Iran. Econ. Rev. Vol. 21, No. 3, 2017. pp. 661-693

Natural Resources, Institutions Quality, and Economic Growth; A Cross-Country Analysis

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Received: 2016, December 3 Accepted: 2017, January 2

Abstract[3]

Natural resources as a source of wealth can increase prosperity or impede economic growth. Empirical studies with different specifications and data are also mixed on whether natural resources are curse or blessing. In fact, the variety of model specifications, measurements, and samples in the empirical literature makes it difficult to generalize the results. In this study, a growth model including natural resources is developed to estimate the effect of natural resource dependency on economic growth, using different measures of natural resources and controlling for the quality of institutions in 149 countries during 1996-2010. The results show that natural resource abundance, proxied by per capita natural wealth, has a positive and significant effect on GDP growth. However, the impact of natural resource dependency on GDP growth depends on the type of natural resources and the quality of institutions. Fuel dependency, for example, can be considered a strong curse, as it has no effect on GDP growth, and agriculture and food dependency a weak curse, as it can increase GDP growth in the presence of good institutional qualities. Results also show that among different indexes used for institutional qualities, government effectiveness, regulatory quality, and rule of law are more effective in avoiding the negative effect of resource dependency. The thresholds above which different types of institutional qualities can turn a curse to a blessing are also estimated for different types of natural resource dependency.

Keywords: Natural Resources, Economic Growth, Institutional Quality, Resource Dependency.
JEL Classification: O01, O13, O57, Q39.

1. Introduction

Natural resources can bring prosperity in a resource-rich country through production or trade. However, natural resources can impede

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3. We would like to thank participants at the Departmental Seminar at the University of Saskatchewan in October 2013, the STM faculty seminar in November 2014, and the 7th International Interdisciplinary Social Science Conference, held in Barcelona, Spain, June 2012, for their helpful comments.

long run growth due to their exhaustibility (Jones, 2002; Aghion and Howitt, 2009). The empirical literature is also mixed. While there is evidence that suggests natural resources have helped long-run economic performance (Stijn, 2005; Alexeev and Conrad, 2011; Cavalcati et al., 2011), some studies have found a negative relationship between natural resources and economic growth (Sachs and Warner 1995, 1997, 2001; Letie and Weidmann, 1999; Dietz et al., 2000; Mehlum et al., 2006; Arezki and van der Ploeg, 2011). More recent literature examines the role of institutions in how natural resources may affect economic performance (Sachs and Warner, 1995, Mehlum et al., 2006). Specifically, countries with good institutional quality are found to benefit from their natural resources and achieve a high standard of living (Mehlum et al., 2006).

The empirical literature calls for some important questions. First is the measurement of the natural dependency. Many studies, such as Sachs and Warner (1995, 2001) and Mehlum et al. (1996), have equated resource dependency with resource abundance, although these measures do not necessarily represent the same idea. Some highly resource abundant countries; such as Canada, New Zealand, and Australia; are not necessarily dependent on those resources. Therefore, as some recent studies indicate, it is important to distinguish between natural resource abundance and natural resource dependency (Arezki and Vander, 2011, Gylfson, 2011). The second question deals with the types of natural resources. Some have argued that point sources such as oil are more subject to authoritarian regimes and rent-seeking activities than diffuse resources such as agriculture and, therefore, the economic performances of countries rich in those resources would not necessarily be the same. The third question concerns the institutions which might affect the relationship between natural resources and growth. Most studies have used a general index for institutional quality or have selected a particular institution, but the degree by which each institution may affect the natural resources management may vary. For instance, while democracy might not have a significant effect on how natural resources are used, government effectiveness can be decisive on how to manage the natural resources.

To shed more light on these three questions, a single framework and a large data set with different measures of natural resources and institutional qualities are applied, focusing specifically on natural resource dependency while controlling for the resource abundance. Our measure of the natural resource dependency is based on the share of primary exports in GDP and for the natural resource abundance on per capita natural capital. The main hypothesis is that *natural resource abundance helps economic growth, but natural resource dependency harms growth.* The former is considered wealth on which a country can build prosperity, but the latter may hinder productive economic activities. A heavy reliance on income from the exports of natural resources may indicate a lack of knowledge and technology to process natural resources and thus boost economic growth in the long-run.

The paper also differentiates among different types of natural resources. Specifically, resource dependency is broken down into three different types: fuel and metal, food, and agriculture. It has been argued that being dependent on fuel and metal resources (point sources) is more detrimental to economic growth than being dependent on food and agriculture resources (diffuse sources), because the former has a higher potential for rent-seeking and other non-productive activities. Our second hypothesis, therefore, is that *dependence on "point source" resources will do more harm to economic growth than dependence on "diffuse" resources.*

To address the impact of institutional quality on economic growth and its interaction with natural resources, a proxy for institutional quality is incorporated in the model and its interaction with natural resources is examined. Furthermore, considering that different institutions may influence the relationship between resource dependency and economic growth differently, the institutional quality index is disaggregated into six components: Voice and Accountability (VA), Political Stability and Absence of Violence (PSAV), Government Effectiveness (GE), Regulatory Quality (RQ), Rule of Law (RL), and Control of Corruption (CC). Our third hypothesis is that *the institutions which reflect more checks and balances through GE, RQ, RL, and CC, are more effective than other institutions in preventing resource dependency from stifling economic growth.*

Using a sample of 149 countries for the period of 1996-2010, our study shows that natural resource abundance is a blessing for economic growth. However, resource dependency is a curse, and the extent of the curse depends on institutional qualities. Our results also show that different types of institutions interact differently with various types of natural resources. The rest of the paper is organized as follows. Section 2 reviews the literature and Section 3 presents the theoretical background and the model specification. Section 4 describes the data and Sector 5 presents the results. Section 6 discusses the findings and Section 7 concludes.

2. Literature Review

In this section, studies focused on the impact of natural resources on growth through economic transmission channels, and then t emphasizing on non-economic factors. The main economic channels are commodity price trends, price and income volatility, sectoral shifts, and exchange rate fluctuations. The commodity prices are known to have a downward trend as opposed to the prices of manufacturing goods, weakening the position of the natural resource dependent countries in international trade (Frankel, 2010). However, this does not apply to all kinds of primary goods and to all periods. For instance, commodity prices have faced several short and long cycles since 1950, and oil prices have been fluctuating much since the 1970s. The price and revenue volatility may also impede investment in infrastructure and other long term projects necessary for long run economic growth. Frankel (2010) argues that revenue volatility is problematic if it leads to pro-cyclical fiscal policies. One might expect governments to adopt an inter-temporal optimization policy that would smooth the consumption flow through time by spending less during the commodity booms and more during the busts. However, failure to control volatile resource revenues adequately in many resource-rich countries has been detrimental to long-run economic growth.

The channels of sectoral changes and exchange rates are traditionally explained by the Dutch disease model. A boom in natural resources leads to de-industrialization through resource shifts from tradable sectors to non-tradable sectors and to exchange rate appreciation (Corden, 1984). Since the tradable manufacturing sector has a strong backward and forward linkage with the rest of the economy (Hirschman, 1958) and positive spillover of learning-by-doing (Matsuyama, 1992), its contraction in favor of primary and non-tradable sectors will harm economic growth. The Dutch disease model, however, suffers from theoretical and empirical shortcomings. For example, the traditional version of the model is static, implying a long-run adverse relationship between oil prices and economic performance. However, the adverse effect of a natural resource boom on the economy might be only temporary (Sachs and Warner, 1995). Furthermore, the sectoral linkage and the learning-by-doing characteristics are not limited to the manufacturing sector. Good macroeconomic policies can expand the primary sector's linkages with other sectors (Polterovich et al., 2010), and learning-by-doing can exist in other economic sectors, depending on the economy's condition (Torvic, 2001).This implies that de-industrialization may not be a necessary component of weak economic performance; even developed resource-poor countries have gone through the same structural changes (Plama, 2004). Finally, the Dutch disease model suggests an absolute negative relationship between natural resources and economic performance. However, there are some conter-examples, such as Botswana, Norway, and Canada, in which natural resources have helped the economies prosper.

