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POLITICAL ECONOMY AND RENT SEEKING: A JOINT EXPLANTION OF THE RESOURCE CURSE

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Submitted to the Economics Faculty
in partial fulfillment of the requirements for the degree of
Bachelor of Science in Business Administration

December 2010

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The purpose of this paper is to provide a better explanation for the resource "curse." To achieve this, a theoretical model combining both political economy and rent seeking mechanisms is proposed. Combining the two mechanisms, which are favored in the literature, provides a more in-depth analysis than previous literature has offered. Empirical testing, using the results from the theoretical model, applies the theory to the real world and confirms the results proposed from the theoretical model.

The goal of this paper was combine the results of previous literature and demonstrate that both rent seeking and political economy explanations can be held accountable for the resource "curse." The theoretical model proposed in this paper shows that both rent seeking and political economy explanations can determine the result of resources and when the two are combined the problem is only exacerbated. The empirical testing confirms the validity of these results.

JEL classifications: C70, D02, H20, O13, O20

Key words: resource curse, rent seeking, political economy

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I. Foundations of the Resource Curse

A logical conclusion can be drawn that a large endowment of natural resources is beneficial. However, much empirical analysis shows the opposite, citing resources in many situations as a "curse." For example, GDP per capita fell by 1.3% per year on average in OPEC countries from 1965 to 1998 (Gylfason, 2001). To be more specific, Sachs and Warner (1995, 1999) find that a one standard deviation increase in natural resource intensity is correlated with a 1% decrease in economic growth per year.

There are three main categories of possible explanations for the resource curse; Dutch disease models, political-economy models, and explanations of endogenous institutions (Damania and Bulte, 2003). Explanations grounded in Dutch disease revolve around decreasing terms of trade and the resulting lack of development in manufacturing industries because of the relative resource abundance. Political-economy models are driven by the assumption that resource rents are easily earned by those in power. The rents are easily earned through the decision making by those in power, examples being policy decisions, and the rents are then used for the benefit of those in power. This ease of capture tends to provide the incentive for inefficient resource extraction and allocation. Endogenous institution models are developed on the assumption that resource rich countries, especially those with point resources[1], have often been controlled by predatory institutions that promote the interests of those in power or other very narrow interests. This differs from the political economy model by the formality of the institution. Endogenous institutions are most often associated with informal institutions and when concerning resources rent seeking is the

[1] Point resources are resources that can be extracted and sold without further refinement, for example crude oil.

primary example. Also, these institutions, both formal and informal, have the tendency to have lasting impact, even though the policies of a country may change (Rodrik, 2001).

It is more likely that the true cause is not simply one of these scenarios but a combination of them. Combining the centralized (political economy/leader's behavior) and decentralized (rent-seeking) mechanisms will create a scenario that more accurately mimics the real world and will provide a more sufficient insight.

II. Literature Review

Many researchers find similar negative relationships between resources and growth (Gylfason, 2001; Bulte et al., 2004; Sachs and Warner 2001; etc.). These results have led researchers to three different conclusions, Dutch-disease models, political-economy models, and models of endogenous institutions. The literature will be divided into these categories.

A. Dutch Disease

Natural resource producers, more specifically oil producers, are likely to crowd out non-resource traded goods sector when a relative abundance of natural resources is present (van Wijnbergen, 1984). This occurs because of the likely transfer of employment and capital from non-resource industries to the natural resource production industry. Over time this divergence is likely to grow as the country gains dependence on the natural resource industries. This dependence causes more employment and capital to move from non-resource to natural resource production, likely at the cost of efficiency.

Krugman (1987) equates the discovery of natural resources (like the discovery of natural gas in the Netherlands) and the income earned as if it were a pure transfer payment from abroad. The short run effects are predicated upon the size of the transfer payment (resource endowment). Thus, a small transfer payment will increase wages but will not alter specialization but a larger transfer payment will likely increase wages to the point that the cost of wages offsets the productivity and changes the pattern of specialization. The long run effects are determined by the duration of the payments. The longer the payments last, the longer the wages stay high. When this occurs the likelihood industries return after the payments stop decreases.

Sachs and Warner (1995) further the Dutch disease arguments by empirically showing that countries with large amount of resource exports relative to GDP, experienced slow or negative growth over the period 1970-1990. When economic growth variables, which previous research had concluded significant (initial GDP, openness policy, investment rates, human capital accumulation, external terms of trade, government expenditure, trade volatility, government institutions), were controlled for the inverse relationship holds.

Sachs and Warner (2001) conclude that countries, since the 1970s, with relative resource abundance have experienced stagnant economic growth. When geographic or climate variables are introduced there is little evidence that they have any effect on growth. Evidence also suggests that resource abundant countries are correlated with high-priced economies (cost of goods is relatively higher). This inflated price tends to crowd-out exports and thus these countries are unlikely to experience export led growth, even though much of their GDP is exports.

