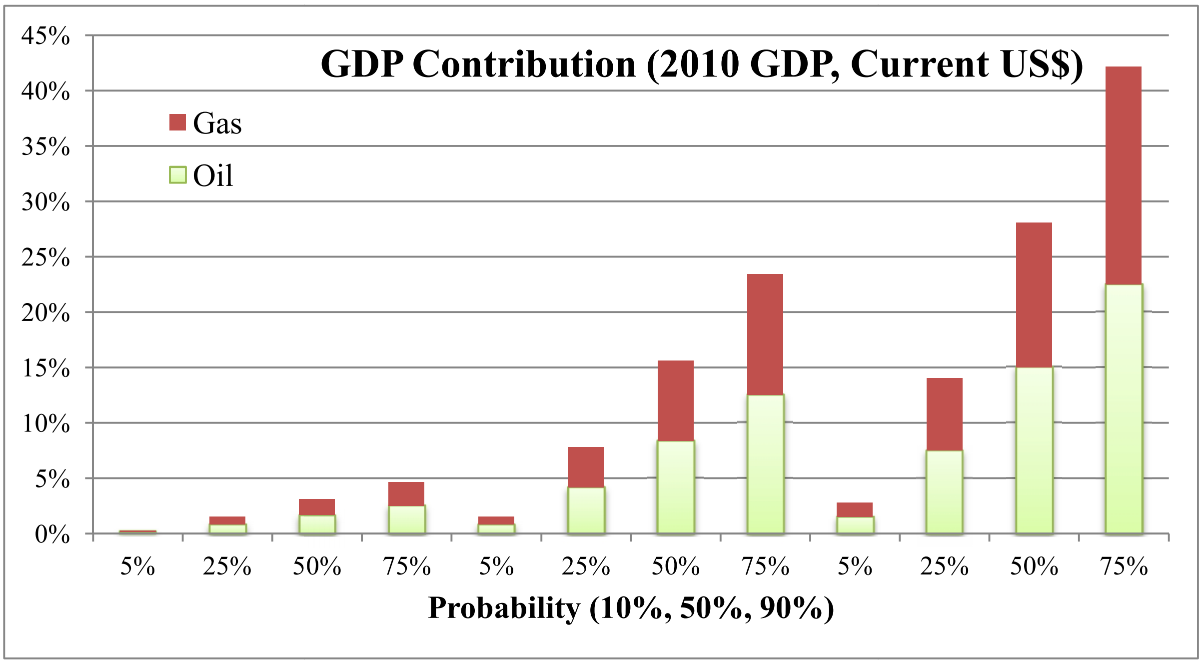
Table 2-5: Linkage Effect of Oil and Gas Industry

Linkages (Million US$)		GVA	Unskilled	Skilled	Capital	Land	Tax	Tariff	Employment	Import
Worst Case Scenario with 10% confidence level and 5% recovery factor	Oil	5.6	1.6	0.4	3.0	0.4	0.1	0.6	6,739	6.7
	Gas	3.6	1.0	0.2	2.0	0.3	0.1	0.4	4,352	4.3
	Total	**9.2**	**2.6**	**0.6**	**5.0**	**0.7**	**0.2**	**1.0**	**11,091**	**11.0**
	%	**0.1%**	**0.1%**	**0.2%**	**0.1%**	**0.1%**	**0.1%**	**0.2%**	**0.1%**	**0.2%**
Average Case Scenario 50% confidence level and 25% recovery factor	Oil	139.7	40.1	9.1	76.2	11.1	3.3	15.6	168,465	166.6
	Gas	90.2	25.9	5.9	49.2	7.1	2.1	10.1	108,800	107.6
	Total	**230.0**	**65.9**	**14.9**	**125.4**	**18.2**	**5.5**	**25.7**	**277,265**	**274.2**
	%	**3.4%**	**3.2%**	**4.6%**	**3.5%**	**3.3%**	**3.7%**	**6.2%**	**3.3%**	**4.5%**
Best Case Scenario 90% confidence level and 75% recovery factor	Oil	754.5	216.3	48.9	411.5	59.8	18.0	84.4	909,709	899.7
	Gas	487.3	139.7	31.6	265.8	38.6	11.6	54.5	587,520	581.0
	Total	**1,241.8**	**356.0**	**80.5**	**677.3**	**98.4**	**29.6**	**138.9**	**1,497,229**	**1,480.7**
	%	**18.5%**	**17.4%**	**24.8%**	**18.7%**	**17.9%**	**20.0%**	**33.5%**	**17.9%**	**24.2%**

Source: Author's calculation based on the 2008 input-output table

The oil and gas industry is a risky business with a low success rate. The best-case scenario is more likely hypothetical than realistic. Therefore, what Cambodia should look forward to is an average case, say 50 per cent of probability and 25 per cent of recovery factor. Ultimately, figures can vary around these scenarios, and more information is needed to precisely project the impacts of the oil and gas industry in Cambodia. With high uncertainty about the oil and gas reserve in Cambodia's offshore area, it is, therefore, best to illustrate a range of economic impacts of the oil and gas industry to accommodate any changes in future figures of oil and gas reserves when more information is available.

Figure 2-7: Contribution from Oil and Gas Industry



Note: Recovery factor is from 5% to 75%. The first 4 columns correspond to the 10% probability; the subsequent 4 columns, 50%, and the last 4 columns, 90%.

Source: Author's calculation

Figure 2-7 provides a spectrum of the economic impacts of the oil and gas upstream sector. Once again, this projection is determined by recovery factors and probability levels. The oil and gas upstream sectors can contribute to Cambodia's GDP ranging from less than one per cent to more than 40 per cent of 2010 GDP. However, the reasonable ceiling should be 16 per cent of 2010 GDP, assuming a 50 percent probability of finding initial estimates and that 50 per cent can be recovered.

2.5.2 Government Revenues

The oil and gas industry is shown to have very minimal linkages with other sectors in the economy. In addition, GDP contribution may not truly represent the economic impacts on Cambodia's national income because all capital owners are foreign investors. What is more important for Cambodia's economy is how much the oil and gas industry can contribute to national income. One channel is through the government revenues from this industry, which is solely determined by the Profit Sharing Contracts with private investors. There are three main sources of government revenues from the oil upstream sector (Johnston, 2009). One is the royalty of 12.5 per cent of the gross revenue (pre-cost-recovery income). Second is oil profit, which is either 45 per cent of post-cost recovery income if daily production is less than 30,000 bpd or 55 per cent if exceeding 30,000 bpd. The third component of the government revenues from the oil and gas industry is the 25 percent income tax.

Future prices and costs of oil and gas extraction in the upstream sector can also significantly affect the government revenues. This study uses a conservative projection of prices and costs. Figure 2-5 is based on EIA's projection of oil and natural gas prices until 2035, which will be high in the coming years. Therefore, for this analysis, the price of oil is assumed to be 60 US dollars per barrel and the price of natural gas is 5 US dollars per thousand cubic feet. The cost of producing one barrel of oil is 25 US dollars and the cost of producing natural gas is assumed as 4 US dollars per thousand cubic feet.

Table 2-6: Sample Government Revenues from Oil

Annual Prod (M' barrels)		**12.50**	**Life**	**20 years**
Price and Cost per barrel		**60.00**		25.00
		Gross Revenue		
Contractor Share		750.00		**Government Share**
		12.5%		
		Royalty		93.75
		656.25		
		312.50		
312.50		***Cost recovery***		
		343.75		
		Profit Oil Split		
154.69	**45%**	34,247	**55%**	189.06
		25%		
(38.67)		***Income tax***		38.67
428.52		Total Income		**321.48**
26.5%	57.1%	(after tax)	42.9%	**73.5%**
Million US$				
Oil: Average Case Scenario 50% Level and 25% Recovery Factor				

Source: Author's calculation based on the model PSC by Johnston, 2009

Table 2-7: All Possible Government Revenues from Oil

Scenario	Revenues (US$ million)	Share of Total Revenues and Grants (2010)	Share of Gross	Share of Economic Profit
Worst-case scenario with 10% confidence level and 5% recovery factor	11.83	0.7%	39.4%	67.6%
Average-case scenario 50% Level and 25% Recovery Factor	321.48	18.4%	42.9%	73.5%
Best-case scenario with 90% confidence level and 75% recovery factor	1,736.02	99.4%	42.9%	73.5%

Source: Author's calculation based on the model PSC by Johnston, 2009

It should be noted that initially the government's revenues will be much smaller due to the recovery cost of contractors during the exploration stage. However, if an average estimation of the whole production period is considered, Table 2-6 illustrates the government's average annual revenue from oil extraction in an average-case scenario with an annual total output of 12.5 million barrels. With an oil price of 60 US dollars, gross revenue is 750 million US dollars. The royalty, therefore, is 93.8 million US dollars; the oil profit split is 189.1 million US dollars (55 per cent of post-recovery profit), and income tax is 38.7 million US dollars. The government's share is 42.9 per cent of gross revenue or 73.5 per cent of economic profit. (See Table 2-7 for the full range of the government's revenues from oil.)

Government employs different terms for the upstream sector of natural gas. If natural gas in any field is not commercially viable, it may be flared away. A fixed 65-35 allocation of gas profit to the advantage of contractors is used in the Model Profit Sharing Contract (PSC) (Insights for Action, 2006b). Furthermore, contractors are guaranteed a 16 per cent real rate of return if natural gas is supplied to the downstream domestic market. As a result, government revenues from natural gas are much harder to project.

Table 2-8 shows a sample revenue flow from upstream natural gas based on the Model PSC. This calculation is based on an average-case scenario with 50 per cent probability and 25 per cent recovery factor. In this case, the revenue from natural gas that will flow into the government's budget is relatively small, only 79.2 million US dollars. This figure is equal to 81.7 per cent of economic profit, assuming that the cost of lifting natural gas from the ground is 80 per cent of the price. In terms of gross revenue, however, the figure is only 16.3 per cent. (See Table 2-9 for the full range of the government's revenues from natural gas.)

Table 2-8: Sample Government Revenues from Natural Gas

Billion Cubic Feet		**96.88**	**Life**	**20 years**
Price and Cost per McF		**5.00**		**4.00**
		Gross Revenue		
Contractor Share		484.38		**Government Share**
		12.5%		
		Royalty		60.55
		423.83		
		387.50		
387.50		***Cost recovery***		
		36.33		
		Profit Split		
23.61	**65%**		**35%**	12.71
	83.7%		16.3%	
		25%		
(5.90)		***Income tax***		5.90
405.21		Total Income		**79.17**
18.3%		(after tax)		**81.7%**
Million US$				
Gas Average Case Scenario 50% Level and 25% Recovery Factor				

Source: Author's calculation based on the model PSC by Johnston, 2009

Table 2-9: All Possible Government Revenues from Natural Gas

Scenario	Revenues (US$ million)	Share of Total Revenues and Grants(2010)	Share of Gross	Share of Economic Profit
Worst-case scenario with 10% confidence level and 5% recovery factor	3.17	0.2%		
Average-case scenario 50% Level and 25% Recovery Factor	79.17	4.5%		
Best-case scenario with 90% confidence level and 75% recovery factor	427.49	24.5%	16.3%	81.7%

Source: Author's calculation based on the model PSC by Johnston, 2009

Put together, government revenues from the upstream oil and gas industry can range from less than 1 per cent to more than 123 per cent of 2010 total revenues and grants (see Table 2-10). In absolute figures, annual revenues from the upstream sector will range from 15 million US dollars to the maximum of more than 2 billion US dollars. As discussed above, the oil and gas industry is so risky that it is better to expect an average case estimation. Therefore, what the government can expect is an average annual revenue flow from the oil and gas industry, which is more than 400 million US dollars or one fifth of 2010 total revenues and grants combined. However, at the beginning and at the end of the production years, revenues will be much smaller than in mid-term production.

Table 2-10: Government Revenues from Oil and Gas Industry's Upstream Sector

Total Government Revenues	Revenues (US$ million)	Share of Total Revenues and Grants (2010)
Worst-case scenario with 10% confidence level and 5% recovery factor	14.99	0.9%
Average-case scenario 50% Level and 25% Recovery Factor	400.65	22.9%
Best-case scenario with 90% confidence level and 75% recovery factor	2,163.51	123.8%

Source: Author's calculation based on the model PSC by Johnston, 2009, Government Revenues and Grants data are from ABD, 2011

2.5.3 Downstream Development

In the downstream sectors of the oil and gas industry, a small refinery and an electricity power plant generated by natural gas are being envisioned as two priorities of the development of this new industry.

2.5.3.1 Refining Crude Oil

Refining crude oil to meet domestic demands is an important step in the development of downstream sectors. In a UNDP study (2006), an oil refinery with a 40,000 bpd capacity can be a big burden on the government's budget. One reason is that a small refinery is very inefficient compared with larger, export-oriented plants in neighboring countries. Prices of domestic refined products will be higher than imported petroleum products. Therefore, to sustain this domestic refinery, the government will have to make two decisions. One is quantitative restrictions on imports, which is not a good solution due to the prevalence of smuggling. The other traditional option, then, is to subsidize the refinery with the share of oil profits that the government is expected to receive from the upstream oil sector.

This subsidy could cost the government up to 100 million US dollars annually based on one analysis (Insights for Action, 2006b, p. 10). However, an oil refinery can significantly reduce or eliminate imported petroleum products depending on the complexity of its configuration. Assuming that this small refinery can meet all domestic demands and that imported petroleum products are no longer needed, this will increase Cambodia's multiplier effects as shown in Table 2-11. The average direct and indirect output multiplier will increase by 6 per cent compared to not having a refinery. Similarly, induced effect will also increase by 4.5 per cent. Therefore, the average total output multiplier will increase by 5.8 per cent. With a new average output multiplier, Cambodia's industrial structure is expected to have stronger linkages.

Table 2-11: Impacts of Imported Petroleum Product Elimination

No imported Petroleum Products		Multiplier
Direct and Indirect Effect	Before	1.430
	After	1.515
	% Change	5.9%
Induced Effect	Before	0.172
	After	0.180
	% Change	4.5%
Total	Before	1.603
	After	1.695
	% Change	5.8%

Source: Author's calculation based on the 2008 input-output table

Table 2-12: Economic Contribution of Petroleum Refinery Sector

Million US$	GVA	Unskilled	Skilled	Capital	Land	Tax	Tariff	Employment	Import
1 Paddy	14.7	9.0	0.0	0.7	4.9	0.1	0.0		0.1
2 OthCrops	14.4	10.9	0.0	0.4	3.0	0.0	0.0	69,569	1.9
3 Livestock	8.8	5.9	0.0	0.3	2.5	0.0	0.0		0.0
4 Forestry	11.4	0.7	0.0	8.8	1.4	0.4	0.0	2,984	0.0
5 Fishery	14.0	5.3	0.0	4.3	4.2	0.0	0.0	9,436	0.0
6 Mining	0.7	0.2	0.0	0.4	0.1	0.0	0.0	607	0.0
7 FoodBevTbaco	6.8	1.9	0.4	3.8	0.0	0.7	0.6		8.9
8 TCF	2.9	0.8	0.1	1.9	0.0	0.1	0.1		7.2
9 WoodPaperPrt	2.5	0.2	0.0	2.1	0.0	0.1	0.0		1.2
10 ChemRubPlas	4.2	0.8	0.2	2.5	0.0	0.7	9.7	9,891	0.0
11 NonMetlMin	0.5	0.1	0.0	0.4	0.0	0.0	0.0		2.7
12 BasFabMtlPrd	0.6	0.1	0.0	0.4	0.0	0.0	0.6		7.8
13 OthManuf	9.6	1.9	0.3	7.0	0.0	0.3	21.5		200.9
14 ElecGasWater	2.4	0.3	0.1	1.9	0.0	0.1	0.0	1,378	1.4
15 Construction	3.2	0.9	0.2	2.1	0.0	0.1	0.0	2,271	0.2
16 Trade	24.7	6.8	1.4	16.0	0.0	0.5	0.0	48,154	0.1
17 TranspComm	16.5	1.3	0.3	14.6	0.0	0.2	0.2	7,501	5.4
18 HotelRest	3.2	0.9	0.2	2.0	0.0	0.1	0.0	791	0.3
19 Finance	5.7	0.4	0.3	4.7	0.0	0.3	0.0	2,298	0.3
20 RealEstBus	32.7	7.2	5.5	19.0	0.0	1.0	0.2	4,818	15.3
21 PubAdmin	7.0	1.2	1.8	4.0	0.0	0.0	0.0	3,513	0.2
22 OtherServ	21.6	2.2	1.6	17.1	0.0	0.7	0.0	19,187	0.2
Crude Oil, Coal &NG	640.7	154.0		385.5		101.2			
Petroleum Refineries	223.4	24.6		63.6		135.3			
Total	1,072.1	250.4		579.7		241.9	33.1	182,396.6	254.1
% Change	16.0%	10.6%		13.9%		163.8%	8.0%	2.2%	4.1%

Source: Author's calculation based on the 2008 input-output table

In addition, a refinery can be a main source of GDP contribution and employment creation through its linkage effects with other sectors. Table 2-12 gives an impact study of a

40,000 bpd refinery, assuming that the profit margin of refining crude oil is 10 US dollars per barrel of oil equivalent. Using the structure of Thailand's Petroleum Refineries sector, petroleum refining activities do not have strong linkages with other sectors, except with Crude Oil, Coal, and NG sector. Gross Value Added that is created by Petroleum Refineries sector is only 223.4 million US dollars, 60 per cent and 30 per cent of which are government tax and capital shares respectively. However, even with relatively small linkage effects on other sectors, indirect employment creation can be almost 200,000 jobs or 2.2 per cent of 2007 labor force.

A 40,000 bpd refinery can generate 135.3 million US dollars of direct tax revenues, while a subsidy of about 100 million US dollars is required to make this small refinery sustainable. Thus, this is not a good business strategy for the government as long as pure economic reasoning is considered. Furthermore, to supply enough crude oil to Cambodia's domestic refinery, at least 40,000 bpd must be produced in the upstream sector. This is equal to about 14.4 million barrels per year, so 300 million barrels of oil must be available in Cambodia's reserves. In other words, a probability of 50 per cent and a recovery factor of at least 25 per cent must be realized for this downstream development option to materialize.

One principal constraint on the downstream development of the oil sector, therefore, is the size of future oil reserves in Cambodia. If the onshore oil exploration yields positive results, adding enough reserves on top of the offshore blocks, there will be a strong possibility that a small refinery will be built to supply domestic demand of petroleum products. Once this option is realized, a petroleum refinery will contribute annually to economic growth in

Cambodia. More importantly, this can also ensure a higher level of national security by reducing dependence on imported petroleum products.

3.5.3.2 Electricity

The second prospect of the downstream sector of oil and gas industry is the downstream development of natural gas in the power generation industry. “Current discussions envision installing a 180 megawatt combined cycle plant” (Insights for Action, 2006a, p. 12). Almost all of Cambodia’s current electricity plants are powered by diesel-fired generators. These plants completely depend on imported diesel from neighboring countries. In the event that a natural-gas power plant can generate electricity at a 180 megawatt capacity, it will reduce the amount of imported diesel.

The economic impacts of such an option are shown in Table 2-13. Operating at full capacity 24 hours per day seven days per week, a 180 MW gas-generated power plant is equal to 1,576.8 million kilowatt hours per year, which is bigger than the 2007 electricity production of 1,378 million kilowatt hours (ADB, 2011). The average retail price ranges from 0.16 to 0.25 US dollars per kilowatt-hour in Phnom Penh, but is higher in the rural area, ranging from 0.3 to 0.6 US dollars per kilowatt-hour. This study assumes that the price of electricity generated by gas power plant is equal to 0.3 US dollars per kilowatt-hour to substitute for other diesel-based power plants. Therefore, annual production is 473 million US dollars.

Table 2-13: Economic Contribution of a Gas-Generated Power Plant

Million US$	GVA	Unskilled	Skilled	Capital	Land	Tax	Tariff	Employment	Import
1 Paddy	2.1	1.3	0.0	0.1	0.7	0.0	0.0		0.0
2 OthCrops	1.7	1.3	0.0	0.0	0.4	0.0	0.0	9,918	0.2
3 Livestock	1.2	0.8	0.0	0.0	0.3	0.0	0.0		0.0
4 Forestry	6.8	0.4	0.0	5.3	0.8	0.3	0.0	1,795	0.0
5 Fishery	1.8	0.7	0.0	0.6	0.5	0.0	0.0	1,221	0.0
6 Mining	1.2	0.3	0.0	0.6	0.2	0.0	0.0	1,085	0.0
7 FoodBevTbaco	1.0	0.3	0.1	0.5	0.0	0.1	0.1		1.3
8 TCF	2.1	0.6	0.1	1.4	0.0	0.1	0.1		5.3
9 WoodPaperPrt	1.4	0.1	0.0	1.2	0.0	0.1	0.0		0.7
10 ChemRubPlas	5.6	1.1	0.3	3.4	0.0	0.9	13.1	1,418	0.0
11 NonMetlMin	0.9	0.2	0.0	0.7	0.0	0.0	0.1		4.5
12 BasFabMtlPrd	1.4	0.3	0.1	1.0	0.0	0.0	1.5		19.5
13 OthManuf	5.8	1.2	0.2	4.2	0.0	0.2	13.0		121.4
14 ElecGasWater	43.4	5.2	2.6	34.1	0.0	1.5	0.3	25,078	25.6
15 Construction	11.8	3.3	0.6	7.7	0.0	0.3	0.0	8,274	0.6
16 Trade	16.5	4.5	1.0	10.7	0.0	0.3	0.0	32,170	0.1
17 TranspComm	7.6	0.6	0.2	6.7	0.0	0.1	0.1	3,446	2.5
18 HotelRest	0.3	0.1	0.0	0.2	0.0	0.0	0.0	71	0.0
19 Finance	7.6	0.5	0.4	6.3	0.0	0.3	0.0	3,088	0.4
20 RealEstBus	2.6	0.6	0.4	1.5	0.0	0.1	0.0	386	1.2
21 PubAdmin	1.3	0.2	0.3	0.7	0.0	0.0	0.0	649	0.0
22 OtherServ	8.5	0.9	0.6	6.7	0.0	0.3	0.0	7,524	0.1
Total	132.6	24.5	6.8	93.8	2.9	4.7	38.7	96,124	183.3

Source: Author's calculation based on the 2008 input-output table

The direct gross value added from this gas-generated power plant will be 43.4 million US dollars annually, which mostly accrues to the capital owner. Linkage effects will boost output in other sectors, which together with direct effects yields an annual gross value added of 132.6 million US dollars and creates roughly 96,124 jobs. Imported products, at the same time, will be increased by 183.3 million US dollars. This means that a gas-generated power plant will increase not only domestic value added but also, to a larger extent, will create value added for countries exporting to Cambodia.

The downstream development of natural gas in the power generation industry is complicated by several constraints, according to a UNDP discussion (Insights for Action, 2006b). One is the 16 per cent minimum rate of return that contractors are guaranteed in the event that natural gas is developed for domestic market. This could be a big burden for the government's revenues from natural gas if the downstream development is not efficient. Secondly, Thailand's existing offshore natural gas infrastructure and its demand for natural gas could be an attractive and cost effective way to sell natural gas. Lastly, there is no domestic market allocation obligation under the Model PSC that will force contractors to sell their share of natural gas to the domestic market.

Once again, as in the case of a refinery for oil, downstream development of natural gas in the power industry may not be realized due to its inefficiency and the costs of installing pipelines and other necessary infrastructure to bring natural gas onshore. Furthermore, the economic contribution from such a plant will be too small for investors to invest heavily in this risky business. However, burning natural gas has environmental advantages compared with other energy sources. Cambodia, whenever possible, should take advantage of this feature by involving in the Clean Development Mechanism (CDM) and other environmental schemes with developed countries.

2.6 Concluding Remarks

This chapter has shown that what is most certain about the oil and gas industry is the upstream sectors. Without enough information about the size of its oil and gas reserves, Cambodia should expect economic contributions from this industry in a range rather than a specific figure. With various realistic assumptions, annual GDP contribution from future oil and gas industry can be about 15 per cent of 2010 GDP, which will act as a main source of economic growth. In addition, around 300,000 new jobs can be created by all sectors through the linkage effects of the oil and gas industry. However, any scenario can happen, which means that the oil and gas industry may not be significant at all to Cambodia's economy.

Even in an optimistic scenario, national income from the oil and gas industry will be small and mainly flow through the government's revenues. Every year the oil and gas industry can contribute more than one fifth of 2010 revenues and grants in an average-case scenario.

The downstream sectors present a different set of challenges. Building a small refinery with the capacity of 40,000 bpd is another potential outcome in the oil industry's downstream sector. Every year, a small refinery could contribute about 223.4 million US dollars to Cambodia's GDP. Together with the upstream oil sector and linkage effects of Refineries sector, about one billion US dollars will be added to the country's value added annually. For national security, this may be worth the 100 million US dollar subsidy, which a UNDP study estimated, if the government needs to keep it sustainable and competitive with imported refined petroleum products. An electricity power plant generated by natural gas, on the other hand, is not worth the huge infrastructure investment needed to bring gas onshore given its small economic contribution, unless its environmental advantage is taken into consideration.

Having projected the economic impacts of the oil and gas industry in Cambodia, this study has three policy recommendations to both the government of Cambodia and relevant stakeholders. Given Cambodia's meager oil and gas resources, policy makers and advisors should focus on revenue management in a way that this new industry provides a long-term benefit rather than only during its windfall period. Efforts should be made to create linkages from oil and gas production to domestic sectors as much as possible to generate income and to create jobs in other sectors. The downstream sectors should be involved with due consideration by the government given its high risks and low returns.

This study lacks two important pieces of information: the exact amount of oil and gas reserves and the true structure of oil and gas industry. In 5 to 10 years' time, when the exploration stage is completed for all blocks in Cambodia's offshore area, a better impact study could yield a more precise projection of the impacts of the oil and gas industry on the economy rather than in a range of figures, as this chapter is done. At the same time, the true structure of the oil and gas industry requires an extensive survey, which can be done only after the production stage starts.

This chapter has made an educated guess on the magnitude of the oil and gas in Cambodia. However, a more important question is whether and how Cambodia is able to gain benefits from its natural resources. There should be a comprehensive discussion on how Cambodia can avoid the resource curse, which has plagued so many resource-rich countries. The following four chapters employ various theoretical and empirical methodologies, quantitative and qualitative, cross-country and case studies, in order to answer the ultimate questions; that is, will Cambodia escape the resource curse?

Chapter 3: Natural Resources and Economic Development- A Literature Survey

3.1 Introduction

The roles of natural resources in economic growth have received so much attention from researchers from various fields and disciplines. Common sense and main economic growth theories suggest that natural resources are a boon through which host countries can build up their capital, and hence achieve economic development. For example, during and after the industrial revolution from the 18th to the 19th century, the importance of natural resources for industrialization and economic advancement were rarely questioned. Coal, fossil fuels, and other minerals have been an important engine of development and technology advancements. The introduction of steam power fueled primarily by coal, the development of advanced metal machine tools and the internal combustion engine have all illustrated the enormous contribution of natural resources.

However, management of natural resource production and the revenue spending of many resource-rich countries in recent history has proven that natural resources have a far more complicated relationship with economic development. The concern over the impacts of great wealth on a society goes back to as early as the 16^{th} century. Quoted in Sachs and Warner (1995, p. 4), a French political philosopher Jean Bodin asserted that "men of a fat and fertile soil, are most commonly effeminate and cowards; whereas contrariwise a barren country make [makes] men temperate by necessity, and by consequence careful, vigilant, and industrious." Later on, Adam Smith echoed the same concern by emphasizing that "projects of mining, instead of replacing the capital employed in them, together with the ordinary profits of stock, commonly absorb both capital and stock. They are the projects, therefore, to which of all others a prudent law-giver, who desired to increase the capital of his nation, would least choose to give any extraordinary encouragement." (Lederman & Maloney, 2007, p. 1).

Concerns about the potential negative impacts of being a natural resource producer emerged among development economists in the 1950s and 1960s. Cited in Stevens (2003), Prebisch (1950, 1964) and Singer (1950) argued that primary product exporters would have disadvantages in trading with industrialized countries because of deteriorating terms of trade. On the other hand, Hirschman (1958), Seers (1964), and Baldwin (1966) all argued that the primary industry has lower linkages with other industries, compared with the manufacturing industry. Following the first oil shock in the 1970s, more research was done to study the impacts of the oil and gas industry on economic growth. Mabro and Monroe (1974) and Mabro (1980) studied the impacts of oil production behaviors of Arab countries on economic growth and other macroeconomic variables of oil-importing countries. It was considered the start of the development of a literature specifically concerned with oil, gas and mineral projects (Stevens, 2003). From the 1990s until recently, various natural resource researchers and practitioners have brought this subject to a much wider audience by focusing on the political economic channels. The relationship between natural resources and economic development is largely determined by government behaviors and institutional quality.

Once we starts to dig into the roles of natural resources in economic development, we often see two groups of scholars who have been constantly arguing theoretically and empirically. One group would say "Curse, Curse, Curse"; the other, "No Curse, No Curse, No Curse." Once one examines more closely the puzzling relationship between natural resources and economic development, a third group is keen to strike a balance by coming up with "Conditional Curse or Blessing". Most recent works follow this third group on the rationale that natural resources are related to economic development through transmission channels.

3.2 The Resource Curse Thesis and the Start of Its Empirical Findings

The first historical cross-country empirical research to approach the relationship between natural resource curse and economic development is the works of Sachs and Warner (1995, 1997). Using the ad-hoc cross-country growth model of Barro (1991), Sachs and Warner (1997) tested the relationship between resource dependence, the ratio of primary products to GDP in 1970, and the average annual growth of real GDP per the economically active population for the following 20 years of more than 70 countries.

Table 3-1: Partial Associations between Growth and Natural Resource Intensity

Dependent Variable: GEA7090

	1	2	3	4	5
LGDPEA70	-0.11	-0.96	-1.34	-1.76	-1.79
	(0.55)	(-5.16)	(-7.77)	(-8.56)	(-8.82)
SXP	-9.43	-6.96	-7.29	-10.57	-10.26
	(-4.75)	(-4.55)	(-5.57)	(-7.01)	(-6.89)
SOPEN		3.06	2.42	1.33	1.34
		(8.05)	(7.06)	(3.35)	(3.44)
INV7089			1.25	1.02	0.81
			(5.63)	(3.45)	(2.63)
RL				0.36	0.40
				(3.54)	(3.94)
DTT7090					0.09
					(1.85)
Adjusted R^2	0.20	0.55	0.67	0.72	0.73
Sample size	87	87	87	71	71

Source: Reproduced from Sachs and Warner, 1997

They found a statistically significant and negative relationship between natural resource dependence and economic growth even after controlling for important cross-country-growth variables such as initial GDP, trade policy, investment rate, terms of trade volatility, inequality, and the effectiveness of bureaucracy (see Table 3-1). Moreover, regional dummy variables, outlier omission, and different measures of natural resource abundance all yielded similar results. This negative link between natural resource abundance and economic growth was echoed in other similar cross-country empirical studies (Gylfason & Zoega, 2006; Gylfason, 2001; Leite & Weidmann, 1999).

3.3 Some Resource-Cursed Countries

Cross-country findings on the negative relationship between natural resources and economic development have been strongly supported by case studies. In particular, many Latin American and African countries have been widely studied to understand why their economic performances were not boosted despite their wealth in natural resources.

3.3.1 Latin American Countries

Latin America is an exporter of primary and primary-based manufactured commodities, which it is said to be one underlying growth problem. Sachs and Warner (1999) have provided both theoretical and empirical evidence for the link between natural resources and economic growth in this region by studying 11 Latin American countries: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico, Paraguay, Peru, Uruguay, and Venezuela.

Natural resource booms are important to break the low-income equilibrium traps according to the big push theory. In their recent history, Latin America countries experienced a big rise in natural resource exports. However, no evidence of faster GDP growth was found after the boom was finished, contrary to the big push reasoning. Instead, in several cases GDP growth seemed to be slower after the boom period. In this regard, Sachs and Warner (1999) studied the importance of natural resources in accounting for slower growth among the 11 Latin American countries by estimating the regression coefficient between natural resources and economic growth, which is -3.26. Table 3-2 shows the results of the estimate. Venezuela's GDP per-capita, the worst case, was about 14 per cent lower at the end of the 1970 to 1990 period than it would have been without its natural resources.

Table 3-2: Basic Data on Natural Resource Intensity and Growth

(1) Country	(2) Natural resource exports (share of GDP, 1970)	(3) Growth in GDP per-capita (1965-1990)	(4) Regression estimate of the natural resources effect = (2) * -3.26
Argentina	0.053	-0.586	-0.172
Bolivia	0.185	0.433	-0.602
Brazil	0.055	2.332	-0.179
Chile	0.149	0.230	-0.485
Colombia	0.094	1.327	-0.307
Ecuador	0.106	1.637	-0.344
Mexico	0.024	0.496	-0.079
Paraguay	0.097	1.212	-0.316
Peru	0.153	-0.666	-0.498
Uruguay	0.091	0.656	-0.297
Venezuela	0.237	-0.200	-0.772

Source: Reproduced from Sachs and Warner, 1999

Natural resource booms not only have negative growth effects but also level effects. Among all the 11 countries, only Ecuador experienced a positive and lasting effect on per-capita GDP; Chile and Colombia probably had neither positive nor major negative effects, while Bolivia, Mexico, Peru and Venezuela saw a fall in per-capita GDP during and/or after the boom period. Theoretically, if the non-tradable sector in an economy has increasing returns to scale, natural resource booms that shift human or capital resources from the tradable sector to the non-tradable sector can act as a big push to support economic growth. In contrast, if the tradable sector has increasing returns, resource booms that absorb resources out of the increasing returns sector will raise incomes only temporarily but will send an economy into a spiral of de-industrialization. On the empirical basis, resource booms in Bolivia, Mexico and Venezuela led to the decline in the level of per-capita GDP while Ecuador initially experienced a boost in GDP level, but it was not followed by faster growth.

Natural resource abundance in Latin American countries, therefore, has not been a blessing to the region, if not a curse. Revenues from resource booms only brought about short-term economic growth. However, after the booms subsided, their economies moved back to their pre-boom levels. In the case of Venezuela, for example, from 1972 to 1993 the country was able to use income from resource booms only to overshoot its steady-state level (Rodriguez & Sachs, 1999). As a result, its GDP level decreased to its steady state from above, leading to negative growth.

3.3.2 Oil-Producing African Countries (OPAC)

Africa has eight major oil-exporting countries (OPAC): Angola, Cameroon, Chad, the Republic of Congo, Ivory Coast, Equatorial Guinea, Gabon, and Nigeria. Together they account for 7.5 per cent of world oil exports from 2003 to 2006. Despite their huge oil exports, the non-oil GDP growth of these countries has lagged behind other oil-poor countries in the region throughout the last decade (Qureshi, 2008). Furthermore, their manufacturing sector has been declining over time.

On the basis of export performance, OPAC's total trade increased from 70 per cent in 1970 to 103 per cent of GDP in the period from 2000 to 2006, compared to only 66 per cent of GDP for the entire Sub-Saharan Africa region from 2000 to 2006. Trade growth in these countries is mainly driven by oil exports, ranging from 30 per cent to over 70 per cent of their total exports. However, its share of world non-oil exports dropped from 0.6 per cent in 1970 to only 0.2 per cent in 2006. OPAC's export structure is highly concentrated on their top five merchandise export sectors, including fuels. They account for 80 per cent of total exports in Ivory Coast and Cameroon and 90 per cent in the other countries (see Table 3-3). In addition, excluding Ivory Coast, OPAC saw their revealed comparative advantage declining and concentrated on primary commodities after the first oil boom in the 1970s (Qureshi, 2008, p. 13).

In addition to their poor export performance, OPAC also has lower productivity and poorer human capital than other oil producers. ICT indicators, which determine productivity, are much lower for OPAC than the entire Sub-Saharan Africa region and other oil exporters. In addition, the Human Development Index for OPAC is among the lowest in the world.

Table 3-3: Export Structure by Product Category, 1970 – 2005 (per cent)

	Primary Commodities			Nonfuel Primary Commodities			Manufactures		
	1970-89	1990-99	2000-05	1970-89	1990-99	2000-05	1970-89	1990-99	2000-05
Angola	94	94	94	25	01	01	05	06	06
Cameroon	92	91	92	65	52	47	03	04	04
Republic of Congo	87	75	95	28	12	11	10	24	03
Ivory Coast	95	89	92	91	82	79	05	11	08
Equatorial Guinea	95	94	96	95	63	05	04	05	04
Gabon	94	97	96	28	23	20	05	03	03
Nigeria	99	98	98	07	04	03	01	02	01
Indonesia	91	52	44	29	22	21	07	47	53
Mexico	53	22	17	26	10	06	40	73	79
Trinida and Tobago	87	60	66	06	13	05	12	39	33
United Arab Emirates	93	82	72	02	04	05	4	15	25
Venezuela	94	81	84	05	06	04	03	14	13

Source: UN-COMTRADE database in Qureshi, 2008

On the basis of institutional quality, OPAC fares badly compared to other Sub-Saharan African countries and oil exporters in all the three measures: Doing Business Indicator (DBI), World Governance Indicators (WGIs), and the Global Competitiveness Index (GCI). In his IMF working paper, Qureshi (2008) used the gravity model to study the relationship between institutions, oil abundance, and economic growth. He concluded that institutions and infrastructure are the main determinants of how oil abundance affects non-oil export flow in oil producing African countries. Akanni (2007) also confirmed that there was evidence of a resource curse in oil exporting African countries while he blamed poor institutions and democracy for the negative effects of oil abundance on their economic growth.

3.4 Evidence against Resource Curse Findings

The link between natural resource abundance and economic development has brought about both theoretical and empirical controversies. While Sachs and Warner (1995) and earlier studies provided influential empirical findings of the natural resource curse, they have suffered from and have been constantly criticized for methodological mistakes and the lack of time-series data availability at the time of the study. In fact, study about the role of natural resources in economic development is still at its early stage and needs more research and appropriate methodologies.

More importantly, historical and contemporary success stories of natural resource dependent countries such as the United States, Norway, Chile, Australia, Peru, Brazil, Botswana and others generate even more skepticism about the findings of the natural resource curse literature (Wright & Czelusta, 2007). Therefore, it is important to have a deeper understanding about the roles of natural resources in economic development by looking at the other side of the coin. Following are some counter-arguments against the natural resource curse findings.

3.4.1 Measurements of Natural Resources

There is a big difference between resource abundance and resource dependence. The former measures how rich a country is; the latter measures how concentrated a country's production or exports are in terms of natural resources. More importantly, their effects on economic growth may run in opposite directions. Stijns asserted "the claim that being resource-export dependent slows down a country's expected rate of growth is different [from] the claim that high mineral reserves or production is associated with slower rates of growth" (2005, p. 111). He found that while there was a high degree of correlation between production and reserve data for oil, coal, gas, and minerals, it was not true for reserve and export data except in the case of land.

The bottom line is that treating the share of primary exports in GDP as a proxy for natural resource abundance is misleading (Ding & Field, 2005). It is possible for a resource-abundant country to have a small primary sector share in GDP (the United States and Canada are two leading examples), and on the other hand, for a resource-poor country, nevertheless, to have an economy that is heavily dependent on primary sectors (good examples are

Tanzania and Burundi). Therefore, in their study they introduced natural resource capital per capita, a proxy for resource endowment, along with the share of natural resource capital in total capital as a proxy for resource dependence. Using both traditional cross-country regression and three-equation model to account for endogeneity, they found a remarkable contrast between the effects of resource endowment and dependence. Their cross-country regression showed that resource endowment is positive and significant for growth while it confirmed the negative and significant effects of resource dependence.

Stijns (2005) made similar findings that once a distinction between primary export intensity and resource reserve or production is made clear, natural resource abundance had no effect on economic growth during the period from 1970 to 1990. Reproducing the results of Sachs and Warner's study (1995), Stijns used the same data and controlling variables, but introduced resource reserves per capita for land, oil, gas, coal, and minerals. Primary export intensity was confirmed to have a negative and significant relationship with economic growth; however, other measures of natural resource reserves, including the first and second principal components of overall minerals, did not have any effect on economic growth during the period from 1970 to 1990. Natural resource production data also confirmed the same results.

In addition to the discussions of resource abundance or dependence and exports or production/reserves, different types of natural resources present different challenges and opportunity to resource-rich countries. Boschini et al. (2007) found that the appropriability of natural resources is one key determinant of economic performance through institutions. Appropriability is the likelihood that natural resources lead to rent-seeking, corruption, conflicts, and other social conflicts that harm economic development. Resources that are very valuable, easily stored, transported, and sold such as gold, diamonds, and silver, are more likely to generate conflict over ownership, especially in countries with poor institutional quality. The struggle over such resources can cause social problems such as rent-seeking and conflicts if and only if the country has a poor institutional quality. Countries with good institutions, on the other hand, are more likely to enjoy more benefits from such resources than less appropriable resources.

Similarly, but taking one step further, Isham et al. (2005) investigated what they classified as point-source vs. diffuse resources. The former refer to oil and gas, minerals and plantation crops, which are normally extracted from a narrow geographic or economic base. Their production characteristics, export structure, and rents define the political structure of resource-rich countries and therefore economic performance. During the 1957 to 1997 period, point-source resource-based economies experienced the worst growth deceleration, compared with diffuse and manufacturing economies. In their empirical findings from 1974 to 1997, the point-source index has a statistically significant and negative relationship with all six institutional variables, while diffuse and manufacturing indexes are not significant. Because all institutional variables have a positive significant effect on economic growth during the same period, point-source dependence that decreased institutional quality indirectly decelerated growth.

The natural resource measurement problem is only one part of the controversies over the evidence of the natural resource curse. Many studies are also critical of the time period from 1970 to 1990 frequently used in this literature.

3.4.2 Sensitivity to the Time Period Used

Many earlier studies relied on cross-country data from 1970 to 1990, a period with frequent economic turbulence such as oil price booms and busts and credit default crises. The natural resource share of total exports or GDP in 1970 is usually used, based on an incorrect assumption that the ranking of countries represented the ranking in earlier periods of time (Lederman & Maloney, 2002). In fact, using earlier historical data proved that the results of Sachs and Warner and other authors are biased. Table 3-4 shows the growth performance of both developed and developing countries from 1820 to 1989 in five periods. The negative effect of natural resources was significant only from 1950 to 1989, while it was positive, though insignificant, from 1820 to 1870 and from 1913 to 1950. More importantly, the same sample used in the period from 1913 to 1950 also showed negative and significant effects after 1950, which suggests that the change in the earlier period was not due to a different country sample.

Therefore, studies that are limited to the period from 1970 to 1990 may not survive the test of time and should be studied with more caution; Frankel (2010) argued that it is important to examine the trend of natural resources in the long run because a mid-term time-series study can be very sensitive to sample time period used. In this regard, attempts to compare this period with a later period from 1990 to 2010 are very informative.

Table 3-4: Historical Sensitivity

Dep.var.: Average Annual Growth Rate	**Period**						
	1820-1870	**1870-1913**	**1913-1950**	**1950-1973**	**1973-1989**	**1950-1973(1)**	**1973-1989(1)**
Log GDP per capita, initial	0.70**	0.49**	0.4304**	0.219	-0.139	0.392	-0.41*
	(4.39)	(2.99)	(2.75)	(0.83)	-(0.65)	(1.23)	-(1.79)
Primary exports / GDP (1970)	2.92	-2.09	3.53	-7.87*	-14.29**	-12.78**	-10.4**
	(1.58)	-(0.77)	(1.64)	-(1.97)	-(3.91)	-(2.40)	-(2.38)
Constant	-4.31**	-2.25*	-2.62**	2.03	4.08**	1.012	6.27**
	-(3.97)	-(1.97)	-(2.22)	(0.96)	(2.14)	(0.41)	(3.11)
Obs.	**19**	**23**	**32**	**37**	**37**	**32**	**32**
Adj R-squared	**0.57**	**0.24**	**0.23**	**0.08**	**0.27**	**0.12**	**0.19**

(t-student values)

Notes: * Significant at 10% level; ** Significant at 5% level; (1) Common sample with period 1913-1950

Source: Reproduced from Lederman and Maloney, 2002

3.4.3 Sensitivity to Omitted Variables

The use of cross-section data with a lagged overall GDP growth as an independent variable makes the coefficients of explaining variables inconsistent if, in fact, there are some correlated time-invariant unobservable characteristics (Lederman & Maloney, 2002; Manzano & Rigobon, 2001). Lederman and Maloney (2002) employed a panel method, with data from 1975 to 1999, to eliminate the fixed effect problem. They found that when government consumption and education variables are controlled for, export concentration (their proxy for resource abundance) lost its significance in the growth regressions. Similarly, using different approaches to measure only the non-resource side of the economy also proved that the effect of resource abundance disappears when fixed effects were introduced.

Manzano and Rigobon (2001) pointed out that the correlated unobserved variables are credit constraints and debt overhang. Many countries in the sample have been prescribed structural adjustments by the International Monetary Fund or the World Bank to deal with their debt crises. The surge in commodity prices in the 1970s might have induced resource-abundant countries to take on excessive loans, which led them to debt crisis when the prices fell during the 1980s. This is especially true when investment and debt decisions in the late 1970s were based on expected price increases. Manzano and Rigobon's suspicion was validated in their cross-section regression of growth rates from 1980 to 1990 that controls for debt over GNP ratio in 1981. The result showed that the effect of natural resources disappears and debt over GDP ratio has a negative and significant effect on growth even after controlling for institutions, education, and financial development.

The above authors found that the impact of resource abundance disappears once fixed effects are taken into account, which implies that this variable is correlated with unobservable characteristics. Therefore, they asserted that a panel method and different measures of the non-resource side of the economy should be used to eliminate this problem of omitted variables, which is just one part of a more general problem in doing cross-section analysis, the endogeneity problems.

3.4.4 Endogeneity Problems

There are several ways that endogeneity problems can appear in regression analysis (Kennedy, 2008). Measurement errors in explanatory variables, autoregression equations with autocorrelated errors (with the inclusion of initial income level), simultaneity, and omitted explanatory variables like those discussed above are all valid arguments against the OLS estimator employed by most resource curse findings.

Comparative advantage theory of international economics can explain one basic fact of the endogeneity problem of natural resource exports. Countries with a high ratio of mineral exports do not necessarily have an abundance of such resources. Theoretically, it is more likely that their lack of competitiveness in other sectors forces them to focus on their comparative advantage, that is, the export of their primary commodities. This is especially true for poor but resource-dependent countries. Therefore, the inclusion of the initial level of income, investment and other explanatory variables as exogenous biases the estimation. For example, in the ratio of primary exports to GDP, the denominator is not independent of economic policies and the institutions that produce them. This type of endogeneity overstates any negative effect that natural resources may have on economic growth (Stijns, 2005).

There are several ways to deal with endogeneity problems. The Generalized Method of Moments with instrumental variables was suggested to deal with both the problems of country-specific effects and endogeneity (Caselli, Esquivel, & Lefort, 1996). Similarly, Lederman and Maloney (2002) used the GMM-IV method and treated the initial level of income and investment rate as endogenous in their panel data analysis. They controlled for the levels of endogenous variables with lagged two and three periods plus regional dummies. As a result, they could not find the presence of significant impacts of resource dependence by Sachs and Warner's measure (primary export over GDP). However, export concentration measure using the Herfindahl index showed a negative and significant sign even after dealing with endogeneity. The channels through which this negative relationship appears are still subject to further research, yet the GMM-IV system should be applied to add more precision to the estimated coefficients.

Ding and Field (2005) also dealt with endogeneity in their study by arguing that resource dependence and human capital should be endogenous in the growth equation. They argued that the degree of resource dependence is a function of various factors and must be treated as endogenous. Due to its roles in economic growth, human capital is also included and is considered endogenous. Therefore, a three-equation recursive model, using the same data set in Sachs and Warner (1995), was used to deal with endogeneity. The impacts of both resource abundance and dependence are not significant in economic growth according to their results.

The above findings are supported by a more recent work of Brunnschweiler and Bulte (2008). They used similar methods of Two-stage Least Squares and Three-stage Least Squares regression analyses of economic growth, and introduced constitutional variables. They argued that constitutional designs may directly affect economic policies. For example, "sectoral lobbying for preferential treatment is [probably] more successful in presidential than in parliamentary systems" (Brunnschweiler & Bulte, 2008, p. 250). Once again, they found that resource dependence might not be a proper exogenous variable. Treating it as endogenous, they showed that the resource dependence measure had no significant impacts on economic growth or institutional quality. More importantly, resource abundance was significantly and positively associated with both growth and institutional quality.

Cavalcanti, Mohaddes, and Raissi (2011) recently criticized both cross-sectional and homogeneous panel data approaches, such as fixed and random effects estimators, the instrumental variable technique, and the generalized methods of moments. The former approach lacks the time dimension of data and is subject to endogeneity problems while the latter approaches still impose a high degree of homogeneity, which is subject to substantial biases. Therefore, they took a heterogeneous panel data approach by recognizing that there is a high degree of heterogeneity in the growth experience of different resource-abundant countries. Moreover, they studied both the level and growth effects of natural resource abundance. An advantage of their approach is that "the fixed effects and the heterogeneous trends capture country-specific unobserved factors, such as social and human capital, which are very difficult to measure or observe accurately, [in addition to omitted variables]" (Cavalcanti et al., 2011, p. 4). A theory-derived econometric model was developed and directly tested, using a panel of 53 countries over 27 years from 1980 to 2006. The real value of oil production, oil rents, and oil reserves (with constant 2000 US$) per capita was used as a proxy for resource abundance. Having successfully checked the robustness of their results, Cavalcanti et al concluded that "oil abundance is in fact a blessing and not a curse, both for the short-(growth effects) and long-(level effects) run" (Cavalcanti et al., 2011, p. 20).

The above authors strongly oppose the resource curse thesis on a global level. Simply treating natural resources as a curse has proved very misleading and unfortunate for resource-rich countries. However, to ignore that fact that many resource-rich countries have experienced bad performance despite their natural endowment is equally risky and unethical.

3.5 Curse or Blessing: Transmission Channels

Why would a source of capital, which is undisputedly important for economic growth, turn out to be so ironic for many resource-rich countries? The natural resource curse thesis is still highly controversial and remains a puzzle in economic growth theories. However, Sachs and Warner's influential work in 1995 has stimulated various researchers to explore the causes of the resource curse. These so-called transmission channels determine whether a resource-rich country is cursed or blessed by its natural endowment.

Stevens (2003) and Frankel (2010) have done an extensive literature survey of the various explanations of the resource curse, and both questioned the arguments of long-term deteriorating terms of trade between exporting countries of primary and manufacturing goods. Since the 1970s, the focus turned to short and mid-term impacts of the transmission channels of natural resources and poor economic performance, which can be grouped into macroeconomic and politico-economic channels.

3.5.1 Macroeconomic Channels

3.5.1.1 The Dutch Disease

The "Dutch Disease" was named after the phenomenon of deindustrialization fears that the Netherlands faced during its discovery of natural gas deposits in the North Sea in the late 1950s and early 1960s. Currency appreciation caused by the expansion of natural gas exports in the 1960s led to a deteriorating competitiveness of the Dutch manufacturing industry, and thus made non-resource exports fall. However, although the fears were short-lived, the name was born from the first patient diagnosed with it.

During the boom of natural resource earnings, there are two effects: the resource movement effect and the spending effect (Corden & Neary, 1982). The former materializes when the boom in natural resource sector absorbs resources such as capital and labor from other sectors. On the other hand, depending on the marginal propensity to consume services, the spending effect appears when the higher real income from the boom is spent on services. In turn, it causes real appreciation of the price ratio of the non-tradable sector to the tradable sector. When the output prices of non-tradables rise their input prices can also rise, which spills over to the input prices of tradables. As a result, export sectors are harmed by lower competitiveness caused by overall real exchange rate appreciation. On an empirical basis, natural resource-intensive economies were found to have higher price levels, leading to lower competitiveness for the manufacturing sector (Sachs & Warner, 2001).

For a detailed explanation, Mikesell (1997) provided what he called a typical set of responses to a primary export boom by a resource-dependent developing country, which determines its impacts on the economy. At first, a surge in foreign exchange causes the exchange rate to appreciate and domestic income to rise. The combination of a rise in the nominal exchange rate and domestic price inflation results in a rise in the real exchange rate. The real exchange rate appreciation of the non-tradable sector absorbs both labor and capital from the tradable sector and makes exports of non-resource tradables decline and imports rise, which may urge governments to impose import restrictions and subsidize exports.

This, in turn, pushes investment into high-cost import-substitution manufacturing and investment opportunities into the resource boom sector. In addition, because of the resource boom, the improved credit standing of the government and private business may also enable external borrowing by the government, which often spent on the non-tradable sector in the form of low-yield public works, defense outlays, and social projects that expand consumption.

The increased capital inflow from both foreign investment and borrowing may lower interest rates, which induces domestic capital to go abroad in search of higher earnings. The movement of resources between sectors may reduce capital accumulation in the non-resource tradable sector. In particular, if the non-tradable sector is relatively labor intensive while the tradable sector is capital intensive, the movement in favor of the non-tradable sector will tend to raise wages and lower returns to capital, thereby reducing capital accumulation.

Traditional trade models suggest that "countries should simply specialize in whatever is their comparative advantage" (Krugman, 1987, p. 49). However, the natural resource sector in contrast to manufacturing lacks positive externalities. The manufacturing industry maximizes forward and backward linkages (Hirschman, 1958) and creates "learning by doing" externalities (Matsuyama, 1992). In addition, there is a general assumption in much of the literature that productivity growth in manufacturing is fastest. Finally, Sachs and Warner (1999) also argued that the manufacturing sector has increasing returns to scale. In short, a natural resource boom that absorbs productive resources from the non-resource tradable sector can send an economy into the path of de-industrialization. Once the natural resources are used up, the lost manufacturing sector will be difficult to recover. In this respect, the contraction of a country's manufacturing sector caused by the Dutch disease is considered a curse for natural resource-rich economies.

3.5.1.2 Investment Channel

In a cross-country study done by (Papyrakis & Gerlagh, 2004), the investment channel of natural resource impacts on economic growth is considered the most important of the four channels under study. It accounts for 41 per cent of the negative impacts of natural resources on growth. To shed light on this channel, Gylfalson and Zoega (2006) derived a theoretical model to study the effect of natural resources on growth through investment in a neoclassical growth model. Including natural resources in the Golden Rule state, a neoclassical growth model suggests that the greater the role of natural resources in the generation of national output, the smaller the optimal saving rate and thus the level of capital and output.

Increased dependence[3] on natural resources reduces both the marginal productivity of capital and the propensity to save in the traditional form of the Golden Rule formula. That is, natural capital crowds out physical capital. Based on their cross-country empirical findings, the share of natural capital in national wealth is inversely related to the accumulation of physical, human, and social capital. They asserted that natural resource dependent economies neglect the need for savings and investments. More importantly, natural resource production is usually accompanied by booms and busts in both prices and quantity. The fluctuations in export earnings can cause exchange rate volatility, especially under a floating exchange rate system. This creates uncertainty that tends to hurt exports and discourage private investment.

Other researchers blame misguided policies that allow too low genuine savings rates (accounting for the depletion of natural resources); as a result, there is no sustainability for economic growth. Atkinson and Hamilton (2003), for example, did an empirical study on 91

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[3] Natural resource dependence and natural resource abundance are two different concepts in their study. The former is the share in output while the latter is per capita. Despite the negative impacts of natural resource dependence, having more natural resources per capita theoretically has a positive effect. (Gylfason & Zoega, 2006, pp. 1107–1110)

countries over the period from 1980 to 1995 and found that resource-rich countries have about 10 per cent lower average genuine savings rates than resource-poor countries. That is, genuine savings rates are negative (on average) 2.6 per cent of GDP in resource-rich countries and are positive (on average 9.2 per cent of GDP) in ‘‘resource-poor’’ countries. Furthermore, that countries with lower genuine savings rates, either in the initial year or of a period average, experienced slower economic growth was proven to have a high significance level.

Quality and quantity of investment is another point of discussion. Nili and Rastad (2007) argued that oil exporting countries actually had an investment rate above the world average. However, financial development is the key determinant of the link between the investment rate and growth rate of these resource-rich economies. In their theoretical explanations, a better financial system is associated with a higher growth rate. It serves many multiple important roles of “mobilization of savings, allocation of investment, facilitating the exchange of goods and services, monitoring managers and facilitating the trading, hedging, diversifying and pooling of risk” (Nili & Rastad, 2007, p. 729).

Empirically, they found that oil-rich economies tend to have lower financial development compared with non-oil developing economies. Despite the big contribution of oil revenues to the investment rate, oil-rich economies have a lower quality of investment. This might be explained by the declining rate of private investment and the dominant role of public investment in total investment.

In addition to physical capital accumulation, human capital accumulation has also been forwarded as one explanation in the resource curse thesis. Investment in education is good for the long-run economic growth and its sustainability. It can increase productivity and efficiency of human capital. However, natural resource abundance is inversely related to education (Gylfason, 2001). Natural resource industries require less high-skill labor force and often give a false sense of security over extended periods, even with poor policies and commitment to education. Therefore, resource-rich countries tend to neglect the need for good education, as is reflected in their expenditure for education. Furthermore, natural resource abundance could also crowd out entrepreneurial activities or innovation if potential entrepreneurs are attracted by high wages that the resource sector provides. Three different measures of education (inputs, outcomes and participation) all show a negative relationship between natural resource abundance and education over the 1980 to 1997 period in 90 countries in Gylfason's study.

3.5.2 Politico-Economic Channels

In recent literature on the link between natural resources and economic development, politico-economic reasoning has been increasingly prioritized since pure macroeconomic explanations have not been convincingly supported by empirical experiences. The following section discusses three main politico-economic channels to fill the explanation gap about the negative impacts of natural resources on economic development.

3.5.2.1 Fractionalization and War

Fractionalization is one candidate for causing the resource curse. Fractionalization in the forms of rival groups can cause violent conflict, which leads to a direct decrease of productive activities and weakens property rights (Hodler, 2006). Hodler developed a model to explain why some countries experienced resource blessing while others experienced resource curse. He based his model on both theoretical and empirical grounds. On the theoretical basis, "oil windfalls should [can] cause intensive fighting and rent seeking in such a fractionalized country, in which property rights should be weak and per capita incomes are low due to the oil windfalls' negative effect" (Hodler, 2006, p. 1382). Nigeria, for example, is among the most fractionalized countries in the world with an index of ethnic fractionalization of 0.85. In Norway, on the other hand, ethnic fractionalization is only 0.06 as almost every citizen (97 per cent) belongs to the same ethnic group. Cross-country results also show that the effect of natural resources on income is positive in ethnically homogeneous and negative in fractionalized countries.

On the other hand, economic and political institutional factors, the structure of the extractive industry, and the management of resource wealth explain the link between natural resources, civil conflict and development (Oyefusi, 2007). In a case-by-case examination, 16 out of 89 countries with varying levels of resource dependence have experienced alleged resource-induced civil conflicts. Countries rich in both oil and mineral resources have the worst institutional quality, the biggest gap between the human development index and GDP growth, the highest income inequality among all the sample countries.

3.5.2.2 Corruption and Rent Seeking

The link between corruption and economic growth has been widely studied and understood. There are some suggestions that corruption might raise economic growth through two types of mechanisms. Corrupt practices, in the forms of speed money, allow individuals to avoid bureaucratic delays. The other mechanism is that corrupt government employees work harder.

However, critics argue that corruption leads to lower economic growth. This argument against corruption has been backed strongly by both theoretical and empirical evidence. In an IMF paper, Leite and Weidmann (1999) showed that natural resources are a major determinant of corruption, especially in less developed countries with less adaptable institutions. The flows of revenues into the government's budget during both the development and the production stages create an opportunity and incentives for corruption by elites or by bureaucracies. Corruption is more complex if the revenue flows into various off-budget accounts, including those established by national oil companies, because such accounts normally fall outside the supervision of government or independent auditors (Insights for Action, 2006b). Corruption and rent seeking can be thought of as two sides of the same coin.

Corrupt governments tend to attract rent seeking, and vice versa. Rent seeking can take place in any stage of the production chain within the public management or between private companies and the government.

Mavortas et al. (2011) recently provided a dynamic model of growth collapse combined with rent seeking along with their empirical cross-country findings. In their theoretical work, rent seeking is proved to be "a diversion of a part of the capital stock from ordinary production" despite the revenues provided by the resource sector (p. 127). While the revenue stream from natural resources can be considered exogenous, rent seeking in this sector endogenously affects economic performance of resource-rich countries, especially those with a grabber-friendly environment or poor institutional quality. In another cross-country study, Mauro (1995) did a survey of 70 countries and found that corruption lowered private investment, which in turn reduced economic growth.

Certain types of natural resources are more likely to lead to rent-seeking activities in countries with a poor institutional quality. The "appropriability" of resources, a coined term referring to the interaction between the types of resources and the quality of institutions, is one main determinant of the roles of natural resources in economic development (Boschini et al., 2007). Precious metals, diamonds, and other precious stones, which are easy to transport, store and sell, are more attractive to rent-seekers. This is what they call "technical appropriability". However, it is the "institutional appropriability" that determines whether technically appropriable resources can harm or boost a country's economic development. In other words, countries with technically appropriable resources experience stronger negative impacts if they have bad institutional quality; those with good institutions experience stronger positive impacts.

3.5.2.3 Political Process

Apart from the problems of conflicts and corruption, a pure political model was developed to study the political channel through which the resource curse happens (J. A. Robinson, Torvik, & Verdier, 2006). The model was applied to both democratic and non-democratic politics. As a starting point, there is an assumption that politicians can use income from natural resources that accrues to the government to influence the outcome of elections. Natural resources can be consumed or distributed as patronage to influence voting behavior. There are then two periods, with the election occurring at the end of the first period.

The authors provided two main innovative results in their paper. First, they formally developed a model to explain why politicians engage in an inefficient redistribution of natural resource revenues by using them to provide patronage in the forms of public employment to influence the outcome of elections. Second, they integrated this model with a model of natural resource extraction to study the political incentives caused by resource booms. What they found from their study shed some light on the reasons behind the inefficient use of resource rents. Resources tend to be over-extracted because politicians discount the future value by the probability that they remain in power. On the other hand, resource booms lead to a more efficient extraction because politicians discount the future less.

However, resource booms create inefficiency in the rest of the economy, particularly the private sector, due to the over-expansion of the public sector in the forms of patronage to influence elections. Whether this phenomenon leads to a resource curse depends on the institutional quality to limit the ability of politicians to use clientelism to bias election outcomes. In general, natural resources tend to have a significant negative effect on the economic growth of countries with poor institutional quality (Mohsen Mehrara, Alhosseini, & Bahramirad, 2008). Countries with rich institutions are more likely to enjoy a significant positive effect on economic growth. In this respect, there are arguments based on empirical evidence that democracy and parliamentary systems are better than non-democracy and presidential regimes in ensuring positive effects from natural resources on economic growth (Bakwena, Bodman, Le, & Tang, 2009). The former forms of institutional design can reduce rent-seeking activities and personal accrual of resources due to their system of checks and balances.

3.6 Concluding Remarks: Can We Generalize the Resource Curse?

One of the most surprising facts in the economic growth models is that in many works natural resource abundance has had negative impacts on economic growth. From the 1970s to the 1990s, there was a negative and significant relationship between primary exports and GDP growth as many argued. Countries rich in natural resources, including both renewable and non-renewable resources such as coal, oil, natural gas and other minerals, received huge revenues, especially during the oil boom periods. Yet they experienced a negative growth or a slower growth than resource-poor countries. The relationship between natural resource abundance and economic development has been discussed widely and actively from the early industrialization era up until now. In fact, further research on this topic is badly needed and expected to continue appearing in both academic and non-academic articles. From common sense and logic to theories and models and from empirical cross-country findings to case studies, the natural resource curse thesis has gained strong supports from earlier studies.

However, previous studies have many critical mistakes that bias the results concerning the existence of the negative relationship between natural resource abundance and economic growth. More recent works, therefore, try to minimize methodological mistakes and provide radically contrasting findings that there is no resource curse by the traditional standards.

Many works on natural resource abundance and economic development heavily depended on traditional cross-country studies of the period from 1970 to 1990, using basic economic growth models. These earlier works have several critical deficiencies. One is the measurement issue. Many studies used the share of primary exports to total exports or

GDP/GNI. This type of measurements may not correctly represent natural resource abundance since they measure the dependence or concentration of natural resources, not their endowments. Using different measures such as total natural resource reserves or capital per capita, for example, yields contradictory results with the resource curse findings. In addition, some studies argue that the period from 1970 to 1990 was seriously affected by economic turbulence, so the use of this period to observe economic performance may be biased and should take into consideration those omitted variables that may have influenced the relationship between economic growth and natural resource abundance. Once again, studies that account for these omitted variables, for instance debt overhang, show that natural resource curse did not exist in cross-country data.

Last but not least, it has been widely agreed that traditional cross-sectional regressions faced the famous endogeneity problems. Some of the variables that are used in the growth equations are not exogenous. Several methods to deal with endogeneity problems are used to reinvestigate the link between natural resource abundance and economic growth. The General Method of Moments with Instrumental Variables (GMM-IV), three-equation recursive model, Two-stage Least Squares and Three-stage Least Squares regression, and a heterogeneous panel data approach are suggested to properly account for endogeneity problems and to correctly study the relationship between natural resources and economic growth. All of these methods consistently provide similar proof that there was no negative relationship between natural resource abundance and economic development. On the contrary, natural resources had a positive and significant relationship with economic growth. In conclusion, natural resource abundance is not curse, but a blessing for the economy of resource-rich countries.

So, is there no resource curse? The answer is yes, there is. There seems to be a consensus that there is a conditional curse rather than an absolute curse. However, there was never a consensus on what really lead to the negative relationship between natural resource abundance and economic growth. There are many different transmission channels, which can be clustered into economic and politico-economic channels. The Dutch disease and investment channels are on top of the list of economic aspects of the link between natural resources and economic development. More recently, many authors point the finger at institutions as the mechanisms that make natural resources a curse or a blessing for an economy.

In Chapter 4, a cross-country empirical study is conducted based on the development of the literature discussed above. No existing studies so far have made a comprehensive investigation into this relationship by accounting for all the main arguments. Therefore, the next chapter will be an important source to understand the controversial relationship between natural resources and economic development.

Chapter 4: The Conditional Curse – A Cross-Country Empirical Study

4.1 Introduction

In chapter III, a large body of literature showed that the link between natural resources and economic development heavily depends on the institutional quality of resource-rich countries. Macroeconomic and political institutions play a significant role in determining whether natural resources are a curse or a blessing by directly affecting both public and private investment. The financial situation, for example, directly affects investors' confidence in resource-rich countries and investment decisions are made according to the judgment about their financial environment, such as the government's debt problems and other types of financial instability.

Similarly, the political environment is very important for resource-rich countries in many ways. Political instability, conflicts and fractionalization are the main impediments to productive activities, and they directly discourage private investment. The same is true for corruption, the business environment, law and order and the quality of the government. These factors can distort or build trust for investors and determine the efficiency of how the revenues from natural resources are used. Altogether, institutional quality either hinders or promotes the economic development of resource-rich countries, depending on whether or not they have favorable or harmful institutions. This chapter attempts to investigate this conditional relationship by analyzing cross-country data for the last three decades.

4.2 Methodology and Data

4.2.1 Economic Growth Model

The objective of this paper is to investigate the impact of natural resources on economic growth. This study follows the conditional convergence economic growth model in

Barro and Sala-i-Martin (2004), which has been commonly used by many authors with some differences in specifications and estimation techniques. The model is as follows:

$$Dy_t = F(y_0, h_0, Z_t, NR_0, IQ_t, NR_0 * IQ_t) \qquad \text{(Eq. IV-1)}$$

Dy_t: A country's GDP per capita growth rate in period t

y_0: Initial GDP per capita

h_0: Initial human capital per person

NR_0: Initial Natural Resource Dependence/Abundance

IQ_t: Institutional Quality, using Political Risk Index and Financial Risk Index

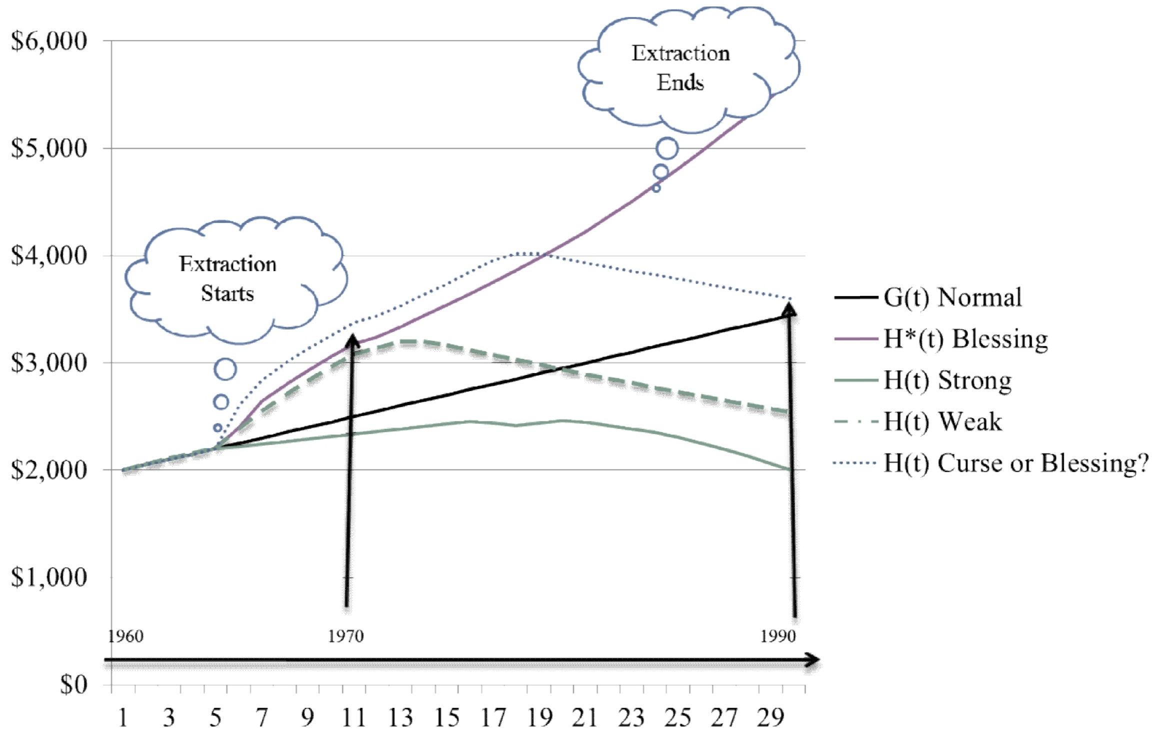
Z_t: Control and environmental variables (the ratio of real gross domestic investment to real GDP, the ratio of government consumption to GDP, and inflation rate)

In the neoclassical growth theory, economies with similar steady states will have similar income levels per capita; and the closer they are to the steady-state point, the slower the growth rate of per-capita income. This implies that holding constant all the variables that determine the steady-state conditions, economies that have a lower initial income level will catch up with those that have a higher income level due to growth effect. To represent the initial conditions, the model above uses initial per-capita GDP and human capital per person, which is represented by the reciprocal of life expectancy and fertility rate at the initial period. The vector of variables, Z_t, includes private investment, government spending, and inflation rate. These variables determine the steady-state level of output; therefore, higher levels of initial physical and human capital will yield lower returns.

4.2.2 Estimation Techniques

One of the problems that can make the finding of resource curse misleading is the decision about the initial year of reference. Figure 4-1 illustrates five scenarios of a typical economy with and without natural resources. G(t) is a case of an economy without natural resources. With a certain average growth rate of GDP per capita, this economy grew smoothly from 1960 to 1990. Now consider the case of H*(t), in which an economy started to produce oil in 1965 and experienced a resource blessing. Together with its non-oil growth, this economy managed to grow rapidly throughout the whole period. This growth path is called a resource blessing. The contrasting phenomenon is the case of H(t) Strong, where a resource-rich country performed worse than one without natural resources. This is strong evidence of a resource curse; that is, the resource-endowed country actually had a lower GDP per capita than before the extraction.

Figure 4-1: Five Scenarios of GDP per capita growth



Source: Author's conceptualization

The interpretation of the link between natural resources and economic growth is vague when the other two scenarios are considered, especially with different initial years. The case of H(t) Weak is one typical scenario where different initial year selections explain different impacts from natural resources. If the initial year is 1965, when the extraction starts, 20 years later the impact of natural resources is most likely neutral, if not positive. However, if 1970 is chosen as the initial year, 20 years later the impact of natural resources would be clearly negative. A more serious misinterpretation of the impact of natural resources is the case of H(t) Curse or Blessing. In this case, the 20 years from 1965 to 1985 show a tremendous increase of GDP per capita, yet researchers who choose 1970 as the initial year are very likely to find that natural resources are insignificant for GDP growth, if not negative. Therefore, initial year selection can be very decisive in the empirical investigation of the link between natural resources and economic growth.

Table 4-1: First Year of Commercial Extraction

Country	Year of First Commercial Extraction	Per Capita PPP GDP in 1960 (1990 International Geary-Khamis dollars)
OPEC		
Algeria	1965	2,088
Indonesia	1883	1,019
Iran	1920	2,154
Iraq	1923	2,735
Kuwait	1938	28,813
Libya	1957	1,830
Nigeria	1960	854
Qatar	1939	33,104
Saudi Arabia	1944	3,719
United Arab Emirates	1965	22,433
Venezuela	1917	9,646
Non-OPEC		
Canada	1920	8,753
Mexico	1901	3,155
Norway	1969	7,204
United Kingdom	1918	8,645
United States	1859	11,328

Source: Reproduced from Alexeev and Conrad, 2009

When an economy goes through its development stages, the accumulation of manufactured capital makes natural capital decline as a proportion of total capital. Before the 1970 to 1990 period, fast-growing economies (such as Norway, the U.S. and Canada) actually had higher dependence on natural resources. Having harnessed their natural resources and accumulated physical and human capital, these countries were able to reduce their dependence. Many empirical works in this literature use the 1970 to 1990 period, which may be the mature stage of many resource-rich countries that started extracting their natural resources well before 1970. Particularly, many fuel-rich countries started their first commercial extraction at least one decade before 1970 (see Table 4-1). It is very likely that these fuel-rich countries slowed down their production near the end of extraction stage unless they discovered new fields. If not, the studies that rely on 1970 as the initial year may find a biased negative impact of natural resources that had been extracted well before 1970.

One solution to the problem of the initial year selection is to choose as many initial years as possible, though it must be kept in mind that economic growth is a long-run phenomenon. Any division of the period into five-year or fewer intervals may face the problem of short-run economic fluctuations. Therefore, the period is divided into 10-year intervals to average out long-run growth rates and avoid any bias resulting from the use of a 20-year average, which may ignore the depletion of natural resources at the last stage of the extraction path as discussed above. This study divided the data into 1980-1989, 1990-1999, and 2000-2009 periods because the Political Risk Index and Financial Risk Index are available only from 1984.

However, to test the hypothesis that different measurements of natural resources lead to different interpretations of the relationship between natural resources and economic growth, this study employs a 20-year OLS estimation to be consistent with previous studies, particularly the work of Sachs and Warner (1997). The regression equation is as follows:

$$DGDP_{7089} = \alpha_1 + \alpha_2 * GDP_0 + \alpha_3 * \frac{1}{Life_0} + \alpha_4 * INF_{7089} + \alpha_5 * OPEN_{7089} + \alpha_6 * INV_{7089} + \alpha_7 * GOV_{7089} + \alpha_8 * NR + \varepsilon \quad \text{(Eq. IV-2)}$$

$DGDP_{7089}$: Average annual GDP per capita growth rate from 1970 to 1989

GDP_0:	Initial GDP per capita in 1970
$Life_0$:	Initial life expectancy at birth in 1970
INF_{7089}:	Average annual inflation rate from 1970 to 1989
$OPEN_{7089}$:	Average trade over GDP ratio from 1970 to 1989
INV_{7089}:	Average rate of investment in GDP from 1970 to 1989
GOV_{7089}:	Average rate of government consumption in GDP from 1970 to 1989
NR:	Different measurements of natural resources

Seemingly Unrelated Regression Estimator (SURE) is used in the period comparison to account for the correlated errors across the four periods, and this allows for more efficient estimates of the coefficients than OLS (Alaba, Oluwayemisi O & Ojo, S.O, 2010). SURE allows constant terms of each decade to vary, but constrains the coefficients to have the same values. This method has also been used recently in a similar study by Butkiewicz and Yanikkaya (2010). The regression equation system is as follows:

$$DGDP_{70} = \alpha_{70} + \alpha_2 * GDP_0 + \alpha_3 * FER_0 + \alpha_4 * \frac{1}{Life_0} + \alpha_5 * INV_{70} + \alpha_6 * GOV_{70} + \alpha_7 * INF_{70} + \alpha_8 * RENT_0 + \varepsilon_{70}$$

$$DGDP_{80} = \alpha_{80} + \alpha_2 * GDP_0 + \alpha_3 * FER_0 + \alpha_4 * \frac{1}{Life_0} + \alpha_5 * INV_{80} + \alpha_6 * GOV_{80} + \alpha_7 * INF_{80} + \alpha_8 * RENT_0 + \varepsilon_{80}$$

$$DGDP_{90} = \alpha_{90} + \alpha_2 * GDP_0 + \alpha_3 * FER_0 + \alpha_4 * \frac{1}{Life_0} + \alpha_5 * INV_{90} + \alpha_6 * GOV_{90} + \alpha_7 * INF_{90} + \alpha_8 * RENT_0 + \varepsilon_{90}$$

$$DGDP_{20} = \alpha_{20} + \alpha_2 * GDP_0 + \alpha_3 * FER_0 + \alpha_4 * \frac{1}{Life_0} + \alpha_5 * INV_{20} + \alpha_6 * GOV_{20} + \alpha_7 * INF_{20} + \alpha_8 * RENT_0 + \varepsilon_{20}$$

(Eq. IV-3)

FER_0: Fertility rate at initial year of each decade

$RENT_0$: Natural Resource Rent in GDP at initial year in each decade

Subscripts "70", "80", "90" and "20" mean average data in 1970s, 1980s, 1990s, and 2000s, respectively. Subscript "0" means initial year of each decade

Numerous works have suggested conditional curse rather than absolute curse. In this regard, it is necessary to classify resource-rich countries by their institutional quality. Several similar studies by Mehlum et al. (2006a, 2006b), Brunnschweiler (2008) and Mohsen et al. (2008) have been done, but they all have their own limitations. One limitation is to rely on the data set from 1965 to 1990, which has been strongly criticized as a period of economic turbulence. Another mistake is to arbitrarily classify resource-rich countries into possessing good or bad institutions. This practice, which has also been employed in several other works, can lead to the wrong judgment of resource-rich countries since the threshold for good and bad institutions is not clear-cut.

In order to estimate the conditional relationship and deal with endogeneity problems, this study employs Three-Stage Least Squares (3SLS), as has been done by Barro and Sala-i-Martin (2004), and includes an interactive term. The regression equation system is as follows:

$$DGDP_{80} = \alpha_{80} + \alpha_2 * GDP_0 + \alpha_3 * FER_0 + \alpha_4 * \frac{1}{Life_0} + \alpha_5 * INV_{80} + \alpha_6 * GOV_{80} + \alpha_7 * INF_{80} + \alpha_8 * SXP_0 + \alpha_9 * IQ_{80} + \alpha_{10} * Interaction + \varepsilon_{80}$$

Instruments: $GDP_{7579}, FER_{7579}, \frac{1}{Life_{7579}}, INV_{7579}, GOV_{7579}, INF_{7579}, SXP_0, IQ_0, SXP_0 * IQ_0$

$$DGDP_{90} = \alpha_{90} + \alpha_2 * GDP_0 + \alpha_3 * FER_0 + \alpha_4 * \frac{1}{Life_0} + \alpha_5 * INV_{90} + \alpha_6 * GOV_{90} + \alpha_7 * INF_{90} + \alpha_8 * SXP_0 + \alpha_9 * IQ_{90} + \alpha_{10} * Interaction + \varepsilon_{90}$$

Instruments: $GDP_{8589}, FER_{8589}, \frac{1}{Life_{8589}}, INV_{8589}, GOV_{8589}, INF_{8589}, SXP_0, IQ_0, SXP_0 * IQ_0$

$$DGDP_{20} = \alpha_{20} + \alpha_2 * GDP_0 + \alpha_3 * FER_0 + \alpha_4 * \frac{1}{Life_0} + \alpha_5 * INV_{20} + \alpha_6 * GOV_{20} + \alpha_7 * INF_{20} + \alpha_8 * SXP_0 + \alpha_9 * IQ_{20} + \alpha_{10} * Interaction + \varepsilon_{20}$$

Instruments: $GDP_{9599}, FER_{9599}, \frac{1}{Life_{9599}}, INV_{9599}, GOV_{9599}, INF_{9599}, SXP_0, IQ_0, SXP_0 * IQ_0$ (Eq. IV-4)

Subscripts "7579", "8589", and "9599" mean average data in 1975-1979, 1985-1989, and 1995-1999, respectively. *Interaction* means $SXP_0 * IQ$

4.2.3 Data

4.2.3.1 World Development Indicators

Most of the data are from the World Development Indicators (World Bank, 2012) unless otherwise stated. Table 4-2 describes all of the main variables used in the regression. All of the variables have expected negative relationships with GDPD, average annual growth in real GDP per capita, except INV, the share of gross fixed capital formation in GDP, and the interaction terms between natural resources and institutional quality as represented by Financial or Political Risk Indexes from the International Country Risk Guide (ICRG) by the PRS Group (2011).

Initial variables such as GDP0, FER0, and LIFE0 are the proxies for initial human and physical capital to represent the initial conditions. Economies with a higher initial level of GDP per capita have a lower growth rate than economies with similar steady-state conditions. This is the notion of the conditional convergence growth theory. On the other hand, any control variable that raises the steady-state level of GDP per capita also leads to a higher growth rate of GDP per capita during the transition from the initial level to the steady-state level.

Table 4-2: WDI Variables used in the regression

No	Variable	Description	Calculation	Sign
1	DGDP	Average annual growth in real GDP per capita	100*(1/z)*ln(GDPcap(t+z)/GDPcap(t))	
2	GDP0	Natural log of real GDP per capita	ln(RGDPcap(t))	-
3	FER0	Natural log of fertility rate, total (births per woman)		-
4	1/LIFE0	Natural log of the reciprocal life expectancy at birth to represent Motality Rate	ln(1/Life)	-
5	INV	Gross fixed capital formation (% of GDP)	Average	+
6	GOV	General government final consumption expenditure (% of GDP)	Average	-
7	INF	Inflation as measured by the annual growth rate of the GDP implicit deflator shows the rate of price change in the economy as a whole. The GDP implicit deflator is the ratio of GDP in current local currency to GDP in constant local currency.	100 + the growth rate of GDP deflator, to eliminate the deflation in some years. Average	-
8	SXP	Share of exports of primary products in GNP in 1970. Primary products or natural resource exports are exports of "fuels" and "non-fuel primary products" from SITC categories 0, 1, 2, 3, 4, and 68.	Both numerator and denominator are measured in nominal dollars. The World Data uses a smoothed exchange rate to convert local currency GNP to dollars	-
9	Rent	Total natural resources rents are the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents.	"The Changing Wealth of Nations: Measuring Sustainable Development in the New Millennium" (World Bank, 2011).	-
10	Interaction Term	Resource Rich with good institution	Natural Resource*Institutional Quality	+

Note: Variables with "0" suffix are initial values in each period; that is 1970, 1980, 1990, and 2000.

A higher fertility rate is equivalent to higher population growth, which negatively affects the steady-state ratio of capital to effective labor. This is the phenomenon of population pressure on economic growth. Similarly, the reciprocal of life expectancy is a proxy for health capital. A higher value of this variable represents a higher mortality rate if it is independent of age. This variable can act as a quality of health, which directly affects the productivity of the labor force, and hence, economic performance. The investment ratio of GDP is expected to determine the steady-state level of GDP per capita. A higher investment ratio is positively correlated with a higher level and growth rate of GDP per capita. In contrast, the inflation rate and the share of government consumption expenditure are considered to create market distortions that can affect private decisions; thus, they have an expected negative relationship with level and growth rate of the economy.

Finally, RENT, SXP and interaction terms between natural resources and institutional quality are the variables in this study. There are strong supports of conditional curse rather than absolute curse. Therefore, without classification of resource-rich countries by their institutional quality, natural resources are not expected to have either a positive or a negative relationship with economic performance. Once that distinction is made, resource wealth with a favorable institutional quality as represented by the interaction terms is expected to have a positive effect on economic growth.

4.2.3.2 Measurements of Natural Resources

Two main controversies on the measurements of natural resources are dealt with in this study. One is the definition of natural resources as only the production of minerals and fuels against the exports of overall primary resources, including renewable commodities. The other discussion is the distinction between natural resource dependence, as represented by the share of GDP, and abundance as represented by exports or production value per capita.

Sachs and Warner (1995, 1997) preferred SXP, the share of primary-product exports to GDP, but they also tested several other measures of natural resources. Their preference for SXP was justified by two main arguments. One is that SXP has arguably more coverage and fewer measurement errors because it is a recorded data as opposed to production value, which is an estimated data and covered fewer countries, especially developing countries, during the time of study. The other reason is that using the share of natural resource exports in GDP can reflect their importance in the economy and thus the impact on economic growth. This study agrees with the use of share of GDP rather than per-capita measures because the objective is to reveal the impacts of natural resources on GDP growth rate. Per-capita measures may not reveal the impact of natural resources on the economy if their share of GDP is small.

However, SXP has a few problems that may require a better alternative, which is RENT, the estimated production value by World Bank (2011). One is that there is a distinction between non-renewable resources and agricultural products, both of which use SXP indiscriminately as a proxy. This distinction has been posited to yield remarkably different interpretations of the impact of natural resources on development. Another reason is that natural resources may be used domestically rather than for exports. Therefore, exports of natural resources do not reveal the true impact of domestic-market oriented production. RENT, thus, is one significant proxy for the measure of natural resources.

Table 4-3: Measurement of Natural Resource Rents

Indicator	Description	Source Note
Oil rent	Product of unit rents from oil extraction and production quantity.	World Bank staff estimates using data from GEM Commodities database, IMF World Economic Outlook, International Energy Agency, Organization of the Petroleum Exporting Countries,
Gas rent	Rents = Unit Rents * Production	
Coal rent	Unit Rents = Unit Price – Unit Cost	
Mineral rent	Product of unit rents from bauxite extraction and production quantity. Rents = Unit Rents * Production Unit Rents = Unit Price – Unit Cost	World Bank staff estimates using data from US Geological Survey Mineral Commodity Summaries, GEM Commodities database, and US Bureau of Mines 1987.
Forest net rent	Forest rents net of increment is calculated as the excess of roundwood harvest over natural growth times the product of average prices and a region-specific rental rate.	World Bank staff estimates using data from Food and Agriculture Organization, United Nations Economic Commission for Europe, World Resources Institute and national sources.

Source: World Bank, 2012

Table 4-3 shows how the rents of fuel, mineral, and forest resources are estimated, and Table 4-4 shows the top 20 ranking of resource-rich countries based on RENT, RENT per capita and SXP in 1990 and 2000. As expected, there are ranking differences depending on the definition of natural resources. Countries in yellow are those that only appear in one measurement, but not in the others. For example, Nigeria, Liberia, Angola, and Uzbekistan were the top 20 richest countries in terms of RENT, yet do not appear in the top 20 in the other two criteria. Similarly, Monaco, Norway, Canada, Russia, and Australia have one of the highest natural resources per capita but not as the share of their GDP. This is one reason why some studies call for the distinction between natural resource dependence and abundance.

Table 4-4: Top 20 Resource-Rich Countries in 1990 and 2000

Rank	Country	RENT0	Country	RENTc0		Country	SXP0	
1	Nigeria	47.4	Monaco	1,813,198	#N/A	Brunei Darussalam	62.6	4
2	Congo, Rep.	45.9	United Arab Emirates	1,142,540	8	Bahrain	49.5	12
3	Papua New Guinea	45.5	Qatar	669,662	6	Qatar	44.5	6
4	Brunei Darussalam	44.4	Brunei Darussalam	620,303	4	Oman	44.4	7
5	Saudi Arabia	43.3	Kuwait	329,679	11	Greenland	43.0	#N/A
6	Qatar	43.1	Bahrain	319,082	12	Angola	38.1	15
7	Oman	42.1	Saudi Arabia	313,029	5	Singapore	36.0	#N/A
8	United Arab Emirates	40.8	Norway	297,946	#N/A	Kuwait	35.7	11
9	Liberia	39.0	Oman	263,391	7	Saudi Arabia	35.3	5
10	Venezuela, RB	38.0	Libya	223,695	14	Venezuela, RB	33.2	10
11	Kuwait	37.3	Gabon	222,142	13	Suriname	30.4	18
12	Bahrain	37.2	Greenland	141,410	#N/A	Papua New Guinea	29.3	3
13	Gabon	34.7	Turkmenistan	125,611	#N/A	Trinidad and Tobago	28.3	17
14	Libya	33.5	Trinidad and Tobago	111,412	17	Honduras	26.6	#N/A
15	Angola	30.4	Venezuela, RB	90,582	10	Nicaragua	25.5	#N/A
16	Yemen, Rep.	27.0	Canada	76,045	#N/A	Ecuador	25.2	#N/A
17	Trinidad and Tobago	26.7	Russian Federation	66,748	#N/A	St. Lucia	22.9	#N/A
18	Suriname	25.5	Australia	60,315	#N/A	Iceland	22.7	#N/A
19	Syrian Arab Republic	24.8	Congo, Rep.	53,756	2	Dominica	22.2	#N/A
20	Azerbaijan	23.9	Iran, Islamic Rep.	42,908	#N/A	Fiji	22.0	#N/A
Rank	**Country**	**RENT0**	**Country**	**RENTc0**		**Country**	**SXP0**	
1	Iraq	92.8	Qatar	1,442,565	11	Iraq	77.8	1
2	Congo, Rep.	74.7	Monaco	1,238,533	#N/A	Turkmenistan	70.5	#N/A
3	Equatorial Guinea	66.4	United Arab Emirates	1,160,377	20	Tajikistan	67.5	#N/A
4	Angola	64.8	Kuwait	1,020,199	6	Qatar	59.7	11
5	Azerbaijan	55.8	Brunei Darussalam	935,471	7	Papua New Guinea	56.8	15
6	Kuwait	52.5	Norway	726,017	#N/A	Guyana	56.0	#N/A
7	Brunei Darussalam	51.0	Oman	427,215	10	Oman	49.5	10
8	Gabon	50.7	Saudi Arabia	409,451	14	Kuwait	48.7	6
9	Uzbekistan	48.9	Bahrain	368,262	#N/A	United Arab Emirates	46.6	20
10	Oman	48.7	Libya	237,476	19	Nigeria	45.5	12
11	Qatar	48.0	Gabon	208,091	8	Gabon	44.0	8
12	Nigeria	47.0	Trinidad and Tobago	195,916	#N/A	Yemen, Rep.	42.9	17
13	Russian Federation	45.3	Equatorial Guinea	159,970	3	Algeria	39.3	#N/A
14	Saudi Arabia	43.6	Turkmenistan	138,407	#N/A	Kazakhstan	38.3	18
15	Papua New Guinea	40.3	Venezuela, RB	136,105	#N/A	Saudi Arabia	38.2	14
16	Iran, Islamic Rep.	39.1	Canada	122,956	#N/A	Trinidad and Tobago	37.3	#N/A
17	Yemen, Rep.	39.1	Iraq	98,741	1	Honduras	36.8	#N/A
18	Kazakhstan	38.7	Russian Federation	80,418	13	Seychelles	30.0	#N/A
19	Libya	36.6	Australia	77,682	#N/A	Azerbaijan	29.8	5
20	United Arab Emirates	33.7	Congo, Rep.	76,684	2	Norway	27.3	#N/A

Source: WDI and calculation based on WDI by World Bank, 2012

However, cross correlations between various measures of natural resources in Table 4-5 do not show any systematic differences but only reduced correlation significance across all four decades. All cross correlations are significant to at least five per cent, except the correlation between initial RENT and exports of primary resources per capita in 2000. The strongest correlation is between initial and decade-average measures of natural resource production in all four decades, which is a strong support for the use of initial measures of natural resources to study growth effect on GDP per capita and avoid reverse causality from the latter.

Table 4-5: Correlations between RENT0 and other measures of natural resources

	_70RENT0		_80RENT0		_90RENT0		_20RENT0
_70RENT	0.9	_80RENT	1.0	_90RENT	1.0	_20RENT	1.0
_70RENT0	1.0	_80RENT0	1.0	_90RENT0	1.0	_20RENT0	1.0
_70RENTC0	0.6	_80RENTC0	0.7	_90RENTC0	0.4	_20RENTC0	0.4
_70RMF0	0.9	_80RMF0	0.5	_90RMF0	0.9	_20RMF0	0.8
_70RMFC0	0.7	_80RMFC0	0.4	_90RMFC0	0.5	_20RMFC0	0.3
_70RSXP0	0.8	_80RSXP0	0.5	_90RSXP0	0.8	_20RSXP0	0.7
_70RSXPC0	0.7	_80RSXPC0	0.4	_90RSXPC0	0.4	_20RSXPC0	0.2

Note: _70, _80, _90, and _20 stands for the 1970s, 1980s, 1990s, and 2000s respectively. RMF is the share mineral and fuel rent in GDP. The suffix “C” stands for per capita; “0” stands for initial year; and variables without “0” are decade averages.

The arguments on the use of share or per-capita measures of natural resources seem less relevant since there is a significant and positive relationship between the two measures. In other words, countries that have a higher share of natural resources in GDP also tend to have higher natural resources per capita. What is more important is the correlation between RENT0 and SXP0. Despite their different interpretations of resource richness, they have a very high correlation across all the four decades. This implies that the choice between RENT and SXP does not lead to structural differences in investigating the link between natural resources and economic growth. Therefore, both measures of natural resources can be safely used and are shown interchangeably in the regression results below.

4.2.3.3 International Country Risk Guide as a Measure of Institutional Quality

It is a common practice to use certain variables as a proxy for political and macroeconomic institutions. For example, the corruption index, bureaucratic quality, constitutional quality, fractionalization and ethnic tension have all been individually used in various studies to represent the political transmission mechanisms. Similarly, debt overhang, financial development, economic volatility, and investment rate or genuine investment rate are candidates for the macroeconomic channels. All of these individual transmission channels have been proved the determinants of the relationship between natural resources and economic growth in one work or another. However, very few works have attempted to investigate the transmission channels by using a comprehensive variable to represent the macroeconomic and politico-economic channels that this study groups from various smaller channels.

To achieve this objective, this study uses the risk assessment index from the International Country Risk Guide (The PRS Group, 2011). Particularly, the Political Risk index and the Financial Risk index are used as a proxy for the macroeconomic and the politico-economic channels, respectively. Based on both subjective and objective assessments, ICRG is widely used by institutional investors, banks, multinational corporations, and so on. The decisions by all of these institutions can have a direct impact on investment plans, and thus the economic performance of resource-rich countries. Therefore, these two indexes are significant proxies for the determinants of the link between natural resources and economic growth.

- The Financial Risk Rating

The Financial Risk Rating measures a country's ability to finance its official, commercial, and trade debt obligations. In this sense, this index can represent the macroeconomic channel in this literature. This rating is an objective index based on five components. The first one is the share of the estimated gross foreign debt in the gross domestic product. Two components are the estimated foreign debt service and the balance of the current account as a percentage of total exports of goods and services. Another component, net liquidity in months, is the total estimated official reserves divided by the average monthly merchandize import cost. The last component is exchange rate stability, which is the appreciation or depreciation of a currency against the US dollar as a percentage change.

- The Political Risk Rating

This rating measures political stability, which acts as a proxy for the politico-economic channel. The rating is a very comprehensive index of 12 components. Before 2001, the index only covered seven components such as corruption, the military in politics, religious tensions, law and order, ethnic tensions, democratic accountability and bureaucracy quality. However, these initial components have been given half weights after five more relevant components were introduced in 2001. The new components are government stability, socioeconomic conditions, investment profile, internal and external conflict.

Table 4-6 shows the political risk rating and the financial risk rating of countries that have more than nine per cent of natural resource exports in GDP.[4] In general, the financial risk rating of resource-rich countries has been improving over time. From 1984 to 1989, a

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[4] The nine percent share of primary exports in GDP is an arbitrary definition of resource-rich countries. Stevens and Dietsche (2008) chose countries with over 30 per cent of fuel and mineral exports in total merchandise exports.

majority of these countries were in a bad financial situation. Many resource-rich countries became indebted after the fall of fuel prices. As a result, almost all of them were rated from moderate to very high risk. However, the last two decades saw an improved rating of the financial situations in resource-rich countries, especially in the 2000s. Unlike their financial risk rating, more than half of the resource-rich countries have been plagued by a poor political risk rating throughout the three decades while many other resource-rich countries managed to increase their rating subsequently.

Table 4-6: Political and Financial Risk Rating of Resource-Rich Countries

SXP0 > 9%	**Political Risk**	1980s	1990s	2000s	**Financial Risk**	1980s	1990s	2000s
Very High Risk	0.0%-49.9%	21	3	6	0.0%-24.5%	19	2	1
High Risk	50%-59.9%	12	10	12	25%-29.9%	11	8	3
Moderate Risk	60%-69.9%	5	13	20	30%-34.9%	6	7	17
Low Risk	70%-79.9%	2	5	14	35%-39%	2	10	22
Very Low Risk	80% or more	8	5	8	40% or more	8	10	17
		48	**36**	**60**		**46**	**37**	**60**

Source: Political and Financial Risks are from The PRS Group, 2011. SXP0 is from World Bank, 2012

4.2.4 Descriptive Statistics

Table 4-7 provides the descriptive statistics of the variables for the four decades used in this study. Each period has a similar standard deviation, which indicates that world income distribution remains generally constant. During the 1970s, the world grew on average at 2.2 per cent annually, yet the 1980s and 1990s were two decades with much slower growth rates of less than one per cent annually. Fortunately, the world picked up 2.2 per cent growth rate again in the 2000s. Similarly, average initial GDP per capita, GDP0, jumps from about 5,000 US dollars in 1970 to almost 6,750 US dollars in 1980, though it slightly dropped to about 6,500 in 1990 before increasing to about 7,900 US dollars in 2000. The share of natural resources in GDP, on the other hand, somehow has been counter-cyclical regardless of different measurements. In the 1970s and 2000s when the world was growing fast, the initial share of natural resources, both Rent0 and RSXP0, were lower than in 1980 and 1990.

Table 4-7: Descriptive Statistics for Four Decades

Variable	Mean	Median	Max	Min	Std. Dev.	Obs
_70GDPD	2.19	2.30	9.60	-3.57	2.23	119
_70GDP0	4,974.34	1,438.31	50,458.25	121.24	7,504.11	119
_70FER0	5.15	5.79	8.14	1.83	1.93	188
_70LIFE0	58.11	60.79	74.65	33.96	11.27	190
_70INV	22.16	22.67	42.14	8.50	6.69	110
_70GOV	16.06	15.11	42.22	5.68	6.31	121
_70INF	114.24	109.93	301.83	100.11	20.75	134
_70RENT0	5.60	2.14	49.23	0.00	9.39	131
_70RSXP0	12.54	7.87	56.04	0.00	13.88	84

Variable	Mean	Median	Max	Min	Std. Dev.	Obs
_80GDPD	0.84	1.18	7.20	-6.29	2.51	142
_80GDP0	6,746.47	2,128.11	65,841.20	135.44	10,578.29	142
_80FER0	4.56	4.74	8.99	1.44	2.04	188
_80LIFE0	61.75	65.01	76.61	34.66	10.51	189
_80INV	22.67	21.96	56.49	4.45	7.66	150
_80GOV	17.41	16.94	58.31	2.34	8.04	155
_80INF	142.05	107.38	2040.80	98.33	194.25	169
_80RENT0	11.61	3.20	92.50	0.00	20.30	145
_80RSXP0	18.99	12.14	215.44	0.00	27.57	91
_80POL	56.45	53.61	94.06	18.14	17.11	123
_80FINAN	28.61	26.88	49.80	12.84	10.25	104

Variable	Mean	Median	Max	Min	Std. Dev.	Obs
_90GDPD	0.72	1.20	13.74	-11.86	2.96	182
_90GDP0	6,504.50	1,833.18	70,463.66	128.97	10,208.20	183
_90FER0	3.95	3.65	8.66	1.26	1.86	192
_90LIFE0	64.72	68.19	78.84	32.83	10.28	192
_90INV	22.03	20.63	64.35	5.95	8.39	177
_90GOV	16.98	16.45	42.53	4.53	6.87	176
_90INF	196.00	107.29	3758.02	96.23	348.85	196
_90RENT0	7.72	2.45	47.42	0.00	11.64	184
_90RSXP0	13.51	8.61	62.56	0.04	12.96	91
_90POL	63.67	63.73	91.60	23.73	13.41	138
_90FINAN	33.51	33.46	48.94	10.63	8.57	125

Variable	Mean	Median	Max	Min	Std. Dev.	Obs
_20GDPD	2.18	1.96	12.96	-5.65	2.38	185
_20GDP0	7,920.70	2,060.58	75,606.20	86.76	12,532.29	199
_20FER0	3.21	2.65	7.73	0.93	1.69	195
_20LIFE0	66.78	70.38	81.08	39.73	10.51	198
_20INV	21.87	21.66	49.59	6.88	5.96	179
_20GOV	16.19	15.71	44.36	3.38	6.14	179
_20INF	107.87	105.33	206.12	97.49	10.78	201
_20RENT0	8.65	2.18	92.85	0.00	16.07	197
_20RSXP0	13.76	7.96	77.83	0.00	15.51	151
_20POL	67.37	66.01	93.48	25.99	13.19	139
_20FINAN	36.59	36.52	47.99	17.22	5.19	139

Source: World Development Indicators by World Bank, 2012 and ICRG by The PRS Group, 2011

The inflation rate had a negative correlation with GDP growth rate. Average inflation rates in the 1970s and 2000s were relatively stable and less than 15 per cent annually. However, inflation rates in the 1980s and the 1990s were 42 and 96 per cent respectively. These average inflation rates were largely due to a dozen of countries whose macroeconomic situations were out of control. The political and financial risk ratings, POL and FINAN, have been improving gradually on average from 1984 to 2009. In fact, these two ratings increased very quickly during the 1990s because many countries that had bad financial and political turbulence during the 1980s were able to recover. Other control variables such as fertility rate, life expectancy, investment ratio and government spending ratio were relatively stable during the period.

4.3 Regression Results

4.3.1 Do Different Measurements of Natural Resources Tell Different Stories?

Despite a huge literature dedicated to the distinction between natural resource abundance and dependence, between renewable and non-renewable resources, and between export and production-oriented resources, this study finds that such distinctions do not produce any different interpretations of the link between natural resources and economic growth.

As Table 4-8 clearly shows, all five measures of natural resources have a significant negative relationship with average annual economic growth rate from 1970 to 1989. Rent70 and SXP70 are two measures to test the distinction between production and export data of natural resources, while M_FUEL70 excludes renewable resources or so-called diffused resources, particularly food products. PRIMCAP70 is used to test the distinction between resource dependence and abundance. Lastly, SXP is the average measure of resource exports over the entire 20-year period as opposed to the initial measure. All five measures of natural resources have a significant negative relationship with annual average economic growth from

1970 to 1989. This is a strong empirical rebuttal against many works that attempted to use different measurements of natural resources to interpret their impacts on economic growth differently.

Table 4-8: Different Measurements of Natural Resources and Economic Growth

Dependent Variable: Average annual growth rate of real GDP per capita between 1970 to 1989										
	1		2		3		4		5	
	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value
Constant	-20.267	0.000	-19.881	0.000	-20.023	0.000	-20.931	0.000	-21.717	0.000
GDP0	-0.576	0.001	-0.627	0.001	-0.440	0.009	-0.528	0.015	-0.156	0.449
1/LIFE0	-5.906	0.000	-6.000	0.000	-5.755	0.000	-5.987	0.000	-6.264	0.000
INF	-0.003	0.004	-0.003	0.003	-0.003	0.002	-0.003	0.005	-0.002	0.008
OPEN	0.007	0.040	0.013	0.000	0.009	0.016	0.008	0.032	0.015	0.000
INV	0.143	0.000	0.132	0.000	0.120	0.000	0.145	0.000	0.116	0.000
GOV	-0.044	0.082	-0.043	0.088	-0.061	0.013	-0.051	0.074	-0.047	0.070
RENT70	-0.041	0.048								
SXP70			-0.080	0.000						
SXP					-0.020	0.016				
M_FUEL70							-0.066	0.000		
PRIMCAP70									-0.543	0.000
R-squared	0.57		0.74		0.60		0.66		0.71	
Obsevations	105		76		96		76		76	

Note: The suffixes "70" and "0" mean that the values are in 1970. "P-value" is the significance level based on t-statistics. M_FUEL70 is the share of only mineral and fuel resource rents in GDP while PRIMCAP70 is primary exports per capita. The estimation method is by OLS with 20-year data.

4.3.2 Can the Resource Curse Findings Survive the Test of Time?

Another controversy in the literature of the resource curse is the time period used. A large number of resource curse studies use the data from 1970 to 1989, which many critics argue as a period of economic failures. Thus, any interpretation drawn from this period can be very misleading. This proves correct, since the comparison between the two periods, 1970 to 1989 and 1990 to 2009, yields contrasting impacts of natural resources on economic growth (see Table 4-9).

From 1970 to 1989, RENT0 is very significant and negative while it turns significantly positive from 1990 to 2009. As expected, the impact of natural resources on economic growth is not significant, though negative, when all the four decades are studied. These findings are very robust since almost all main control and initial variables keep their expected signs and significance levels across the three regressions.

Table 4-9: Natural Resources and Economic Growth, 1970-89 vs. 1990-09

Dependent Variable: Average annual growth rate of real GDP per capita for four decades						
	1970-1989		1990-2009		All four decades	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Constant 1970s	-7.644	0.147			-1.255	0.740
1980s	-9.168	0.084			-2.826	0.458
1990s			3.360	0.506	-3.147	0.409
2000s			4.213	0.401	-2.220	0.558
GDP0	-0.705	0.000	-0.528	0.000	-0.619	0.000
FER0	-1.565	0.001	-1.498	0.000	-1.440	0.000
1/LIFE0	-3.784	0.006	-0.321	0.797	-2.033	0.033
INV	0.151	0.000	0.163	0.000	0.161	0.000
GOV	-0.043	0.045	-0.070	0.000	-0.065	0.000
INF	-0.002	0.018	-0.003	0.000	-0.003	0.000
RENT0	-0.035	0.001	0.021	0.015	-0.003	0.638
R^2	**0.27, 0.50**		**0.27, 0.47**		**0.29, 0.39, 0.26, 0.44**	
Observation	**95, 119**		**159, 166**		**95, 119, 159, 166**	

Note: The estimation is by Seemingly Unrelated Regression Estimator (SURE) with decade average data; that is the period averages in 1970s, 1980s, 1990s, and 2000s. Each decade has its own R^2 and observations. The suffix “0” means initial values in each decade. The “P-value” is derived from t-statistics.

Therefore, can it be concluded that natural resources have not had any impact on economic growth for the past four decades? As discussed in the literature, the impact of natural resources is positive or negative according to the institutional quality of the resource-rich countries. Failure to classify resource-rich countries based on their institutional quality cannot reveal the relationship between natural resources and economic growth. The next section attempts to achieve this objective.

4.3.3 The Conditional Curse of Natural Resources

The link between natural resources and economic growth is conditional upon the institutional quality of resource-rich countries. Table 4-10 reveals the relationship between natural resources and economic growth in resource-rich countries conditional upon their financial risk rating. Columns 1 and 2 show the impact of natural resources without the interaction. As expected, in general the relationship is insignificant. Column 3 shows the interaction between natural resources and financial risk rating. The interaction term is significant and positive. This suggests that resource-rich countries that have a more favorable financial environment tend to benefit more from their natural endowments.

Table 4-10: Natural Resources, Financial Risk and GDP growth

Dependent variable is average annual growth rate of real GDP per capita from 1980 to 2009

	(1)			(2)			(3)		
	Coef	S.E	P-value	Coef	S.E	P-value	Coef	S.E	P-value
Constant 1980s	-1.7432	5.2779	0.741	-6.7410	5.4855	0.220	-2.9246	5.3905	0.588
1990s	-1.6853	5.3041	0.751	-7.1571	5.5495	0.198	-3.3344	5.4481	0.541
2000s	-1.8376	5.2628	0.727	-7.1994	5.5012	0.192	-3.4215	5.4011	0.527
GDP0	-1.1006	0.1238	0.000	-1.3090	0.1423	0.000	-1.2625	0.1377	0.000
FER0	-2.5542	0.3273	0.000	-2.0907	0.3497	0.000	-2.1496	0.3410	0.000
1/LIFE0	-3.1233	1.3396	0.020	-3.8550	1.3706	0.005	-3.1698	1.3370	0.019
INV	0.0830	0.0291	0.005	0.0588	0.0311	0.060	0.0730	0.0302	0.016
GOV	0.0169	0.0216	0.435	0.0271	0.0209	0.196	0.0317	0.0207	0.126
INF	-0.0022	0.0011	0.054	-0.0008	0.0010	0.417	-0.0007	0.0010	0.479
SXP0	0.0061	0.0056	0.280	0.0015	0.0054	0.782	-0.1052	0.0399	0.009
FinanRisk				0.1030	0.0236	0.000	0.0603	0.0256	0.019
Interaction							0.0028	0.0010	0.007
R^2	0.46, 0.29, 0.49			0.53, 0.39, 0.54			0.58, 0.37, 0.56		
Observation	74, 79, 134			66, 73, 115			66, 73, 115		

Note: Estimation is by Three-Stage Least Squares with decade average data; that is, the period averages in 1980s, 1990s, and 2000s. Each decade has its own R^2 and observations. The instrumental variables include five-year averages of lagged values of GDP, FER, 1/LIFE, INV, GOV, and INF. The initial value of the FinanRisk is used as its instrumental variable and in the interaction term.

Table 4-11 shows a similar result with political risk rating. The interaction term between natural resources and political risk rating is positive and highly significant. This suggests that resource-rich countries with better political institutions also benefit more from their natural endowments.

It should be noted that three control variables such as government consumption, inflation and the political risk rating have significant impacts on growth in OLS or SURE estimation, but they lose their significance level in the 3SLS estimation. This suggests that there could be reverse causality between growth and these variables.

Table 4-11: Natural Resources, Political Risk and GDP growth

Dependent variable is average annual growth rate of real GDP per capita from 1980 to 2009

	(1)			(2)		
	Coef	S.E	P-value	Coef	S.E	P-value
Constant 1980s	-2.6780	5.8753	0.649	0.3330	5.7941	0.954
1990s	-2.5254	5.9287	0.671	0.4628	5.8426	0.937
2000s	-2.6662	5.8895	0.651	0.3680	5.8078	0.950
GDP0	-1.1131	0.1688	0.000	-1.0636	0.1641	0.000
FER0	-2.4196	0.3638	0.000	-2.4689	0.3538	0.000
1/LIFE0	-3.1131	1.4706	0.035	-2.6579	1.4296	0.064
INV	0.0889	0.0327	0.007	0.0888	0.0316	0.005
GOV	0.0196	0.0224	0.384	0.0227	0.0218	0.299
INF	-0.0018	0.0011	0.102	-0.0013	0.0011	0.259
SXP0	0.0043	0.0058	0.453	-0.1220	0.0483	0.012
PolRisk	0.0098	0.0161	0.542	-0.0130	0.0178	0.465
Interaction				0.0019	0.001	0.009
R^2			0.47, 0.30, 0.50			0.49, 0.31, 0.54
Observation			66, 72, 116			66, 72, 116

Note: Estimation is by Three-Stage Least Squares with decade average data; that is, the period averages in 1980s, 1990s, and 2000s. Each decade has its own R^2 and observations. The instrumental variables include five-year averages of lagged values of GDP, FER, 1/LIFE, INV, GOV, and INF. The initial value of the PolRisk is used as its instrumental variable and in the interaction term.

The interactive model also provides consistent results using the other measurements of natural resources, especially the RENT0. However, its interaction terms with both FinanRisk and PolRisk slightly lose their significance levels, suggesting that RENT0 is not a good proxy for natural resource endowment, given the fact that it is estimated data.

Furthermore, it should be kept in mind that the regression result tables above are not sufficient to interpret the relationship between natural resources and economic growth. The coefficients and significance levels of SXP0 are given in the tables only when FinanRisk and PolRisk are zero, which is not realistic and out of sample. In other words, we cannot infer that natural resources have a negative main effect on economic growth. To see this, remember that the coefficient and significance levels of SXP0 are given as follows:

$\frac{dDGDP}{dSXP0} = -0.105 + 0.0028 * FinanRisk$, is the conditional effect of SXP0 for the interactive model with the financial risk rating and,

$\frac{dDGDP}{dSXP0} = -0.122 + 0.0019 * PolRisk$, is the conditional effect of SXP0 for the interactive model with the political risk rating.

Similarly,

$S_{(\alpha_8+\alpha_{10}FinanRisk)} = \sqrt{var(\alpha_8) + FinanRisk^2 * var(\alpha_{10}) + 2FinanRisk * cov(\alpha_8, \alpha_{10})}$, is the standard error of the conditional effect of SXP0 for the interactive model with the financial risk rating and,

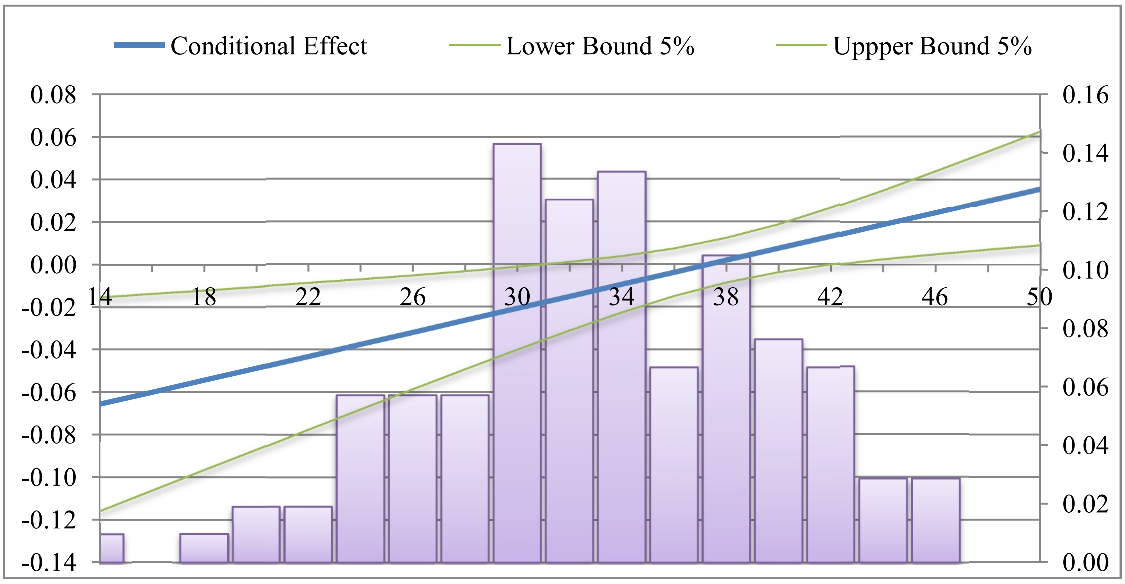
$S_{(\alpha_8+\alpha_{10}PolRisk)} = \sqrt{var(\alpha_8) + PolRisk^2 * var(\alpha_{10}) + 2PolRisk * cov(\alpha_8, \alpha_{10})}$, is the standard error of the conditional effect of SXP0 for the interactive model with the political risk rating[5].

The conditional effects of natural resources on economic growth, therefore, can be shown in Figure 4-2 and Figure 4-3. In the case of the conditional effects based on the financial risk rating, natural resources have a positive relationship with economic growth once a country has a score of more than 36. The relationship is significant at a five per cent level if

[5] These standard errors can be derived using these three equations: $\text{var}(aX) = a^2\text{var}(X)$; $\text{var}(X+Y) = \text{var}(X) + \text{var}(Y) + 2\text{cov}(X,Y)$; and $\text{cov}(X, aY) = a\text{cov}(X,Y)$. Refer to Friedrich (1982) for details.

a country is rated with a score of more than 42. In the ICRG's criteria, this means that a country with a very low risk has been blessed by their natural endowments for the last three decades. On the other hand, there is still strong evidence for the resource curse for those countries that had a high financial risk with a score of 30 or less. These countries account for more than 37 per cent of the sample. What is more interesting is that more than half of the sample has experienced neither curse nor blessing from their natural resources. In other words, countries that had only moderate or lower financial risk could safely escape from the resource curse even though only very low financial risk countries have experienced significant resource blessing.

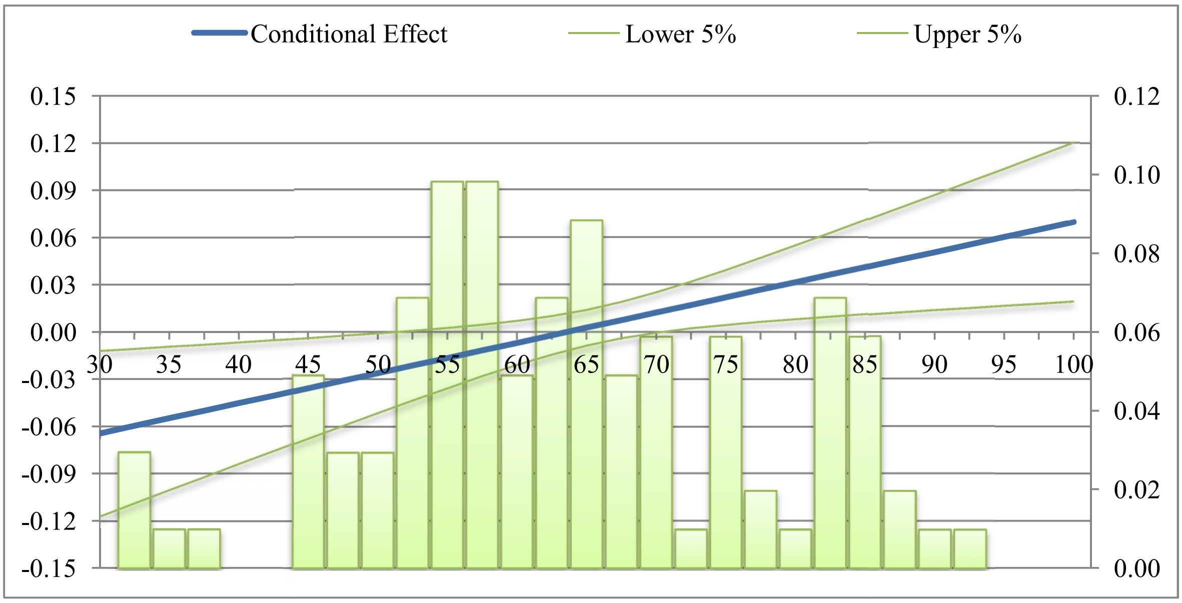
Figure 4-2: Conditional Effects of SXP0 at Different Financial Risk Rating Index



Note: The horizontal axis shows the Financial Risk Rating index. The left vertical axis shows the conditional effects of natural resources on economic growth (the lines). The right vertical axis shows the percentage of resource-rich countries (the histogram).

The same explanation goes for the conditional effects based on political risk, yet natural resources are more favorable to those with a low political risk. Figure 4-3 shows that there is strong evidence of the resource curse only for countries with a very high political risk (a score of 50 or less) and this group accounts for only about 16 per cent of the sample. However, there is also a strong evidence of resource blessing for countries with a low political risk of more than 70 on the ICRG index, which accounts for about 26 per cent of the sample. Countries with a moderate to high political risk from 50 to 70 have experienced neither curse nor blessing from their natural resources.

Figure 4-3: Conditional Effects of SXP0 at different Political Risk rating index



Note: The horizontal axis shows the Political Risk Rating index. The left vertical axis shows the conditional effects of natural resources on economic growth (the lines). The right vertical axis shows the percentage of resource-rich countries (the histogram).

In terms of resource-rich countries that have more than nine per cent of their primary exports in GDP, Table 4-6 provides the number of resource-blessed or cursed countries based on the above results. In terms of financial risk rating in the 1980s, around 65 per cent, or 30 out of 46 resource-rich countries fell prey to the resource curse because of their financial turmoil, especially debt crisis and exchange rate fluctuation. Only 16 countries, or around 35 per cent, have escaped the resource curse, half of which have been blessed by their natural resources. Fortunately, resource-rich countries better managed their financial environment in subsequent decades. As a result, in the 1990s, 27 per cent of resource-rich countries were resource-cursed; and interestingly another 27 per cent of resource-rich countries experienced resource blessing. Furthermore, in the 2000s, only 7 per cent of resource-rich countries were cursed because of their financial risk while roughly 28 per cent were able to significantly gain benefit from their natural endowment.

Natural resources have been more generous to their countries with poor political quality. Around 44 per cent of resource-rich countries in the 1980s were resource-cursed while around 21 per cent were blessed. Resource-rich countries substantially increased their political rating in the subsequent decades. Due to the improvement of their political stability, only around 8 per cent of resource-rich countries fell into the category of the resource curse because of their political risk in the 1990s and 10 per cent in the 2000s. More importantly, around 28 per cent of resource-rich countries with a low political risk rating in the 1990s and 36 per cent in the 2000s were blessed.

The results from this empirical investigation yield a breakthrough explanation for the contradictions in the literature regarding the link between natural resources and economic development. Instead of concluding that natural resources have been a curse or a blessing, empirical data shows that there have been both cases. However, on average more than half of the sample cannot be decisively described as a resource blessed or cursed country with a statistical significance level.

4.4 Concluding Remarks: The Myth of Natural Resource Curse

This paper takes account of methodological mistakes for which earlier works in support of the resource curse thesis were criticized. Particularly, measurements of natural resources, the time dimension and endogeneity problems are handled using appropriate estimation techniques. More importantly, the conditional relationship between natural resources and economic growth is clearly explained by collective macroeconomic and politico-economic channels rather than small individual channels that have been employed in various works.

The findings from this study are very comprehensive in nature. They answer three controversial questions that are still a problem in the literature about the link between natural resources and economic growth. First, different measurements of natural resources do not lead to structurally different interpretations of their impacts on economic growth. Natural resources had a negative impact on economic growth from 1970 to 1989 regardless of their measurements. However, this study found that the effect of natural resources on economic growth did not maintain its sign across time. In fact, from 1990 to 2009 natural resources had a positive and significant relationship with economic growth while the relationship disappears in the four-decade regression. This time survival test calls for a deeper investigation into the relationship between natural resources and economic growth.

The last and most important finding from this study, therefore, is the answer to the change of direction from negative in the first two decades to positive in the last two decades. It also explains the disappearance of the significant relationship between natural resources and economic growth across the four decades. Resource curse or blessing is conditional upon the macroeconomic and political institutions of resource-rich countries. Only countries with favorable institutions, as reflected by their financial and political risk assessments, can gain benefits from natural resources. On the contrary, only high-risk countries experienced a negative impact, while about half of resource-rich countries were not considered as resource-cursed or resource-blessed countries.

Chapter 5: Curse vs Blessing - A Macroeconometric Comparison

5.1 Introduction

Using a cross-country economic growth methodology, the previous chapter reveals that there is a conditional curse or blessing, depending on macroeconomic and politico-economic channels in resource-rich countries. While it is difficult to investigate the mechanisms of the politico-economic channels because theoretical models linking politics to economics are not common, the comparison of the macroeconomic channels between resource-cursed and resource-blessed economies has also been sparingly studied in a structural form despite many well-developed macroeconometric models of resource-rich economies. For example, to study the impacts of oil exports on domestic economies, Benedictow (2010) built a macroeconometric model for Russia, Eika and Magnussen (2000) for Norway, Akanbi and Du Toit (2011) for Nigeria, Karnik and Fernandes (2005) for the UAE, and so on. Regardless of their different sizes, specifications, and assumptions, macroeconometric models enlarge the scope of resource economists to study the economic impacts of the natural resource sector on the rest of the resource-rich economies.

However, there has never been, at least to the author's knowledge, a comparison of the economic impacts of the resource sector between resource-cursed and resource-blessed economies. This kind of study is complementary to conventional cross-country investigations, as done in Chapter 4, in several ways. One is that the macroeconometric model relies on structural equations as opposed to the reduced-form equation of the cross-country regression model in the previous chapter. This approach enables a more elaborate explanation of the impacts of the natural resources on different components of a resource-rich economy. Therefore, this allows a detailed investigation of the transmission mechanisms from the resource sector to the rest of the economy.

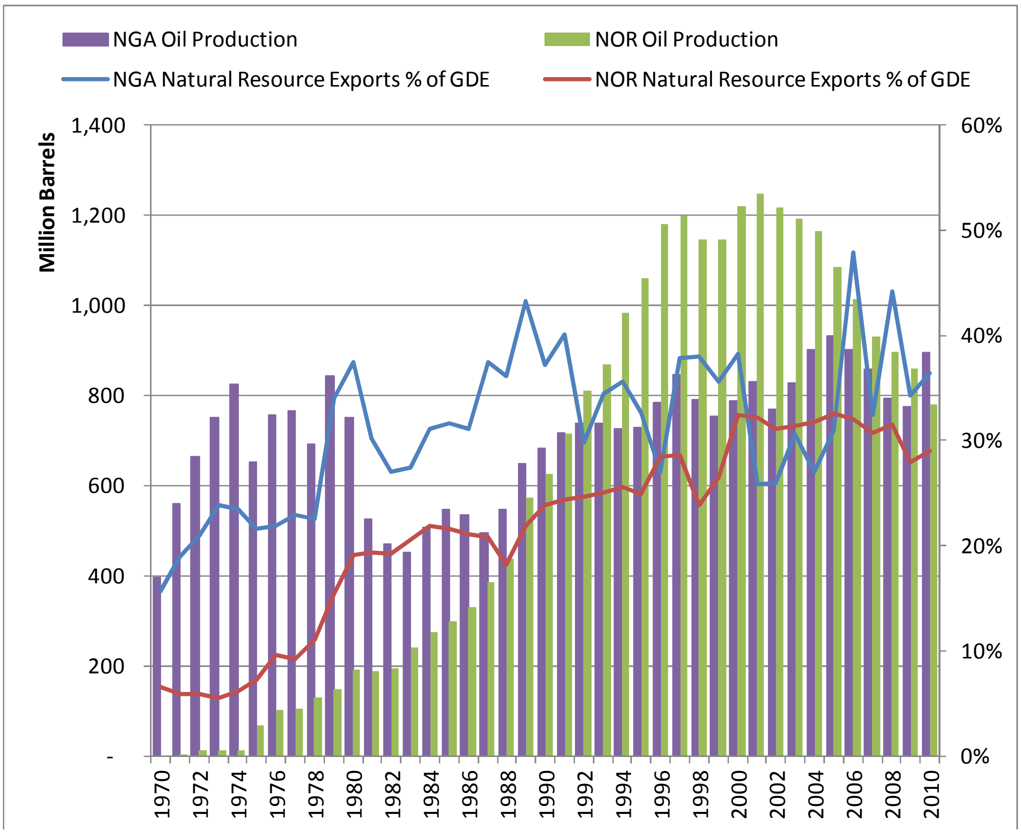
Secondly, by building two macroeconometric models for both resource-blessed and resource-cursed countries, this approach can act as a case study to understand the divergent experiences of resource-rich countries in addition to the cross-country investigation. Lastly, while the growth study in Chapter 4 is a long-run investigation, this macroeconometric modeling follows the demand-driven approach, which is significant to understand the link between natural resources and economic growth in the short to the mid-term period.

To achieve this objective, Chapter 5 builds two macroeconomic models with similar specifications of two resource-rich countries to make a fair comparison and investigate why the resource-cursed economy cannot benefit from its natural resources as much as its counterpart. Nigeria and Norway are chosen to make the comparison for a few reasons. Firstly, Nigeria and Norway are among the most frequently quoted examples of resource-rich countries in the literature of the resource curse. The former is a perfect case of the resource curse while the latter is a perfect example of a resource-blessed economy. Secondly, they have similar natural resource dependence. Both Nigeria and Norway heavily rely on their oil exports and are on top of the list of oil exporters. More interestingly, despite their similar resource dependency, another advantage of this comparison is that they had completely divergent experiences with their natural resources. Finally, both countries have a small and open economy. This characteristic provides a more accurate estimation of the models because it follows normal assumptions of macroeconometric modeling.

5.2 Overview Comparison between Nigeria and Norway

Nigeria and Norway are comparatively abundant in natural resources, particularly oil, natural gas, and mineral products (see Figure 5-1). In terms of oil production, Nigeria has been extracting from 400 to more than 800 million barrels annually since 1970. Norway only achieved this production rate after 1987, but has been producing increasingly up to 1.2 billion barrels in the later two decades; meanwhile, its mineral exports have been gradually shrinking from about 22 per cent in 1970 to less than 6.5 per cent as a share of total exports in the 2000s. Nevertheless, the average export share of natural resources of the real gross domestic expenditure in Norway was about 22 per cent, or 27 per cent from 1987 to 2010, while Nigeria was about 31 per cent from 1970 to 2010.

Figure 5-1: Oil Production and Export Share of Natural Resources in GDE



Note: NGA is Nigeria; NOR is Norway. Natural resource exports in Nigeria are mainly of oil and natural gas while Norway produces oil, natural gas and a few other minerals. The lines use the right scale.

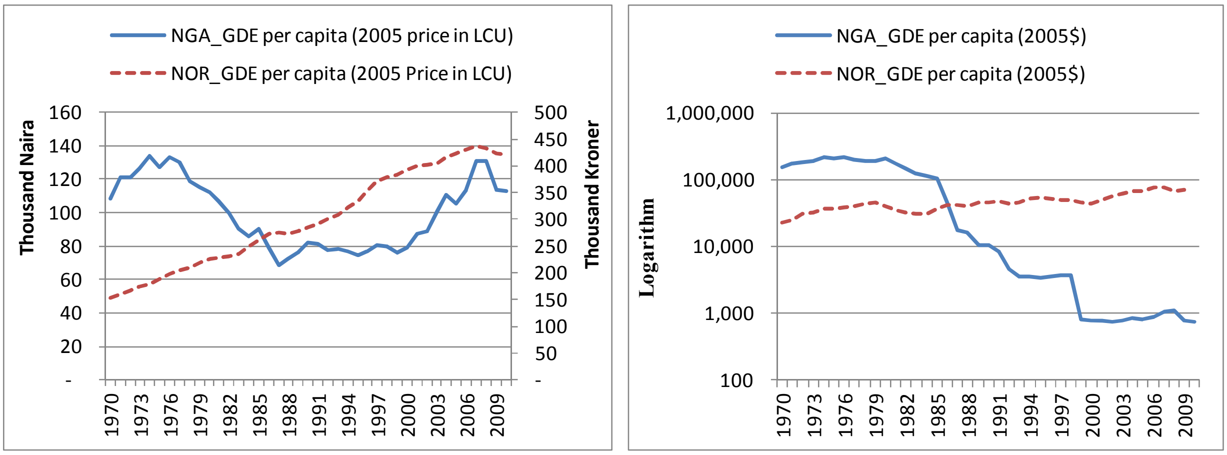
Source: Oil production data is from EIA, 2013, Export Share data is from WDI by World Bank, 2012, and GDE data is from PWT 7.1 by Heston, Summers, & Aten, 2012. GDEs are in LCU at 2005 prices.

Despite their comparable resource abundance, Nigeria and Norway are currently in a completely different stage of economic development. In 2010, Nigeria's GDE per capita in 2005 US dollars was only 752 US dollars while Norway's was 69,440 US dollars. However, back in 1970, Nigeria's GDE per capita in 2005 US dollars was actually much higher than

Norway's (see Figure 5-2). As they both started extracting and exporting natural resources, Nigeria's GDE per capita has been decreasing dramatically while Norway's GDE per capita has been steadily increasing. From the graph, both Nigeria and Norway enjoyed the benefits from their resource abundance in the early 1970s, a period of oil price booms.

However, Norway handled its economy much better during the period of oil price bursts in the 1980s. Its GDE per capita continued to grow in spite of a slight decline in the first half of the decade. Nigeria's GDE per capita, on the other hand, fell drastically during the same period. In 1987, its GDE per capita in 2005 US dollars became lower than Norway's and continued to tumble until 2000, although in its local currency units Nigeria's GDE per capita did not fall during this period.

Figure 5-2: Gross Domestic Expenditure per capita



Source: Author, based on GDE, Exchange Rate, and Population data from PWT7.1 by Heston et al., 2012

Several reasons explain the dramatic collapse of Nigeria's GDE per capita. One is the collapse of the exchange rate regime after Nigeria's debt crisis went out of control, and it adopted the Structural Adjustment Programme from the International Monetary Fund in December 1985 (Oyejide, 1991). Nigeria's currency, the naira, had been seriously overvalued at less than one naira per US dollar before 1986 (see Figure 5-3). Moreover, limited by its fixed exchange rate system, Nigeria's monetary policy had been highly influenced by the booms and busts of oil exports in order to keep its exchange rate stable.

In 1974, when the oil price almost quadrupled from 3.3 to 11.6 US dollars per barrel, the Central Bank of Nigeria (CBN) increased its money supply by 89 per cent in 1974 and 56 per cent in 1975. Accordingly, it injected less than nine per cent of money supply on average from 1981 to 1986 when the oil price was continuously decreasing from 36.8 to 14.4 US dollars per barrel. Even though the monetary policy actually managed to fix the exchange rate, the inflation resulting from the increase in money supply was out of the control of the CBN. After the launch of the floating exchange rate system, the Nigerian Naira dramatically depreciated from less than 1 naira before 1986 to more than 150 naira per US dollar in 2010, along with a forceful surge in monetary expansion and the resulting volatile hyperinflation afterwards.

Norway, on the other hand, has a disciplined monetary policy and a stable monetary environment, both before and after it changed its exchange rate regime to a floating system in March 2001 (Cappelen & Mjøset, 2009). Monetary expansion was stable, at around 9 per cent on average from 1970 to 2010, regardless of the exchange rate regime and irresponsive to the fluctuations in its natural resource exports. As a result, the price level in Norway has been increasing naturally at around five per cent on average without wild fluctuations. The exchange rate, on the other hand, has been fluctuating with the resource sector, but the central bank had managed its rate to move between five to nine kroner per US dollar before 2001. After the introduction of the floating exchange rate, the Norwegian Krone appreciated from nine to six kroner per US dollar.

Figure 5-3: Monetary Measures in Nigeria

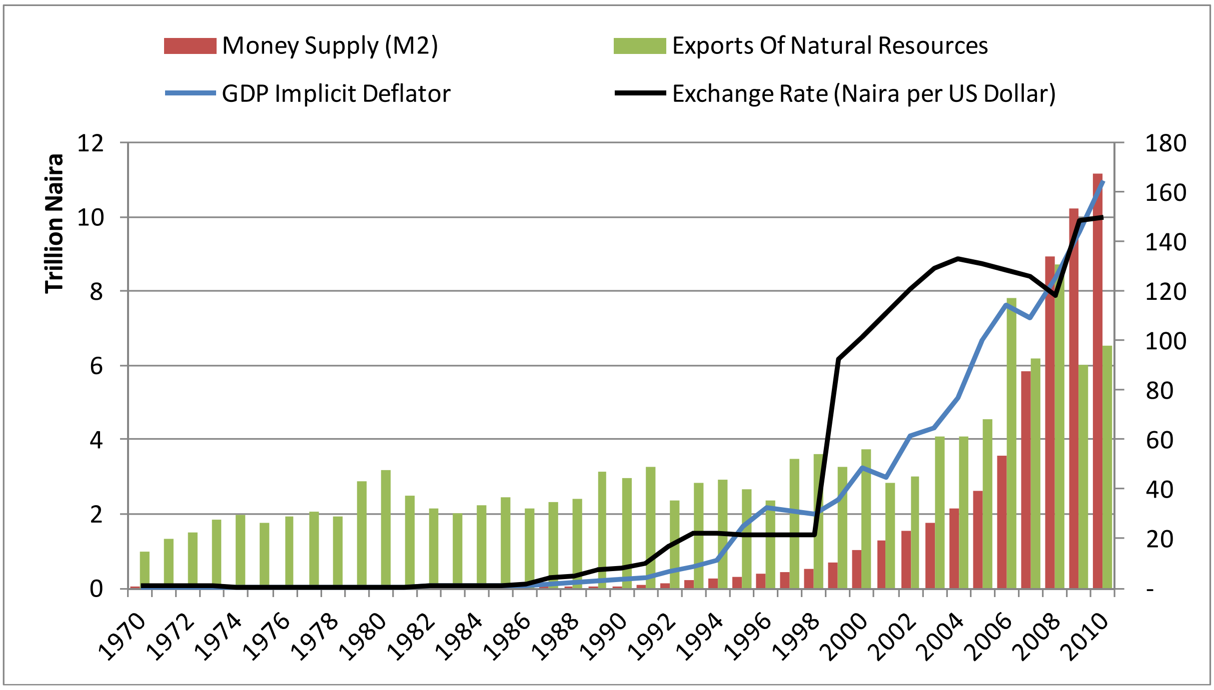
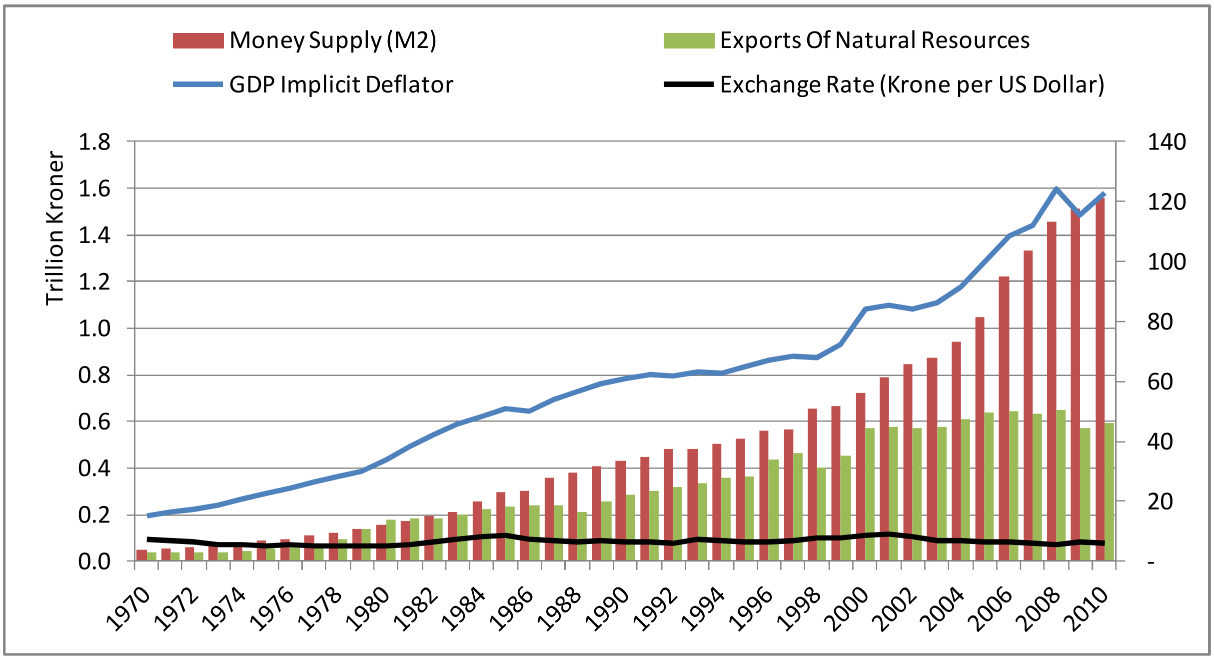


Figure 5-4: Monetary Measures in Norway



Note: Money Supply (M2) is in current prices while Exports of Natural Resources are in 2005 prices.

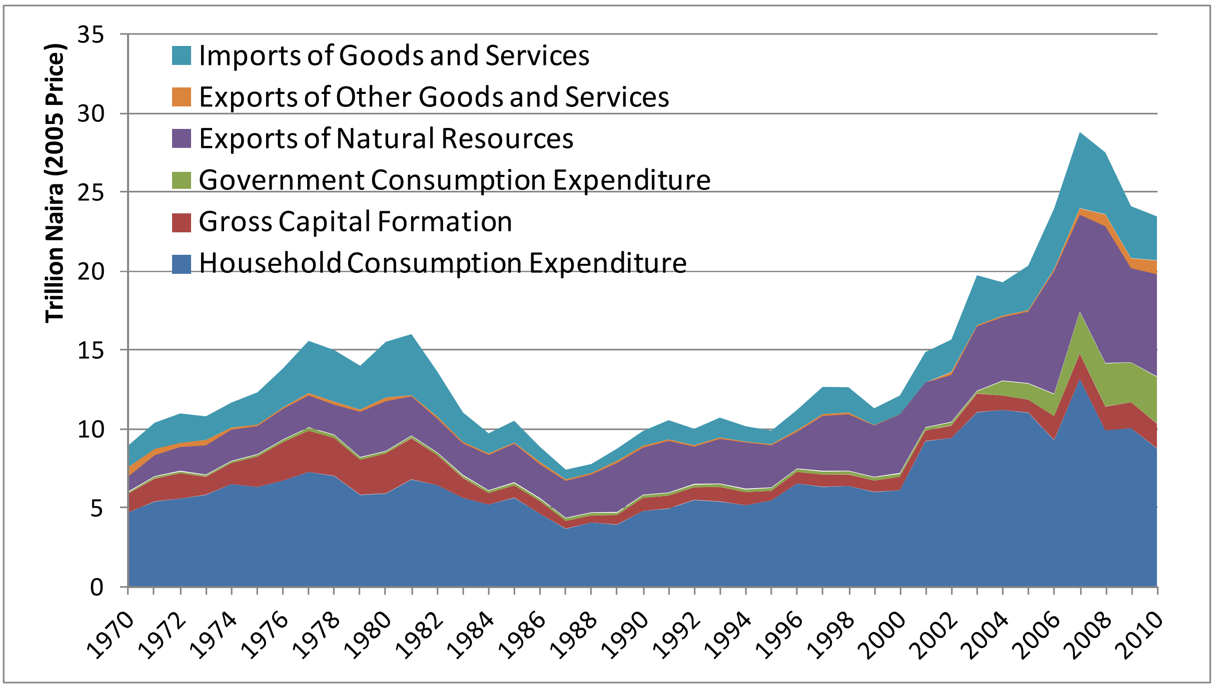
Source: Exports of Natural Resources data is from WDI by World Bank, 2012, M2, Deflator, and Exchange Rate data is from PWT7.1 by Heston et al., 2012.

Another explanation for the fall in GDE per capita in Nigeria is its high population growth. From 1970 to 2010, its population grew at a rate of about 2.57 per cent annually, putting a downward pressure on the overall economic growth, which grew at only 2.93 per cent annually. In contrast, Norway's population grew at only about 0.58 per cent annually, while its economic growth was about 3.17 per cent on average from 1970 to 2010.

The two reasons above still do not offer enough explanations for the poor economic performance of Nigeria, especially after the collapse of oil prices from 1980 to 2000. The problems lie deep in the structure of Nigeria's economy. From Figure 5-5, in the early 1970s, the non-resource sector, as represented by the exports of other goods and services, which are mostly agriculture goods, started to fall quickly and was taken over by the increasing share of the export of natural resources. In fact, in the early 1960s, the share of agriculture exports in merchandise export was more than 50 per cent. After the extraction of oil and natural gas, fuel exports have been increasing as a share of total exports. From 1974, it has contributed more than 90 per cent of total exports of goods and services.

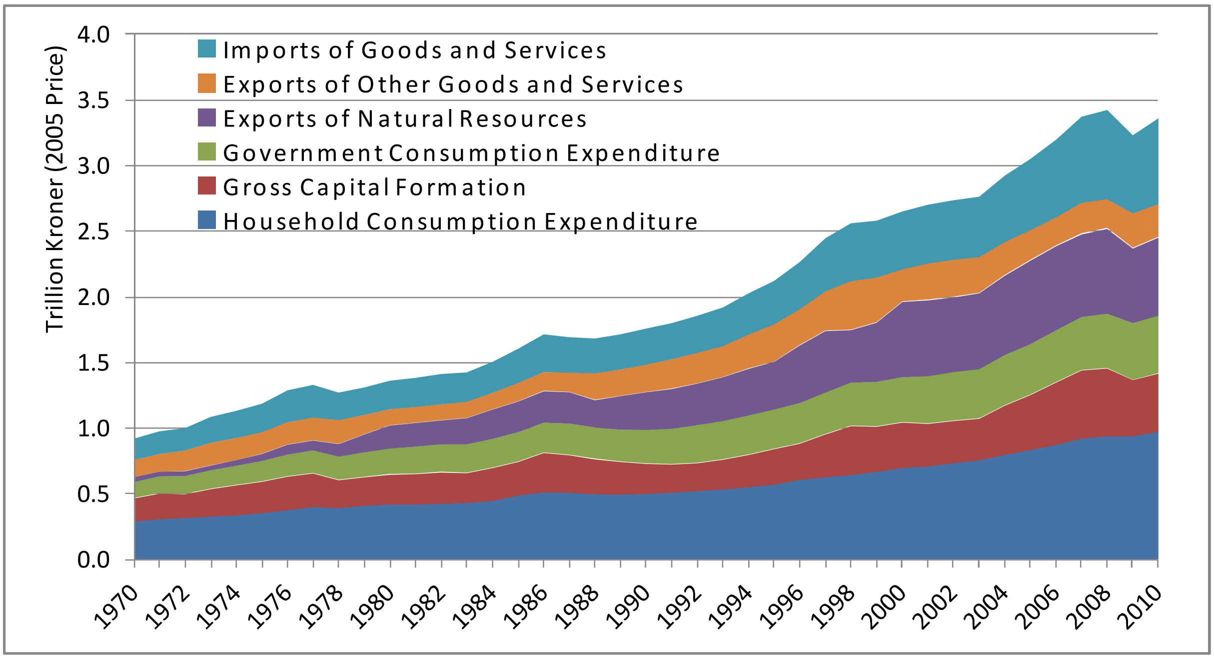
This is the phenomenon of the Dutch Disease and the investment channel discussed in Chapter 3. The export of natural resources actually crowds out the non-resource sector. When the non-resource sector cannot compete in the world market, the result is the sudden inflow of imported goods, as can be seen in Figure 5-5. In addition, private investment in the non-resource sector declined, partly because of the depreciation of the exchange rate and the hyperinflation that made imported capital goods more expensive. The remaining shrinking investment was made up mainly of inefficient public investment and private investment in the natural resource sector itself.

Figure 5-5: Gross Domestic Expenditure in Nigeria



Source: Data is from PWT7.1 by Heston et al., 2012.

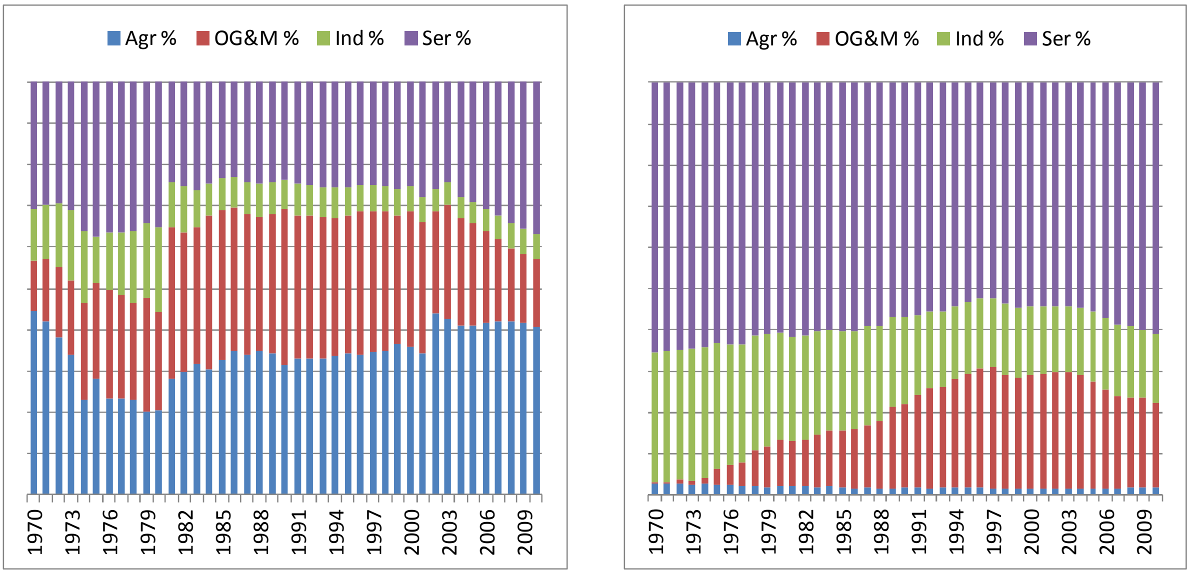
Figure 5-6: Gross Domestic Expenditure in Norway



Source: Data is from PWT7.1 by Heston et al., 2012.

In Norway, once again, the non-resource sector has remained robust despite the increasing share of the exports of natural resources. Figure 5-6 shows that all components of gross domestic expenditure have been growing proportionally since 1970. For the past four decades, the export of other goods and services and the gross capital formation have been playing a significant role in Norway's economic growth side by side with the increasing share of the exports of natural resources. Figure 5-7 clearly shows the different economic performances between Nigeria and Norway since 1970. In Nigeria, the growing sector of oil, natural gas and minerals has taken the shares of the agriculture and industry sectors. In contrast, Norway still has a significant industry sector, although its natural resource sector is growing over time.

Figure 5-7: Sectoral Share of Gross Domestic Products



Note: Nigeria is on the left, Norway on the right. Total share is 100 per cent. Agr is Agriculture; OG&M is Oil, Natural Gas, and Minerals; Ind is Industry; and Ser is Services.

Source: National Bureau of Statistics, Nigeria, 2010, and Statistics Norway, 2013

Based on this overview macroeconomic comparison, the following sections show the transmission channels of the economic impacts from the natural resource sector to the rest of the economy in Nigeria and Norway.

5.3 Methodology

5.3.1 Data

This study uses annual data from 1970 to 2010 from various sources such as the Penn World Table 7.1, the World Development Indicators, the US Energy Information Administration, and Nigeria's and Norway's national institutions for some missing observations. Table 5-1 lists all the variables used in the estimation of both Nigeria's and Norway's macroeconometric models. All monetary variables are in local currency units, except the world imports of natural resources that are in current US dollars. All real variables are in 2005 prices.

Table 5-1: Variable Names and Sources

No.	Code	Name	Source	Notes
1	**RGDE**	Gross Domestic Expenditre	PWT7.1	LCU (2005 Prices)
2	**RCONS**	Household Consumption Expenditure	PWT7.1	LCU (2005 Prices)
3	**RINV**	Gross Capital Formation	PWT7.1	LCU (2005 Prices)
4	RGOV	Government Expenditure	PWT7.1	LCU (2005 Prices)
5	**RIMP**	Imports of Goods and Services	PWT7.1	LCU (2005 Prices)
6	REXPALL	Exports of Goods and Services	PWT7.1	LCU (2005 Prices)
7	**REXPNR**	= Fuels in Merchandise Exports*REXPALL	WDI	LCU (2005 Prices)
8	REXPO	Exports of Other Goods and Services	= REXPALL - REXPNR	LCU (2005 Prices)
9	WIMPNR	World Imports of Mineral Fuels (SITC Sec.3)	WDI	Current US$
10	NRPROD	Oil Production	EIA	Barrels per annum
11	**DMS**	Money Supply (M2)	WDI	LCU (Current Prices)
12	**DPRICE**	GDP Implicit Price Deflator	PWT7.1	LCU (2005 Prices)
13	**EXCH**	Naira/Norwegian Krone Per US Dollar	PWT7.1	
14	**RINT**	Real Interest Rate	= INT - @PCH(DPRICE)	Decimal Points
15	WINT	U.S. Lending Interest Rate	WDI	Decimal Points
16	**UCC**	User's cost of capital	= (1+RINT)*EXCH	
17	DUM_F	Dummy of Floating Exchange Rate Period		

Note: "R-" prefix stands for real variables. Endogenous variables are in bold.

5.3.2 Unit Root Test and Autocorrelation Test

Unit root tests have been carried out on all the variables used in the equations to make sure that they are all integrated of order one. Table 5-2 shows that all variables are stationary at first difference, which means they should be cointegrated at levels. Furthermore, this cointegration is reinforced by the fact that all the equations estimated below follow main economic theories. In other words, they have a long run relationship, which means that all the equations are not spurious regressions.

Table 5-2: Augmented Dickey-Fuller Unit Root Test

		Nigeria				Norway			
		Level (P-Value)		1st Diff. (P-Value)		Level (P-Value)		1st Diff. (P-Value)	
	Variable	**Cons**	**Cons &Trend**	**Cons**	**Cons &Trend**	**Cons**	**Cons &Trend**	**Cons**	**Cons &Trend**
1	RGDE	0.951	0.978	0.132	0.002	0.154	0.881	0.024	0.013
2	RCONS	0.535	0.690	0.000	0.000	0.957	0.498	0.004	0.019
3	RINV	0.214	0.893	0.058	0.157	0.736	0.330	0.000	0.000
4	RGOV	0.981	0.949	0.000	0.000	0.005	0.540	0.003	0.003
5	RIMP	0.543	0.819	0.000	0.001	0.939	0.625	0.000	0.000
6	REXPNR	0.323	0.042	0.000	0.000	0.176	0.966	0.002	0.000
7	REXPO	0.123	0.461	0.000	0.000	0.564	0.761	0.000	0.000
8	WIMPNR	0.302	0.389	0.000	0.001	0.302	0.389	0.000	0.000
9	NRPROD	0.262	0.260	0.000	0.002	0.168	0.013	0.320	0.000
10	DMS	0.923	0.378	0.004	0.018	0.019	0.695	0.183	0.000
11	DPRICE	0.924	0.790	0.000	0.001	0.079	0.710	0.000	0.000
12	EXCH	0.956	0.551	0.000	0.001	0.115	0.232	0.000	0.000
13	RINT	0.000	0.000	0.000	0.000	0.012	0.055	0.000	0.000
14	WINT	0.070	0.029	0.001	0.003				
15	UCC	0.937	0.043	0.000	0.000				

Note: "Cons" means constant, and "1st Diff" means first difference. All variables are in natural logarithms, except RINT and WINT. The numbers are probability values derived from the t-statistic. Lag length is determined by Schwarz Info Criterion.

However, in order to ensure that all the estimated parameters are free from autocorrelation problem, this study further employs the Breusch-Godfrey Lagrange multiplier test with two lags. This test is superior to the Durbin-Watson test when there are lagged dependent variables in the equations. All the statistics and significance levels from this test are reported below each equation. In case that some equations do not pass this test, the Cochrane-Orcutt procedure is employed to correct for the autocorrelation problems.[6]

5.3.3 Model Framework and Closure

This study builds two macroeconometric models for Nigeria and Norway, following the approach by Pyndick and Rubinfeld (1997). The models follow the Mundell-Fleming demand-driven approach to study the impacts of the export of natural resources on the goods and money markets. The two economies are assumed to be small open economies with interest rates equal to the world interest rate plus the risk premiums. Capital flows freely into and out of the countries to maintain the equilibrium interest rate. Therefore, the exchange rate, exports, and imports are three main variables that determine the equilibrium of the economy.

There are two markets in the economy (see Figure 5-8). The goods market encompasses the expenditure components of gross domestic expenditure, RGDE, which is a sum of household consumption expenditure, RCONS, gross capital formation, RINV, government consumption expenditure, RGOV, the export of natural resources, REXPNR, the export of other goods and services, REXPO, and the import of goods and services, RIMP.

Therefore,

$$Eq.V1a \qquad RGDE = RCONS + RINV + RGOV + REXPNR + REXPO + RIMP$$

Even though each component has a share of natural resources, the export of natural resources, REXPNR, represent the most important part of the natural resource sector. One reason is that this component brings in foreign currency, which has a significant impact on the exchange rate and the inflation rate in the money market. The increase in REXPNR not only directly increases RGDE but also has an impact on the money market. The increase in foreign currency and RGDE lead to an increased demand for domestic money. Depending on the

[6] For details of the procedure, EViews 7 User’s Guide II (2009) offers a simple introduction.

monetary policy, this can lead to the increase in the domestic money supply to lighten appreciation pressure on the exchange rate, especially during the fixed exchange rate regime before 1986 in Nigeria and before 2001 in Norway. This increase in the money supply leads to increase in the domestic price level, and vice versa.

An extreme increase in the money supply is clearly seen in Nigeria during the period of oil booms, both before and after the change in the exchange rate regime. Aggravated by the loss of currency confidence, this macroeconomic instability caused the exchange rate to depreciate suddenly after the introduction of the floating regime. This depreciation made imported products more expensive and raised the cost of investment, since Nigeria heavily depended on imported capital products and foreign investors who would make proportionally less real return when they exchanged their domestically earned currency into US dollars[7]. In addition, the exchange rate depreciation can represent the risk premium in Nigeria (Akanbi & Du Toit, 2011).

Therefore, Eq.V1b $UCC = (1 + RINT) * EXCH$

The user cost of capital, UCC, is determined by both the real interest rate and more importantly the exchange rate. When the exchange rate depreciates, the user cost of capital increases and crowds out private investment in the non-resource sector. The remaining investment has been dominated by the public and the resource sectors, which are not determined by the exchange rate. As a result, the non-resource tradable sector, both domestic and export-oriented, could not compete against imported products. This can be illustrated by the solid line from RGDE to RIMP. The increase in the export of natural resources crowds out the non-resource domestic and export-oriented sector and increases imports. Furthermore, the

[7] Investment in Norway is not influenced as much by the exchange rate because it does not heavily depend on imported capital goods and foreign investors. Therefore, the exchange rate is not part of the user cost of capital in Norway's model.

inflation caused by monetary expansion also directly reduces the household consumption expenditure through the real interest rate identity.

In the real interest rate identity,

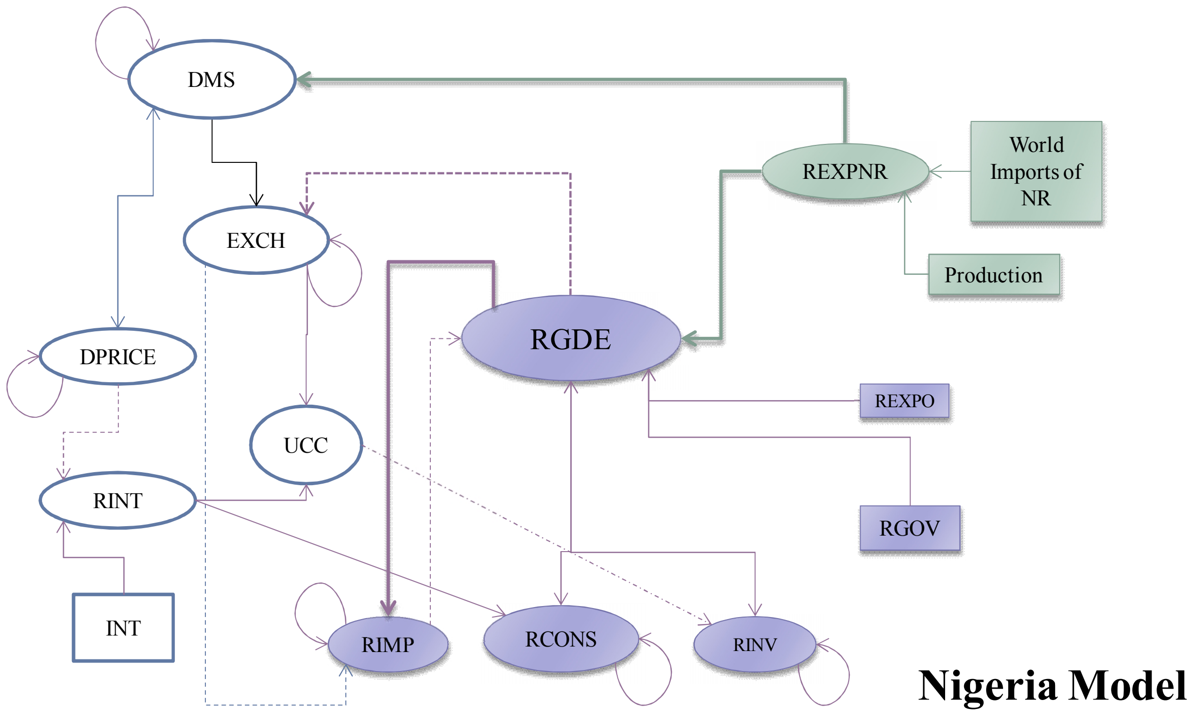
$$Eq.V1c \qquad RINT = INT - (DPRICE - DPRICE(-1))/DPRICE(-1)$$

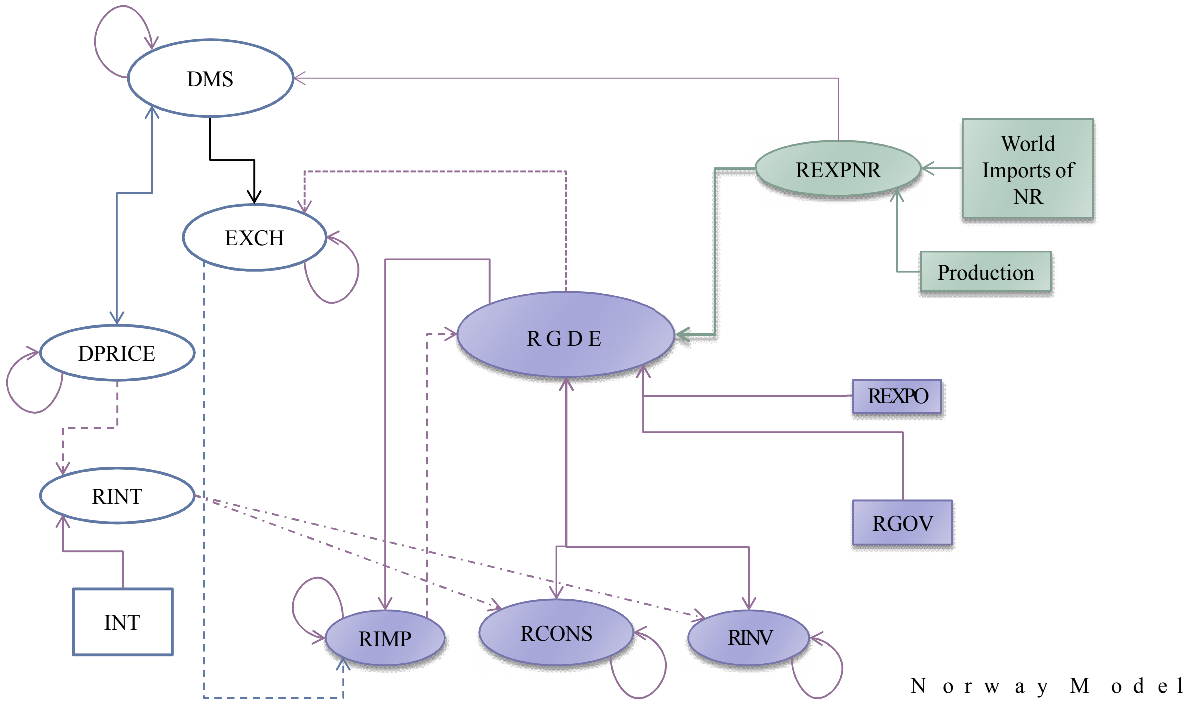
Because the nominal interest rate is assumed to be exogenous as the difference between the world interest rate and the risk premium, the real interest rate is just a proxy of the inflation rate in Nigeria. Therefore, the increase in the price level, caused by monetary expansion, leads to the decrease in the real interest rate and household consumption expenditure.

Norway's model is slightly different because of how it responds to the booms of the resource sector. In this respect, the fiscal and the monetary policies have not been affected as much by the export of natural resources. Its monetary expansion policy has been more stabilizing than in Nigeria. Thus, both the exchange rate and the inflation rate have been much more stable even after the introduction of a market-determined exchange rate. This investment-friendly environment has made it possible for private investment in the non-resource sector to thrive alongside the resource sector. As a result, the non-resource sector in the economy is able to survive and compete against imported products. From Figure 5-8, the solid line from RGDE to RIMP is much smaller than in the case of Nigeria. This indicates that the increase in the export of natural resources does not crowd out the non-resource sector.

Some researchers label Norway's policies as "clever policies" (Cappelen & Mjøset, 2009, p. 1). Norway managed to integrate the natural resource sector with the rest of the economy. Its institutions were able to handle shocks from the export fluctuations of natural resources. For example, Norway created a buffer fund that not only helped lessen the volatility of the resource sector but also became a financial asset for future returns.

Figure 5-8: Model Frameworks in Nigeria and Norway





5.3.4 Model Estimation

The side-by-side comparison of the economic impacts of natural resource exports between Nigeria and Norway are discussed in the behavioral equations below. They are in pairs, with the upper equations belonging to Nigeria and the lower equations belonging to Norway.

All equations, except the export of natural resources equations, are estimated by taking into account the endogeneity problem, particularly the reverse causality between dependent and independent variables. To do this, this study employs a two-stage least squares (2SLS) method by using the exogenous variables and the one-year-lagged variables of the endogenous variables as the instrumental variables. J-statistics and their significance levels are reported below each equation to confirm the hypothesis of valid instruments for all the equations that are estimated with the 2SLS. All equations have a J-statistic that cannot reject the null hypothesis of valid instruments. In other words, all 2SLS equations are free from invalid instruments that may influence the estimated parameters.

In addition, this study checks and deals with the autocorrelation problem by both the Engle-Granger two-step method and the Breusch-Godfrey Lagrange multiplier test. Both the Durbin-Watson statistics and the LM statistics are reported below each equation. As can be seen, no equations suffer from autocorrelation problems.

Eq.V2 Consumption Equations

The household consumption expenditure in Nigeria is positively determined by past habit, income, and the real interest rate. It should be noted that the real interest rate is only significant at a 10 per cent level and has a positive sign as opposed to the economic theory. Theoretically, the real interest rate raises the return on savings and reduces the current consumption expenditure because consumers will save more today to consume tomorrow. However, as discussed above, the real interest rate is a proxy for the inflation rate because the nominal interest rate is assumed to be exogenous and determined by the world interest rate. An increase in the real interest rate means a decrease in inflation, so too the increase in the household consumption expenditure, and vice versa.

Norway's consumption equation is slightly different. The real interest rate is not a significant determinant of household consumption expenditure. The share of the elderly in the population, however, has a negative and significant relationship with household consumption expenditure, given the fact that Norway is an aging society. This finding is reinforced by the study of Erlandsen and Nymoen (2008) who, using Norwegian data, found that the aging population puts a downward pressure on consumption.

$$\underset{}{LOG(RCONS)} = \underset{(1.693)}{3.864} + \underset{(3.622)}{0.551} * LOG(RCONS(-1) + \underset{(2.082)}{0.315} * LOG(RGDE) + \underset{(1.781)}{0.301} * RINT$$

Instruments: LOG(RGDE(-1)) RINT(-1) LOG(IMP_P) LOG(NRP) LOG(NRPROD) LOG(REXPO) LOG(RGOV) LOG(WPRICE) LOG(WIMPNR)

Adjusted R^2 : 0.837 Durbin-Watson Stat: 1.738

J-Stat: $\underset{(0.101)}{11.988}$ LM Stat: $\underset{(0.357)}{2.058}$

$$LOG(RCONS) = \underset{(0.895)}{0.193} + \underset{(17.045)}{0.817} * LOG(RCONS(-1) + \underset{(3.975)}{0.179} * LOG(RGDE) - \underset{(-0.811)}{0.073} * RINT$$

$$- \underset{(-2.548)}{1.446} * POP65 + \underset{(4.640)}{0.070} * DUM\_1985 + \underset{(2.811)}{0.048} * DUM\_1986$$

Instruments: LOG(RGDE(-1)) RINT(-1) LOG(IMP_P) LOG(NRP) LOG(NRPROD) LOG(REXPO) LOG(RGOV) LOG(WIMPNR)

Adjusted R^2 : 0.998 Durbin-Watson Stat: 1.949

J-Stat: $\underset{(0.311)}{7.113}$ LM Stat: $\underset{(0.978)}{0.045}$

Eq.V3 Investment Equations

Investment in Nigeria is dominated by the public sector and the resource sector. Therefore, it is highly influenced by the rise and fall of the oil sector in 1984 and 1986 and political turmoil in 1990, 1995 and 2005. The user cost of capital, which is determined by the real interest rate and the exchange rate, also negatively affects gross capital formation, especially the private non-resource sector. Most importantly, a one per cent increase in the real gross domestic expenditure leads to a 0.86 per cent increase in investment, which is mainly from the public sector and the resource sector.

The investment equation in Norway is different. Norway's investment was also influenced by the booms and busts of the resource sector in 1978, 1986, 1998, and 2007. However, the public sector has not aggressively spent its earnings from the resource sector. A one per cent increase in the real gross domestic expenditure only leads to 0.2 per cent increase in gross capital formation. In addition, the exchange rate is not part of the user cost of capital even though the real interest rate has a negative relationship with investment.

It should be noted that a stronger increase in investment in Nigeria might seem like the correct path for Nigeria's future development. However, Nigeria's public investment has been very inefficient, and foreign direct investment in the resource sector has been found to have an insignificant effect on growth (Akinlo, 2004). There are several reasons why FDI in the resource sector does not benefit the rest of the economy. One is that it has low linkages with other sectors. Technology transfer is limited, and Nigeria failed to integrate the resource sector into the rest of the economy like Norway did. Therefore, the increase in gross capital formation induced by resource booms is not beneficial to Nigeria’s economic growth.

$$\text{LOG(RINV)} = \underset{(-3.682)}{-14.593} \underset{(5.537)}{+0.603 * \text{LOG}(\text{RINV}(-1))} \underset{(-3.425)}{-0.107 * \text{LOG(UCC)}} \underset{(4.528)}{+0.860 * \text{LOG(RGDE)}}$$

$$\underset{(-3.791)}{-0.613 * \text{DUM\_1984}} \underset{(1.399)}{+0.237 * \text{DUM\_1986}} \underset{(2.295)}{+0.369 * \text{DUM\_1990}} \underset{(-2.296)}{-0.404 * \text{DUM\_1995}} \underset{(-2.627)}{-0.429 * \text{DUM\_2005}}$$

Instruments: LOG(UCC(-1)) LOG(RGDE(-1)) LOG(IMP_P) LOG(NRP) LOG(NRPROD) LOG(REXPO) LOG(RGOV) LOG(WPRICE) LOG(WIMPNR)

Adjusted R^2 : 0.881 Durbin-Watson Stat: 2.429

J-Stat: $\frac{5.107}{(0.647)}$ LM Stat: $\frac{4.898}{(0.086)}$

$$\text{LOG(RINV)} = \underset{(3.889)}{3.929} \underset{(9.013)}{+0.647 * \text{LOG}(\text{RINV}(-1))} \underset{(-5.776)}{-1.301 * \text{RINT}} \underset{(3.765)}{+0.196 * \text{LOG(RGDE)}} \underset{(-2.842)}{-0.170 * \text{DUM\_1978}}$$

$$\underset{(4.713)}{+0.306 * \text{DUM\_1986}} \underset{(3.352)}{+0.202 * \text{DUM\_1998}} \underset{(2.631)}{+0.163 * \text{DUM\_2007}}$$

Instruments: RINT(-1) LOG(RGDE(-1)) LOG(IMP_P) LOG(NRP) LOG(NRPROD) LOG(REXPO) LOG(RGOV) LOG(WPRICE) LOG(WIMPNR)

Adjusted R^2 : 0.957 Durbin-Watson Stat: 1.894

J-Stat: $\frac{3.500}{(0.835)}$ LM Stat: $\frac{0.019}{(0.991)}$

Eq.V4 Export of Natural Resources Equations

The exports of natural resources are determined by oil production, NRPROD and the world imports of natural resources, WIMPNR. However, the export of natural resources in Nigeria is dominated by oil, while Norway's exports also consist of mineral products. Hence, the effect of oil production in Nigeria is slightly higher than in Norway while the opposite is true regarding the effect of the world imports of natural resources.

$$\text{LOG(REXPNR)} = \underset{(2.531)}{8.681} + \underset{(3.165)}{0.558} * \text{LOG(NRPROD)} + \underset{(6.907)}{0.323} * \text{LOG(WIMPNR)} + \underset{(3.107)}{0.368} * \text{DUM\_2006}$$

$$+ \underset{(2.261)}{0.275} * \text{DUM\_2008} + \underset{(3.276)}{0.496} * \text{AR(1)}$$

Estimation Technique: OLS

Adjusted R^2: 0.909 | Durbin-Watson Stat: 1.903

J-Stat: (OLS) | LM Stat: $\underset{(0.872)}{0.27}$

$$\text{LOG(REXPNR)} = \underset{(5.288)}{6.716} + \underset{(12.345)}{0.477} * \text{LOG(NRPROD)} + \underset{(7.441)}{0.375} * \text{LOG(WIMPNR)} + \underset{(7.284)}{0.514} * \text{AR(1)}$$

Estimation Technique: OLS

Adjusted R^2: 0.982 | Durbin-Watson Stat: 1.551

J-Stat: (OLS) | LM Stat: $\underset{(0.267)}{2.644}$

Eq.V5 Import of Goods and Services Equations

Imports in Nigeria are positively determined by past imports and real gross domestic expenditure and negatively determined by the depreciation of the exchange rate. The imports in Norway have similar determinants, but the effect of the exchange rate is not significant, while the terms of trade appreciation, EXP_P/IMP_P, has a positive relationship.

The import equation is one of the two main equations that define the success and failure of these two economies. The partial effect of the increase in real gross domestic expenditure is 2.074 in Nigeria while it is only 0.349 in Norway. This means that the increase in the export of natural resources through the real gross domestic expenditure in Nigeria leads to much higher leakage out of the economy than in Norway. In other words, Nigeria's absorptive capacity is much smaller because Nigeria's non-resource sector is not as vibrant as that of Norway.

$$\underset{}{LOG(RIMP)} = \underset{(-3.333)}{-36.008} \underset{(0.465)}{+0.094 * LOG(RIMP(-1))} \underset{(3.153)}{+2.074 * LOG(RGDE)} \underset{(-3.278)}{-0.200 * LOG(EXCH)}$$

$$\underset{(2.901)}{+0.585 * AR(1)}$$

Instruments: LOG(RGDE(-1) LOG(EXCH(-1)) LOG(IMP_P) LOG(NRP) LOG(NRPROD) LOG(RGOV) LOG(EXPO) LOG(WIMPNR) DUM_1984 DUM_1990 DUM_1993 DUM_1995

Adjusted R^2 : 0.879 Durbin-Watson Stat: 1.951

J-Stat: $\frac{15.142}{(0.127)}$ LM Stat: $\frac{0.588}{(0.745)}$

$$\underset{}{LOG(RIMP)} = \underset{(-1.090)}{-0.838} \underset{(5.359)}{+0.661 * LOG(RIMP(-1))} \underset{(2.670)}{+0.349 * LOG(RGDE)} \underset{(-0.324)}{-0.027 * LOG(EXCH)}$$

$$\underset{(2.224)}{+0.193 * EXP\_P/IMP\_P}$$

Instruments: LOG(RGDE(-1)) LOG(EXCH(-1)) EXP_P(-1)/IMP_P(-1) LOG(IMP_P) LOG(NRP) LOG(NRPROD) LOG(REXPO) LOG(RGOV) WINT

Adjusted R^2 : 0.980 Durbin-Watson Stat: 1.560

J-Stat: $\frac{10.431}{(0.108)}$ LM Stat: $\frac{3.369}{(0.186)}$

Eq.V6 Exchange Rate Equations

The exchange rate in Nigeria is positively determined by the past exchange rate, monetary expansion and interest rate disparity, which is a proxy of the risk premium. Therefore, the increases in the money supply and in the risk premium made the local currency lose creditability and depreciate quickly after 1986. The real gross domestic expenditure, RGDE, has a negative relationship with the exchange rate at a 10 per cent significant level. An increase in RGDE leads to the appreciation of the exchange rate through the demand for money for transactions.

Norway's equation is similar, except that interest rate disparity actually leads to the appreciation of the exchange rate. This is because Norway has a very low risk premium, so an increase in the domestic interest rate attracts capital inflow that leads to more supply of foreign currency, and thus the appreciation of the exchange rate.

$$\underset{}{LOG(EXCH)} = \underset{(1.457)}{8.694} \; \underset{(13.671)}{+0.849 * LOG\big(EXCH(-1)\big)} \; \underset{(3.066)}{+0.113 * LOG(DMS)} \; \underset{(-1.836)}{-0.377 * LOG(RGDE)}$$

$$\underset{(2.152)}{+1.715 * (INT - WINT)} \; \underset{(-1.121)}{-0.198 * DUM\_1995} \; \underset{(-1.043)}{-0.179 * DUM\_1998} \; \underset{(6.846)}{+1.182 * DUM\_1999}$$

Instruments: LOG(DMS(-1)) LOG(RGDE(-1)) LOG(NRP) LOG(NRPROD) LOG(WIMPNR) LOG(EXPO) LOG(RGOV) LOG(WPRICE)

Adjusted R^2 : 0.995 Durbin-Watson Stat: 1.680

J-Stat: $\frac{7.421}{(0.284)}$ LM Stat: $\frac{1.183}{(0.554)}$

$$\underset{}{LOG(EXCH)} = \underset{(0.392)}{2.112} \; \underset{(8.792)}{+0.896 * LOG\big(EXCH(-1)\big)} \; \underset{(0.974)}{+0.110 * LOG(DMS)} \; \underset{(-0.566)}{-0.169 * LOG(RGDE)}$$

$$\underset{(-1.519)}{-0.866 * (INT - WINT)} \; \underset{(-2.772)}{-0.109 * DUM\_F}$$

Instruments: LOG(DMS(-1)) LOG(RGDE(-1)) LOG(IMP_P) LOG(NRP) LOG(NRPROD) LOG(REXPO) LOG(RGOV) LOG(WIMPNR) LOG(WPRICE)

Adjusted R^2 : 0.762 Durbin-Watson Stat: 1.510

J-Stat: $\frac{11.340}{(0.125)}$ LM Stat: $\frac{3.620}{(0.164)}$

Eq.V7 Price Level Equations

Price level in Nigeria is positively determined by past price, the price of the imported products, and monetary expansion. Norway's price level is similarly determined, except that the past price does not have an effect on the current price. Nevertheless, the price level, DPRICE, and the money supply, DMS, have a mutual positive relationship. This means that an increase in the money supply leads to an increase in the price level, leading to more increase in the money supply, and the cycle continues until the effect dies out.

$$\underset{}{\mathrm{LOG(DPRICE)}} = \underset{(-2.875)}{-3.139} \; \underset{(6.367)}{+0.489 * \mathrm{LOG}(\mathrm{DPRICE}(-1))} \; \underset{(7.815)}{+0.296 * \mathrm{LOG(IMP\_P)}} \; \underset{(3.043)}{+0.140 * \mathrm{LOG(DMS)}}$$

$$\underset{(1.849)}{+0.204 * \mathrm{DUM\_2006}}$$

Instruments: LOG(DMS(-1)) LOG(NRP) LOG(NRPROD) LOG(REXPO) LOG(RGOV) LOG(WPRICE) LOG(WIMPNR)

Adjusted R^2 : 0.998 Durbin-Watson Stat: 1.784

J-Stat: $\frac{2.828}{(0.830)}$ LM Stat: $\frac{1.034}{(0.596)}$

$$\mathrm{LOG(DPRICE)} = \underset{(-11.081)}{-8.979} \; \underset{(3.304)}{+0.338 * \mathrm{LOG(IMP\_P)}} \; \underset{(9.695)}{+0.433 * \mathrm{LOG(DMS)}} \; \underset{(5.306)}{+0.684 * \mathrm{AR}(1)}$$

Instruments: LOG(DMS(-1)) LOG(NRP) LOG(NRPROD) LOG(RGOV) LOG(WPRICE) LOG(WIMPNR) WINT

Adjusted R^2 : 0.997 Durbin-Watson Stat: 2.100

J-Stat: $\frac{13.095}{(0.070)}$ LM Stat: $\frac{0.637}{(0.727)}$

Eq.V8 Money Supply Equations

Money supply is assumed to be endogenous because the monetary policy in Nigeria has been highly influenced by the export of natural resources. These equations, more importantly, show a remarkable difference between Nigeria’s and Norway's monetary policies. In both equations, the money supply is positively determined by the habitual effect, price level, and export of natural resources. However, the effect of the export of natural resources on monetary expansion in Norway is not significant and only 0.02 per cent, while Nigeria's money supply is increased by 0.46 per cent when the export of natural resources is increased by one per cent. In other words, monetary policy in Norway is irresponsive to the natural resource sector in contrast to that in Nigeria, the reasons for which were discussed above.

The money supply is a positive determinant in the exchange rate and the price level equations. Therefore, in Nigeria, an increase in the exports of natural resources, which leads to an increase in the money supply, indirectly leads to exchange rate depreciation and inflation. As a result, the user cost of capital in the domestic sector increases because investors pay more to import intermediate and capital goods in foreign currency. Furthermore, inflation raises the cost of production, lowers the competitiveness of the non-resource sector, and reduces household consumption expenditure. Because the resource sector is not as affected by these macroeconomic instabilities, eventually the resource sector takes over the shares of agriculture and manufacturing industries in Nigeria's economy.

$$\underset{}{LOG(DMS)} = \underset{(-2.260)}{-7.243} \; \underset{(11.825)}{+0.757 * LOG\big(DMS(-1)\big)} \; \underset{(3.350)}{+0.211 * LOG(DPRICE)} \; \underset{(3.378)}{+0.461 * LOG(REXPNR)}$$

Instruments: LOG(DPRICE(-1)) LOG(IMP_P) LOG(REXPNR(-1)) LOG(NRP) LOG(NRPROD) LOG(REXPO) LOG(RGOV) LOG(WPRICE) LOG(WIMPNR)

Adjusted R^2 : 0.998 Durbin-Watson Stat: 1.403

J-Stat: $\underset{(0.201)}{9.788}$ LM Stat: $\underset{(0.107)}{4.471}$

$$\underset{}{LOG(DMS)} = \underset{(2.381)}{3.628} \; \underset{(13.817)}{+0.813 * LOG\big(DMS(-1)\big)} \; \underset{(1.832)}{+0.241 * LOG(DPRICE)} \; \underset{(0.442)}{+0.017 * LOG(REXPNR)}$$

$$\underset{(2.278)}{0.044 * DUM\_F}$$

Instruments: LOG(DPRICE(-1)) LOG(REXPNR(-1)) LOG(IMP_P) LOG(NRP) LOG(NRPROD) LOG(REXPO) LOG(RGOV) LOG(WPRICE) WINT

Adjusted R^2 : 0.999 Durbin-Watson Stat: 1.403

J-Stat: $\underset{(0.870)}{3.163}$ LM Stat: $\underset{(0.079)}{5.069}$

5.3.5 Baseline Simulation and Model Evaluation

Figure 5-9 shows the comparison between the actual and simulated data from 1971 to 2010 for Nigeria on the left side, and Norway on the right side. In general, Norway's simulated data more accurately fit the actual data, probably because there is more quality data and a more stable macroeconomic environment than in Nigeria, which has faced macroeconomic and political disturbances and a surge in the public sector, especially before 1990. This is especially true for the simulated data of investment and imports that have underestimated the actual data during the oil boom period. From 1970 to 1981, the Nigerian government invested its oil windfall heavily in manufacturing and services (Sala-i-Martin & Subramanian, 2003). Nevertheless, the simulated data of real gross domestic expenditure and the money supply in both economies closely fit the actual data.

Table 5-3 provides five criteria for evaluating all the variables (refer to Pyndick and Rubinfeld, 1997, pp. 384–389). Norway's model provides a much better prediction of the actual data than Nigeria in almost all criteria.

The first criterion is the mean absolute percent error (MAPE), which is calculated as follows,

$$MAPE = \frac{1}{T}\sum_{t=1}^{T}\left|\frac{Y_t^s - Y_t^a}{Y_t^a}\right| \qquad \text{(Eq.A1)}$$

Where Y_t^s = simulated value of Y_t

Y_t^a = actual value

T = number of periods in the simulation

This mean absolute percent error is a measure of the deviation of the simulated values from the actual data. The perfectly fit simulated data will yield the MAPE value of zero while the worse simulation will receive the MAPE value of one.

The next four criteria use Theil's inequality coefficient and its manipulation to define the sources of the errors in each simulated variable. They are calculated as below,

$$U = \frac{\sqrt{\frac{1}{T}\sum_{t=1}^{T}\left(Y_t^s - Y_t^a\right)}}{\sqrt{\frac{1}{T}\sum_{t=1}^{T}\left(Y_t^s\right)^2} + \sqrt{\frac{1}{T}\sum_{t=1}^{T}\left(Y_t^a\right)^2}} \qquad \text{(Eq.A2)}$$

This can be decomposed as follows,

$$\frac{1}{T}\sum(Y_t^s - Y_t^a)^2 = (\bar{Y}^s - \bar{Y}^a)^2 + (\sigma_s - \sigma_a)^2 + 2(1-\rho)\sigma_s\sigma_a \qquad \text{(Eq.A3)}$$

Where $\bar{Y}^s$= mean of the Y_t^s

$\bar{Y}^a$= mean of the Y_t^a

σ_s= standard deviation of the Y_t^s

σ_a= standard deviation of the Y_t^a

ρ = correlation coefficient

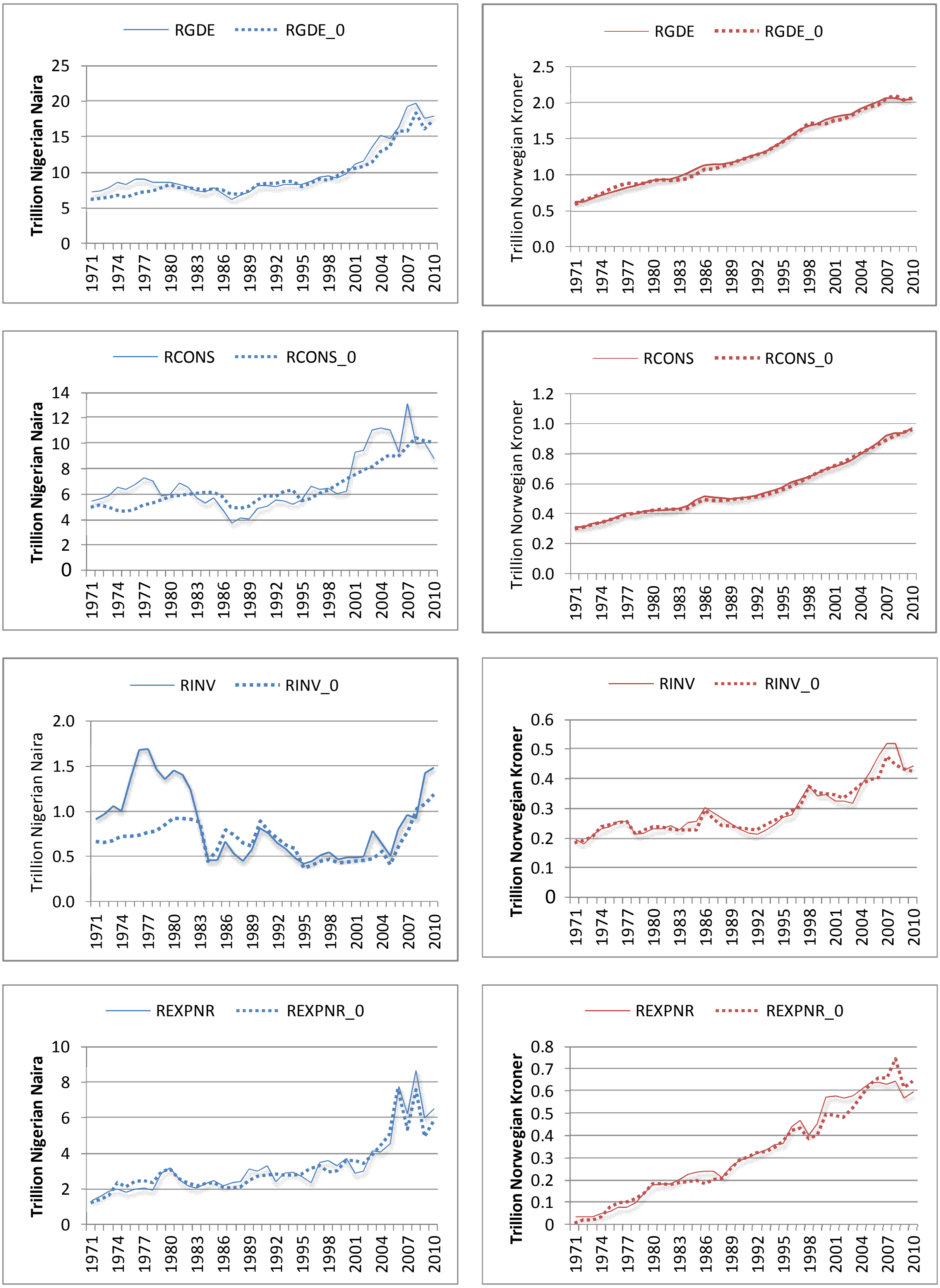
$$U^B = \frac{(\bar{Y}^s - \bar{Y}^a)^2}{(1/T)\sum\left(Y_t^s - Y_t^a\right)^2} \qquad \text{(Eq.A4)}$$

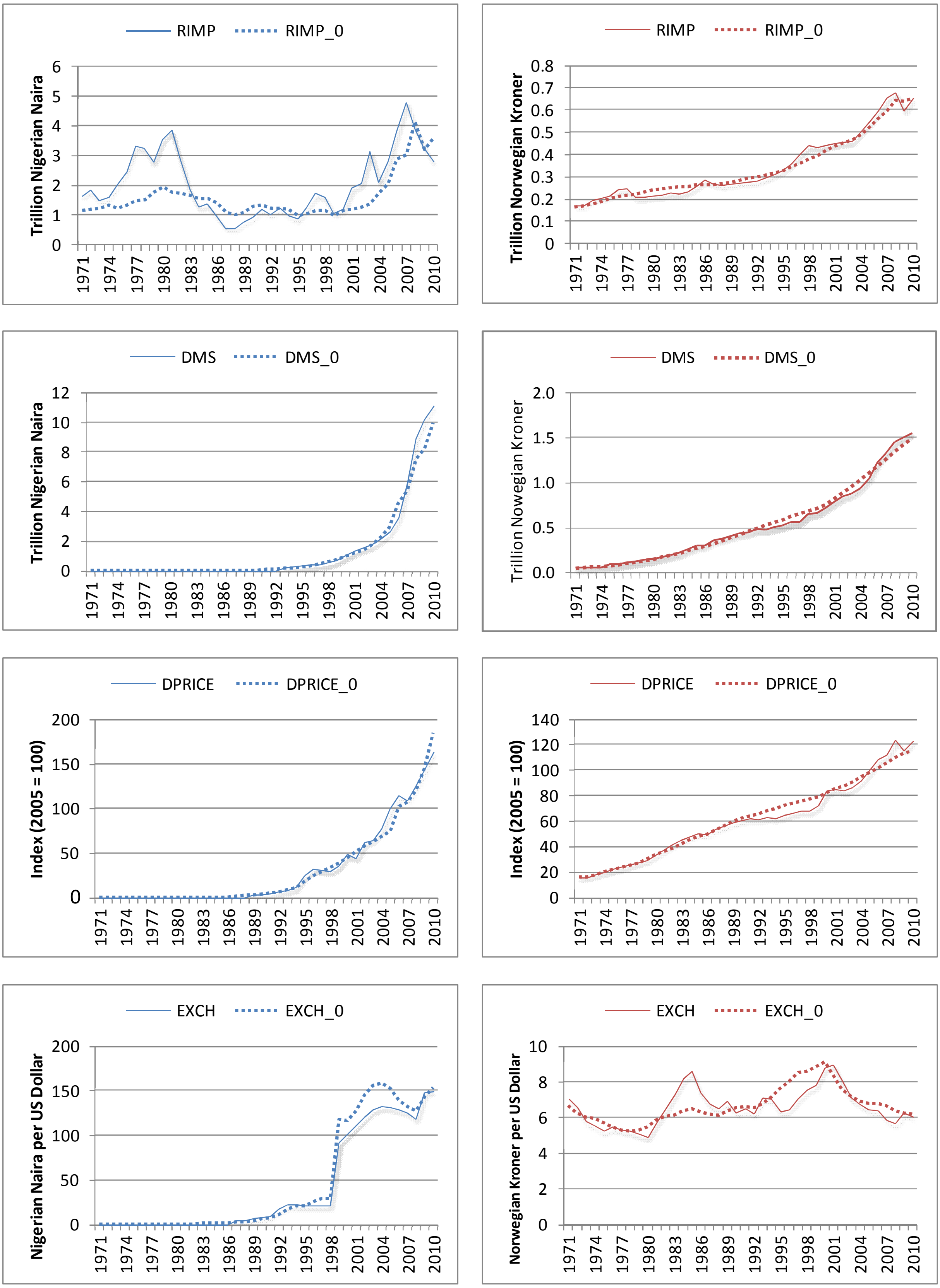
$$U^V = \frac{(\sigma_s - \sigma_a)^2}{(1/T)\sum\left(Y_t^s - Y_t^a\right)^2} \qquad \text{(Eq.A5)}$$

$$U^C = \frac{2(1-\rho)\sigma_s\sigma_a}{(1/T)\sum\left(Y_t^s - Y_t^a\right)^2} \qquad \text{(Eq.A6)}$$

The term *U* refers to Theil's inequality coefficient, which measures the overall simulation error. If *U=0,* the simulated variable is a perfect fit while *U=1* means the simulation is the worst. The following terms U^B, U^V, and U^C are the bias, the variance, and the covariance proportions of the error sources. The first term is the measure of the systematic error as it compares the average values of the simulated data with the actual data. The second measures the variability of the simulated data and the last term measures the remaining source of error, or unsystematic error. Ideally, the bias and the variance proportions should be as small as possible.

Figure 5-9: The Baseline Simulation





Note: The left side belongs to Nigeria; the right side belongs to Norway.

Table 5-3: Model Evaluation

No.	Variable	Nigeria					Norway				
		MAPE	Theil	Bias	Var	Covar	MAPE	Theil	Bias	Var	Covar
1	DMS	13.0	8.0	4.8	53.7	41.6	5.8	3.4	2.1	1.7	96.2
2	DPRICE	8.0	5.6	1.8	0.0	98.2	4.9	3.3	0.6	1.6	97.8
3	EXCH	30.9	7.0	20.1	43.1	36.8	8.2	5.7	0.7	0.1	99.2
4	RCONS	15.3	9.5	8.8	18.8	72.4	1.6	1.0	22.7	3.0	74.3
5	REXPNR	11.8	6.4	1.1	22.8	76.1	13.4	4.8	6.3	0.0	93.7
6	RGDE	8.1	5.3	27.0	15.7	57.3	2.4	1.3	11.5	0.0	88.5
7	RIMP	30.9	21.1	25.7	15.5	58.8	6.0	3.3	5.4	9.0	85.6
8	RINV	22.6	20.1	27.6	33.3	39.1	5.1	3.7	2.3	24.0	73.6

Note: All numbers are in percentage. "MAPE" is the mean absolute percent error; "Theil" is Theil's inequality coefficient; "Bias", "Var", and "Covar" refer to the bias, the variance, and the covariance proportions, respectively. Source: Author's calculation

5.4 Simulation Results and Discussion

Different scenarios are simulated to compare the impacts of the export of natural resources on goods and money markets in both economies. The simulation is from 1980 to 2000, when both economies were significantly dominated by the resource sector.

5.4.1 Scenario 1: The Increase in the World Imports of Natural Resources

In this scenario, a 15 per cent increase from the actual data on the world imports of mineral fuels, WIMPNR, is simulated to compare its economic impacts between Nigeria and Norway (see Figure 5-10). The increase in world demand leads to a larger export of the natural resources in Norway by one percentage point. However, the average impact on real gross domestic expenditure in Nigeria is 1.93 per cent, only slightly bigger than the impact on Norway, which is 1.51 per cent.

The impacts of this resource boom on the real gross domestic expenditure in these two economies seem comparable, if not in favor of Nigeria. However, the impacts on the money market clearly divide these two economies into distinct categories. The resource boom does not put pressure on monetary expansion in Norway. The domestic money supply is increased by less than one per cent from the baseline. Thus, from the baseline the price level is increased by less than 0.5 per cent, although the exchange rate appreciates about 1.08 per cent on average.

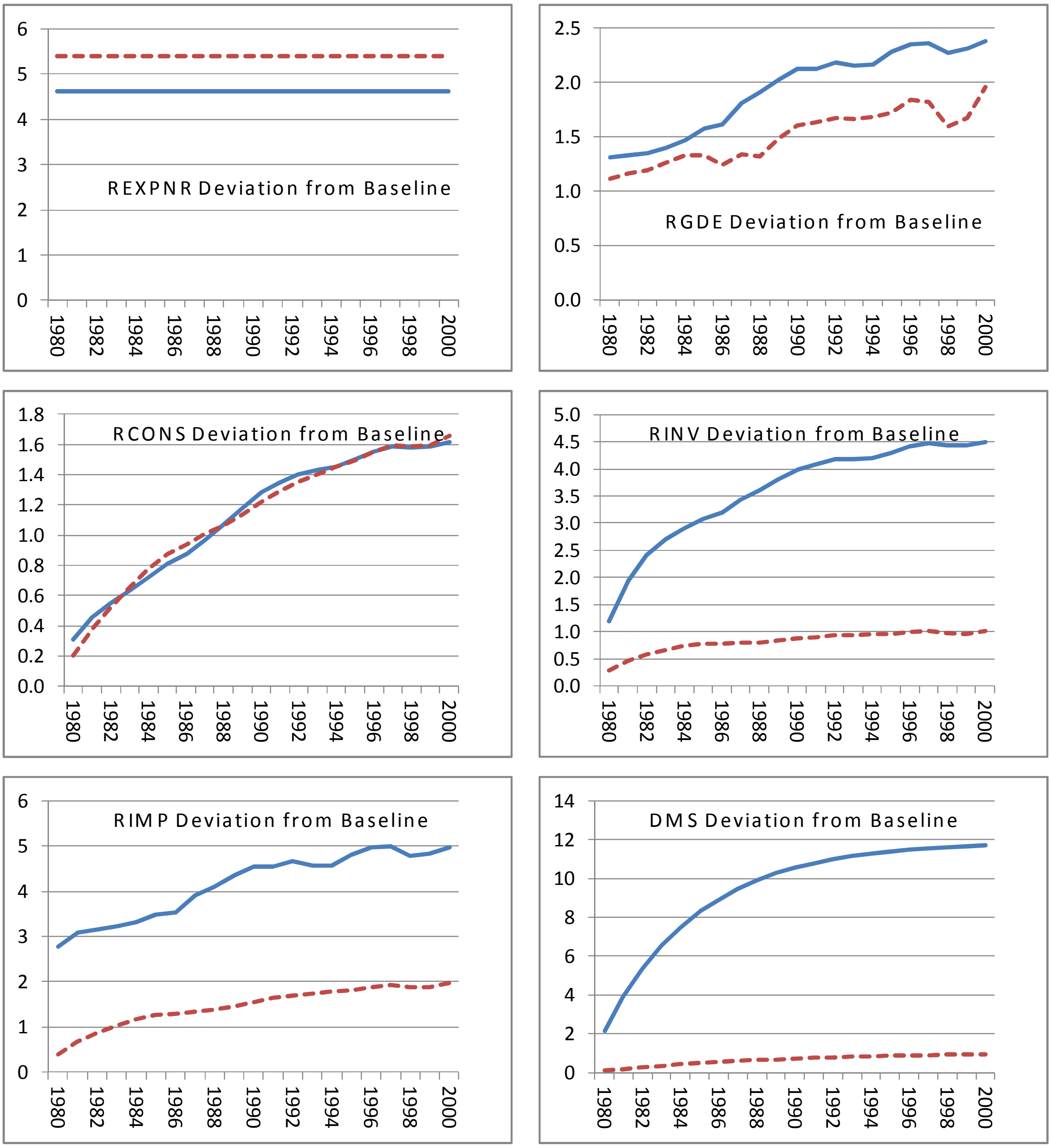
In contrast, Nigeria's monetary policy is highly influenced by the resource boom. The increase in the export of natural resources of 4.61 per cent leads to an increase of around 9.36 per cent on average from the baseline in the domestic money supply. As a result, on average, the price level is about 2.33 per cent higher; and the exchange rate depreciates about 1.29 per cent. The turbulence in the money market has negative impacts on the goods market in the long run. Nigeria's high price level and tumbling exchange rate, caused by this resource boom, crowd out private investment in the non-resource sector, particularly the agriculture and the manufacturing sectors. The collapse of these sectors is substituted by imported goods and services. This is why the average impact of the resource boom, which is only 4.61 per cent, on the imports of goods and services in Nigeria is about 4.15 per cent, while Norway would only import about 1.46 per cent more in response to a 5.6 per cent increase in the export of the natural resources.

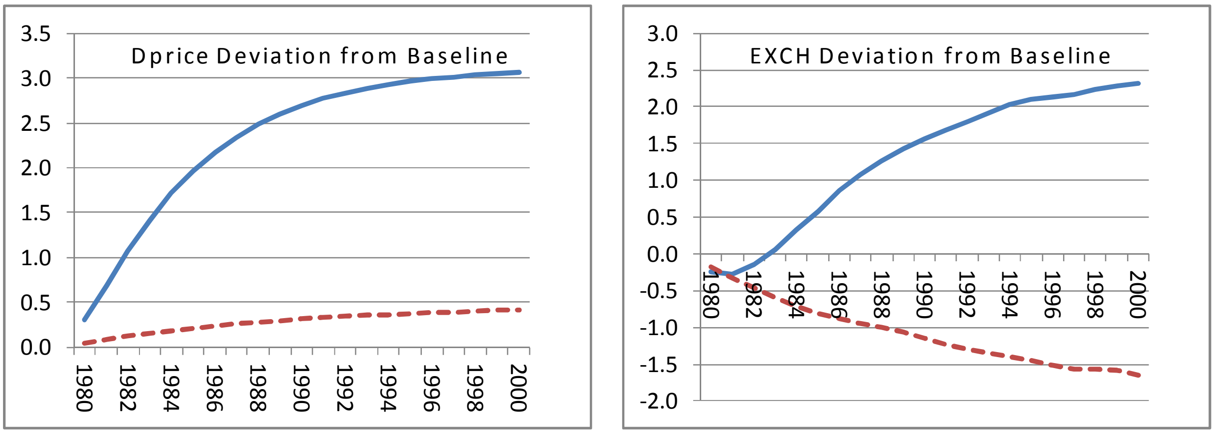
More importantly, the increase in real gross domestic expenditure in Nigeria is largely caused by investment in the resource sector and the public sector. This form of investment is unfavorable to Nigeria's economy in the long run in two ways. One is that it is based on an extractive and exhaustive industry that is not stable or sustainable in the future. The resource sector, particularly oil and natural gas, has a history of wild fluctuations in both prices and production. An economy with growth volatility is very unfavorable for private investment in the non-resource sector. Similarly, this kind of investment will eventually decrease after Nigeria has passed the peak of its extraction rate.

Secondly, public investment is very inefficient and considered a waste of physical capital. Sala-i-Martin and Subramanian (2003) estimated that two-thirds of Nigerian public investment in the manufacturing industry has been wasted. They found that the capacity utilization of the government-owned facilities had been declining from 77 per cent in 1975 to about 50 per cent in 1983, to around only 35 per cent in 2000. For example, the Ajakouta steel complex, built in the 1970s by government oil revenues, has never been operating at a commercial level. Public investment in Nigeria has been mainly for political gain, such as through patronage and jobs to supporters.

Finally, a slightly bigger impact on the real gross domestic expenditure of the increased exports of natural resources in Nigeria is not as satisfactory as the smaller impact in Norway. Theoretically, the impacts in Nigeria of the same increase in the export of the natural resources on real gross domestic expenditure should be much bigger than in Norway. According to the conditional convergence theory of the economic growth, Nigeria, with a much lower GDE per capita and a faster population growth rate, is supposed to benefit much more from the same resource boom because marginal capital yields more returns than in Norway. In addition, Nigeria requires a higher economic growth to raise its living standards because of population growth pressure. Lastly, Nigeria's bigger impact on real gross domestic expenditure turns out to be much lower in terms of US dollars because Nigeria's exchange rate substantially depreciates while Norway's exchange rate appreciates. Therefore, in terms of the GDE per capita in US dollars, the economic impact of the same increase of the world imports of natural resources is much smaller in Nigeria than in Norway. In conclusion, Nigeria fails to benefit from its resource sector as much as Norway does.

Figure 5-10: The Economic Impacts of Scenario 1





Note: The solid lines belong to Nigeria and the dashed lines belong to Norway.

5.4.2 Scenario 2: The Reduction of Imported Products

The previous scenario shows one reason that Nigeria could not benefit as much from the resource boom is because it has a much lower absorptive capacity. Therefore, another scenario of interests is what the economic impacts in Nigeria would be if its non-resource sector could compete with imported products and absorb the impact from the resource sector. This would mean that the expenditure induced by the earnings from the export of natural resources is absorbed more into the domestic agriculture and manufacturing sectors. Thus, in this scenario, it is assumed that Nigeria's marginal propensity to import is reduced by 10 per cent.

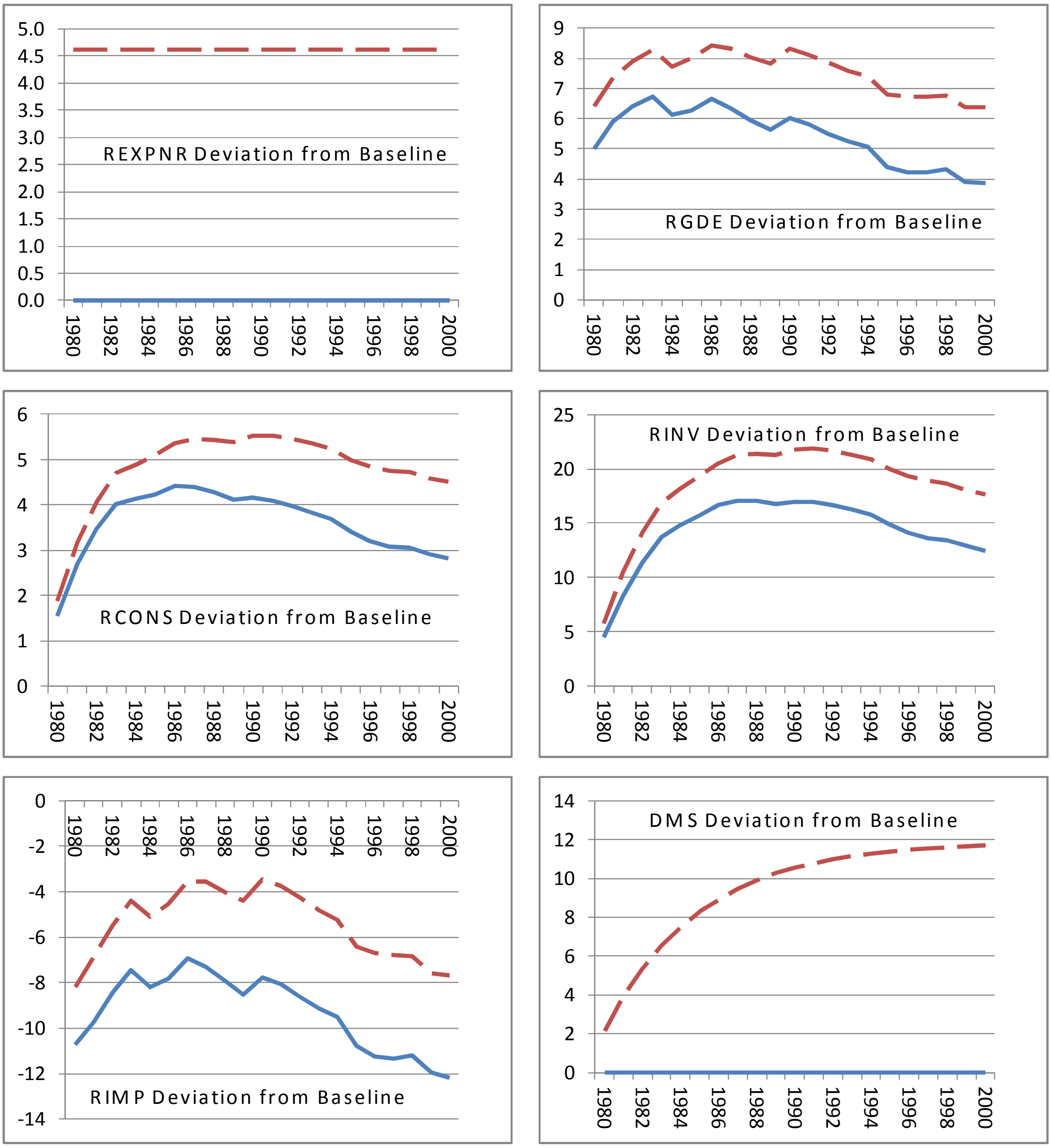
The economic impacts of this simulation are presented by the blue lines in Figure 5-11. In this scenario, the imports are on average lower than the baseline by around 9.3 per cent, which, in turn, increases gross domestic expenditure by about 5.4 per cent. Household consumption expenditure is about 3.6 per cent, and gross capital formation is about 14.3 per cent higher than the baseline. The increase in investment is possible through two channels: the increase in the RGDE and the appreciation of the exchange rate by about 9.7 per cent, which lower the user cost of capital by the same amount because the real interest rate is unchanged.

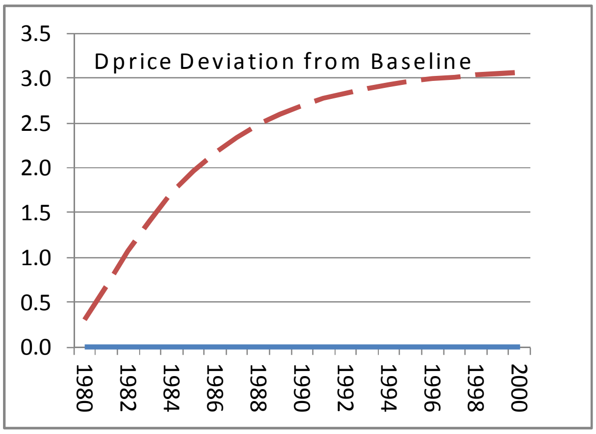
Compared with scenario 1, the dashed lines show the impacts of an increase in the world imports of natural resources along with the reduction of the marginal propensity to import in Nigeria[8]. In other words, Nigeria is able to increase its absorptive capacity from its export of natural resources. In this respect, a 15 per cent increase in world demand would increase the RGDE of Nigeria by about 7.5 per cent, compared with a mere 1.93 per cent impact on Nigeria's status quo. More importantly, even though monetary expansion in response to the increase in the REXPNR still leads to inflation, the exchange rate appreciates by about 8.9 per cent from the baseline instead of losing its value. This means that, in addition to the lower user cost of capital, the Nigerian Naira can also maintain its creditability among foreign currencies.

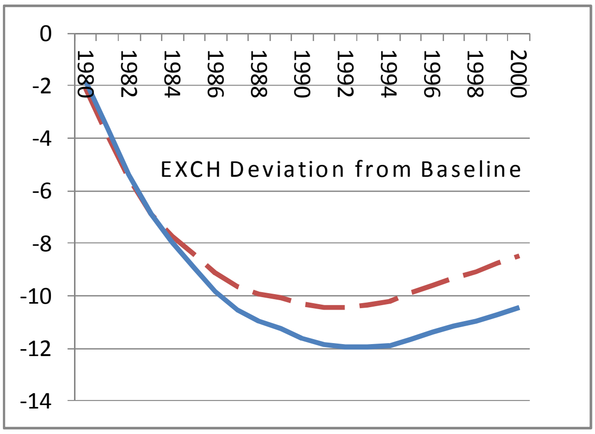
It is clear from this scenario that the resource boom in Nigeria would benefit its economy much more if it could increase its absorptive capacity. This can be achieved by ensuring a favorable environment for the non-resource sector to grow alongside the resource sector. It is especially significant that the agriculture and the manufacturing sectors could remain competitive against imported products because they are a source of employment creation, productivity growth, and sustainability. However, there remains the question of how to create an investment-friendly environment for the non-resource tradable sector to benefit from and flourish together with the resource sector. The next scenario answers this question.

[8] Simulation scenarios 2 and 3 are applied to Nigeria only. The objective is to compare the impacts between scenario 1 and the following scenarios.

Figure 5-11: The Economic Impacts of Scenario 2 in Nigeria







Note: The solid lines belong to scenario 2; and the long-dashed lines belong to scenario 2 plus scenario 1.

5.4.3 Scenario 3: Less Responsive Monetary Expansion

It is more prescriptive if there is an understanding of the impacts of an independent monetary policy from the export of natural resources in Nigeria. Monetary policy has crucial economic impacts because it can stabilize or destabilize the macroeconomic environment in the short run, which determines private investment in the non-resource sector. In turn, this investment determines the economic growth in the long run. At status quo, the monetary expansion in Nigeria is very responsive to the resource sector and, therefore, destabilizing its macroeconomy by creating inflation and eroding confidence in its currency.

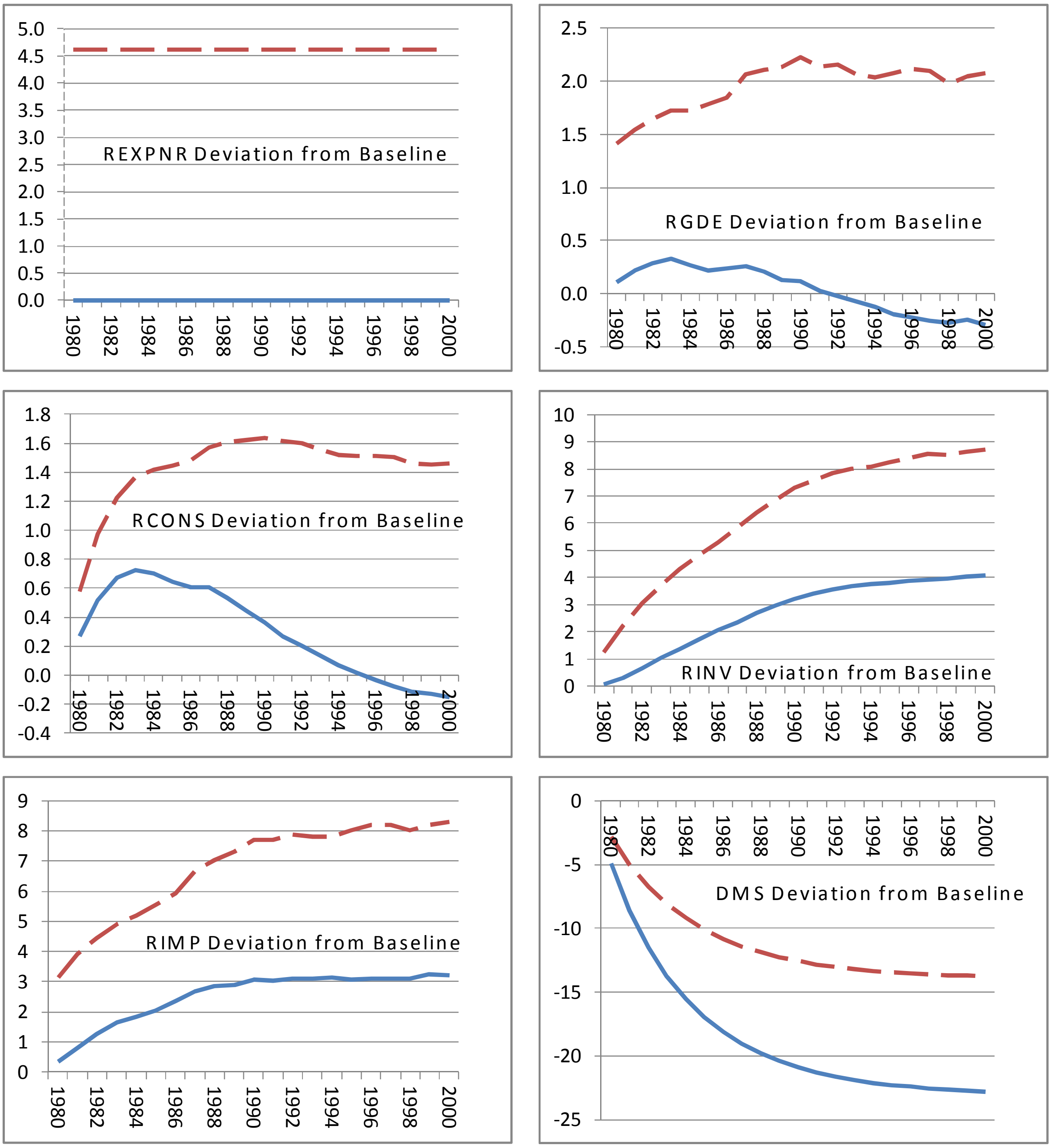
Therefore, in this scenario, it is assumed that the impact of the export of natural resources on money supply expansion is reduced by 10 per cent. The blue lines of Figure 5-12 illustrate the economic impacts of this simulation. In the short run, real gross domestic expenditure is higher than the baseline for the first decade, but it becomes lower for the last decade because the imports of goods and services are higher during the last decade. This is because of the appreciation of the exchange rate that raises the purchasing power to import.

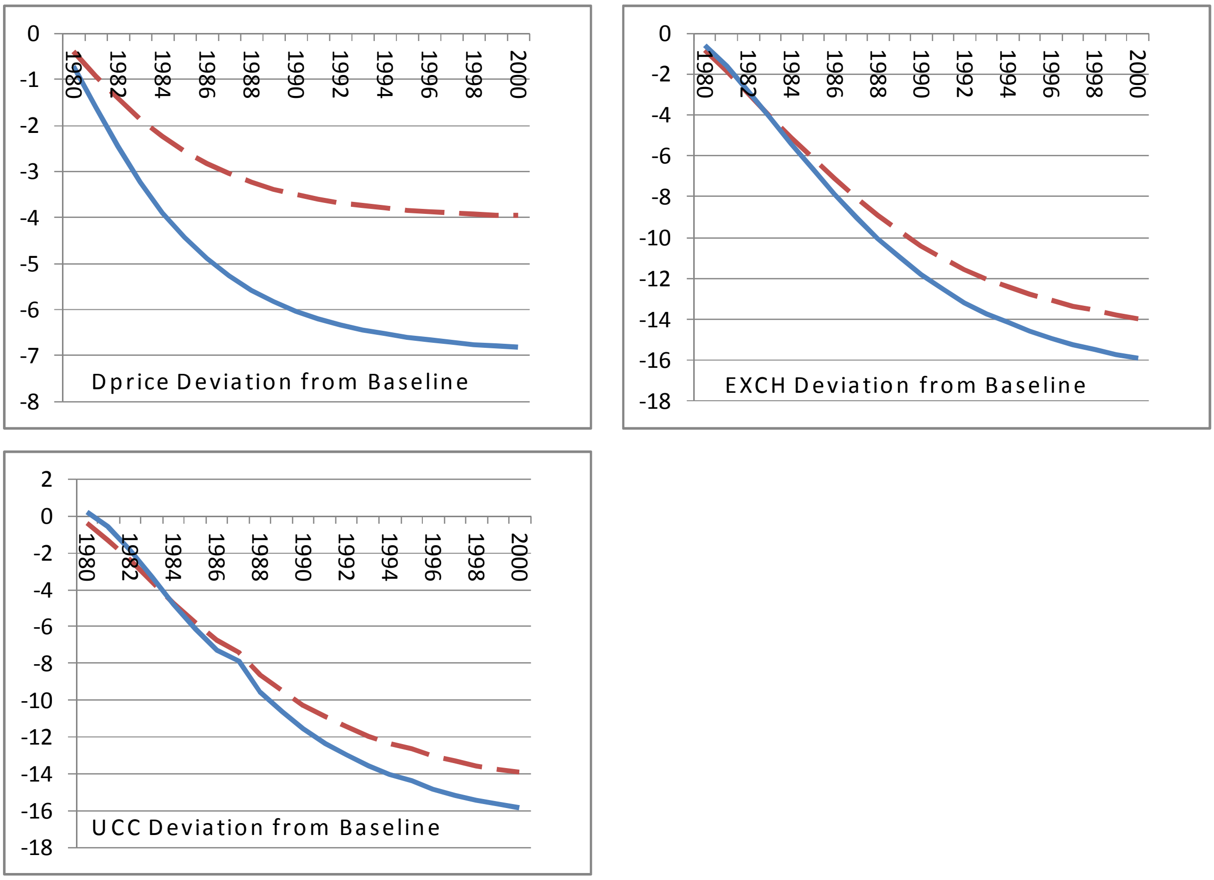
On the positive side, however, the slow-down of monetary expansion, which is up to more than 20 per cent lower than the baseline in the last decade, is actually favorable to Nigeria's economy in the long run for two reasons: it lowers the price level and raises confidence in the domestic currency. The price level is about 6 per cent lower than the baseline, and the exchange rate appreciates more than 12 per cent in the last decade. It should be noted that this lower price level does not mean deflation annually; it simply means the inflation rate in Nigeria would be lower if it slowed down its monetary expansion during this period. Similarly, the appreciation of the exchange rate from the baseline in this simulation means the Nigerian Naira would depreciate more slowly annually.

As a result of this more investment-friendly macroeconomic environment, eventually gross capital formation in Nigeria is increased by more than 3 per cent in the last decade. This is due to the lower user cost of capital that is mainly caused by exchange rate appreciation. Moreover, the lower price level increases the competitiveness of the private non-resource sector. This increase in investment should be mainly in the non-resource sector because it is more responsive to the user cost of capital, while resource and public sector investment are mainly determined by the income effect of the export of natural resources.

This is particularly illustrated by the dashed lines in Figure 5-12, which shows the impacts of a combination of scenario 1 and scenario 3. When the world demand for natural resources is increased by 15 per cent, the RGDE is increased by more the two per cent, along with a more than seven per cent increase in investment. These impacts are mainly in the resource sector because the resource boom depresses the non-resource sector through the monetary expansion, which is now only 13 per cent lower than the baseline.

Figure 5-12: The Economic Impacts of Scenario 3 in Nigeria





Note: The solid lines belong to scenario 3, and the long-dashed lines belong to scenario 3 plus scenario 1.

5.5 Concluding Remarks

This chapter completes the puzzle of the relationship between economic growth and natural resource abundance. It uses a macroeconometric approach to compare the impacts of the resource sector on the economies in a resource-cursed country, Nigeria, and a resource-blessed country, Norway.

Nigeria and Norway, both abundant in natural resources, had divergent experiences during the last four decades. Both countries started relatively well during the oil price booms in the 1970s, but Norway handled its economy much better with smart policies. Among them, Norway managed to integrate its resource sector to the rest of the economy, made its monetary policy independent of the resource sector, and has a well-disciplined revenue spending policy. As a result, Norway's non-resource sectors were able to thrive alongside the resource sector, and the impacts of the resource boom were absorbed into its economy accordingly.

Nigeria's macroeconomic institutions were not as friendly, and its domestic sectors have lower absorptive capacity. Its monetary and fiscal policies are dependent on the resource sector. The resource boom was accompanied by an intensive monetary expansion and an unrestraint increase in public investment. The former policy caused the price level to rise and its exchange rate to lose value. In turn, this led to an unfavorable environment for private investment in the non-resource sector. The latter policy was very inefficient and wasteful because the public investment projects were designed for political gains rather than overall economic welfare. Therefore, Nigeria's absorptive capacity was low, and the impacts of the resource boom led to an even more unfavorable environment for private investment in the non-resource sector.

This is illustrated by the import and the money supply equations. A one per cent increase in the export of natural resources in Nigeria leads to more than two per cent increase in imports, while it is less than 0.4 per cent in Norway. This means the absorptive capacity in Nigeria is much lower than in Norway. In addition, a one per cent increase in the export of natural resources in Nigeria leads to an increase of about 0.5 per cent in money supply, while it is less than 0.02, and not significant, in Norway's equation. To put these differences into perspective, a 15 per cent increase in the world demand for natural resources leads to a more favorable impact in Norway. In Nigeria, this resource boom leaks more to imports, creates higher price level, and makes the exchange rate lose more value. More importantly, simulation scenarios 2 and 3 show that if Nigeria could increase its absorptive capacity or make its monetary policy independent of the resource sector, it could substantially benefit from its resource richness much more than per its status quo.

The remaining question is about how to manage the resource sector so that resource-rich countries can avoid the resource curse and make the most out of their natural gifts. The next chapter compiles and compares best management practices among resource-rich countries to give recommendations to resource-rich countries, especially a prospective resource-rich country such as Cambodia.

Chapter 6: Natural Resource Management Policy

6.1 Introduction

Natural resources, particularly oil, gas, and minerals, provide a different source of national income from other conventional income sources in several aspects (Sachs, 2007). One is that the income from the natural resource sector comes in the form of a rent, which does not rely on as much physical and human capital as the non-resource sector. This leads to another aspect of natural resources: public ownership. It is very common that hydrocarbon and mineral resources are found on or under public land or water. In addition, most constitutions require public ownership of these natural resources. These two characteristics of natural resources sometimes lead to a wrong impression that the government has a secure and easy source of income.

However, four main aspects of natural resources require appropriate management policies to realize their true potential. One is that both exploration and production require huge investment capital, which often forces resource-rich developing countries to seek a private partnership. Second, they are depleting assets, so their extraction essentially means converting the natural capital into other forms of capital. The third aspect is the volatility of price and production, which are often beyond the control of national policies. The last aspect is that natural resources can be used as collateral to borrow from international credit markets. The governments of resource-rich countries have to make right policy choices to handle these realities.

In chapter 3, the extensive literature on the relationship between natural resources and economic development showed that natural resources can be a curse or a blessing, depending on macroeconomic policies and political institutions. Chapter 4 empirically confirmed the conditional relationship through a long-run cross-country investigation. Only resource-rich countries with good macroeconomic and political environments have been blessed by their natural resources. This finding is reinforced by a short-run model in Chapter 5, which shows a macroeconometric comparison between a resource-blessed and resource-cursed country. Nigeria, because of a failure in fiscal and monetary policies, has not benefited as much as from its resource booms compared with Norway.

Similar to the complicated relationship between natural resources and economic development, international experiences in avoiding the resource curse provide far more complex lessons for a new resource-rich country to follow. No exact prescription from one successful country can be administered to another country. New resource-rich countries need to evaluate and constantly re-evaluate their macroeconomic policies and political institutions to devise a suitable set of management policies to truly realize the potential of their natural endowment. This chapter surveys and discusses different resource management and policy practices in both successful and resource-cursed countries to give policy recommendations to resource-rich countries. The objective of this chapter is twofold: to avoid the resource curse and to gain most benefits out of natural resources.

6.2 Dealing with the Macroeconomic Challenges

6.2.1 Diversification

As shown in Chapter 2, the natural resource sector, particularly the oil and gas extraction and refining sectors, has low linkages with the rest of the economy. In developing countries that rely heavily on imported products, the resource sector is even more isolated. As a result, resource-rich developing countries tend not to gain the most benefits from the indirect effect of the resource sector. In addition, they are likely to have a more concentrated source of national income and are more susceptible to both price and production volatility in the resource sector. Successful resource-rich countries have showed that to reap the most benefits from their natural endowment, they have to diversify their economies.

There are two ways to enhance the effects of the resource sector: close-to-resource-market diversification and far-from-resource-market diversification (Insights for Action, 2006b). To diversify the economy close to the resource market means to create resource-based industry clusters by taking advantage of the backward and forward linkages. In terms of backward linkages, there are several ways to foster the development of local industry to supply the resource sector. First, the government should invest in both physical infrastructure and local skills creation that enable local people to be involved with the resource sector. In addition, the government can enforce legal requirements and provide incentives for natural resource companies to have a closer relation with the local industry through mandatory domestic supply, skill training, and knowledge sharing. Lastly, the government should also provide financial supports and facilitate an open access to the credit market for the development of small and medium enterprises supplying the resource sector.

Forward linkages, on the other hand, involve downstream developments of the resource sector. These include oil and gas refineries, power plants, fertilizer plants, and mineral and metal processing plants. If created, these forward linkages create much more value added for the domestic economy. However, there are several key considerations in downstream developments. One is the economies of scale that require special assessments of the size of the reserves, market demands, and the domestic demand mixture in the case of oil refineries. The government also needs to consider if the downstream developments require substantial subsidies and necessary infrastructure that are not beneficial to other non-resource sectors. Finally, the government should also weigh in the politics of dependence on imported products and national energy security compared to inefficient downstream developments.

One of the resource-rich countries that successfully harnesses both backward and forward linkages of the resource sector is Norway (Cappelen & Mjøset, 2009). In the early days of its petroleum sector, Statoil, Norway's state-owned company, actively encouraged technology transfers and heavy investment in education in resource-related areas. Furthermore, existing Norwegian manufacturing firms were restructured into suppliers of both oil-exploration and production equipment. In terms of forward linkages, Norway has been able to make of use its resource industry to develop semi-manufactured industry that relies on the inputs from its petroleum industry. As a result, even though there has been a decline of traditional manufacturing sectors, Norway's resource sector has actually helped developed other resource-related manufacturing.

The successful experiences of Norway and other resource-rich developed countries that have been able to link the resource sector to the rest of the economy contrast with other countries that have instead diversified away from the resource sector. Far-from-resource market diversification means spending resource revenues on physical infrastructure and human capital creation in both tradable and non-tradable sectors. Several resource-rich countries are considered to have succeeded in achieving this endeavor (Insights for Action, 2006b). Indonesia, for example, managed to diversify into the manufacturing sector by using its resource revenues to create an investment-friendly environment, while Uganda has invested in infrastructure to foster its rural economy. The case of direct public sector investment and industrial policies to diversify the economy has been a success in Botswana and Malaysia, but Nigeria's experience in public investment has been a disaster.

6.2.2 Avoiding the Dutch Disease

The Dutch Disease is one of the main causes, and probably the most over-rated cause, in the resource curse literature. As explained in Chapter 3, the Dutch Disease refers to the deterioration of the non-resource tradable sector due to real exchange rate appreciation. This can happen in two ways depending on the exchange rate regime and macroeconomic policy response of the resource-rich country. In a floating exchange rate regime, the sudden inflow of foreign currencies from resource booms makes the nominal exchange rate appreciate. As a result, the non-resource tradable sector loses its competitiveness, and prices fall because of cheaper imported goods. The non-tradable sector with a rising price relative to the non-resource tradable sector, therefore, draws both human and capital resources away from the shrinking non-resource tradable sector.

In a fixed exchange rate regime, the booms increase the price of the non-tradable sector through the spending effect by both the resource sector and the government. Because the price of the tradable sector remains constant by the fixed nominal exchange rate, the spending increase puts upward pressure on the prices in the non-tradable sector; thus, it absorbs both human and capital resources from the non-resource tradable sector. Real appreciation is further aggravated by domestic inflation if fiscal expansion is too quick and monetary expansion has to follow to maintain the fixed nominal exchange rate. This is especially true in resource-rich countries that have to pay a huge debt service. Nigeria's fiscal and monetary policies are one good example, as discussed in Chapter 5.

Sachs (2007) argued that the Dutch Disease can be handled with the right policy choices. In the short term, both fiscal and monetary policies should be implemented to avoid the unpredictable, sudden, and persistent appreciation of the real exchange rate. Two ways are suggested. One is to adopt an adjustable peg exchange rate, which can add predictability to the price level. However, resource-rich countries need to maintain appropriate foreign exchange reserves and avoid excessive borrowing and debt-service payments. On the other hand, since the real appreciation is partly caused by excessive spending, fiscal expansion has to be balanced with, and to increase, the domestic absorptive capacity.

The real exchange rate appreciation does not necessarily squeeze the non-resource tradable sector if there is a long-term solution to the Dutch Disease. The solution is to use public investment, made possible by the resource sector, to increase the productivity of both the non-tradable and non-resource tradable sectors. Such infrastructure investments as transportation, electricity, irrigation, and telecommunication can boost the productivity of both the agricultural and manufacturing sectors, which are not only good for export and economic growth but also significant in reducing poverty and inequality in resource-rich developing countries.

6.2.3 Complementary Public Investment with Resource Revenues

As Chapter 3 has showed, resource-rich countries tend to neglect the need for investments in both human and physical capital (Gylfason & Zoega, 2006). In fact, resource-rich countries have genuine savings rates about 10 per cent lower than resource-poor countries because the former do not account for the depletion of their natural resources (Atkinson & Hamilton, 2003). Furthermore, Nili and Rastad (2007) found that the effectiveness and efficiency of public investment in resource-rich countries are far inferior to private investment, due to the fact that private investment is determined by the financial market. The dominance of public investment in many resource-rich countries weakens their financial development, which in turn distorts private investment.

To ensure that public investment by the resource revenues is beneficial for economic development, there are several main principles for resource-rich countries, depending on their economic and political environments (Sachs, 2007). One, both public and private investments should thrive alongside each other. Public investment should be in areas that create a favorable climate and complement rather than substitute for private investment. Those areas that require public investment include underprovided, non-rival, and non-excludable public goods such as the rule of law, technology transfers, social protection, education and basic infrastructure. These areas build up the fundamental elements for long-term growth by attracting private investment into the agriculture, manufacturing and services sectors.

Two, public investment plans should take into account macroeconomic stability and fiscal solvency. Macroeconomic stability refers to the fluctuations of macroeconomic variables such as inflation, the exchange rate, the unemployment rate and economic growth, which are influenced by the public investment spending. Fiscal solvency refers to the ability of the government to sustain its long-term investment projects. In this regard, public investment plans should take account of the fluctuations and the depletion of the resource sector. Thus, the third principle of the public investment by the resource revenues calls for a development strategy with long-term goals. Long-term public investment should be based on an assessment of the sustainability of the resource sector and be incorporated into the Millennium Development Goals and the National Poverty Reduction Strategy.

Lastly, public investment plans using resource revenues should be sequenced according to the development stage of the economy (Sachs, 2007). For low-income countries such as Nigeria and Sao Tome and Principe, resource revenues should be spent on priority sectors that meet the basic needs and infrastructure including food, safe drinking water, health and education services, roads, power, irrigation, and so on. For middle-income countries, the focus should be on diversifying from a resource-based into human capital and knowledge-based economy. Resource revenues should be invested to create a friendly environment that attracts non-resource private investment and enables knowledge and technology transfer and creation. High-income countries, however, should use resource revenues to secure social insurance such as pensions, health care, and social safety nets.

6.3 Dealing with the Political and Institutional Challenges

6.3.1 Natural Resource Funds

6.3.1.1 Objectives of Natural Resource Funds

Natural resources are characterized by both price and production volatility and unpredictability, and they are exhaustible assets. These factors can affect the budget planning and expenditure of the government and require a partial saving for future generations after they are depleted. For these reasons, natural resource funds are normally created to serve three main objectives (see Table 6-1). One is to reduce the volatility and stabilize the macroeconomy and the government budget plans. The aim is to transfer surplus revenues to the funds when oil prices or production is higher than a benchmark point, and transfer them back to finance the government budget when revenues are low. The Copper Fund in Chile, the Foreign Currency Reserve Account in Iran, the General Reserve Fund in Oman, and the Future Generation Fund in Chad have been established to achieve this objective.

Apart from stabilization, another objective is to sterilize the impacts of the resource sector on the economy, particularly the Dutch Disease and limited absorptive capacity. This involves limiting the impacts of resource booms on the exchange rate and inflation rate due to excessive inflows of foreign exchange and expansionary fiscal policies while the domestic institutional and productive capacity are low. Two countries, Chile and Iran, have established a resource fund for this objective.

Table 6-1: Resource Funds in Resource-Rich Countries

Name of Fund	Country	Date	Sterilization	Volatility	Savings
Heritage Savings Fund	Alberta, Canada	1976			√
Copper Fund	Chile	1986	√	√	
Foreign Currency Reserve Account	Iran	2000	√	√	√
Reserve Fund for Future Generations	Kuwait	1976			√
General Reserve Fund	Oman	1980		√	√
Alaska Permanent Fund	Alaska, USA	1976			√
Future Generations Fund	Chad	1999		√	√

Source: Reproduced from Insights for Action, 2006b

The other objective that most resource-rich countries have considered is to save some part of the revenues for future generations and for when the resources are depleted. This ensures long-term fiscal sustainability and inter-generational equity. To achieve this objective, resource revenues should be managed with a long-term asset investment strategies (Insights for Action, 2006b). One strategy is to have a sustainable spending plan; for example, the saving funds are invested in low-risk and diversified portfolios and the government can only spend the return of the funds. Alternatively, another option is to set a specific percentage of the funds to be withdrawn to finance the budget. As can be seen from the table, all countries, except Chile, have established a resource fund for savings in addition to other objectives.

6.3.1.2 Challenges of Natural Resource Funds

Regardless of the objectives of the resource funds, it is argued that many resource funds have failed to achieve their original objectives and collapsed due to domestic economic and political policies. Davis et al. (2001) argued that resource funds created to solve inherent economic and political problems have serious drawbacks. The benchmark price is determined based on the projection of resource prices, though it is hard to predict whether they will fall or rise. A wrong benchmark price leads to either a continuous accumulation or depletion of the fund. Similarly, savings funds may not actually be transferred to future generations because of the fungibility problems. This is especially true during resource booms, when the government borrows to finance its budget gap which it is supposed to receive from the diverted revenues. Using the prospect of resource booms as the collateral, some resource-rich countries even borrowed at a much higher rate than the return of the resource fund investment.

Indeed, attempts to manage resource revenues through a resource fund involves a political, rather than economic, aspect (Humphreys & Sandbu, 2007). Norway and Chad are two contrasting experiences, showing that a political incentive is more important than the rules and guidelines of the resource funds. In Norway, the rules of withdrawal from its resource fund are extremely weak on paper, but policy makers commit to an informal rule not to withdraw more than four per cent annually. Chad, on the other hand, has rigid rules on how to spend its resource fund, as a precondition for access to the World Bank financing. However, the government has freely changed the rules whenever it wants greater access to the fund.

6.3.1.3 Institutional Solutions to the Natural Resource Funds

A lack of coordination between policy makers now and in the future leads to over-spending of the resource fund if the present policy makers use it for political gains and fear that future rules will be changed to their disadvantage by a new government. Therefore, resource-rich countries with weak institutions should build institutional mechanisms to ensure a strong commitment and predictability for their resource funds across different political regimes. Humphreys and Sandbu (2007) suggest several institutional arrangements for an effective natural resource fund (NRF). Resource-rich countries with poor institutional quality should follow strict rules governing the inflow of revenues, the magnitude and the composition of the NRF expenditure. Regarding the inflow of revenues into the NRF, there should be specific rules as to what kinds of revenues are transferred to the fund. Norway, East Timor and Sao Tome and Principe transfer all of their oil revenues, while Alaska, Ecuador, and Chile transfer a fixed proportion of their resource revenues directly to their NRFs.

On the expenditure side, there should be both quantitative and qualitative constraints on NRF expenditure. The quantitative constraints determine either the exact or the maximum amount that the government can withdraw from the NRF, which is a function of the revenue flow and stock or the return from the NRF investment. In addition, qualitative constraints determine how the spending is allocated. Chad, for instance, has a regulation that a fixed proportion of its oil revenues must be spent on priority sectors such as health and education. Similarly, fifty per cent of the investment return from the Alaska Permanent Fund has to be distributed to residents while the other half is used for inflation adjustment and other purposes.

Such NRF rules, nevertheless, cannot solve political issues without strong mechanisms to restrain the political incentives to change them. One mechanism is to share the spending decisions across different political constituencies about how much to spend and on what. The constituencies involved can be between the government and the parliament, between the lower and the upper houses, and between central and local governments. Another mechanism is to give the power to approve and/or supervise spending decision to an independent entity that has no political incentive to overspend the NRF. Sao Tome and Principe and Chad, for instance, include civil society representatives in their NRF committees. In an extreme case, the NRF can be deposited in a foreign financial institution, which acts as a clearinghouse and only follows predetermined rules on the withdrawal decisions.

Last but not least, Humphreys and Sandbu (2007) suggest that the expenditure from natural resource funds should be created with greater transparency and integrated into general budgets to avoid fungibility problems. With budget integration, the government can overspend in other parts of the budget and fill the budget gaps in the areas where NRF can be spent. A unified budget also reduces the complexity of budget expenditure and promotes transparency. This is reinforced by the sharing of spending decisions because different constituencies pressure for more information about the NRF. However, there are more mechanisms to ensure a transparency in resource revenue management. This topic is discussed in details in the following section.

6.3.2 Transparency

There are three benefits from greater transparency to governments of resource-rich countries. One is that greater transparency sends a signal to investors and financial institutions that the countries are committed to an investment-friendly climate. It shows that the government has good governance and strong accountability, which is essential for economic and political stability. Secondly, transparency in resource revenue management also yields national political benefits. It shows a strong commitment by political leaders to their voters that all the benefits from the resource sector are managed and distributed with full awareness among the public. As a result, this reduces the pressure on and the skepticism toward the government when the resource sector is not operating favorably for the economy. Lastly, greater transparency opens up more involvement by civil society, such as international NGOs and institutions. This civil society participation can lead to better management practices in various processes of the resource sector, which can ensure that resource-rich countries are taking out the most and making the best use of their natural endowments.

Various transparency practices and initiatives are implemented by resource-rich countries, which have to adopt and adapt the most appropriate forms of policies according to their economic and political environments. Among them are the Extractive Industry Transparency Initiative, Publish What You Pay, and the IMF Guide on Resource Revenue Transparency.

6.3.2.1 Government's Role: Extractive Industries Transparency Initiative (EITI)

The Extractive Industries Transparency Initiative is a global coalition of governments, companies, and civil society. Twelve EITI Principles to promote payment and revenue transparency were established in 2003 during the Lancaster House Conference attended by resource-rich countries, petroleum companies, and civil society organizations (EITI International Secretariat, 2013). The main theme of the principles is to use resource revenues for sustainable development for every citizen by promoting transparency and accountability and through cooperation among all stakeholders, including governments, private companies, financial institutions, and civil society organizations. Currently, there are 23 compliant countries that meet all requirements and 16 candidate countries that partially implement the EITI standards.

With civil society participation and transparency at the core of its mission, the EITI plays a significant role in promoting the effectiveness of revenue collection in resource-rich countries. However, the EITI's narrow mission misses out other stages of resource extraction, such as the awarding of contracts and the expenditure of resource revenues (Kolstad & Wiig, 2009). Corruption, fungibility, and inefficiency in expenditure are also fundamental parts of the resource curse. To solve these issues, resource-rich countries also have to implement other management policies.

6.3.2.2 Civil Society's Role: Publish What You Pay (PWYP)

Established in 2002, "Publish What You Pay" is a solely civil campaign by a coalition of NGOs (Revenue Watch Institute, 2013). Working with civil society groups from over 70 countries, PWYP directly involves the citizens of resource-rich countries to hold their governments accountable in resource management. Unlike the EITI, which is a voluntary effort by governments and only focuses on transparency in revenue collection, PWYP campaigns for both transparent and accountable revenue management and public disclosure of contracts and licensing procedures. To achieve these objectives, PWYP plays two main roles in advocacy for revenue transparency and capacity building for local citizens to effectively participate in expenditure policy debates. In addition, PWYP has a high influence on private companies and importing countries, which is an important mechanism to oversee the EITI compliance of resource-rich countries.

6.3.2.3 International Community's Role: Guide on Resource Revenue Transparency

The IMF is one of the international organizations that actively promote resource revenue transparency. Applying the principles of the Code of Good Practices on Fiscal Transparency, it has produced a Guide on the Resource Revenue Transparency, which provides comprehensive resource management guidelines to resource-rich countries. The guide has four pillars to promote resource revenue management and transparency (IMF, 2007). One pillar is the clarity of roles and responsibilities, which calls for a legal framework to define authorities in charge of all stages of resource development. The second pillar is open budget processes; that is, there should be a clear statement of the exploitation policy, clear rules for resource revenues and resource-related funds, and a well-established accounting system to regularly and publicly report all resource revenues and investment policies.

A more important pillar is the public availability of information. The guide calls for publicly available documentation of all resource-related transactions, including government receipts from company payments and resource funds. Furthermore, non-resource fiscal balance and resource-related debts have to be disclosed in annual reports to assess the fiscal sustainability and the macroeconomic impact of natural resources. The documentation should also include all government financial assets, estimates of resource asset worth along with any contingent liabilities and fiscal risks resulting from the resource sector, and contracts with private companies. The last pillar is integrity assurances. To ensure the integrity of the resource management policies, resource-rich countries should clearly establish internal audit procedures, tax administration, and an independent organization to oversee revenue flows and regularly report to the legislature.

Based on the guide, many countries have also made a fiscal transparency assessment through the IMF Reports on the Observance of Standards and Codes (IMF, 2013). These voluntary reports increasingly include the assessment of the resource revenue management. Furthermore, the IMF has regular surveillance and capacity-building programs that help improve fiscal transparency, resource revenue management, and assessment of fiscal management.

Besides the three transparency mechanisms discussed in this section, there are numerous other transparency initiatives. However, it is important that resource-rich countries have three mechanisms that are both complementary and counterbalancing to ensure resource revenue transparency. In other words, a government's role in promoting transparency may be voluntary, but civil society can put pressure on the government. The role of international organizations such as the IMF, the World Bank, and the UNDP is also important because many resource-rich countries are also receiving development assistance.

6.3.3 Capacity Building

Transparency alone certainly cannot lead to a good resource management. Kolstad and Wiig (2009) argued that transparency is insufficient for effective resource revenue management. Resource-rich countries should strengthen accountability mechanisms and build capacity by involving stakeholders to monitor and process information from the increased transparency. Education and capacity building, thus, are significant for the citizens and the legislature of resource-rich countries to take advantage of transparency and to hold the government accountable for resource management.

Many resource-rich countries are receiving assistance and advice from international organizations regarding institutional strengthening and human capacity building at both the national and sub-national level. The areas of capacity building include dealing with private companies, resource fund management, resource sector development, and public expenditure policy. Local business linkages and skill development are also part of the human capacity building for local citizens to benefit from the resource sector. Last but least, capacity building for the legislature, the media, and civil society organizations are significant in promoting the oversight capacity.

6.3.4 Reducing Inequality

One common aspect of the political challenges in resource-rich countries is the prevention of social unrest, rebel groups, conflicts and civil wars. Natural resources are likely to cause national fractionalization in countries that have competing groups, but more importantly in countries that unequally share the benefits of natural resources across different regions and population groups. There are some practical solutions to prevent loot-seeking rebels, such as encouraging the international community to boycott looted commodities, establishing minority rights and providing basic services to poor regions. However, the real problem is inequality.

There are two types of inequality that require different solutions (Ross, 2007). Vertical inequality refers to the unequal distribution between rich and poor, which slows growth and leads to poverty. This kind of inequality is caused mainly by the Dutch Disease that pushes workers from deteriorating labor-intensive agriculture and manufacturing sectors into capital-intensive oil and non-tradable sectors. Therefore, three policy responses are suggested: promote productivity in the agriculture and manufacturing sectors, provide government jobs, and adopt pro-poor policies.

Horizontal inequality across different regions of resource-rich countries can lead to conflicts and rebellions. Several policy responses can reduce horizontal inequality or prevent conflicts at the very least. One is the direct distribution of resource revenues to poor regions to give them a sense of ownership. A better approach is to link the development of the resource sector to local people by encouraging the resource companies to train and hire local workers, investing in local development, promoting communication through civil society mediation, and making revenue management transparent to local people. Lastly, the decentralization of resource revenues is also implemented in many resource-rich countries. Resource-rich countries should adopt an appropriate policy, or a combination, to ensure horizontal inequality does not lead to social fractionalization.

6.4 Resource Management and Aid

In recent decades, development aid has been playing increasingly significant roles in filling the financial and the technology gaps for developing countries, many of which are resource-rich. The capital inflows of aid share many aspects of resource windfalls, which can provide important lessons for resource-rich countries. Aid and resource booms can both create a surge in investment spending. This can act as a big push capital to generate growth if invested properly, or it can lead to the Dutch Disease and depress economic growth if it fails to increase the absorptive capacity of the economy. Fungibility and accountability problems are also present in the use of development aid.

Furthermore, the fact that many resource-rich developing countries are also receiving development aid creates an opportunity to use aid to foster resource management to meet their development goals (Insights for Action, 2006b). International donors should rethink their coordination strategies to integrate development aid with resource revenues. The coordination should be in the general budget or sector support, debt relief, capacity building, reform programs, or investment policies to help resource-rich countries achieve development goals such as poverty reduction. International donors should assess the efforts of resource-rich governments in resource management and accordingly provide development aid in the form of financial and technical supports.

6.5 Concluding Remarks

Based on solid literature about the conditional relationship between natural resources and economic development, this chapter reviewed resource management policies from both resource-blessed and resource-cursed countries. The government's role in dealing with the resource curse is the most important part of the solution, although the participation of civil society and international organization should also play roles to ensure that resource-rich countries escape the resource curse. While the list is far from complete, management and policy practices can be categorized into two main groups as follows.

To deal with the macroeconomic challenges of natural resources, there are three main solutions: diversifying the economy, avoiding the Dutch Disease effects, and making proper public investment policy. In the first solution, resource-rich countries can achieve economic diversification by linking the resource sector close to the rest of the economy. Exploiting raw natural resources normally has low linkages with other sectors. Resource-rich countries should intensify both backward and forward linkages of the resource sector. Norway is a leading example of close-to-resource-market diversification. On the other hand, where the resource sector is isolated, particularly offshore oil and gas, resource-rich countries should invest resource revenues to create an investment-friendly environment for other sectors, including agriculture, manufacturing, and the rural economy, to prosper alongside the resource sector. Indonesia is a leading example of using the resource sector to promote the manufacturing sector.

Another cause of the resource curse is the Dutch Disease. Economic diversification can only work when resource-rich countries are able to prevent real exchange rate appreciation and keep the non-resource tradable sector competitive in the world market. To achieve this objective, countries should adopt an adjustable peg exchange rate, keep enough foreign exchange reserves, avoid excessive borrowings, and implement fiscal expansion policies in domestic absorptive capacity. More importantly, resource-rich developing countries should invest in basic infrastructure, technology transfer, and institution building to increase the productivity of the agriculture, manufacturing and service sectors.

Last but not least, while many resource-rich countries neglect the importance of investment, the dominance of public investment can also be the cause of the resource curse. Public investment with resource revenues should complement, not substitute for private investment. The former should be spent on priority areas that create an investment-friendly environment to attract the latter into the agriculture and manufacturing sectors. Public investment spending should also take into account the sustainability of resource revenues, the absorptive capacity of the economy, and the stage of development.

Regarding political and institutional challenges, resource-rich countries have been plagued by various issues, such as inefficiency in resource exploitation, corruption, and conflicts. There are four main solutions to deal with these challenges. One is to create a natural resource fund. In addition to its economic objectives of stabilizing, sterilizing and saving, a well-designed resource fund with strict rules and shared decision making about spending can tackle both inefficient revenue collection and inefficient expenditure driven by political incentives.

In addition, an effective natural resource fund also promotes transparency, but resource-rich countries need further mechanisms to ensure transparency and accountability in resource management. Transparency mechanisms must be led by the government, but civil society and international organizations should also be actively involved in promoting transparency in resource-rich countries. However, transparency alone cannot lead to effective resource management. Resource-rich countries have to build capacity in priority areas ranging from parliament to local citizens so that they have the capability to be involved in decision making, to monitor and supervise resource management, and to hold the government accountable for its management practices.

The other challenge in many resource-rich countries, which have intense competing interest groups, is social fractionalization caused by the natural resources. Although policies such as diversification, transparency, and capacity building can mitigate this problem, the best solution is to reduce horizontal inequality between resource-poor and resource-rich regions. The government should develop local areas around the resource site, distribute some part of the revenues, and decentralize resource revenues to provide a sense of ownership and benefit sharing.

Finally, many resource-rich developing countries are receiving both financial aid and technical assistance from international organizations. This creates an opportunity to learn from the lessons from aid such as the Dutch Disease, transparency, and capacity building. At the same time, it gives the international community an opportunity to link the resource management to development aid.

Sometimes resource management policy solves multiple issues; and at other times, multiple policies are required to solve a single problem of the resource curse. Similarly, the solutions to macroeconomic challenges can address political and institutional challenges, and vice versa. With an appropriate assessment of the economic and political environments and the right implementation of management policies, resource-rich countries can safely escape the resource curse and enjoy the blessing of their natural resources.

Chapter 7: Summary, Conclusion and Policy Recommendations

This dissertation was motivated by the announcement of the first oil and gas discovery in Cambodia in 2005. However, since then, the government has been tight-lipped about the detailed information related to the size, the definition, and the revenues of this new industry. Although it is still in the exploration stage, some revenue streams have already started flowing, and the production stage is expected to start in 2016. Based on this timeline, international organization such as the UNDP and the World Bank have been actively providing management and policy advice to the government, which has constantly refused to make any official preparations and argued that the oil and gas industry is still very uncertain.

The seeming neglect of the government and the lack of transparency about the potential of this industry have led to fading public attention, which is a central part of accountable and effective resource management. More importantly, the relationship between natural resources and economic development in many resource-rich countries is a strong reminder that natural resources require a proper preparation to truly realize their potential. With this background, this dissertation has three main objectives:

1. To project the potential of the oil and gas industry on Cambodia's economy: the contribution to GDP, employment creation, and government revenues
2. To investigate the relationship between natural resources and economic development by a literature survey, a cross-country empirical study, and a macroeconometric comparison between resource-blessed and resource-cursed countries
3. To recommend best resource management policies to Cambodia, as well as new resource-rich countries

7.1 Summary of Findings

Based on its research objectives, this dissertation has used different methodologies and made the following findings:

7.1.1 Chapter 2

This chapter used input-output analysis to project the potential of the oil and gas industry on Cambodia's economy. It found that Cambodia has a potential economic contribution from the oil and gas industry. Using the 2008 input-output table and various realistic assumptions, the projection showed that this industry can contribute up to 15 per cent of 2010 GDP annually and provide around 300,000 new jobs through linkage effects. Nevertheless, even in an optimistic scenario, national income from the oil and gas industry will be small and mainly flow to the government revenues. Every year the oil and gas industry can contribute more than one fifth of 2010 revenues and grants in an average-case scenario.

The downstream sectors present a different set of challenges, if successfully developed. A small refinery with a capacity of 40,000 bpd can contribute about 223.4 million US dollars to Cambodia's GDP. Together with upstream oil sector and linkage effects of the refineries sector, about one billion US dollars will be added to the country's value added annually. For national security, this may be worth the 100 million US dollar subsidy, which a UNDP study has estimated, if the government needs to keep it sustainable and competitive with imported refined petroleum products. An electricity power plant generated by natural gas, on the other hand, is not worth the huge infrastructure investment needed to bring gas onshore, given its small economic contribution, unless its environmental advantage is taken into consideration.

Given Cambodia's meager oil and gas resources, policy makers and advisors should focus on revenue management in a way that this new industry provides a long-term benefit rather than only during its windfall period. The following four chapters, Chapter 3, 4, 5 and 6 employed various quantitative and qualitative, cross-country and case studies, and theoretical and empirical methodologies in order to answer the ultimate questions; that is, will Cambodia escape the resource curse?

7.1.2 Chapter 3

This chapter surveyed the literature on the link between natural resources and economic development. One of the most surprising facts in the economic growth models in many works is that natural resource abundance has had negative impacts on economic growth. However, previous studies have many critical mistakes that bias the existence of the negative relationship between natural resource abundance and economic growth. More recent works, therefore, try to minimize methodological mistakes and provide radically contrasting findings that there is no resource curse by the traditional standards.

Many earlier works have several critical deficiencies. One is the issue of measurement. Some measurements may not correctly represent natural resource abundance since they measure the dependence or concentration of natural resources, not their endowments. Different measures such as total natural resource reserves or capital per capita, for example, yield contradictory results with the resource curse findings. In addition, some studies argue that the period from 1970 to 1990 was seriously affected by economic turbulence, so the use of this period to observe economic performances may be biased and should take into consideration those omitted variables that may have influenced the relationship between economic growth and natural resource abundance. Once again, studies that account for these omitted variables, for instance debt overhang, show that the natural resource curse did not exist in cross-country data.

Last but not least, it has been widely agreed that traditional cross-sectional regressions faced the famous endogeneity problems. Some of the variables that are used in the growth equations are not exogenous. Several methods to deal with endogeneity problems were used to reinvestigate the link between natural resource abundance and economic growth. All of these methods consistently provided similar answers that there was no negative relationship between natural resource abundance and economic development.

So, is there no resource curse? The answer is yes, there is. There seems to be a consensus that there is a conditional curse rather than an absolute curse. However, there was never a consensus on what really leads to the negative relationship between natural resource abundance and economic growth. There are many different transmission channels, which can be grouped into economic and politico-economic channels. The Dutch Disease and investment channels are on top of the list of economic aspects of the link between natural resources and economic development. More recently, many authors point at institutions as the mechanisms that make natural resources a curse or a blessing for an economy.

In Chapter 4, a cross-country empirical study was conducted based on the development of the literature discussed above. No existing studies so far have made a comprehensive investigation into this relationship by accounting for all the main arguments. Therefore, the findings in that chapter will be an important source to understand the controversial relationship between natural resources and economic development.

7.1.3 Chapter 4

This chapter took into account methodological mistakes in earlier works on the resource curse that were criticized in more recent studies. Specifically, measurements of natural resources, the time dimension and endogeneity problems were handled using appropriate estimation techniques. More importantly, the conditional relationship between natural resources and economic growth was clearly explained by collective macroeconomic and politico-economic channels rather than small individual channels that have been used in various works.

The findings from this study are very comprehensive in nature. They answer three controversial questions in the literature on the link between natural resources and economic growth. First, different measurements of natural resources do not lead to structurally different interpretations of their impacts on economic growth. Natural resources had a negative impact on economic growth from 1970 to 1989 regardless of their measurements. However, this study found that the effect of natural resources on economic growth did not maintain its sign across time. In fact, from 1990 to 2009, natural resources had a positive and significant relationship with economic growth while the relationship disappears in the four-decade regression. This time survival test calls for a deeper investigation into the relationship between natural resources and economic growth.

The last and most important finding from this study, therefore, was why there was a change of direction from negative in the first two decades to positive in the last two decades; and it also explained the disappearance of the significant relationship between natural resources and economic growth across the four decades. Resource curse or blessing is conditional upon the macroeconomic and political institutions of resource-rich countries. Only countries with favorable institutions, as reflected by their financial and political risk assessments, can gain benefits from natural resources. On the contrary, only high-risk countries experienced a negative impact while about half of resource-rich countries were not considered resource-cursed or resource-blessed countries.

7.1.4 Chapter 5

This chapter completed the puzzle about the relationship between economic growth and natural resource abundance. It used a macroeconometric approach to compare the impacts of the resource sector on the economy in a resource-cursed country, Nigeria, and a resource-blessed country, Norway.

Nigeria and Norway, both abundant in natural resources, had divergent experiences during the last four decades. Both countries started relatively well during the oil price booms of the 1970s, but Norway handled its economy much better with smart policies. Among them, Norway managed to integrate its resource sector to the rest of the economy, made its monetary policy independent of the resource sector, and has a well-disciplined revenue spending policy. As a result, Norway's non-resource sectors were able to thrive alongside the resource sector, and the impacts of the resource boom were absorbed into its economy accordingly.

Nigeria's macroeconomic institutions were not as friendly and did not increase its absorptive capacity. Its monetary and fiscal policies are dependent on the resource sector. The resource boom was accompanied by intensive monetary expansion and aggressive increase in public investment. The former policy caused the price level to rise and its exchange rate to lose value. In turn, this led to an unfavorable environment for private investment in the non-resource sector. The latter policy was very inefficient and wasteful because the public investment projects were designed for political gains rather than overall economic welfare. Therefore, Nigeria's absorptive capacity was low, and the impacts of the resource boom led to an even more unfavorable environment for private investment in the non-resource sector.

This was illustrated by the import and money supply equations. A one per cent increase in the export of natural resources in Nigeria led to a more than two per cent increase in imports while it was less than 0.4 per cent in Norway. This means the absorptive capacity in Nigeria is much lower than in Norway. In addition, a one per cent increase in the export of natural resources in Nigeria led to an increase of about 0.5 per cent in money supply while it was less than 0.02, and not significant, in Norway's equation. To put these differences into perspective, an increase of 15 per cent in the world demand of natural resources led to a more favorable impact in Norway. In Nigeria, resource boom leaked more to imports, created higher price levels, and made the exchange rate lose more value. More importantly, it showed that if the Nigeria can increase its absorptive capacity or make its monetary policy independent of the resource sector, it can benefit from its resource richness much more than per its status quo.

The remaining question was about how to manage the resource sector so that resource-rich countries can avoid the resource curse and take the most out of their natural gifts. Chapter 6 compiled and compared best management practices among resource-rich countries to give recommendations to prospective resource-rich countries such as Cambodia.

7.1.5 Chapter 6

Based on the literature on the conditional relationship between natural resources and economic development and the findings in the previous chapters, this chapter reviewed resource management policies from both resource-blessed and resource-cursed countries. The government's role in dealing the resource curse was the most important part of the solution, although the civil participation and international organizations should also play roles to ensure that resource-rich countries can escape the resource curse. While the list is far from complete, management and policy practices can be categorized into two main groups as follows.

To deal with the macroeconomic challenges of t natural resources, there are three main solutions: diversifying the economy, avoiding Dutch Disease effects, and making proper public investment policy. In the first solution, resource-rich countries can achieve economic diversification by linking the resource sector close to the rest of the economy. Exploiting raw natural resources normally has low linkages with other sectors. Resource-rich countries should intensify both backward and forward linkages of the resource sector. Norway is a leading example in this close-to-resource-market diversification. On the other hand, where the resource sector is isolated, particularly offshore oil and gas, resource-rich countries should invest resource revenues to create a friendly environment for other sectors, including agriculture, manufacturing, and the rural economy, so they prosper alongside the resource sector. Indonesia is a leading example is using its resource sector to promote its manufacturing sector.

Another cause of the resource curse is the Dutch Disease. Economic diversification can only work when resource-rich countries are able to prevent real exchange rate appreciation and keep the non-resource tradable sector competitive with the world market. To achieve this objective, nations should adopt an adjustable peg exchange rate, keep enough foreign exchange reserves, avoid excessive borrowings, and implement fiscal expansion policies within domestic absorptive capacity. More importantly, resource-rich developing countries should invest in basic infrastructure, technology transfer, and institution building to increase the productivity of the agriculture, manufacturing and service sectors.

Last but not least, while many resource-rich countries neglect the importance of investment, the dominance of public investment can also be a cause of the resource curse. Public investment with resource revenues should complement, not substitute for private investment. The former should be spent on priority areas that create an investment-friendly environment to attract the latter into the agriculture and manufacturing sectors. Public investment spending should also take into account the sustainability of resource revenues, the absorptive capacity of the economy, and its stage of development.

In the political and institutional sphere, resource-rich countries have been plagued by various issues, such as inefficiency in resource exploitation, corruption, and conflicts. There are four main solutions to deal with these challenges. One is to create a natural resource fund. A well-designed resource fund with strict rules and shared decision making can tackle both inefficient revenue collection and inefficient expenditure driven by political incentives.

In addition, an effective natural resource fund also promotes transparency, but resource-rich countries need further mechanisms to ensure transparency and accountability in resource management. Transparency mechanisms must be initiated by the government, but civil society and international organization should also be actively involved in promoting transparency in resource-rich countries. However, transparency alone cannot lead to effective resource management. Resource-rich countries have to build capacity in priority areas ranging from parliament to local citizens so that they have the capability to be involved in the decision making, monitoring and supervision of resource management, and hold the government accountable.

The other challenge in many resource-rich countries with intensely competing interest groups is social fractionalization caused by resources. Although policies such as diversification, transparency and capacity building can help solve this problem, the best solution is to reduce horizontal inequality between resource-poor and resource-rich regions. The government should develop local areas where resources are found, distribute part of the revenues and decentralize resource revenues to provide a sense of ownership and benefit sharing. Finally, many resource-rich developing countries are receiving both financial aid and technical assistance from international organizations. This creates an opportunity to learn lessons from aid such as avoiding Dutch Disease, transparency, and capacity building. At the same time, it gives the international community a way of linking resource management to development aid.

Sometimes, a resource management policy solves multiple issues; at other times, multiple policies are required to solve a single problem of the resource curse. Similarly, the solutions to macroeconomic challenges can also address political and institutional challenges, and vice versa. With an appropriate assessment of their economic and political environments and the right implementation of management policies, resource-rich countries can safely escape the resource curse and enjoy the blessing of their natural resources.

7.2 What Cambodia Can Learn from International Experiences

From the findings in Chapter 2, Cambodia has a large potential for economic contribution from the oil and gas industry. This new industry, if managed properly, will act as a principal engine of economic development in Cambodia by providing national income in addition to its traditional dependence on the garment, rice, and tourism sectors. However, from the experiences of many resource-rich countries, the impacts of natural resources on economic development are far more complicated and require well-prepared resource management policies.

7.2.1 SWOT Analysis of the Oil and Gas Industry Management in Cambodia

In order to give policy recommendations for resource management in Cambodia, there must be an analysis of the current and future environment of its oil and gas industry. To achieve this objective, a SWOT analysis is carried out below to discuss the situation of this new industry.

7.2.1.1 Strengths

Cambodia has many strengths in its management of resources. One is the characteristics of its oil and gas industry, which involves diversified and offshore private investment. This can provide several advantages. A diversified investment will help Cambodia avoid dependence on a concentrated revenue stream, while offshore extraction will minimize the impacts on local communities and the environment. In addition, Cambodia's dollarization and pegged exchange rate regime are two strengths in its macroeconomic environment, which will help avoid the Dutch Disease effects of future resource booms.

Another strength is that Cambodia does not have any national fractionalization based on ethnicity, religion, or geography. This national unity can ensure that Cambodia is free from any conflict or rebellion caused by the distribution of resource revenues, which has been happening in many resource-rich countries.

More importantly, the fifth national election in August 2013 was a good indicator of improved political balance in Cambodia, which has several significant implications in its resource management. According to the National Election Committee of Cambodia (2013), the opposition party, the Cambodia National Rescue Party, gained 55 of 123 seats in the national assembly while the Cambodian People's Party declined from 90 seats during the fourth mandate to only 68 seats in this mandate. One implication from this increased political power balance is pressure on the government to shift its political incentives towards more national interests. Institutional reforms, stronger demand for transparency, and accountability in resource management are some results from this pressure.

The other strength is the vibrant roles of civil society and international organizations. Cambodia, as a developing country, has been receiving development assistance in the forms of budget supports and technical assistance in institutional reforms, capacity building, and basic infrastructure. Lessons from this development assistance such as inefficiency, fungibility, and accountability can be very important for resource management policies. Similarly, the presence of a strong civil society network can be an advantage in information sharing, capacity building and coordination between the government and local community to ensure transparent and accountable resource management.

7.2.1.2 Weaknesses

Despite its strengths, Cambodia has several serious weaknesses in resource management. One weakness is the increasing political balance between the winning party and the opposition party, which will push Cambodia further to become a factional democracy. As discussed in the previous chapter, a government with a higher probability of falling in the next period will likely use the resource sector for patronage and political gain. With a politicized bureaucracy, judicial systems, and legislature power, the Cambodian government will likely resort to short-term resource policies that yield immediate results but overlook long-term investment plans.

This problem is aggravated by the lack of transparency and accountability in current resource management policies. The government, for example, withholds most information related to the size of oil and gas reserves and mining deposits, individual contracts with private companies, and revenues from the exploration stage. With a high corruption perception index of 157 among 176 countries according to Transparency International (2012), the lack of transparency in resource management is a serious concern for the future oil and gas industry in Cambodia. Furthermore, this lack of transparency has led to public negligence, which is an important part of effective resource management. Similarly, the accountability issue is also of high concern, as reflected by its recent land concession policy that has led to rapid deforestation and adverse effects on the environment and the livelihood of local people.

Even if there is political will, in the technical area, Cambodia's institutional capacity to deal with private companies, to manage resource revenues effectively, and to make effective investment plans is in question. More importantly, citing that it is still at the exploration stage, the Cambodian government has constantly refused to make any official preparations for the oil and gas industry even though Chevron plans to start production in 2016 (Weinland, 2012b).

7.2.1.3 Opportunities

There are several unique opportunities to effectively manage and learn from the future oil and gas industry in Cambodia. Diversified investments in the offshore oil and gas fields allow the government to sequent the extraction stage and negotiate different contract terms to keep revenue streams flowing smoothly over a desired period. This can reduce the fluctuation in the resource revenues and promote sustainability.

Another opportunity is in the role of civil society and international organizations. Cambodia has a vibrant local NGO network, which has an increasing influence in spreading information, building capacity, and participating in policy debates on various issues, such as land grabbing, deforestation, and recently in election monitoring. Furthermore, development assistance can be diverted to play a role in monitoring, institutional reforms, and capacity building in resource management. Together with the increasing political balance, civil society and the international organizations can be a strong force to push the government towards more transparency and accountability in the resource sector.

Despite the challenges in the oil and gas industry, technology, the skills and expertise in the resource sector, and resource management policies will have positive effects on the public sector and the rest of the economy.

7.2.1.4 Threats

The management of the oil and gas industry faces several threats. The increasing political balance and the increasing pressure from civil society can lead to an inefficient extraction path. As discussed in the weaknesses, the government will likely push for a faster rate of extraction in order to use resource revenues for political gain. Moreover, an increasing Chinese influence in development aid, loans, and investments can be a counterbalance to the western influence that tries to attach government's efforts in resource management to development aid or concessional loans.

Another threat to resource management in Cambodia is natural resource-backed debts. With development aid decreasing, natural resources can be a kind of collateral for the government to borrow from the credit market, especially in times of resource booms. Coupled with existing debts prior to the resource boom, resource revenues will end up being used to service debt. This will ultimately lead to macroeconomic instability that hurts other sectors.

Finally, the lack of expertise in the public sector to deal with the private companies and the lack of preparation for revenue management could minimize the benefits from the oil and gas industry. Private companies will try to gain the biggest possible share from product sharing agreements. Whatever the government takes from exploitation, revenue collection and expenditure policies will also determine the benefits from this industry.

7.2.2 Policy Implications for Cambodia's Future Oil and Gas Industry

Based on its the macroeconomic and the political environments, this dissertation has some policy recommendations for Cambodia to gain the maximum benefits from the oil and gas industry, as well as mining industry, as follows.

- Make advance preparations in terms of resource revenue policies, a long-term resource development plan, and expenditure policies. Many aspects of resource management require a long-term plan to be effective. For example, the capacity-building program must be carried out many years before the extraction or the exploration starts so that Cambodia has a sufficient capacity to handle the sector effectively. More importantly, as shown in Chapter 2, revenue flow from the oil and gas industry into the national income is mainly through the government's take. In turn, the government's share of revenues is technically determined by the tax regime, contracts with private companies, and petroleum regulations. To maximize its share, Cambodia's government must prepare its institutions well in advance to strike the best deals with private contractors.

- Resource revenues from the oil and gas industry should be used to diversify its economy in the agriculture and manufacturing sectors. As shown in Chapter 2, the linkages from the oil and gas industry to other sectors in the Cambodian economy are very limited because of the characteristics of the offshore industry and Cambodia's heavy dependence on imported products. Close to resource market diversification, on the other hand, is very difficult for Cambodia due to the size of the estimated reserves.

- Use resource revenues for investment in basic infrastructure such as education, health, roads, irrigation, electricity, and technology transfer. This will create a private investment-friendly environment, which will increase the absorptive capacity in Cambodia. Furthermore, public investment should not be in areas where private investment could lead the way. The disaster of public investment in Nigeria, discussed in Chapter 5, is a strong reminder for Cambodia.

- Keep an adjustable pegged exchange rate, maintain enough foreign reserves for exchange rate stabilization, and avoid resource-backed debts that will aggravate fiscal deficits after the resource boom. These macroeconomic policies have a significant implication for resource-rich countries in Chapter 3 and 4. Resource-rich countries with a high financial risk have been cursed by their natural resources.

- Create a resource fund. Depending on the context and the development needs of the country, a resource fund can be for stabilization, sterilization, or saving. More importantly, as shown in Chapter 6, there must be well-established rules, power sharing, and checks and balances in the resource fund. Once an effective natural resource fund is created, it can greatly reduce and restrain the political incentive to use resource revenues inefficiently, which is one principal political transmission channel that leads to the resource curse as discussed in Chapter 3.

- Promote transparency and accountability in all stages of resource development, especially resource revenue flows. The government should adopt some transparency mechanisms to guide its policies, and allow civil society to get involved in the process. By promoting transparency and accountability in resource management, Cambodia can reduce corruption and rent-seeking activities, restrain political incentive for inefficient expenditure, and improve the bureaucracy quality. This can greatly improve the political environment in the resource sector as well as the whole country, which was found to determine the impact of natural resources on economic growth in Chapter 3 and 4.

- Implement capacity building and institutional reform programs in the parliament, relevant ministries, and social media. The government can negotiate with private companies to get involved in these programs either through financial or technical supports.

- Use development assistance to facilitate resource management policies. The government should learn from the lessons of aid such as efficiency, fungibility, corruption, civil society participation and so on. In addition, part of development assistance should be directed to helping resource management policies.

Cambodia's oil and gas industry is small by any standards, compared to many resource-rich countries, but its potential is huge for Cambodia's economy. Therefore, Cambodia has to make the best use of this historical opportunity to lift its development to the next stage, eliminate poverty and raise the living standards of Cambodian people. With political will, appropriate management mechanisms, civil society participation, and international assistance, Cambodia will experience a resource blessing from its oil and gas industry.

7.3 Limitations and Future Research

Despite its numerous findings, this dissertation is far from complete in the analysis of the resource-development relationship and policy recommendations for resource-rich countries, in general, and for Cambodia in particular. In addition, some findings in the dissertation have some limitations in terms of methodologies, data, and discussions. Naturally, future research on this topic in Cambodia should aim to overcome the limitations and include further improvements like those below:

- Build the production structure of the oil and gas extraction and refinery sectors to accurately project the impacts of this industry on Cambodia's economy, national income and employment creation. The current study uses the structure from the Thailand Input-Output Table.

- After the government releases enough information regarding exploration results, future research can define the oil and gas reserves more properly and project their economic impacts more precisely.

- Onshore petroleum fields and the mining industry also have a huge potential and should be studied in addition to the current research.

- The discussion on the impacts of natural resources and social development such as poverty reduction and inequality has been untouched in this research. This is also important because poverty reduction is one of Cambodia's priority development goals.

- Dealing with private companies and legal arrangements are two other significant topics for future research, which is beyond the scope of this dissertation.

References

ADB. (2011). Cambodia: Key Indicators 2011. Asian Development Bank. Retrieved from www.adb.org/Documents/Books/Key_Indicators/2011/xls/CAM.xls

AFP. (2010, July 1). Cambodia to Pump Oil in 2012. *the Straits Times*. News. Retrieved November 11, 2010, from http://www.straitstimes.com/BreakingNews/SEAsia/Story/STIStory_548327.html

Akanbi, O. A., & Du Toit, C. B. (2011). Macro-econometric modelling for the Nigerian economy: A growth–poverty gap analysis. *Economic Modelling*, *28*(1–2), 335–350.

Akanni, O. P. (2007). *Oil Wealth and Economic Growth in Oil Exporting African Countries* (Research Paper No. RP_170 Key words: Oil, wealth, economic growth). African Economic Research Consortium. Retrieved from http://econpapers.repec.org/paper/aerrpaper/rp_5f170.htm

Akinlo, A. E. (2004). Foreign direct investment and growth in Nigeria: An empirical investigation. *Journal of Policy Modeling*, *26*(5), 627–639.

Alaba, Oluwayemisi O, & Ojo, S.O. (2010). Efficiency of Seemingly Unrelated Regression Estimator over the Ordinary Least Squares. *European Journal of Scientific Research*, *39*(1), 153–160.

Alexeev, M., & Conrad, R. (2009). The Elusive Curse of Oil. *Review of Economics and Statistics*, *91*(3), 586–598.

Andreas Benedictow, D. F. and O. L. (2010). *Oil dependency of the Russian economy: an econometric analysis* (Discussion Paper No. 617). Research Department of Statistics Norway. Retrieved from http://ideas.repec.org/p/ssb/dispap/617.html

Atkinson, G., & Hamilton, K. (2003). Savings, Growth and the Resource Curse Hypothesis. *World Development*, *31*(11), 1793–1807.

Bakwena, M., Bodman, P., Le, T., & Tang, K. K. (2009). *Avoiding the Resource Curse: The Role of Institutions* (MRG Discussion Paper Series No. 3209). School of Economics, University of Queensland, Australia. Retrieved from http://ideas.repec.org/p/qld/uqmrg6/32.html

Baldwin, R. E., & others. (1966). Economic development and export growth: a study of Northern Rhodesia, 1920-1960. *Economic Development and Export Growth: A Study of Northern Rhodesia, 1920-1960.* Retrieved from http://www.cabdirect.org/abstracts/19671801192.html

Barro, R. J. (1991). Economic Growth in a Cross Section of Countries. *The Quarterly Journal of Economics*, *106*(2), 407–443.

Barro, R. J., & Sala-i-Martin, X. (2004). *Economic Growth* (2nd ed.). Cambridge, Massachusetts: The MIT Press.

Boschini, A. D., Pettersson, J., & Roine, J. (2007). Resource Curse or Not: A Question of Appropriability*. *Scandinavian Journal of Economics*, *109*(3), 593–617.

Brunnschweiler, C. N. (2008). Cursing the Blessings? Natural Resource Abundance, Institutions, and Economic Growth. *World Development*, *36*(3), 399–419.

Brunnschweiler, C. N., & Bulte, E. H. (2008). The resource curse revisited and revised: A tale of paradoxes and red herrings. *Journal of Environmental Economics and Management*, *55*(3), 248–264.

Butkiewicz, J. L., & Yanikkaya, H. (2010). Minerals, Institutions, Openness, and Growth: An Empirical Analysis. *Land Economics*, *86*(2), 313–328.

Cappelen, Å., & Mjøset, L. (2009). *Can Norway be a role model for natural resource abundant countries?* (No. 2009.23). Research paper / UNU-WIDER. Retrieved from http://www.econstor.eu/handle/10419/45096

Caselli, F., Esquivel, G., & Lefort, F. (1996). Reopening the convergence debate: a new look at cross-country growth empirics. *Journal of Economic Growth*, *1*(3), 363–389.

Cavalcanti, T. V. de V., Mohaddes, K., & Raissi, M. (2011). Growth, development and natural resources: New evidence using a heterogeneous panel analysis. *The Quarterly Review of Economics and Finance*, *51*(4), 305–318.

Corden, W. M., & Neary, J. P. (1982). Booming sector and de-industrialisation in a small open economy. *The Economic Journal*, *92*(368), 825–848.

Davies, M., Ntamatungiro, J., & Luengnaruemitchai, P. (2007). *Cambodia: Selected Issues and Statistical Appendix*. Washington, D.C.: International Monetary Fund.

Davis, J., Ossowski, R., Daniel, J., & Barnett, S. (2001). Oil funds: problems posing as solutions? *Finance and Development*, *38*(4), 56–59.

Ding, N., & Field, B. C. (2005). Natural Resource Abundance and Economic Growths. *Land Economics*, *81*(4), 496–502.

EIA. (2010). EIA - Forecasts of Analysis of Energy Data. U.S. Energy Information Administration. Retrieved from http://www.eia.doe.gov/oiaf/forecasting.html

EIA. (2013). International Energy Statistics. *US Energy Information Agency*. Retrieved February 28, 2013, from http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=5&pid=53&aid=1&cid=NI,&syid=1980&eyid=2011&unit=TBPD

EIC. (2008). *Cambodia's Emerging Oil and Gas Industry: Managing Public Expectation*. Economic Institute of Cambodia.

Eika, T., & Magnussen, K. A. (2000). Did Norway gain from the 1979–1985 oil price shock? *Economic Modelling*, *17*(1), 107–137.

EITI International Secretariat. (2013). *The EITI Standard*. Norway: EITI International Secretariat. Retrieved from http://eiti.org/document/standard

Erlandsen, S., & Nymoen, R. (2008). Consumption and population age structure. *Journal of Population Economics*, *21*(3), 505–520.

Frankel, J. A. (2010). *The Natural Resource Curse: A Survey* (Working Paper No. 15836). National Bureau of Economic Research. Retrieved from http://www.nber.org/papers/w15836

Friedrich, R. J. (1982). In Defense of Multiplicative Terms in Multiple Regression Equations. *American Journal of Political Science*, *26*(4), 797–833.

Gylfason, T. (2001). Natural resources, education, and economic development. *European Economic Review*, *45*(4–6), 847–859.

Gylfason, T., & Zoega, G. (2006). Natural Resources and Economic Growth: The Role of Investment. *World Economy*, *29*(8), 1091–1115.

Heston, A., Summers, R., & Aten, B. (2012, November). Penn World Table Version 7.1. Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania. Retrieved from https://pwt.sas.upenn.edu/php_site/pwt_index.php

Hirschman, A. (1958). The strategy of economic development. *The Strategy of Economic Development*, 12–19.

Ho, V. (2010). *Petroleum Development in Cambodia*. Presentation File presented at the The Cambodia Forum, Phnom Penh.

Hodler, R. (2006). The curse of natural resources in fractionalized countries. *European Economic Review*, *50*(6), 1367–1386.

Humphreys, M., & Sandbu, M. E. (2007). The political economy of natural resource funds. In M. Humphreys, J. D. Sachs, & J. E. Stiglitz (Eds.), *Escaping the resource curse* (pp. 194–234). New York: Columbia University Press.

IEA. (2010). *World Energy Outlook 2010 Factsheet*. Paris: OECD, International Energy Agency.

IMF. (2007). *Guide on Resource Revenue Transparency* (2007 Revised Edition.). International Monetary Fund. Retrieved from http://www.imf.org/external/np/pp/2007/eng/101907g.pdf

IMF. (2009). *Stastical Appendix: Cambodia* (IMF Country Report No. 09/48). Washington, D.C.: The International Monetary Fund.

IMF. (2013). *How Does the IMF Encourage Greater Fiscal Transparency?* (IMF Factsheet). Washington, D.C.: International Monetary Fund. Retrieved from http://www.imf.org/external/np/exr/facts/pdf/fiscal.pdf

Insights for Action. (2006a). *A Review of Development Prospects for the Cambodian Oil and Gas Sector (English)* (No. 2). UNDP Cambodia. Retrieved from http://www.un.org.kh/undp/knowledge/publications/discussion-paper-2-a-review-of-development-prospects-for-the-cambodian-oil-and-gas-sector-english

Insights for Action. (2006b). *Meeting the Challenge of the "Resource Curse" (English)* (No. 3). Phnom Penh: UNDP Cambodia. Retrieved from http://www.un.org.kh/undp/knowledge/publications/discussion-paper-3-meeting-the-challenge-of-the--resource-curse--english

Isham, J., Woolcock, M., Pritchett, L., & Busby, G. (2005). The Varieties of Resource Experience: Natural Resource Export Structures and the Political Economy of Economic Growth. *The World Bank Economic Review*, *19*(2), 141–174.

Johnston, D. (2009). *International Petroleum Fiscal Systems* (pp. 30–47). Phnom Penh: UNDP Cambodia.

Karl, T. L. (1997). *The paradox of plenty: oil booms and petro-states*. Berkeley, Calif. [u.a.: Univ. of Calif. Press.

Karnik, A. V., & Fernandes, C. (2005). Macro-economic Modeling for an Oil Dependent Economy: An Instruments-Targets Approach for the UAE Economy. *University of Wollongong in Dubai-Papers*, 5.

Kennedy, P. (2008). *A Guide to Econometrics* (6th ed.). MA, USA: Blackwell Publishing Ltd.

Kolstad, I., & Wiig, A. (2009). Is Transparency the Key to Reducing Corruption in Resource-Rich Countries? *World Development*, *37*(3), 521–532.

Krugman, P. (1987). The narrow moving band, the Dutch disease, and the competitive consequences of Mrs. Thatcher: Notes on trade in the presence of dynamic scale economies. *Journal of Development Economics*, *27*(1–2), 41–55.

Lederman, D., & Maloney, W. (2002). *Open Questions about the Link Between Natural Resources and Economic Growth: Sachs and Warner Revisited* (Working Papers Central Bank of Chile No. 141). Central Bank of Chile. Retrieved from http://ideas.repec.org/p/chb/bcchwp/141.html

Lederman, D., & Maloney, W. F. (2007). *Natural Resources: Neither Curse nor Destiny*. World Bank Publications. Retrieved from http://siteresources.worldbank.org/INTLAC/Resources/NaturalResourcesWMaloney.pdf#page=23

Leite, C., & Weidmann, J. (1999). *Does Mother Nature Corrupt - Natural Resources, Corruption, and Economic Growth* (IMF Working Paper No. 99/85). International Monetary Fund. Retrieved from http://ideas.repec.org/p/imf/imfwpa/99-85.html

Lim, V. (2006). *Pretroleum Policy and Management Project: Update on Petroleum Activities in Cambodia*. Presentation File presented at the Cambodia Case Study Workshop, Siem Reap, Cambodia.

Mabro, R. (1980). *Oil revenues and the cost of social and economic development in Energy in the Arab world*.

Mabro, R., & Monroe, E. (1974). Arab wealth from oil: problems of its investment. *International Affairs (Royal Institute of International Affairs 1944-)*, *50*(1), 15–27.

Manzano, O., & Rigobon, R. (2001). *Resource Curse or Debt Overhang?* (Working Paper No. 8390). National Bureau of Economic Research. Retrieved from http://www.nber.org/papers/w8390

Matsuyama, K. (1992). Agricultural productivity, comparative advantage, and economic growth. *Journal of Economic Theory*, *58*(2), 317–334.

Mauro, P. (1995). Corruption and Growth. *The Quarterly Journal of Economics*, *110*(3), 681–712.

Mavrotas, G., Murshed, S. M., & Torres, S. (2011). Natural Resource Dependence and Economic Performance in the 1970–2000 Period. *Review of Development Economics*, *15*(1), 124–138.

May, K., & Mullins, J. (2010, October 26). Block D forecast: Oil's well. *The Phnom Penh Post*. News. Retrieved October 26, 2010, from http://www.phnompenhpost.com/index.php/2010102644297/Business/block-d-forecast-oils-well.html

Mehlum, H., Moene, K., & Torvik, R. (2006a). Cursed by Resources or Institutions? *World Economy*, *29*(8), 1117–1131.

Mehlum, H., Moene, K., & Torvik, R. (2006b). Institutions and the Resource Curse. *The Economic Journal*, *116*(508), 1–20.

Mikesell, R. F. (1997). Explaining the resource curse, with special reference to mineral-exporting countries. *Resources Policy*, *23*(4), 191–199.

Miller, R. E., & Blair, P. D. (2009). *Input-Output Analysis: Foundations and Extensions* (2nd ed.). Cambridge University Press.

Mohsen Mehrara, M., Alhosseini, S., & Bahramirad, D. (2008). *Resource curse and institutional quality in oil countries* (MPRA Paper No. 16456). University Library of Munich, Germany. Retrieved from http://ideas.repec.org/p/pra/mprapa/16456.html

NBS, Nigeria. (2010). Table C.1.2: Gross Domestic Product at Constant Basic Prices (N' Million). National Bureau of Statistics, Nigeria. Retrieved from http://www.nigerianstat.gov.ng/

NEC. (2013, September 8). The Official Results of the Elections. National Election Committee of Cambodia. Retrieved from http://necelect.org.kh/nec_khmer/images/stories/Results/2013/01-The%20official%20results%20of%20the%20elections.pdf

Nili, M., & Rastad, M. (2007). Addressing the growth failure of the oil economies: The role of financial development. *The Quarterly Review of Economics and Finance*, *46*(5), 726–740.

NIS. (2008). *Statistical Yearbook of Cambodia 2008*. Phnom Penh: National Institute of Statistics, Cambodia.

Oum, S. (2007). An Estimation of Input-Output Table for the Cambodian Economy 2003. GTAP. Retrieved from https://www.gtap.agecon.purdue.edu/resources/download/3051.pdf

Oyefusi, A. (2007). Natural Resource Abundance and Development: Is There A Paradigm Shift? *Journal of Business and Public Policy*, *1*(3). Retrieved from http://en.scientificcommons.org/38296818

Oyejide, T. A. (1991). Adjustment with growth: Nigerian experience with structural adjustment policy reform. *Journal of International Development*, *3*(4), 485–498.

Papyrakis, E., & Gerlagh, R. (2004). The resource curse hypothesis and its transmission channels. *Journal of Comparative Economics*, *32*(1), 181–193.

Prebisch, R. (1950). The economic development of Latin America and its principal problems. *Economic Bulletin for Latin America 1962*, *7*.

Prebisch, R. (1964). *Towards a New Trade Policy for Development: Report*. New York: United Nations for UNCTAD.

Pyndick, R. R., & Rubinfeld, D. L. (1997). *Econometric Models and Economic Forecasts* (4th ed.). McGraw-Hill/Irwin.

Quantitative Micro Software (Firm). (2009). *EViews. 7 User's Guide*. Irvine CA: Quantitative Micro Software.

Qureshi, M. S. (2008). *Africa's Oil Abundance and External Competitiveness: Do Institutions Matter?* International Monetary Fund.

Reuters. (2008, November 4). Cambodia's First Oil Unlikely before 2010. *Reuters*. News. Retrieved November 11, 2010, from http://www.reuters.com/article/idUSSP19326620081104

Revenue Watch Institute. (2013). Publish What You Pay (PWYP). *Revenue Watch Institute*. Retrieved October 7, 2013, from http://www.revenuewatch.org/training/resource_center/backgrounders/publish-what-you-pay-pwyp

RGC. (2008). National Accounts of Cambodia 1993-2008. National Institute of Statistics, Cambodia.

Robinson, A. A. (n.d.). Oil and Gas Cambodia. *Invest in Cambodia*. Retrieved November 12, 2010, from http://www.investincambodia.com/oil&gas.htm

Robinson, J. A., Torvik, R., & Verdier, T. (2006). Political foundations of the resource curse. *Journal of Development Economics*, *79*(2), 447–468.

Rodriguez, F., & Sachs, J. D. (1999). Why Do Resource-Abundant Economies Grow More Slowly? *Journal of Economic Growth*, *4*(3), 277–303.

Ross, M. L. (2007). How Mineral-Rich States Can Reduce Inequality. In M. Humphreys, J. D. Sachs, & J. E. Stiglitz (Eds.), *Escaping the resource curse* (pp. 237–255). New York: Columbia University Press.

Sachs, J. D. (2007). How to Handle the Macroeconomics of Oil Wealth. In M. Humphreys, J. D. Sachs, & J. E. Stiglitz (Eds.), *Escaping the Resource Curse*. New York: Columbia University Press.

Sachs, J. D., & Warner, A. M. (1995). *Natural Resource Abundance and Economic Growth* (Working Paper No. 5398). National Bureau of Economic Research. Retrieved from http://www.nber.org/papers/w5398

Sachs, J. D., & Warner, A. M. (1997). *Natural Resource Abundance and Economic Growth*. Harvard University. Retrieved from http://hdl.handle.net/1902.1/14496

Sachs, J. D., & Warner, A. M. (1999). The big push, natural resource booms and growth. *Journal of Development Economics*, *59*(1), 43–76.

Sachs, J. D., & Warner, A. M. (2001). The curse of natural resources. *European Economic Review*, *45*(4–6), 827–838.

Sala-i-Martin, X., & Subramanian, A. (2003). *Addressing the Natural Resource Curse: An Illustration from Nigeria* (Working Paper No. 9804). National Bureau of Economic Research. Retrieved from http://www.nber.org/papers/w9804

Seers, D. (1964). The mechanism of an open petroleum economy. *Social and Economic Studies*, 233–242.

Singer, H. W. (1950). The distribution of gains between investing and borrowing countries. *The American Economic Review*, *40*(2), 473–485.

Statistics Noway. (2013). My Page: StatBank Norway. Retrieved from https://www.ssb.no/statistikkbanken/SelectVarVal/saveselections.asp

Stevens, P. (2003). Resource impact–curse or blessing. *CEPMLP Online Journal V*, *14*.

Stevens, P., & Dietsche, E. (2008). Resource curse: An analysis of causes, experiences and possible ways forward. *Energy Policy*, *36*(1), 56–65.

Stijns, J.-P. C. (2005). Natural resource abundance and economic growth revisited. *Resources Policy*, *30*(2), 107–130. doi:10.1016/j.resourpol.2005.05.001

The PRS Group. (2011). ICRG Methodology. *The PRS Group*. Retrieved July 4, 2012, from http://www.prsgroup.com/ICRG_Methodology.aspx

Transparency International. (2012). 2012 Corruption Perceptions Index -- Results. Retrieved October 10, 2013, from http://cpi.transparency.org/cpi2012/results/

UNDP. (2006). *A SWOT Analysis of the Cambodian Economy*. Phnom Penh: UNDP Cambodia.

Weinland, D. (2012a, June 26). Chevron Report Completed. *The Phnom Penh Post*. News. Retrieved July 2, 2012, from http://www.phnompenhpost.com/index.php/2012062657015/Business/chevron-report.html

Weinland, D. (2012b, July 2). Chevron aims for 2016. *The Phnom Penh Post*. News. Retrieved July 2, 2012, from http://www.phnompenhpost.com/index.php/2012070257137/Business/chevron-aims-2016.html

World Bank. (2008). *Refining Crude Oil - Part 1*. Phnom Penh: The World Bank.

World Bank. (2011). *The changing wealth of nations : measuring sustainable development in the new millennium.* Washington, D.C.: World Bank.

World Bank. (2012). World Development Indicators | Data. Retrieved from http://data.worldbank.org/data-catalog/world-development-indicators

Wright, G., & Czelusta, J. (2007). Resource-based growth past and present. *Natural Resources: Neither Curse Nor Destiny*, 185.