Recent studies have paid more attention to the social and political characteristics of a society that affect the natural resources and economic growth relationship. One approach has been to assume institutions are endogenous with respect to natural resources. For instance, rent-seeking models suggest that natural resources deteriorate institutional qualities and draw entrepreneurs from productive sectors to rent-seeking activities. An alternative approach is to consider institutional quality as an environment in which natural resources affect economic performance. Specifically, natural resources have a positive effect on economic growth if institutional quality is good and supports productive economic activities. The empirical evidence on the institution-natural resource-growth nexus is also mixed. Sachs and Warner (1995) show that although natural resources have a negative effect on growth, there is no significant relationship between institutional qualities and resource abundance. However, Sala-i-Martin and Subranabian (2003) report that resource abundance has an insignificant affect on growth, but it affects institutional quality negatively and significantly. Alexee-a and Conard (2011) claim that in most countries, except transition economies, the quality of institutions is altered slowly and there is little probability that natural resources will impact institutional qualities. Brunnschweiler and Bulte (2006) indicate a reverse causality in which natural resource dependency is endogenous with respect to institutional quality. They argue that, in the absence of qualified institutions, there is a tendency to depend on primary exports.

Some studies have also examined the effect of natural resources on specific institutions such as property rights and democracy. For instance, Hodler (2006) shows that natural resources have a negative effect on economic growth through deterioration of property rights. Sachs and Warner (1995) indicate that natural resource abundance creates a climate that resists openness and, therefore, limits economic growth. The empirical results of studies on the effect of natural resources on democracy and, in turn, the effect of democracy on growth are not conclusive (Ross, 2001; Haber and Menaldo, 2009; Frankel, 2010). Collier and Hoeffler (2009), Acemoglu and Robinson (2010), and Gylfson (2011) argue that checks and balances are more important than democracy in economic performance. Other studies have examined the interaction between war and corruption and natural resources (Collier and Hoeffler, 1998; Bruuschweiler and Bulte, 2006; Tornell and Lane, 1999; Torvic, 2001). The question of endogeneity is also not resolved yet and the growth effect of corruption is not clear.

The idea that resource abundance impacts incentives and institutional qualities is intriguing; however, there is an important caveat. When we assume that natural resources deteriorate the quality of institutions, we implicitly consider natural resources as an absolute unconditional curse. However, the experience of some resource abundant countries, such as Norway, contradicts this unidirectional relationship. This notion has led to the emergence of a third phase of studies in natural resource literature that examines ways in which the quality of institutions restricts the adverse effects of natural resources on economic performance. For instance, Tornell and Lane (1999) develop a two-sector model with a formal sector as a productive sector under taxation and a shadow sector as an unproductive sector without taxation. They show that, in the absence of good institutions, if the rate of return increases in the formal sector, growth will fall, and conclude that the impact of windfalls is conditioned on institutional qualities. This result can be directly applied to the natural resource-growth relationship as the resource abundance is a main source of windfalls and rents.

Mehlum et al. (2006) also argue that in societies, where production and rent-seeking sectors support each other, natural resources are beneficial. However, competition between these two sectors turns natural resources into a curse. In contrast with Sachs and Warner (1995), they indicate that even if institutions are not endogenous with respect to natural resources, the natural resources' impact on growth is conditioned by institutional qualities. Diets et al. (2007), Boschini et al. (2007), and Arezki and van der Ploeg (2011) also show that institutional quality determines the impact of natural resources on growth. With a more specific definition of institution qualities, Collier and Hoeffler (2009) argue that the combination of democracy and natural resources in developing countries leads to a low level of growth while the interaction between natural resources and check and balance has a positive impact on growth. Bhattacharyya and Hodler (2010) also show that, in the absence of democratic institutions, natural resource abundance increases corruption. In a recent paper, Moshiri (2015) tests if oil shocks have asymmetric effect on economic growth in oil-exporting countries and shows how the effect depends on the institutional quality. In oil-exporting countries with good institutional quality, oil shocks do not have a major effect on growth, however, in countries with weak institutional quality, negative oil shocks deteriorate economic performance, but positive oil shocks do not generate long-run growth.

The mixed results in the literature call for more studies. In this study, the theoretical framework which incorporates natural resources in the neoclassical growth model is described and then an empirical model, taking into account the concerns rose above about the relationship between natural resources and economic growth is presented. Specifically, we incorporate different measures for resource dependency and resource abundance and discern between "point source" resources and "diffuse" resources. The institutional quality and its interaction with natural resource dependency is also controlled for. In most studies, an index of institutional quality, which is an un-weighted average of six different aspects of institutional quality, is used. However, “institution” is a broad concept with various economic, social, and political aspects, and the effects of different institutions on how natural resources affect economic activities may vary. Therefore, we use disaggregated indices of institutional quality to investigate which feature of institutional quality is more effective in alleviating the negative effect of resource dependency.

3. Theoretical Framework and Model Specification

Natural resources such as land and other non-renewable resources can be viewed as inputs in the production process as follows (Jones, 2002):

$$Y(t) = K(t)^{\alpha} R(t)^{\beta} T(t)^{\gamma} [A(t)L(t)]^{1-\alpha-\beta-\gamma} \quad (1)$$

Where Y is the aggregate production, K physical capital, L labour, T land, R exhaustible natural resources, and A labour–augmented technology. $\alpha, \beta,\ and\ \gamma$ are the output shares of inputs under the assumption of perfect competition where $\alpha, \beta, \gamma > 0\ and\ \alpha + \beta + \gamma <1$ and production is characterised by constant return to scale. The laws of motions of inputs in the production function are as follows:

$$\dot{K}(t) = sY(t) - \delta K(t) \quad (2)$$
$$\dot{L}(t) = n\,L(t)$$
$$\dot{A}(t) = g_A A(t)$$
$$\dot{T}(t) = 0$$
$$\dot{R}(t) = -bR(t)$$

where s is the rate of investment, δ depreciation rate, n labour growth rate, and g_A exogenous technological growth rate. Land is constant and natural resources stock diminishes with the depletion rate of 0<b<1. Given the assumption that in the balanced growth path (BGP), all the variables grow in a constant rate, solving the model for the growth rate of output in the BGP will result in the following solution[1]:

$$g_Y = \theta(g_A + n) - \mu b \quad (3)$$

Where $\theta = 1 - \frac{(\beta+\gamma)}{1-\alpha}, \quad and \quad \mu = \frac{\beta}{1-\alpha}$

1. For the details of the solution process, see Jones (2002).

Equation (3) shows that increasing the share of exhaustible natural resources in production (β) and the depletion rate (b) dampens economic growth, but technological progress (g_A) may offset the negative outcome, as it makes natural resources more productive and, therefore, less scarce. Aghion and Howitt (2009) also show that the negative effect of resources could be hindered by appropriate innovations in a Schumpeterian growth model including natural resources. Using a general equilibrium model, Cavalcanti et al. (2011) show that the long-run GDP growth are sustainable if non-renewable resources are traded internationally. Boyce and Emery (2011) also develop a two-sector model and show that a resource abundant economy grows more slowly but has a higher income level than a pure manufacturing economy. This result is similar to that of the neoclassical growth model above, which indicates that the natural resource curse in the form of slower growth rate can occur in perfectly functioning competitive markets.

In order to analyse the impact of natural resources on economic growth empirically, an empirical growth equation can be specified as follows (Mankiew et al., 1992; Sachs and Warner, 1995):

$$GDPG = \alpha_0 + \alpha_1 IGDP + \alpha_2 I + \alpha_3 POPG + \alpha_4 RD + \alpha_5 Z + \varepsilon \tag{4}$$

where $GDPG$ is GDP growth, $IGDP$ is initial income to capture the convergence effect, I shows the ratio of investment to GDP, $POPG$ is population growth, RD is the resource dependency, and Z represents variables commonly used in the empirical growth models, such as openness and human capital. The Institutional Quality (IQ) as an explanatory variable is also added to our estimation model. Economic and political institutions shape incentive structure and rules in an economy to comfort exchanges and decrease transaction costs, which inspires economic growth (North, 1991, Rodrick et al., 2004, Acemoglu and Robinson, 2010). In our context, institutions can be seen as an environment in which natural resources affect economic performance. For instance, in a resource dependent country, good institutions may impede rent-seeking behavior arising from resource windfalls. Furthermore, proper checks and balances and control of corruption lead to productive use of resource revenues. In a good quality institutional environment, governments are also able to manage the resource revenues well, leading to sustainable economic growth.

Institutional quality is a broad concept. Hence, different types of institutional qualities may have different influences on the relationship between resource dependency and economic growth. Only a limited number of studies have addressed this concern, and the focus has been on indices such as democracy and checks and balances (Collier and Hoeffler, 2008; Gylfason, 2011; Dietz et al., 2007). In this study, six types of institutional qualities are used as follows: Voice and Accountability (VA), Political Stability and Absence of Violence (PSAV), Government Effectiveness (GE), Regularity Quality (RQ), Rule of Law (RL), and Control of Corruption (CC). Definitions of these institutional quality indices are provided in the appendix.

As discussed in Section 1, natural resource abundance and natural resource dependency are two different variables with possibly different effects on growth. Therefore, two separate variables for resource dependency and resource abundance are used in the model. Our regression equation is as follows:

$$GDPG = \alpha_0 + \alpha_1 IGDP + \alpha_2 I + \alpha_3 POPG + \alpha_4 RD + \alpha_5 Z + \alpha_6 IQ + \alpha_7 IQ^{*}RD + \alpha_6 RA + \varepsilon \quad (5)$$

where IQ represents institutional quality and RA the resource abundance. Various types of natural resources for the natural resource dependent (RD) variable are also used to examine if the relationship between resource dependency and economic growth is influenced by different types of natural resources. The RD is broken down into three categories: fuel, metal and ores (FUELMET), food (FOOD), and agriculture (AGRI). The decomposition of institutional quality and natural resource dependency allows us to examine if the interactions of institutional qualities with natural resource dependency vary across different types of institutions and resource dependency.

4. Data and Variables

Table 1 summarizes the statistical description of the main variables for 149 countries during 1996-2010. The dependent variable is GDP growth which is the average yearly growth rate of GDP during 1996-

2010[1]. The natural resource dependency is measured by the ratio of total primary export to GDP (TOTEX). Total primary export is the sum of four commodity (fuel, metal and ores, food, and agriculture) export share in GDP during 1996-2010 collected from World Development Indicators (WDI). Tajikistan, Bahrain, Brunei Darussalam, and Papua New Guinea are the most resource dependent countries while Djibouti, Japan, Cape Verde, and Sierra Leone are at the bottom of the list.

Table 1: Summary Statistics of Main Variables (1996-2010)

Variable	Number of Countries	Mean	Std. Dev.	Min	Max
GDP Growth	149	3.97	2.007	0.53	12.56
Total Primary Export Share in GDP	146	14.06	13.84	0.46	79.02
Agricultural Export Share in GDP	149	1.21	2.34	0.0007	15.63
Food Export Share in GDP	149	5.20	5.92	0.023	35.68
Fuel and Metal Export Share in GDP	148	7.40	12.31	0.005	63.54
Log Per Capita Natural Capital	114	8.13	1.10	4.42	11.28
Institutional Quality	137	0.07	0.88	-1.52	1.88
Voice and Accountability	137	0.04	0.93	-1.91	1.60
Political Stability and Absence of Violence	137	-0.01	0.8	-2.26	1.50
Governance Effectiveness	137	0.11	0.97	-1.56	2.15
Regularity Quality	137	0.12	0.90	-1.96	1.90
Rule of Law	137	0.06	0.96	-1.46	1.94
Control of Corruption	137	0.10	1.01	-1.21	2.4

Resources: WDI, WGI, and World Bank, and the authors' calculations

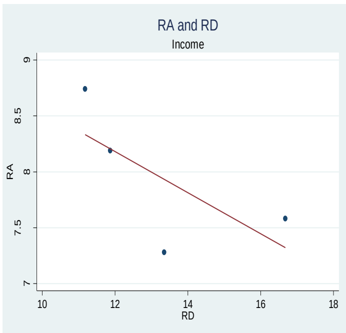
FUELMET (RD) is the average share of Fuel and Ores and Metals exports in GDP during 1996-2010. FUELMET (RD) varies from 63.54% for Tajikistan to 0.0056% for Cape Verde. FOOD (RD) is the average share of food exports in GDP during 1996-2010. Guyana has the highest share of food export in GDP (35.68%) and Brunei Darussalam has the lowest (0.02%). AGRI (RD) is the average share of agriculture raw materials exports share in GDP during 1996-2010. Mali has the highest share of agricultural export in GDP and Djibouti the lowest.

In the literature, both resource dependency and resource abundance are used as a measure of natural resources. As Figure 1

1. The number of countries and the time period are chosen based on the availability of the data. Full description of the data is provided in the appendix.

shows, although there is a positive correlation between resource abundance and resource dependency on average, there are some resource abundant countries, such as Australia, New Zealand, Canada, and United States, which are not resource dependent. This becomes clearer when we examine the correlation in different income groups. Table 2 shows an inverse relationship between resource dependency and resource abundance when we control for income groups.[1] That is, RA is high and RD low in high income countries, but the opposite is true in low income countries. Therefore, it seems plausible to discern between two measurements of natural resources.

Table 2: Resource Abundance and Resource Dependency in Different Income Groups

Income*	**Resource Abundance (RA)**	**Resource Dependency (RD)**	**Correlation between RA and RD when income is controlled for**
High (>$12,275)	8.74	11.18	
High-mid ($3976-$12,275)	8.19	11.87	
Low-mid ($1,006-$3,976)	7.58	16.68	
Low (<=$1005)	7.28	13.35	

Resource: WDI and authors' calculation
*. Countries are divided into four income groups based on their GNI per capita in 2010
RA: Resource abundance measured by the per capita natural capital.
RD: Resource Dependency measured by total primary export share in GDP

The Resource Abundance (RA) is measured by natural capital per person in 2000 and collected from the World Bank dataset[2]. Natural capital includes sub-soil assets (oil, natural gas, hard coal, soft coal, bauxite, copper, gold, iron ore, lead, nickel, phosphate rock, silver, tin, zinc), forest (timber assets: round wood and fuel wood), forest (non-timber forest assets), cropland, pasture land, and protected areas.

1. The same pattern emerges when countries are divided based on IQ.
2. More information on the calculation of natural resource wealth can be found in "A Guide to Valuing Natural Resources Wealth" by Policy and Economics Team, Environment Department, World Bank, 2006.

Brunei Darussalam, Norway, New Zealand, Canada, and Trinidad and Tobago are the most resource abundant countries, while Seychelles and Gambia are the least resource abundant countries. Five of the high resource abundant countries (Brunei Darussalam, Norway, New Zealand, Canada and Australia) are among the developed countries.

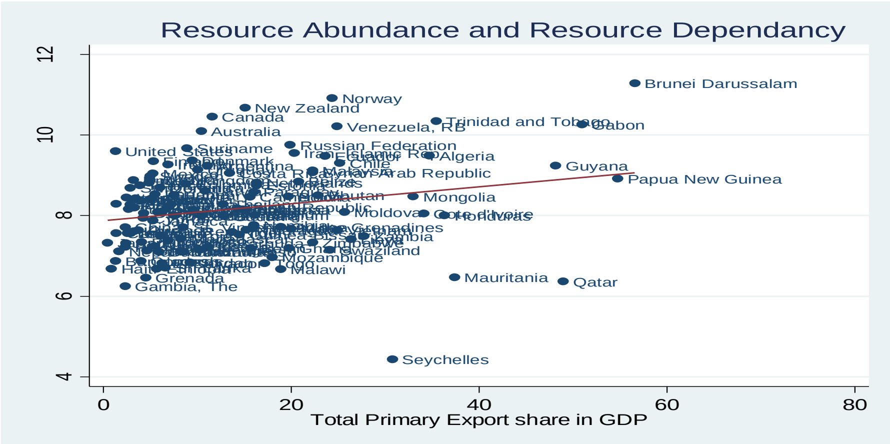


Figure 1: Resource Dependency and Resource Abundance
Resource: World Bank, WDI and authors' calculation

Institutional Quality (IQ) is an un-weighted average of six aggregate governance indicators, based on the data from the Worldwide Governance Indicators (WGI) research project (World Bank). This database includes governance information in 212 countries for periods 1996, 1998, 2000, and 2002-2010. The IQ variables range from -2.5 to +2.5 with an ascending order showing better qualities. The definition of the six types of IQ variables is provided in the Appendix.

Figure 2 depicts the simple correlation between the average resource dependency and the average yearly GDP growth rate for 149 countries for the period 1996-2010. Panels a, b, c, and d demonstrate that there is no strong correlation between the GDP growth and different measures of resource dependency[1]. This result is in contrast to the natural resources curse hypothesis, and calls for a more careful control of other determinants of economic growth.

1. We also plotted the resource dependency in the first year (1996) against the average GDP growth rate, but the results remain unchanged, showing no relationship between economic growth and resource dependency.

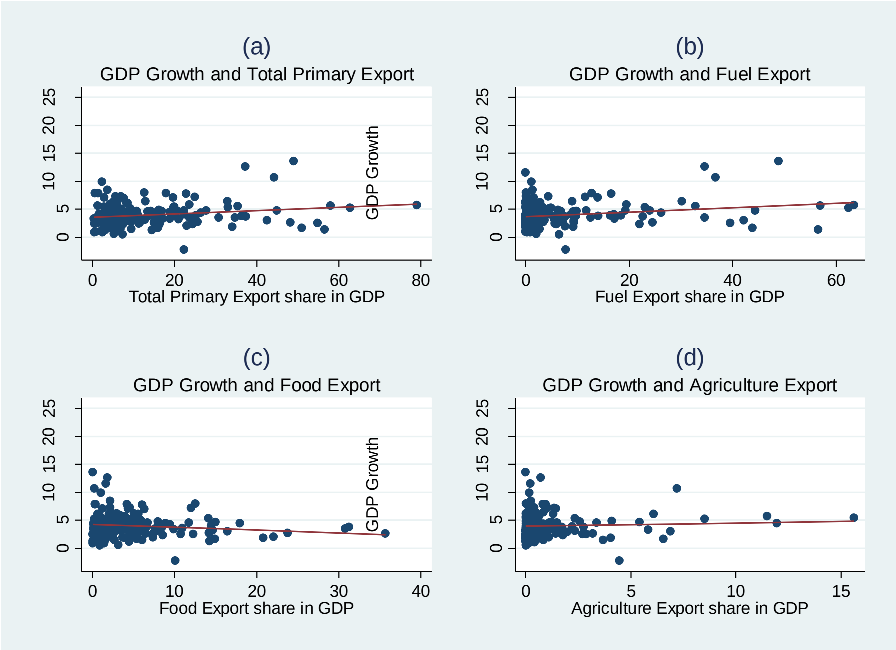


Figure 2: Resource Dependency and GDP Growth (1996-2010)
Resource: WDI and authors' calculation

To address the question if IQ would determine the effect of RD on GDP growth, countries are divided into two categories: those with good institutional quality with IQ>0 and those with bad institutional qualities with IQ≤0. Figure 3 shows that the total primary export, fuel exports and agriculture exports have positive correlations with GDP growth in countries with IQ>0 but no major correlation when IQ≤0. Food exports and GDP growth have negative correlation in low IQ countries and no correlation in high IQ countries.[1]

We can draw the following observations from the figures and data description: First, some resource abundant countries (north-east block in Figure 1), which are also highly developed countries, are not resource dependent. This justifies the distinction between RA and RD in the estimation model. Second, the figures suggest that there might be variations in the relationship between different types of RD (agriculture, food, fuel and metal exports) and GDP growth. Third, the data description implies a mixed pattern of development level among

1. The same pattern emerges when we change the threshold for the good and bad institutions to 1.

resource dependent countries. Some resource dependent countries are growth leaders, but others are losers. Fourth, Figure 3 shows that institutional quality might be an important factor in explaining the resource dependency and GDP growth relationship. Figures show that countries with lower IQ are more dependent on primary exports and perform poorly. In the next section, we present the regression estimation results in which other factors determining economic growth is controlled for.

5. Regression Results

To estimate the model, a large sample size, which includes 149 countries for the period 1996-2010, is constructed. To avoid cyclical changes and focus on the long-run relationship, we estimate the regression equation (5) using the averages of the variables over the sample period. The estimation method is least square with robust standard errors to control for heteroscedasticity. A test for endogeneity using a different set of instrumental variables is also carried out.

The equations are estimated in the following order. First, a simple regression with main determinants of growth and resource dependency is estimated. Second, the test for endogeneity has been conducted using different IVs. Third, the interaction between institutional quality and natural resource dependency is included in the model. Fourth, natural resource abundance is added to the regression equation. Fifth, institutional quality is broken down into its components, and six, natural resource dependency is divided into its three components. In each case, the institutional quality thresholds in the natural resource dependency and growth relationship are also estimated.

Our first and basic growth model estimation results are reported in Column 1 of Table 3. As the results show, investment (I), human capital (HC), and population growth have positive and significant effects on GDP growth. The negative and significant coefficient of initial income confirms the notion of conditional convergence. Although institutional quality (IQ) and openness demonstrate positive effects on growth, they are insignificant. Resource dependency indicator (TOTEX (RD)) shows a negative but insignificant impact on GDP growth, which is consistent with previous work such as Sachs and Warner (1995) and Mehlum et al. (2006).

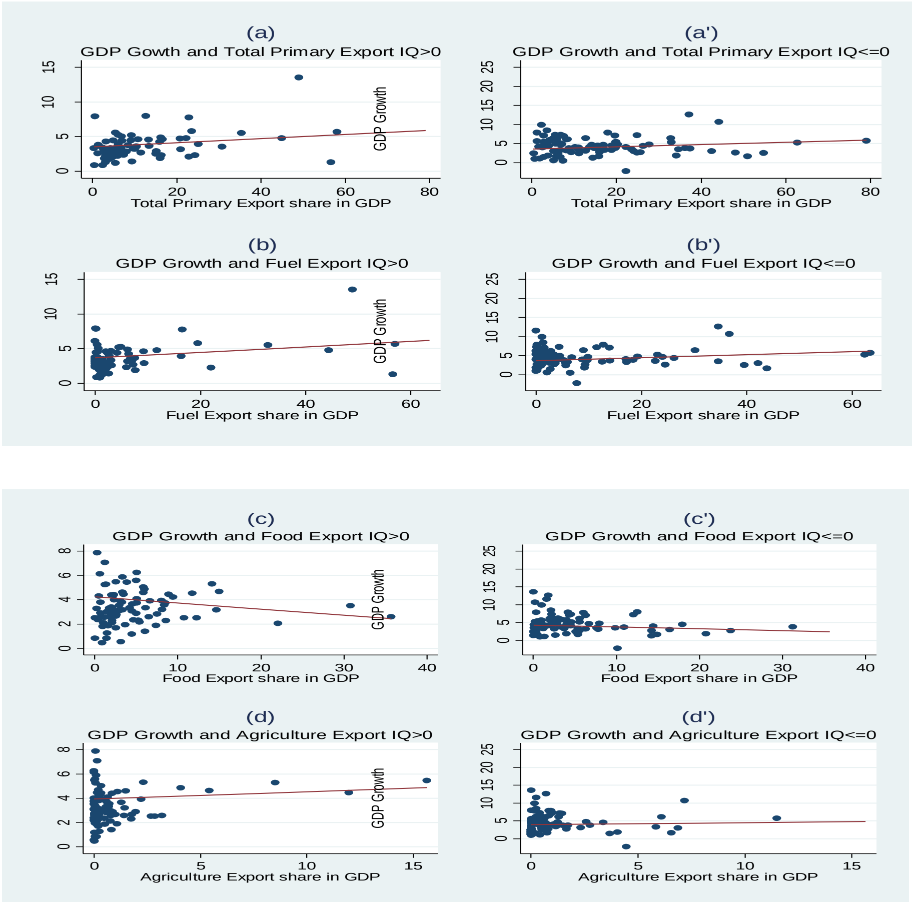


Figure 3: Resource Dependency and GDP Growth Controlling for IQ (1996-2010)

Resource: WDI and authors' calculation

One concern in the estimation is the endogeneity of IQ. That is, GDP growth and IQ might be driven by the same unobserved determinants, making IQ's coefficient biased. To address this problem, we apply four types of instrumental variables (IV) suggested in the literature: "mortality rate of colonial settlers (Acemoglu et al., 2001), the fraction of the population speaking English, the fraction of the population speaking European languages, and latitude (Hall and Jones, 1999). The idea for using the mortality rate of colonial settlers as an IV is that European settlers created "extractive institutions" to extract resources in colonies in which they were more vulnerable to diseases such as Malaria and Yellow fever and their mortality rate was higher. In contrast, they launched better quality institutions in colonies in which their mortality rate was lower, such as Canada, Australia, New Zealand, and United States. This hypothesis proposes that countries' "current performance" is affected by their "early institutions." The use of the fraction of the population speaking English/European language as an IV is justified on the ground that since Western Europe was a pioneer in implementing property rights and checks and balances, it is more probable that of the countries most affected by Europeans (for example, speaking European languages), more also adopted European good IQ (Hall and Jones, 1998). Finally, the latitude can be used as an IV because European settlers were more interested in immigrating to regions which had a similar climate to Western Europe and were less congested.

The results of the endogeneity tests are reported in Table 4. Although the Wald test[1] shows that mortality rate is a strong IV, the Durbin and the Wu-Hausman tests reject the endogeneity of IQ. Furthermore, the Wald test indicates that the fraction of the population speaking English and European languages and latitude are weak instruments for IQ. Overall, the test results reject the endogeneity of IQ in the model, confirming that OLS is a consistent and efficient estimator. The remaining regression equations are therefore estimated by least square with robust standard errors to control for heteroscedasticity.

To analyze the effect of IQ on the relationship between RD and GDP growth, an interaction term between IQ and RD is added to the regression. The results are presented in Column 2. The interaction term has a positive but insignificant effect on growth, indicating that better institutions may reduce the negative effect of resource dependency. The growth effects of a marginal increase in resource dependency ($\frac{\partial G}{\partial RD}$) in all levels of IQ are also insignificant. In Column 3,[2] RA is added to the regression model. The results show that resource abundance has a positive and significant effect on growth, but resource dependency a negative and significant effect. The

1. To examine the endogeneity of a variable, a regression equation with a single endogenous variable is estimated. If F statistic of IV in the first regression is less than ten, then this IV is weak (Green, 2012).
2. Since HC and openness are not significant, they are removed from the regressions. The results remain unchanged when these two variables are excluded.

Table 3 :Estimation Results (1996-2010)

Variables	1	2	3	4	5	6	7	8	9
I	0.13*	0.13*	0.15*	0.15*	0.15*	0.15*	0.16*	0.15*	0.15*
TOTEX(RD)	-0.002	-0.002	-0.03*	-0.03*	-0.04*	-0.03*	-0.03*	-0.03*	-0.03*
POP. Growth	0.39**	0.39**	0.35*	0.37*	0.30**	0.34*	0.37*	0.34*	0.35*
Initial Income	-0.95*	-0.95*	-0.92*	-0.60*	-0.90*	-1.1*	-1.05*	-0.97*	-0.88*
HC	0.017**	0.017**							
Openness	0.003	0.003							
IQ	0.009		-0.25						
RA			0.37*	0.35*	0.42*	0.37**	0.37***	0.38*	0.38*
IQ* TOTEX(RD)		0.0003	0.03*						
VA				-0.77*					
VA* TOTEX(RD)				0.04*					
PSAV					-0.28				
PSAV*TOTEX(RD)					0.02*				
GE						0.18			
GE* TOTEX(RD)						0.02*			
RQ							0.14		
RQ* TOTEX(RD)							0.02**		
RL								-0.12	
RL* TOTEX(RD)								0.02*	
CC									-0.26
CC*TOTEX(RD)									0.03*
R2	0.34	0.34	0.55	0.56	0.55	0.56	0.55	0.55	0.55
No. of Observations	148	148	121	121	121	121	121	121	121

- Dependent variable: GDP growth during 1996 to 2010. I: Investment. TOTEX (RD): Total primary Export share in GDP as the resource dependency indicator. RA: the logarithm of natural capital per person in 2000. Hc: Human Capital (secondary school enrolment). Openness: Share of Trade in GDP. IQ = Institutional Quality, VA= Voice and Accountability, PSAV=Political Stability and Absence of Violence, GE=Governance Effectiveness, RQ=Regularity Quality, RL=Rule of Law, CC= Control of Corruption.
- All variables are average for the period 1996-2010
- The estimation method in all models is OLS except model 2 which is 2SLS.
Robust standard errors are used.
- *, **, and *** denote significance levels at 1%, 5%, and 10%, respectively.

marginal effect of resource dependency on growth depends on IQ as follows:

$$\frac{\partial G}{\partial RD} = -0.03 + 0.02 * IQ$$

The resource dependency has a negative effect on growth, but the effect diminishes as institutional quality improves. The IQ thresholds based on which RD effect on growth becomes significant or changes its sign are presented in Table 5. The results show that in countries with IQ (-2.5, +2.5) greater than 1.1 the marginal effect of RD is positive. However, the Wald test shows that $\frac{\partial G}{\partial RD}$ is only significant when IQ≤0.4. In other words, resource dependency might be a curse for countries with lower IQ or neutral for countries with higher IQ.[1]

Table 4: Test for IQ Endogeneity

```
Ho: variables are exogenous

Durbin (score) chi2(1)          =  1.00748  (p = 0.3155)
Wu-Hausman F(1,55)              =  .879655  (p = 0.3524)
```

IV	Null Hypothesis	F-statistics	IV
Mortality	mortality = 0	F(1, 56) = 15.32	Strong
Latitude	latittud = 0	F(1, 114) = 0.38	Weak
Engfrac	engfrac = 0	F(1, 114) = 5.97	Weak
Eurfrac	eurfrac = 0	F(1, 114) = 0.51	Weak

Mortality: mortality rate of colonial settlers (Acemoglu et al., 2001).
Latitude: latitude (Hall and Jones, 1999).
engfrac: the fraction of the population speaking English (Hall and Jones, 1999).
eurfrac: the fraction of the population speaking European languages (Hall and Jones, 1999).

Table 5: Marginal Effect of Total Primary Export on GDP Growth

	3		4		5		6		7		8		9	
	Eff	**Thr**	**Eff**	**Thr**	**Eff**	**Thr**	**Eff**	**Thr**	**Eff**	**Thr**	**Eff**	**Thr**	**Eff**	**Thr**
$\frac{\partial G}{\partial RD}$	-*	IQ ≤0.4	-*	VA ≤0.8	-*	PSAV ≤1.1	-*	GE≤0.4	-*	RQ≤0.5	-*	RL≤0.3	-*	CC≤0.4
	+	IQ≥1.14	+	VA≥ 3.14	+	PSAV ≥ 2.51	+	GE ≥1.12	+	RQ≥1.3	+	RL≥1.23	+	CC ≥1.47

- Eff” shows the sign and significance of the impact of natural resource dependency (RD) on growth.
- “Thr” means threshold indicating the IQ range in which the marginal RD impact is negative and significant using Wald test (first row), and the impact becomes positive (second row).
- * means significance level at 1 percent.
- The column numbers represent the regression models presented in Table 3.

In the next step, the IQ is broken down into six categories and the

1. We added a dummy variable for transition economies because of their recent institutional changes (Albania, Armenia, Azerbaijan, Belarus, Bulgaria, Croatia, Georgia, Hungary, Kazakhstan, Kyrgyz Republic, Latvia, Lithuania, Macedonia, FYR, Moldova, Mongolia, Montenegro, Poland, Romania, Russian Federation, Serbia, Slovenia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan). The dummy variable was insignificant and the results did not change.

results are presented in Columns 4-9 of Table 3. The overall results in all regressions are the same as those in regression 3, but the IQ thresholds for the sign and the significance levels vary. Table 6 shows the ranges of IQs in which the marginal effects of resource dependency ($\frac{\partial G}{\partial RD}$) are significant and the thresholds by which they become positive. In all regressions, resource dependency has either a negative effect which is alleviated with an improvement in various types of IQ, or no significant effect on growth. The marginal effects of RD on growth at different levels of IQ are also shown in Figure 4. Overall, IQ improves the effect of RD on growth, but the extent by which the improvement takes place depends on the type of IQ. For instance, GE has the highest impact on RD-growth relationship followed by RL, RQ, CC, PSAV, and VA. That is, an improvement in the quality of government effectiveness would help resource dependent countries to exit the resource curse zone more and faster than the improvement in the quality of the other institutional qualities such as PSAV and VA. In fact, GE, RL, RQ, and CC reflect the government's ability to formulate and implement rules and laws while VA and PSAV represent political condition and the level of democracy, which might not necessarily boost economic growth. These results seem in line with those of Acemoglu and Robinson (2010) and Collier and Hoeffler (2009), who argue that checks and balances are more important than democracy in a resource dependent country. This implies that some individual freedom and good rules are necessary but not sufficient to evade the mismanagement of resource windfalls. However, implementing adequate rules in a transparent environment free from corruption would permit resource incomes to be used productively. The existence of democracy per se does not establish such a condition.

Table 6 shows the marginal effect of IQ and its components on GDP growth, given different levels of resource dependency. The results show that the impact of IQ and its components on GDP growth increases as countries become more resource dependent. Table7 shows the relative importance of different types of IQs on GDP growth given different degrees of resource dependency. For instance, in countries where RD is between 40-60 percent, the most effective institutional quality is GE followed by RL, CC, RQ, and PSAV. In all resource dependent groups, except the last one, where RD is between 0-10 percent, GE has the most impact on GDP growth.

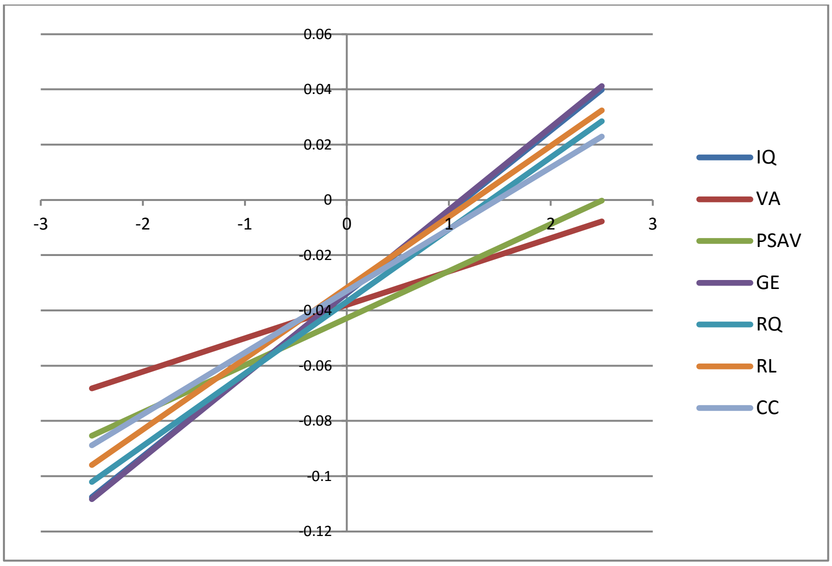


Figure 4: The Marginal Effect of RD at Different Levels of IQ

Table 6: Marginal Effects of IQ and its Components on GDP Growth[1]

RD %	Q	dVA	dPSAV	dGE	dRQ	dRL	dCC
40-60	1.73*	1.46	1.14*	1.49*	1.30*	1.43*	1.37*
30-40	1.05*	0.69	0.65*	1.04*	0.90*	0.90*	0.81*
20-30	0.63*	0.22	0.35*	0.77*	0.66*	0.57*	0.47*
10-20	0.31*	-0.14	0.12	0.55*	0.47*	0.32*	0.20
0-10	-0.07	-0.57*	-0.16	0.30	0.25	0.02	-0.11

1. The marginal effects are calculated based on the estimation results reported in Table3.
* represents significance level at 1 percent

Table 7: Relative Importance of Institutional Qualities for Different RD

RD (%)	Institional Quality				
40-60	GE	RL	CC	RQ	PSAV
30-40	GE	RQ	RL	CC	PSAV
20-30	GE	RQ	RL	CC	PSAV
10-20	GE	RQ	RL		
0-10	VA				

VA= Voice and Accountability, PSAV=Political Stability and Absence of Violence, GE=Governance Effectiveness, RQ=Regularity Quality, RL=Rule of Law, CC= Control of Corruption.

To address the effect of “point source” vs. “diffuse” sources, the resource dependency indicator (RD) is divided into three measures: the share of fuel, metal and ores exports in GDP as a proxy for point source resources and the shares of food exports and agricultural exports in GDP as proxies for diffuse sources. The estimation process outlined in Table 3 is redone, but with different measures for RD[1]. The results show that the effect of RA on growth is positive and significant, but fuel, metal and ores (FUELMET) dependency has negative and significant effect on growth. Furthermore, the estimated coefficient of the IQ interaction term shows a positive and significant effect on growth, indicating that the better IQ will alleviate the negative impact of fuel dependency on growth. Also, similar to previous results, the marginal effect of resource dependency ($\frac{\partial G}{\partial RD}$) is either significantly negative or neutral. The Wald test results also indicate that the marginal effect of fuel dependency becomes insignificant at the higher levels of IQ. That is, better institutional qualities can reduce the curse of fuel dependency.

The regression results when IQ is divided into its components show that GE, RQ, RL, and CC have almost the same impact on the RD – growth relationship, while VA and PSAV are less important. The estimation results when we use food export ratio as an indicator for resource dependency show that the negative effect of food dependency on growth is more than that of fuel dependency. The results also indicate that the IQ improvement is more effective in reducing the curse in the case of food dependency than of fuel dependency (except for VA). That is, one unit improvement in the institutional qualities alleviates more of the negative effect of food dependency on growth than of the negative effect of fuel dependency. The Wald test results demonstrate that food exports are either curse or neutral, but they become beneficial when IQ exceeds 1.7. Overall, there are three effects of RD on growth depending on different levels of IQ: The effect is positive and significant for high levels of IQ, negative and significant (natural resource curse) for low levels of IQ, and neutral if IQ is in the mid ranges. Except for VA, PSAV, and CC,

1. To save space, the regression results are not reported here, but they are available from the authors upon request.

the same pattern exists for GE, RQ, and RL with GE having the highest effect on the impact of food dependency on growth followed by RL, RQ, CC, PSAV, and VA. That is, an improvement in governance effectiveness quality helps food dependent countries get out of the resource curse zone more than does improvement in other IQs. As in fuel dependent countries, PSAV and VA have the least importance in food dependent countries.

Finally, agricultural dependency has a negative effect on growth, but better IQs would help alleviate the negative impact. In comparison with the food and fuel dependency, agriculture dependency leaves more room for IQ improvement to reduce the negative impact of RD on growth. The estimation results also show that RD has negative and insignificant effect on growth when RQ is considered as IQ, a positive and insignificant effect when GE, RL, and CC are considered as IQ, and a negative and significant effect when VA and PSAV are used for IQ. F-statistic results of Wald test indicate that the marginal effect of agricultural dependency on growth is positive and significant when IQ is equal and greater than 0.04 and negative and significant when IQ is less than -0.03. The same pattern can be seen with different types of IQ. That is, the marginal effect of agriculture dependency is positive in good IQ, negative in bad IQ, and neutral in middle IQ ranges. For instance, the marginal effect of agricultural dependency is positive and significant when GE $\geq$ 0.3, negative and significant when GE $\leq$ -0.7 and insignificant when -0.7 < GE < 0.8. These results indicate that although agriculture has a positive effect on growth, the blessing is conditioned by good institutions. These results cast doubt on the idea that the resource curse can be attributed only to “point source” resources such as fuel, metal, and ores exports. Among different types of IQ, RL and RQ are the most important institutional qualities affecting the marginal effect of food dependency on growth followed by PSAV, CC, GE, and VA. That is, an improvement in rule of law and regulatory quality is more effective in agricultural dependent countries. These results can be justified based on the fact that RQ reflects the policies and regulations that permit and promote private sector development, and RL the implementation of property rights. This result is in line with previous work in which privatization, property rights (RQ), and control of corruption (CC) promote economic growth in agriculture dependent countries (Mwangi and Meinzen Dick, 2009).

6. Discussion

The results clearly indicate the positive effect of IQ on growth through its interaction with natural resource dependency. The legitimate policy question will then be how much investment in IQ in comparison with the investment in physical capital is needed in order to improve economic performance. In other words, given limited resources and the fact that changes in IQ are often demanding and slow, would a country be better off to invest in IQ or in its physical capital? To address this question, we compare the outcomes of these two options for different resource dependent countries by calculating elasticities, regardless of the nature of these two variables and their limitations. Table 8 reports the growth elasticises for IQ, I, and RD for different RD groups.

The following observations from the results reported in Table 8 can be made. First, the improvement in institutional quality on GDP growth is more pronounced in countries with higher natural resource dependency. Specifically, the IQ elasticity of GDP growth is positive and significant when natural resource dependency is 16 percent and increases when countries become more resource dependent. For instance, in countries with high degrees of resource dependency (40-60 %), one percent increase in IQ would increase GDP growth by 0.20 percent, but the impacts are only 0.03 percent for countries with average degrees of resource dependency (30-40 %), and 0.004 percent for the low RD countries. In other words, one percent improvement in IQ would increase the average GDP growth from 1.97 percent to about 1.99 percent in high resource dependent countries, but from 4.36 to 4.37 percent in mid-range RDs and zero in low resource dependence countries. Second, in comparison with physical investment, IQ has less effect on GDP growth across all RD groups. For instance, in the first group, the investment elasticity of GDP growth is 8.6 times more than the IQ elasticity of GDP growth. Specifically, one percent increase in investment rate increases GDP growth by 1.72 percent (from 1.97 percent to 2.02 percent), while one percent increase in IQ would increase GDP growth by 0.20 percent (from 1.97 percent to 1.99 percent). This implies that to obtain the same effect of investment on GDP, IQ should improve from -0.22 to -0.20. Third, the importance of investment on physical capital over institutional quality increases as countries become less resource dependent. For instance, the ratio of investment elasticity to the IQ elasticity for the low RD group is 222.5 versus 8.6 for high RD group. That is, the significance of improving IQ relative to investing in physical capital is stronger for countries with higher resource dependency. Finally, resource dependency has a negative effect on GDP growth, and the effect intensifies as the level of natural resource dependency rises. For example, in the low RD group (0-10%), the RD elasticity is -0.03 percent, whereas in high RD group (40-60 %), it is -1.12 percent, a ratio of 1 to 37.

Table 8: Resource Dependency (RD) and Institutional Quality (IQ) Elasticity of GDP Growth

RD %	EIQ(%)	ERD(%)	EI(%)	IQ1	IQ2	G1	G2	I
40-60	0.20	-1.12	1.72	-0.23	-0.21	1.99	1.97	22.87
30-40	0.10	-0.43	0.97	-0.39	-0.35	3.86	3.84	25.05
20-30	0.03	-0.22	0.88	-0.17	-0.11	4.37	4.36	25.75
10-20	0.002	-0.14	0.84	-0.03	0.08	3.75	3.74	21.10
0-10	0.004	-0.03	0.89	0.23	0.70	3.77	3.77	22.49

- RD: Resource Dependency
- EIQ: the IQ elasticity of GDP growth, EIQ = $\frac{d(G)}{d(IQ)} \times \frac{IQ}{G}$, where $\frac{d(G)}{d(IQ)} = \alpha_6 + \alpha_7 RD$ in equation 10 and G is GDP growth.
- ERD: the RD elasticity of GDP growth, ERD = $\frac{d(G)}{d(RD)} \times \frac{RD}{G}$, where $\frac{d(G)}{d(RD)} = \alpha_4 + \alpha_7 IQ$ in equation 10. EI: Investment elasticity of GDP growth, EI = $\frac{d(G)}{d(I)} \times \frac{I}{G}$. $\frac{d(G)}{d(I)}$ is 15 percent.
- IQ: Institutional quality. IQ1 is the initial IQ. IQ2 shows the new level of IQs required to achieve the same growth level as I rises by 1%.

These results call for diverse policies in different countries depending on their degree of natural resource dependency and their levels of IQ. Although the overall effect of investment on growth is stronger than that of IQ, investment in IQ in high resource dependent countries, which often are at the low end of IQ, would have a much higher impact on growth than in low RD countries.

7. Conclusion

Natural resources as production factors can be considered a blessing. However, the poor economic performance of some resource-rich countries has lent support to the argument that natural resources may be a curse. Economists have proposed economic and non-economic transmission channels to explain the puzzle. The decreasing trend of commodity price, revenue volatility due to commodity price volatility, exchange rate, and structural changes can be categorized as economic channels for explaining the natural resource curse. Non-economic channels, such as institutional quality, may also help us explain if the natural resources are detrimental to prosperity.

The paper investigates the effects of the natural resources on long-run economic performance across a large number of countries over a long period. We distinguish between the natural resource abundance (RA) and the natural resource dependency (RD) and show that while the former, measured by the natural capital per person, has a positive and significant impact on GDP growth, the latter, measured by the share of total primary and fuel exports in GDP, has a negative but insignificant effect on growth

Our study also finds that the RD impact on growth is conditioned on institutional qualities. In other words, although natural resource dependency is detrimental to growth, good institutional qualities can ameliorate the predicament. The results show that in all levels of IQ and its components (VA, PSAV, GE, RQ, RL, and CC), RD, when measured by total primary and fuel exports shares of GDP, has either negative (in low IQs) or no (in high IQs) effect on growth. On the other hand, RD, when measured by food and agriculture shares in GDP, influences growth according to the level of IQ: RD is a curse when IQ is low, neutral in mid-ranges of IQ, and a blessing when high. These results support the "point source" argument indicating that fuel and metals dependency is curse, but the negative effect of agriculture and food dependency is conditional on the level of IQ. Therefore, fuel, metal and ores dependency can be called a *strong curse,* and food and agriculture dependency a *weak curse*.

Institutional quality can help reduce the curse or may even turn it into a blessing, but it is not obvious what type of institutional qualities is most beneficial in reaping the benefits of natural resources. This has important policy implications for government or international agencies who tend to invest in improvements of the institutions in resource-rich countries to avoid the curse. Our results show that VA, which represents democracy, is less effective in all types of resource dependency.

Resource abundance as wealth is beneficial to economic growth, but resource dependency may hinder it. Specifically, in fuel dependent countries, resource dependency is a curse or has no long-run effect on growth; agriculture and food dependency are detrimental to growth but high IQ inhibits the negative effect of RD on growth. Furthermore, in food and fuel dependent countries, GE, RL, RQ, and CC are more beneficial in alleviating the curse of RD, calling for prudent systems of checks and balances. In agriculture dependent countries, RL and RQ play more important roles, pointing out the importance of property rights in managing natural resources. Furthermore, although the overall effect of physical capital investment on growth is larger than that of investment on IQ, the difference becomes much smaller for higher RD countries. This implies that policies on improving IQ will be more effective in countries with higher degrees of RD.

Although a variety of measures for natural resource dependency are used and many variables are controlled for in this study, the results might be subject to a caveat. One concern is that the share of primary exports in GDP may not be an adequate proxy for natural resource dependency. Some countries, such as Japan, are resource-poor, but their manufacturing industry relies heavily on imports of natural resources from other countries and, therefore, can be considered as natural resource dependent countries. Furthermore, some countries use their natural resources domestically rather than exporting. In both cases, whether natural resources are imported or domestically produced and used, they are embodied in other products and are, therefore, not included in our measure of natural resource dependency. Unfortunately, the detailed data on natural resources embodied in final products is not readily available for cross-country analysis. Furthermore, we define natural resource dependency based on how a country's income is dependent on its final natural resources commodities. From this perspective, countries using natural resources as an intermediate good in production process are not considered as resource dependent.

References

Acemoglu, D., Johnson, S., & Robinson, J. (2001). Colonial Origins of Comparative Development: An Empirical Investigation. *American Economic Review*, *91*(5), 1369-1401.

Acemoglu, D., & Robinson, J. (2010). The Role of Institutions in Growth and Development. *Review of Economics and Institutions*, *1*(2), 1-33.

Aghion, P., & Howitt, P. (2009). *The Economics of Growth*. Massachusetts: The MIT Press.

Alexeev, M., & Conrad, R. (2011). The Natural Resource Curse and Economic Transition. *Economic Systems*, *35*(4), 445-461.

Arezki, R., & Ploeg, F. V. D. (2011). Do Natural Resources Depress Income Per Capita? *Review of Development Economics*, *15*(3), 504-521.

Bhattacharyya, S., & Hodler, R. (2010). Natural Resources, Democracy and Corruption. *European Economic Review*, *54*(4), 608-621

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

Boyce, R. J., & Herbert Emery, J. C. (2011). Is A Negative Correlation Between Resource Abundance And Growth Sufficient Evidence That There Is A Resource Curse? *Resource Policy, 36*, 1-13.

Brunnschweiler, C. N., & Bulte, E. H. (2006). The Resource Curse Revisited and Revised. *CER-ETH - Center of Economic Research at ETH Zurich*, *Working Paper,* Retrieved from www.cer.ethz.ch.

Cavalcanti, T. 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*, 305-318.

Collier, P., & Hoeffler, A. (2009). Testing the Neo-Con Agenda: Democracy in Resource-Rich Societies. *European Economic Review*, *53*, 293-308.

---------- (1998). On Economic Causes of Civil War. *Oxford Economic Papers*, *50*(4), 563-573.

Corden, W. M. (1984). Booming Sector and Dutch Disease Economics: Survey and Consolidation. *Oxford Economic Papers*, *36*(3), 359-380.

Dietz, S., Neumayer, E., & de Soysa, I. (2007). Corruption, the Resource Curse and Genuine Saving. *Environment and Development Economics*, *12*(1), 33-53.

Frankel, J. A. (2010). The Natural Resource Curse: A Survey. *NBER Working Paper*, *15836*, Retrieved from http://www.nber.org.

Gylfason, T. (2011). Natural Resource Endowment: A Mixed Blessing? *CESifo Working Paper*, Retrieved from http://www.cesifo-group.de/ifoHome/publications/working-papers/CESifoWP.html.

Haber, S., & Menaldo, V. (2009). Do Natural Resources Fuel Authoritarianism? A Reappraisal of the Resource Curse. *American Political Science Review*, *105*(1), 1-26.

Hall, R., & Jones, C. (1999). Why Do Some Countries Produce So Much More Output per Worker than Others? *Quarterly Journal of Economics*, *114*(1), 83-116.

Hirschman, A. O. (1958). *The Strategy of Economic Development*. New Haven: Yale University Press.

Hodler, R. (2006). The Curse of Natural Resources in Fractionalized Countries. *European Economic Review*, *50*(6), 1367-86.

Jones, C. I. (2002). *Introduction to Economic Growth* (2nd Ed.). New York: Norton.

Keefer, P. (2010). Database of Political Institutions: Changes and Variable Definitions. Retrieved from https://openknowledge.worldbank.org/.

Matsuyama, K. (1992). Agricultural Productivity, Comparative Advantage and Economic Growth. *Journal of Economic Theory*, *58*(2), 317-334.

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

Moshiri, S. (2015). Asymmetric Effects of Oil Price Shocks in Oil-Exporting Countries; The Role of Institutions. *The OPEC Energy Review, 39*(2), 222-246.

Mwangi, E., & Meinzen-Dick, R. S. (2009). Understanding Property Rights in Land and Natural Resource Management. In J. F. Kirsten, A. R. Dorward, C. Poulten, & N. Vink (Ed.), *Institutional Economics Perspectives on African Agricultural Development*. Washington, DC: International Food Policy Research Institute (IFPRI).

Nomman, A. M., Maas, S., & Schmitz, P. M. (2010). Analyzing Agricultural Productivity Growth in a Framework of Institutional Quality. Retrieved from http://purl.umn.edu/90793.

Polterovich, V., Popov, V., & Toni's, A. (2010). Resource Abundance: A Curse or Blessing? *DESA Working Paper*, Retrieved from http://www.un.org/esa/desa/papers/2010/wp93_2010.pdf.

Ross, M. (2001). Does Oil Hinder Democracy? *World Politics*, *53*(3), 325-361.

Sachs, J. D., & Warner, A. M. (2001). Natural resources and economic development: The curse of natural resources. *European Economic Review*, *45*, 827-838.

---------- (1997). Sources of Slow Growth in African Economies. *Journal of African Economies*, *6*(3), 335-376.

---------- (1995). Natural Resource Abundance and Economic Growth. In G. Meier, & J. Rauch (Eds.), *Leading Issues in Economic Development*. New York: Oxford University Press.

Sala-I-Martin, X., & Subramanian, A. (2003). Addressing the Natural Resource Curse: An Illustration from Nigeria. *IMF Working Paper*, Retrieved from https://repositori.upf.edu/bitstream/handle/10230/344/685.pdf?sequence=1&isAllowed=y.

Tornell, A., & Lane, P. (1999). The Voracity Effect. *American Economic Revi*ew, *89*(1), 22-46.

Torvik, R. (2001). Learning by Doing and the Dutch Disease. *European Economic Review, 45*, 285-306.

Appendix

List of Variables and Data Source

Variable	Definition	Source
TOTEX (RD)	Share of total primary export in GDP. Total primary export is the sum of four commodity exports (Fuel, Metal and ores, Food, and Agriculture) during 1996- 2010	WDI
AGRI (RD)	Share of agricultural raw materials exports in GDP during 1996-2010. "Agricultural raw materials comprise SITC section 2 (crude materials except fuels) excluding divisions 22, 27 (crude fertilizers and minerals excluding coal, petroleum, and precious stones), and 28 (metalliferous ores and scrap).	WDI
FOOD (RD)	Food exports share in GDP during 1996-2010. Food comprises the commodities in SITC sections 0 (food and live animals), 1 (beverages and tobacco), and 4 (animal and vegetable oils and fats) and SITC division 22 (oil seeds, oil nuts, and oil kernels).	WDI
FUELMET (RD)	Share of Ores and metals exports in GDP during 1996-2010.Fuels exports includes mineral fuels in SITC section 3. ().Ores and metals exports includes the commodities in SITC sections 27 (crude fertilizer, minerals); 28 (metalliferous ores, scrap); and 68 (non-ferrous metals).	WDI
RA	The proxy for Resource Abundance is the logarithm of Word Bank's natural capital per person in 2000. Natural capital includes Sub-soil assets (oil, natural gas, hard coal, soft coal, bauxite, copper, gold, iron ore, lead, nickel, phosphate rock, silver, tin, zinc), Forest (timber assets: round wood and fuel wood), Forest (non-timber forest assets), Cropland, Pasture land, and Protected areas.[2]	World Bank
IQ	Institutional Quality is an un-weighted average of six aggregate governance indicators-VA, PSAV, GE, RQ, RL, and CC. The database includes 212 countries' governance information for the periods 1996, 1998, 2000, 2002-2010	WGI[3]
VA	Voice and Accountability captures perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.	WGI

Variable	Definition	Source
PSAV	Political Stability and Absence of Violence captures perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism.	WGI
GE	Government Effectiveness captures 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.	WGI
RQ	Regulatory Quality captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development	WGI
RL	Rule of Law captures 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.	WGI
CC	Control of Corruption captures 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.	WGI

1. World Development Indicators (World Bank)
2. The natural resource wealth is calculated using the total existing and future rents based on assumptions on future growth and interest rates.
3. Worldwide Governance Indicators (WGI) research project (Word Bank).[1]

1. More details on the methodology of estimation and dataset can be found in: Kaufmann D., A. Kraay and M. Mastruzzi (2010), "The Worldwide Governance Indicators: A Summary of Methodology, Data and Analytical Issues", *World Bank Policy Research Working Paper No. 5430* and www.govindicators.org.