B. Political Economy

Political economy models are based on the notion that those in political power can influence industry. Influence can be demonstrated through policy, tax rates, or simply controlling the industry in the country they control.

Auty (2001) comments on the necessary conditions for sustained economic development. Research previous had proposed four conditions; relatively equitable access to land and education (Squire, 1993), effective markets and public accountability (World Bank, 1993), open trade policy (Sachs and Warner, 1995), and competitive economic diversification (Balassa, 1985). Auty adds a fifth condition a "developmental political state." The developmental political state has two key assumptions; sufficient autonomy to pursue economic policy and the goal of raising welfare long-term. Auty finds that the developmental political state is strongly correlated with countries with relatively low natural resources. The proposed reasons for the correlation are; intense pressure on land resources creates a low tolerance for rent extraction, low resource endowments create the incentive for effective resource allocation, trade policy openness is correlated with resource endowment, and economic diversification happens sooner and at a lower per capita income. It is likely that resource abundant countries create foundations for their own slow economic growth.

Acemoglu et al. (2003) show that Kleptocrats, rulers that implement highly ineffective economic policy for personal gain, most often use the political strategy of divide-and-rule. This strategy is made possible by the weak institutional structure that exists in these societies and increases the intensity of collective action issues. Kleptocratic rulers are likely to use foreign aid and natural resource rents to maintain power and buy off opponents.

Robinson et al. (2006) propose a political economy model that present similar results to those of modeling the endogenous institutions. By studying the political incentives in resource extraction, their research demonstrates a theoretical growth in the public sector caused by resource endowment. This growth tends to be inefficient in two ways. First, resources are allocated to areas in which they normally would not be. Thus, workers move to resource extraction, where if not for the resources and public sector jobs they would work in other sectors. The second form of inefficiency resides in the government expenditure. Politicians seek to remain in power and provide more generous public programs using much of the rents gained from the resource extraction. These public programs continue, forcing a greater rate of extraction or increased government debt. The level of inefficiency depends on the quality of institutions; a lower quality institution would result in worse policies and more inefficiency.

Caselli and Cunningham (2009) propose multiple theoretical political economy models explaining how political elite can affect resource extraction and cause slow or negative growth. The paper includes models of four specific leader types the Busy Leader, the Repressive Leader, the Strategic Leader, and the Fatalistic Leader. Each leader has different characteristics and goals but each, when endowed with natural resources, reaches a similar outcome.

C. Endogenous Institutions

Knack and Keefer (1995) use institutional indicators compiled by the International Country Risk Guide and Business Environmental Risk Intelligence to perform a cross-country analysis determining how institutional quality influences economic performance. The analysis concludes the institutions that protect property rights are crucial for economic growth and this effect remains even after controlling for investment.

Leite and Weidmann (1999) show how natural resource intensity can create opportunities for rent seeking. The amount of rent seeking opportunities is an important factor in determining the level of corruption in the county. Using a basic growth model Leite and Weidmann show the interrelationship between natural resources, corruption, and economic growth. They determine these factors to be crucial in determining a countries economic growth prospects. The results from both the theoretical and empirical models demonstrate that institutions are an important aspect of economic growth.

Rodrik (2000) concludes that institutions are necessary for economic growth, yet there is no objective way to identify “good” institutions from “bad.” Institutions that allow markets to function adequately are associated with economic growth and vice versa. To create “good” institutions a good practice is to include local knowledge. Democracy is an effective way for adding local knowledge to institutions and available evidence suggests that democracies are associated with high-quality growth.

Torvik (2001) creates a theoretical model that shows rent seeking and increasing returns to scale can be the cause of decreased welfare in natural resource intensive areas. With a model that includes rent seeking as a factor, a higher natural resource endowment increases the number of entrepreneurs. These entrepreneurs are more likely to increase productivity in the resource industry. Increased productivity decreases welfare if the increased profits provide incentive for rent seeking. The increased incentive for rent seeking also is likely to draw entrepreneurs away from other productive areas of the economy.

Damania and Bulte (2003) develop a theoretical model combining the rent seeking and lobbying efforts of firms with the behavior expected from governments endowed with resources. This model seeks to demonstrate the conditions under which the resource curse can exist. The resource curse, according to their model, may exist because firms are successful in lobbying attempts for semi-public goods in the resource sector or the lack of political competition. Thus, a resource boom would cause increased lobbying and would lead the government to pursue policies benefitting the resource industry at the expense of the manufacturing sector. This change in policy would lead to decreases in the manufacturing industry, decreases welfare, and slows economic growth. Damania and Bulte find that empirical evidence is consistent with this theory.

Bulte et al (2004) provide empirical research determining the effect of resources on not only economic growth but a larger set of variables more related to welfare and development. They find that point resources are associated with less democratic regimes and regimes of lower institutional quality. The explanations for this vary, but are centered on those in power wishing to maintain in power. They also find that countries exhibiting resource curse symptoms tend to score lower on a broader scale of variables, not just economic growth. They also find that resource quantity has no significant impact on growth, that institutional quality is a much more likely vehicle for growth.

The quality of institutions, as determined by Mehlum, Moene, and Torvik (2006), are the primary concern in determining whether a country will experience the resource curse. Using data that imitates Sachs and Warner (2005) they determine producer friendly institutions tend to decrease the tendency of rent seeking and use the resource abundance to its full advantage. This conclusion empirically rules out resources as a curse and also Dutch disease explanations and contributes that the mix of resource abundance and poor institutions is more likely to lead to depressed growth.

Dietz et al. (2007) seek to empirically determine the effect of resource endowment and corruption on the level of genuine saving. Genuine saving is a measure of total investment in capital and generally thought of as a necessary condition for economic growth. Lower levels of genuine savings are correlated with lower levels of future growth. They find that institutional quality, using corruption, bureaucratic quality and rule of law indices as proxies, is correlated with the level of genuine saving. Thus, reducing the level of corruption is correlated with an increase in genuine saving. The increase in genuine saving will increase the future economic growth, regardless of the resource endowment of the country.

III. Methodology

A. Theoretical Model

The current state of the resource curse literature consists of research that considers only one of the proposed explanations as tenable. One exception to this is the research done by Damania and Bulte (2003) that considers primarily the influence of government policy on rent seeking. While this begins to address both political economy and the rent seeking explanations, it does not address the fact that the government or those in power may act to capture some or all of the resource rent for themselves.

For that reason, this paper considers both rent seeking and political economy explanations by defining a model that includes both a rent seeking and political economy mechanisms for the extraction of resources.

1. Industry

Following the form of previous rent seeking literature, the country has a set number of entrepreneurs, N. This can be divided into two categories, resource industry, R_t, and value-added manufacturing/production, P_t, such that:

$$N = R_t + P_t \tag{1.1}$$

where *t* denotes the period. (Mehlum et. al, 2006; Nizan, 1993) Entrepreneurs commit to one industry for a given period, but have the ability to switch after each period. This designation explains the relative costs to switching industries.

The country also has a set number of available natural resources, β_t. Thus, defining p_{r_t}as the price of natural resources, the natural resource extracted is Δ_t, and the revenue from resources can be expressed as $\Delta_t p_{r_t}$. The firm employs labor defined as L_t. The labor input explaines the amount of resources the entrepreneur can extract. Thus, the total expenditure on inputs is $p_{Lt}L_t$. Also, the leader may impose an *ad valorem* tax on resource revenue, let this be defined as t_{r_t}. Therefore the potential revenue from resource extractions is defined as:

$$\pi_{rt} = (\Delta_t p_{r_t} - p_{Lt}L_t)(1 - t_{r_t}) \tag{1.2}$$

The potential income from value added manufacturing/production is the total value of goods produced for both public and private consumption. The distinction between the two goods, public and private, is necessary to form a link from the models of the entrepreneur to the political leader. Similarly, the leader may again impose an *ad valorem* tax on the production industry, denoted as t_{p_t}. The revenue of a firm in this sector is:

$$\pi_{P_t} = (G_t p_{Gt} - p_{Lt} L_t)(1 - t_{p_t}) \quad (1.3)$$

where π_{P_t} is the annual profit, G_t is quantity of goods produced, and p_{Gt} is the price of the good.

The entrepreneur plays a mixed strategy, thus X_t is the probability that the entrepreneur selects the resource industry in any period. The entrepreneur seeks to maximize the expected profit, for any period *t,* denoted as:

$$E(\pi) = \frac{X_t}{\lambda}(\pi_{rt}) + (1 - X_t)(\pi_{pt}) \quad (1.4)$$

Again, following the rent seeking literature (Mehlum, et al, 2006) λ is an informal institutional parameter, defined from 0 to 1, measuring the ease of resource rent capture. Considering $\frac{1}{\lambda}$, for smaller values of λ a relatively large gain from resource extraction is expected, conversely for larger values of λ relatively smaller gains are expected. When $\lambda = 1$, there are no rents available from resource extraction.

The entrepreneur is constrained by the production function, which can be defined as:

$$G_t = \sqrt{L_t} \quad (1.5)$$

for the production industry. