Natural Resource Abundance and Economic Growth in Hydrocarbon Exporting Countries (1996-2015)

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Abstract

Growth literature heavily argues that resource-rich economies are “cursed” by their own natural resources. The effect of natural resource abundance on economic growth in eighteen middle income hydrocarbon exporting countries was investigated in this thesis. In order to analyze this relationship, a Fixed Effects model with panel data covering the years between 1996 and 2015 was employed. In contrast with previous studies, this thesis identified both economically and statistically significant positive relationship between natural resource richness and economic growth after controlling for traditional economic growth determinants and possible transmission channels through which natural resource abundance may affect the growth. However, it is acknowledged that the results might be driven by high hydrocarbon price environment during the observation period. Nevertheless, the findings indicate strong resource income dependence in the sample countries. The problem can be addressed with commitment to human capital development and institutional quality improvement, also by diversifying the economy.

Keywords: natural resource curse, economic growth, hydrocarbon rents

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Introduction

Commodity, especially hydrocarbon[1] prices are characterized as highly volatile, so are the revenues from them. Although they were largely low during the subsequent years of the boom period of the 1970-80s, prices started to increase starting from the inception of the millennium and both crude oil and natural gas reached their historical peak in 2008. After a short fall during the Global Financial Crisis, prices recovered, but started to fall again in 2014 (See Figure A1).

What was the economic impact of these boom and bust cycles on the oil and natural gas exporting countries? How did these countries use the resource windfalls? Was there any significant improvement in economic activity or natural resource abundance resulted in unwanted outcome? Angus Deaton (1999) quotes from Issawi (1966) the story of modern Egypt and its failed cotton-backed attempt of industrialization in the 19th century. He narrates how the cotton windfalls were used inefficiently and the country ended up in high debt and in a political and economic crisis.

The story is familiar; even though around two centuries have passed, still many natural-resource-endowed countries lack stable economic growth (See Figure A2). The same natural resources which boosted growth in countries such as Canada, Australia, Norway, the USA and the UK in the 19th century were not very much of a help for their developing peers. Moreover, Four Asian Tigers - South Korea, Taiwan, Hong Kong and Singapore have successfully industrialized and reached a high level of development without natural resource stocks. On the other hand, many resource-rich African countries have been struggling to catch sustainable economic growth for decades. One of these countries, Nigeria, had the same level of per capita GDP in

[1] The term hydrocarbon refers to crude oil and natural gas.

2000 as it had in 1970 despite the enormous amount of oil windfalls (Sala-i-Martin and Subramanian, 2003). Venezuela, one of the largest oil exporters is just another example of the countries which tried to industrialize with support from commodity revenues. Venezuelans called this “seeding the seeds of oil revenues” (Sachs and Warner, 1995). Today, Venezuela struggles with economic and political instability, high level of inflation and food shortages. Moreover, as the commodity exporters are exposed to commodity price changes, a sharp decline in prices significantly affects the GDP in these economies (IMF, 2012). After a rapid drop in oil and natural gas prices, hydrocarbon exporting countries such as Russia, Azerbaijan and Kazakhstan found themselves in an economic and financial crisis.

In response to these failures many economists claimed that resource-rich economies are “cursed” by the resource abundance itself. Many of them used cross-sectional regressions where average growth rate for the selected period was regressed on resource abundance and other chosen control variables and found a negative relationship between the first two. However, it is claimed that this methodology is not an appropriate one to draw such a conclusion about the resource richness as the cross-sectional regressions are incapable to explore “the dynamics of resource curse” and they suffer from potential omitted variable bias (Collier and Goderis, 2007).

The phenomenon which describes the negative relationship between natural resource abundance and economic development is investigated in this study. Panel data covering a sample of 18 hydrocarbon exporting countries during the period between 1996 and 2015 was used for empirical analysis. The results suggest that natural resource abundance has a statistically and economically significant positive impact on economic growth in these countries.

The rest of this thesis is organized as follows. Section 1 provides a comprehensive literature review and the main transmission channels of the “natural resource curse” thorough which it affects economic growth. Section 2 covers the data and methodology used in empirical analysis. The results of empirical analysis are discussed in Section 3. Finally, the last section summarizes the main results and discusses limitations of the thesis along with possible policy implications.

1. Natural Resource Curse

1.1. The Curse and Its Transmission Channels

The natural resource curse – the phenomenon of natural resource rich countries performing worse compared to resource poor economies – emerged following the Second World War to explain the weak economic performance of resource rich developing economies. While the expression was coined by Gelb (1988), Mikesell (1997) argued that the curse is paradoxical because the natural resource production has been engine of almost all development, it provides ample foreign currency, attracts foreign capital and technologic & human skills and finally it supplies raw materials for manufactured products.

There were several attempts to describe the transmission channels from natural resource abundance to slow economic growth. Some of these channels were described by Gylfason (2001), Sala-i-Martin and Subramanian (2003), Manzano and Rigobon (2001) and van der Ploeg (2011):

Dutch disease is a term first used by *Economist* in 1977 to explain the problems in the Dutch economy after the discovery of natural gas resources[2]. Natural resource abundance often leads to overvaluation of real exchange rate driven by increased resource export. This hurts other exports and crowds out the tradable sector (mainly manufacturing), resulting in deindustrialization and slower economic growth.

As the tradable manufacturing sector employs more learning-by-doing compared to natural resource sector, decrease in the first one negatively affects the *human capital*. Furthermore, resource rich nations often neglect the importance of

[2] "What Dutch disease is, and why it's bad." http://www.economist.com/blogs/economist-explains/2014/11/economist-explains-2

human capital; parents overlook the need for a better education for children and governments spend less on human development.

Citizens of these countries may get a false sense of security and this can lead the governments to neglect the need for *bureaucratic efficiency*, *good institutional quality* and *policies*. Resource abundance also leads to inequality and anti-democratization in these countries.

Resource rich countries often experience a *rent-seeking* behavior among public servants associated with a higher level of corruption as a result of high rents from resource windfalls. Moreover, governments of these countries impose tariff protection and other privileges to protect domestic producers which hurts free trade. Growth literature found both to be inversely related to economic growth.

Highly volatile commodity prices lead to boom and bust cycles. These can affect the economy through *debt overhang*; resource-rich countries collateralize their resources to get external debt during the boom periods and they face liquidity constraints during the bust times. Therefore, they make unfavorable decisions (devaluations and etc.) to bring the current accounts to balance at the cost of a slow economic growth.

1.2. Literature Review

There has been an extensive research on natural resource curse and the transmission channels through which it affects economic growth. One of the early works was done by Kader (1980) and he argued that in oil exporting countries substitution of imports with local production and expansion of non-oil exports is slow due to “the unique characteristic of these economies”. He noted that natural resources crowd out the potential for industrialization as oil-exporting countries mainly

concentrate on resource export due to their comparative advantage stemming from relatively low cost of FX earnings in this sector.

Jeffrey Sachs and Andrew Warner published a series of papers in which they attempted to investigate the reasons for the curse. In their first work from this series (Sachs and Warner, 1995) they ran multiple cross-country growth regressions and after controlling for several variables which affect economic growth such as initial GDP, trade policy, inequality and institutional quality they found a negative, statistically significant and robust relationship between natural resource intensity and economic growth. Moreover, they found that the relationship holds across different regions and even when different measures of natural resource richness were used it remains the same.

Later they examined the reasons why primary commodities exporting Latin American countries experienced slower growth compared to East Asian economies which mainly specialized first on labor-intensive and then capital and technology-intensive exports (Sachs and Warner, 1999). The rationale for the discrepancy was discussed both theoretically and empirically. On the theoretical side they found that natural resource booms can foster economic growth depending on the type of production in the economy. If the increasing-returns-to-scale (IRS) production is in the non-tradeable sector, resource booms can positively impact growth while if IRS is in the tradeable sectors then they can depress growth through the Dutch disease effect. On the empirical side they detected little evidence for natural-resource-led growth and confirmed their previous findings of a negative correlation between resource richness and economic growth.

They found more support for the Dutch disease channel in Sachs and Warner (2001). The authors identified that natural resource abundant countries failed to

achieve other types of economic growth except the direct impact of the natural resource sector. As these countries are usually high-price economies, they overlooked the (manufacture etc.) export-led growth. They also suggested that it is hard to explain the resource curse by omitted geographical and climate variables or other unobserved growth determinants.

Bravo-Ortega and de Gregorio (2005), based on their own model, found that natural resources have a positive effect on level of income, but a negative influence over its growth rate. They tested their model using panel data for the period of 1970-1990 and a modified version of usual growth regressions extended with an interaction term between natural resources and human capital. They found that natural resources negatively affect the human capital, but high levels of the latter may minimize the negative effects of natural resource abundance.

Gylfason (2001) also drew attention to the crucial importance of human development for the economic growth. The author noted that in natural-resource-rich economies both citizens and authorities neglect this importance. Consequently, many people become stuck in resource-based sectors of the economy (which involves less learning-by-doing relative to manufacturing industry) and thus they fail to improve their or their children's development. Although this is not the case for oil exporting countries as the oil industry is capital intensive and employs a very small portion of labor force (Kader, 1980), windfalls from oil exports may delude the nation that education does not reward, thus lead them to underestimating its noteworthiness.

Behrudi et al. (2010) looked at the abovementioned claim; they found an inverse relationship between natural resource abundance and economic growth in two different groups of petroleum exporting countries; major petroleum exporters in which petroleum constitutes more than 50% of total exports (Gulf States, Venezuela, Nigeria

and etc.) and other exporters with little petroleum exports (Norway, UK, Canada etc.). They argue that natural resources are harmful for countries with low level of human capital and resource richness causes negligence of human capital. However, in the second group of countries the strong human capital base offsets the negative effect of natural resource abundance. They also found a negative (albeit weak) relationship between human capital and the natural resources, thus suggesting that human capital indeed is one of the transmission channels of the curse.

In contrast Sala-i-Martin and Subramanian (2003) did not find any evidence for the direct impact of natural resources on economic growth. However, when they studied the institutional quality channel of the curse, they found that the reason for weak long-term economic performance of oil-exporting Nigeria was poor institutional quality and corruption. They identified a non-linear, robust and negative relationship between natural resource abundance and institutional quality, through which oil richness impacted economic growth.

Leite and Weidmann (1999) found that capital intensive natural resources are a major source of corruption after an empirical and theoretical investigation of the rent-seeking channel. Furthermore, their growth regressions confirmed the negative relationship between corruption and economic growth, thus leading to the conclusion that the corruption channel is one of the most critical ones in explaining the growth rates of resource-endowed countries.

Manzano and Rigobon (2001) found more evidence on resource-cursed economic growth using cross section data. Discussing the results of the cross sectional analysis the authors also detected that the curse is not due to the presence of natural resources but rather because of the debt overhang; resource-rich countries used their resources as implicit collateral during the boom periods to get external

financing and when the prices started to decline it was difficult for them to borrow more due to debt overhang. Finally, devaluations and other cutbacks had to be taken to balance the current accounts, which in the end led to lower growth rates. On the other hand, they argue that once panel data is used this negative effect disappears.

Collier and Goderis (2007) found that although in the short run commodity booms have a positive effect on output, in the long run this effect becomes negative. They argue that high public and private consumption, overvalued exchange rate, low or inefficient investment, and to a limited extent commodity price volatility and slow growth in the services sector can be possible transmission channels for the natural resource curse. Additionally, they claim that commodity booms encourage non-productive activities such as rent-seeking, lobbying and/or public sector employment. They conclude that the resource curse can be avoided with the help of higher institutional quality.

van der Ploeg (2011), after conducting a literature survey, concluded that natural resource windfalls cause appreciation of the real exchange rate and consequently deindustrialization and lower economic growth. He noted that this effect is stronger in countries with low institutional quality, lack of democracy, high level of corruption and weak financial system. Moreover, natural resources lead to rent seeking, civil conflicts, corruption and keeping bad policies in place. Lastly, the author mentioned that resource rich countries are unable to transform these resources into other productive assets.

On the other hand, some found little evidence supporting the natural resource curse. Davis (1995), for instance, after analyzing 22 developing mineral economies came to the conclusion that they performed as good as developing resource poor

countries. They have not been cursed through any of aforementioned channels; in fact, they even performed well, perhaps due to natural resource abundance.

Moreover, Mikesell (1997) argued that the usual factors which illustrate endogenous growth are too complex to be explained by the county's resource abundance. Also, none of the justifications (mainly the quality of government policies) suggested to expound the poor performance of mineral-rich countries has anything to do with natural resource exports. He pointed out that there might be other omitted factors which affect resource-rich countries as a group compared to resource-poor economies.

As it was presented above, the literature overwhelmingly acknowledges the existence of natural resource curse. Majority of these claim that natural resource abundance affects economic growth through the transmission channels rather than its direct impact. Among these channels the Dutch disease effect, human capital, institutional quality and rent seeking found the most support among contributing authors. Only a few studies found contrary results and most of them pointed out the problems associated with methodology. It was claimed that the employment of cross-section regressions induces heterogeneity due to omitted variable bias and time-invariant unobservable factors and thus once panel data is used and these factors are controlled for the negative effect from natural resource richness to growth might disappear.

In light of the findings of literature this thesis utilizes the methodology presented in the next section where economic growth is regressed on natural resource abundance, the Dutch disease, human capital, institutional quality, rent-seeking and debt overhang measurements along with traditional growth elements. The main motivation for such methodology is to control for these transmission channels and find

the most accurate estimates for the impact from natural resource abundance to economic growth. Also, this thesis uses panel data to minimize the heterogeneity resulting from omitted variable bias.

2. Data and Methodology

2.1. Sample Selection

While the vast majority of previous studies includes either all developing economies and/or resource-rich (all types of natural resources) countries for the analysis, this study focuses only on middle income developing hydrocarbon exporting countries. The main motivation for this type of sample selection is to exclude outliers which are either resource rich, but are in a high income group (such as Kuwait, Saudi Arabia, Qatar and etc.) or resource rich, but are low income countries (such as Chad and South Sudan). The first group have already reached the desirable income level and the second group have different dynamics with the rest of the sample. Therefore, both high and low income countries could over- or underestimate the effect of hydrocarbon export on economic growth. Additionally, due to the methodology used in the analysis and described later in this section, including only one group of countries would give more accurate results.

Economies used in analysis were chosen based on the level of oil and natural gas revenue dependence. The threshold for the selection was set at 10% of the ratio of total hydrocarbon rents to GDP. 18 countries which fit these characteristics have been identified. The sample includes five lower middle income and thirteen upper middle income economies. According to the World Bank lower middle income economies are those in which 2015 GNI per capita was between $1,026 and $4,035 and upper middle income economies are those in which 2015 GNI per capita was between $4,036 and $12,475.

Individual country statistics on hydrocarbon dependence, GDP per capita, GNI per capita, total population and literacy rate are given in Table 1.

Table 1 Description of Countries Used in the Analysis

Country	Primary Hydrocarbon Resource	World Bank Income Group	Oil Rents (% of GDP, average, 1996-2015)	Natural Gas Rents (% of GDP, average 1996-2015)	Total Hydrocarbon Rents (% of GDP, average 1996-2015)	GDP per capita, PPP (current international $, 2015)	GNI per capita, PPP (current international $, 2015)	Population (million, 2015)	Literacy rate (adult total, % of people ages 15 and above, 2015)
Algeria	Oil	UMIC	15.13	2.55	17.68	14,688	14,300	39.6	79.6
Angola	Oil	UMIC	41.16	0.05	41.21	7,387	6,470	25.0	71.2
Azerbaijan	Oil	UMIC	24.84	2.72	27.56	17,780	17,170	9.7	99.8
Congo, Rep.	Oil	LMIC	43.05	0.03	43.08	6,381	6,320	4.6	79.3
Ecuador	Oil	UMIC	10.25	0.02	10.27	11,474	11,270	16.1	94.5
Equatorial Guinea	Oil	UMIC	42.96	1.00	43.96	40,719	27,200	0.9	95.2
Gabon	Oil	UMIC	30.48	0.06	30.54	20,081	18,880	1.7	83.2
Iran, Islamic Rep.	Oil	UMIC	21.70	1.42	23.12	...	...	79.1	87.2
Iraq	Oil	UMIC	48.11	0.05	48.17	15,395	15,340	36.4	79.7
Kazakhstan	Oil	UMIC	13.19	1.14	14.32	25,045	23,480	17.5	99.8
Libya	Oil	UMIC	42.38	0.63	43.02	...	...	6.3	91.4
Nigeria	Oil	LMIC	20.50	0.41	20.91	6,004	5,810	182.2	59.6
Russian Federation	Oil	UMIC	9.21	3.83	13.04	25,186	24,510	144.1	99.7
Syrian Arab Republic	Oil	LMIC	20.42	0.47	20.89	...	...	18.5	86.3
Turkmenistan	Natural Gas	UMIC	13.88	27.85	41.72	16,532	15,760	5.4	99.7
Uzbekistan	Natural Gas	LMIC	1.05	10.78	11.83	6,087	6,200	31.3	100.0
Venezuela, RB	Oil	UMIC	15.11	0.43	15.54	...	...	31.1	95.4
Yemen, Rep.	Oil	LMIC	25.39	0.45	25.84	2,821	2,720	26.8	70.0

LMIC: Lower-middle-income countries. UMIC: Upper-middle-income countries
Source: World Bank Development Indicators

2.2. Data Sources

The data used in the analysis was obtained from World Bank Database, namely from World Development Indicators[3] and World Governance Indicators[4] covering the period 1996-2015. WB Development Indicators provide comprehensive information about the various dimensions of economic, social and financial development and the data is available annually for 217 economies over 1960-2016. WB Governance Indicators are available biennially prior to 2002 and annually in the following years and it reports aggregate and individual governance indicators for over 200 countries and territories for the period of 1996–2015, for different aspects of governance.

2.3. Methodology

While the majority of literature has employed cross section data (Sachs and Warner (1995, 1997, 2011), Gylfason (2001), Sala-i-Martin and Subramanian (2003) etc.), I have found very few studies which use panel data: Bravo-Ortega and de Gregorio (2005), Manzano and Rigobon (2001), Behrudi et al. (2010). This thesis also employs a panel data method. The main motivation for using this method is to control for heterogeneity caused by omitted variable bias due to unobserved time-invariant factors (historical, geographical, ethnic, ethno-linguistic variations etc.) which one may face in cross-sectional models (Arellano, 2003), also to increase the preciseness of the results by including more data. The model used in this thesis was built on findings of growth literature and empirical models used in the studies in resource curse analysis. I started with a standard Solow growth model (Solow, 1956) which takes capital and labour as main ingredients for the growth. Therefore, population growth

[3] http://data.worldbank.org/data-catalog/world-development-indicators

[4] http://info.worldbank.org/governance/WGI

and school enrolment rate for human capital and investment for physical capital was included to the model. Moreover, Fischer (1993) found that the economic growth is negatively associated with inflation and Sachs and Warner (1995) concluded that countries which are open to trade are more likely to grow. Alesina et al. (1996) found that political instability results in lower economic growth.

Additionally, several variables are included in the regression in order to control for previously mentioned transmission channels through which natural resource abundance may affect economic growth. These variables are: manufactures exports for Dutch disease; external debt stocks for debt overhang; rule of law, government effectiveness and regulatory quality for institutional quality; and corruption for rent-seeking channels.

The benchmark growth model used in analysis is:

$$growth_{it} = \beta_0 + \beta_1 pop\_growth_{it} + \beta_2 enroll_{it} + \beta_3 invest_{it} + \beta_4 inf_{it} + \beta_5 trade_{it} + \beta_6 instable_{it} + \beta_7 nat\_resource_{it} + \beta_8 indust_{it} + \beta_9 debt_{it} + \beta_{10} corrupt_{it} + \beta_{11} rule\_of\_law_{it} + \beta_{12} gov_{it} + \beta_{13} reg_{it} \quad (1)$$

where *i* denotes country identities from 1 to 18, and *t* denotes time periods from 1996 to 2015.

Different measures of natural resource abundance have been used in empirical literature. For instance, Sachs and Warner (1995) exploited the share of primary exports in GDP, while Gylfason (2001) used the share of natural capital in national wealth. This thesis uses the sum of oil and natural gas rents (the difference between the value of crude oil (natural gas) production at world prices and total costs of production) as a percentage of GDP to measure hydrocarbon abundance of the sample countries. Other variables used in the benchmark growth model are described in Table 2.

Table 2 Variable Description

Variable	Description
$growth_{it}$	annual GDP per capita growth (%)
pop_growth_{it}	annual population growth (%)
$enroll_{it}$	primary school enrolment (% gross)
$invest_{it}$	gross capital formation (% of GDP)
inf_{it}	annual inflation measured by the consumer price index (%)
$trade_{it}$	trade is the sum of exports and imports of goods and services measured as a share of gross domestic product (% of GDP)
$instable_{it}$	likelihood of political instability and/or politically-motivated violence, including terrorism (ranging from approximately -2.5 to 2.5)
$nat\_resource_{it}$	the sum of oil and natural gas rents (% of GDP, rents are the difference between the value of crude oil (natural gas) production at world prices and total costs of production)
$indust_{it}$	manufactures exports (% of merchandise exports). Manufactures comprise chemicals, basic manufactures, machinery and transport equipment and miscellaneous manufactured goods, excluding non-ferrous metals.
$debt_{it}$	external debt stocks (% of GNI)
$corrupt_{it}$	perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests (ranging from approximately -2.5 to 2.5)
$rule\_of\_law_{it}$	perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. (ranging from approximately -2.5 to 2.5)
gov_{it}	perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. (ranging from approximately -2.5 to 2.5)
reg_{it}	perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development (ranging from approximately -2.5 to 2.5)

Source: WB Development Indicators and WB Governance Indicators

The summary statistics of variables is presented in Table 3.

Table 3 Summary Statistics of Variables

Variable	Obs.	Mean	Std. Dev.	Min	Max
$growth_{it}$	342	3.937	11.800	-62.214	141.642
pop_growth_{it}	360	1.832	1.123	-3.339	3.657
$enroll_{it}$	255	103.814	11.923	59.390	144.099
$invest_{it}$	335	27.462	22.764	1.729	219.069
inf_{it}	312	28.275	235.909	-16.117	4145.108
$trade_{it}$	343	87.494	58.458	0.027	531.737
$instable_{it}$	306	-0.864	0.842	-3.185	0.814
$nat\_resource_{it}$	333	26.716	15.867	1.546	83.543
$indust_{it}$	234	8.813	8.141	0.000	36.763
$debt_{it}$	281	51.064	56.147	1.024	358.803
$corrupt_{it}$	306	-1.035	0.307	-1.837	-0.223
$rule\_of\_law_{it}$	306	-1.075	0.360	-1.991	-0.158
gov_{it}	306	-0.952	0.386	-1.947	-0.015
reg_{it}	306	-1.081	0.539	-2.237	0.141

In order to control for the heterogeneity caused by time-invariant unobservable factors this thesis utilizes the Fixed Effects as a main method; pooled OLS is included as a benchmark method for comparison purposes only. The main motivation for FE method is that it assumes this unobserved factors don't change over time, therefore any changes in dependent variable must be driven not by these fixed components, but other independent variables (Stock and Watson, 2003). For instance, Sala-i Martin et al. (2004) found that growth rates in Sub-Saharan Africa and Latin America countries were below the level that would be determined by their other characteristics. As the country's geographic location does not change over time, in the Fixed Effects model we assume this factor is not correlated with the growth.

3. Estimation Procedure and Results

3.1. Model Selection

In order to find empirically best fitting model this thesis starts with a standard growth model which regresses economic growth (dependent variable) on population growth, school enrolment, investment, inflation, trade and political stability and the interest variable natural resources. Later, the possible transmission channels from natural resource abundance to economic growth – industrialization, debt overhang, institutional quality and rent seeking – are being added to this model (expect human capital which has already been included). As there are three variables representing the institutional quality the issue of multicollinearity has to be addressed. Table 4 shows correlation between $rule\_of\_law_{it}$, gov_{it} and reg_{it}.

Table 4 Correlation Table for Variables Representing Institutional Quality

	$rule\_of\_law_{it}$	gov_{it}	reg_{it}
$rule\_of\_law_{it}$	1.0000		
gov_{it}	0.6841	1.0000	
reg_{it}	0.5713	0.6188	1.0000

As it was suspected there exists a multicollinearity between variables representing the institutional quality. Therefore, each of them is included separately. The model selection results based on Fixed Effects method is presented in Table 5 (pooled OLS results are included in Table A1). Clustered errors were used while estimating the FE models to satisfy the condition for no serial correlation. All the variables in all the models but model 1.1 are jointly significant. Model 1.8 was chosen as the final model as it had the highest explanatory power.

Table 5 Model Selection (Fixed Effects method)

Dependent Variable is *growth*								
	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8
pop_growth	0.074 (0.05)	-0.759 (-0.67)	-0.183 (-0.20)	0.329 (0.29)	0.279 (0.25)	0.240 (0.20)	0.203 (0.17)	0.235 (0.21)
enroll	-0.084 (-0.89)	-0.140* (-1.82)	-0.212*** (-2.82)	-0.225*** (-2.67)	-0.225*** (-2.66)	-0.226*** (-2.64)	-0.230*** (-2.63)	-0.220** (-2.58)
invest	-0.043 (-0.48)	0.050 (0.59)	0.105 (1.32)	0.130 (1.50)	0.124 (1.42)	0.124 (1.41)	0.121 (1.36)	0.135 (1.49)
inf	-0.091** (-2.07)	-0.032 (-0.88)	-0.071** (-2.09)	-0.080** (-2.20)	-0.078** (-2.12)	-0.079** (-2.07)	-0.079** (-2.12)	-0.084** (-2.17)
trade	0.095** (2.23)	-0.000 (-0.00)	0.102 (1.59)	0.081 (1.13)	0.082 (1.15)	0.083 (1.15)	0.084 (1.16)	0.083 (1.16)
instable	-3.426** (-2.03)	-2.920** (-2.05)	-3.639*** (-2.66)	-3.755*** (-2.63)	-3.935*** (-2.66)	-3.925*** (-2.63)	-4.054** (-2.58)	-3.877** (-2.60)
nat_resource		0.382*** (4.76)	0.255*** (2.80)	0.288*** (2.93)	0.279*** (2.77)	0.278*** (2.75)	0.278*** (2.76)	0.280*** (2.77)
indust			0.086 (0.96)	0.182 (1.54)	0.174 (1.45)	0.174 (1.44)	0.179 (1.46)	0.177 (1.47)
debt				0.008 (0.36)	0.010 (0.41)	0.010 (0.40)	0.010 (0.42)	0.008 (0.34)
corrupt					1.349 (0.46)	1.209 (0.37)	1.139 (0.37)	0.794 (0.25)
rule_of_law						0.263 (0.10)		
gov							0.774 (0.23)	
reg								0.979 (0.51)
R^2 *N*	0.0913 184	0.2526 179	0.3343 145	0.3457 138	0.3469 138	0.3470 138	0.3472 138	0.3484 138

*Note: t statistics in parentheses. Constants are not reported. * p < 0.1, ** p < 0.05, *** p < 0.01*

3.2. Estimation Results and Discussion

The estimation results based on model 1.8 are presented in Table 6 I also estimated the same model with pooled OLS method for comparison reasons.

Table 6 Estimation Results

Dependent variable is $growth_{it}$		
	Pooled OLS	Fixed Effects
nat_resource	0.172** (2.15)	0.280*** (3.49)
pop_growth	-1.782*** (-2.95)	0.235 (0.18)
enroll	-0.126*** (-3.66)	-0.220** (-2.57)
invest	0.143** (1.99)	0.135 (1.32)
inf	-0.054*** (-2.75)	-0.084** (-2.54)
trade	0.023 (0.65)	0.083 (1.78)
instable	-0.006 (-0.01)	-3.877** (-2.94)
indust	-0.048 (-0.66)	0.177 (1.21)
debt	0.013 (1.04)	0.008 (0.40)
reg	1.331 (1.18)	0.979 (0.50)
corrupt	-1.275 (-0.67)	0.794 (0.39)
R^2	0.3010	0.3484

*t statistics in parentheses. Constants are not reported. * p < 0.1, ** p < 0.05, *** p < 0.01*

The results of this thesis suggest that after controlling for other traditional growth determinants and possible transmission channels – human capital, the Dutch disease, institutional quality, rent-seeking and debt overhang – through which natural resource abundance may affect the economic growth, the former has a positive impact on the latter; 1 percentage point increase in the share of hydrocarbon rents in GDP ceteris paribus causes 0.28 percentage point increase in GDP per capita growth. This means around one third of change in hydrocarbon rents gets reflected in economic growth. The result is statistically very significant too. While the finding contradicts majority of the research in the field, it is in line with Davis (1995). However, this thesis acknowledges that the high sensitivity to hydrocarbon price swings in the sample countries coupled with market upturn of 1999-2014 might be the reason for the positive relationship. On the flip side, this means these countries may experience a significant drop in economic growth per one percentage point decline in the contribution of hydrocarbon rents during the market downturns. This might explain the poor performance of countries such as Azerbaijan, Russia and Kazakhstan in the aftermath of 2014 hydrocarbon market crash. However, the high-price-high-revenue relationship is not a sufficient reason to explain the chronical poor performance of resource-rich African countries.

Among the transmission channels only the primary school enrolment is statistically significant. Based on the findings of this thesis, education-human capital has a negative impact on economic growth. This does not fit in the economical intuition. Although, it is not sufficient to draw such a causal relationship, a simple scatter plot is presented in Figure A3 within the Appendices. The outcome is that natural resource abundance did not affect the human capital negatively. Other possible reasons for the negative relationship between education and economic

growth can be either low quality of public education or high drop outs from the primary school. Nevertheless, the results indicate that these countries are not investing enough in human development. The literature suggest that human capital is crucial to offset the negative effects of high commodity export dependence (Bravo-Ortega and de Gregorio, 2005), and by neglecting this importance the sample countries forgo this protection against the market downturns.

As expected inflation and political instability have negative effects on growth. These are in line with findings of Fischer (1993) and Alesina et al. (1996) respectively.

The coefficients on population growth, investment, trade openness, manufactures exports and regulatory quality are statistically insignificant. However, the signs of these variables are in line with economic intuition and the previous research. Debt and corruption are also statistically insignificant, but their signs contradict both economic intuition and findings of the previous research.

Concluding Remarks

This thesis investigated the relationship between natural resource abundance and economic growth. Data covering eighteen hydrocarbon (oil and natural gas) exporting middle income countries for the period of 1996-2015 was used for empirical analysis. Based on findings of literature five possible transmission channels (human capital, the Dutch disease, institutional quality, rent-seeking and debt overhang) from natural resource abundance to economic growth have been identified. A growth regression including these channels and standard growth determinants was employed to reveal the causal relationship between natural resource richness and economic growth. Also, the Fixed Effects method was utilized in order to minimize the heterogeneity driven by omitted variable bias due to time-invariant unobservable factors.

This thesis revealed that, all else equal, there is a positive relationship between natural resource richness and economic growth. The relationship is statistically and economically significant. However, the thesis acknowledges that the results might be driven by high hydrocarbon price environment during 1999-2014. On the other hand, none of the transmission channels, but human capital found to be negatively correlated with economic growth. Nevertheless, no causal relationship between natural resource richness and human capital was found.

The main policy implication of this thesis is that natural resource rich middle income countries should invest more in human capital in order to offset negative effects of hydrocarbon rent dependence during the market downturns. Furthermore, they should decrease their reliance on hydrocarbon rents by diversifying economic activity and support this with institutional quality improvements and curbing the rent-seeking activities.

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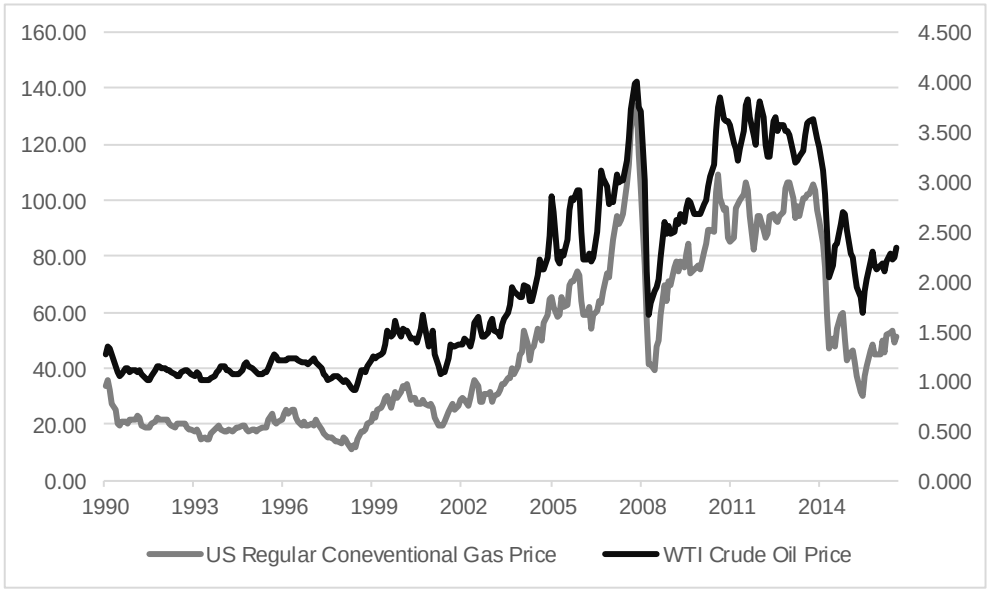
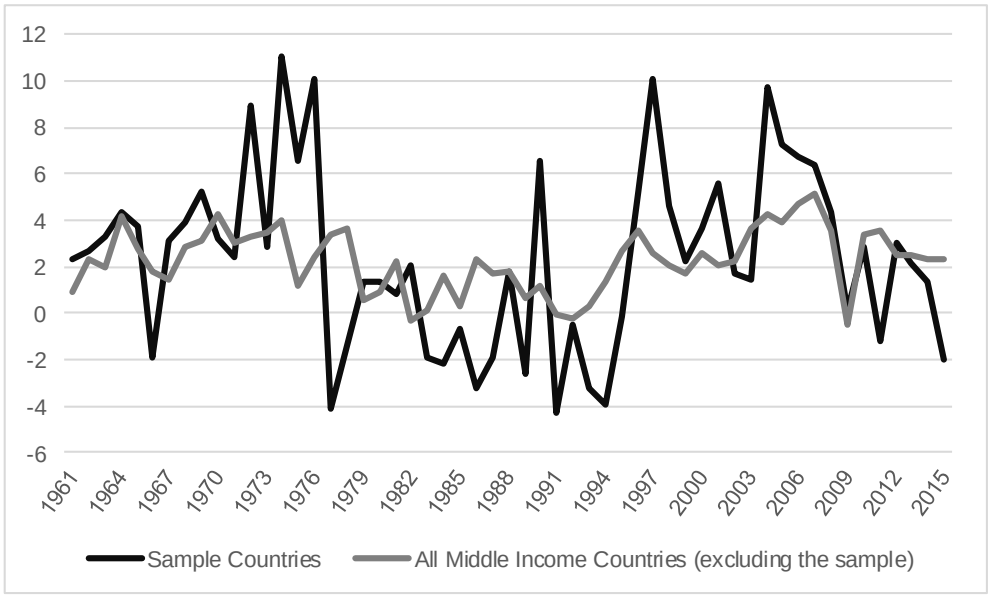
Appendices

Figure A1 Crude Oil (per barrel) and Natural Gas (per gallon) prices (in $)



Source: Federal Reserve Economic Data, Federal Reserve Bank of St. Louis

Figure A2 Growth in sample and other middle income countries (%)



Source: World Bank Development Indicators

Figure A3 Correlation between hydrocarbon rents and primary school enrolment

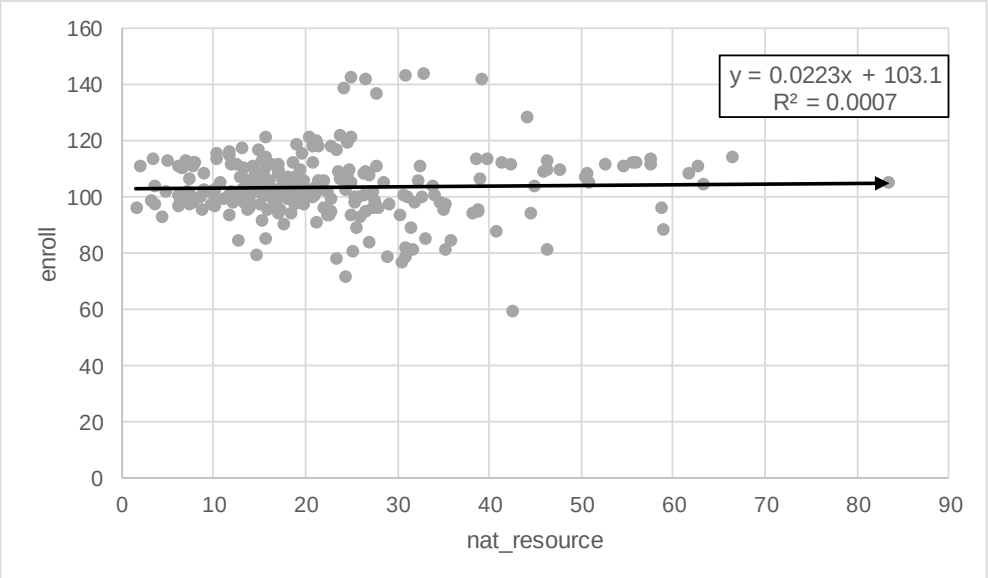


Table A1 Model Selection (Pooled OLS method)

Dependent Variable is *growth*								
	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8
pop_growth	-1.448** (-2.33)	-2.107*** (-3.58)	-2.307*** (-3.07)	-2.108*** (-3.31)	-2.108*** (-3.29)	-2.075*** (-3.38)	-2.117*** (-3.48)	-1.782*** (-2.95)
enroll	-0.057 (-0.93)	-0.041 (-0.91)	-0.053 (-0.76)	-0.131*** (-3.79)	-0.128*** (-3.71)	-0.131*** (-3.63)	-0.128*** (-3.58)	-0.126*** (-3.66)
invest	0.008 (0.15)	0.024 (0.64)	0.069 (1.34)	0.101** (1.99)	0.108* (1.90)	0.106* (1.86)	0.108* (1.91)	0.143** (1.99)
inf	-0.062** (-1.98)	-0.016 (-0.63)	-0.018 (-0.55)	-0.049** (-2.50)	-0.050** (-2.54)	-0.048** (-2.42)	-0.051** (-2.50)	-0.054*** (-2.75)
trade	0.047 (1.36)	0.005 (0.25)	0.070** (1.99)	0.043 (1.60)	0.039 (1.31)	0.041 (1.33)	0.039 (1.22)	0.023 (0.65)
instable	-0.657 (-0.37)	-1.243 (-0.93)	-1.656 (-0.94)	0.034 (0.04)	0.041 (0.05)	-0.045 (-0.05)	0.055 (0.06)	-0.006 (-0.01)
nat_resource		0.220*** (3.16)	0.205** (2.24)	0.145** (2.14)	0.149** (2.08)	0.146** (2.05)	0.150** (2.09)	0.172** (2.15)
indust			-0.048 (-0.67)	-0.073 (-1.01)	-0.072 (-0.98)	-0.072 (-0.97)	-0.073 (-1.00)	-0.048 (-0.66)
debt				0.014 (1.10)	0.014 (1.13)	0.012 (0.89)	0.014 (1.13)	0.013 (1.04)
corrupt					-0.518 (-0.32)	-1.100 (-0.54)	-0.485 (-0.26)	-1.275 (-0.67)
rule_of_law						1.026 (0.55)		
gov							-0.088 (-0.04)	
reg								1.331 (1.18)
R^2	0.0837	0.1958	0.2999	0.2953	0.2955	0.2971	0.2955	0.3010
N	184	179	145	138	138	138	138	138

*Note: t statistics in parentheses. Constants are not reported. * p < 0.1, ** p < 0.05, *** p < 0.01*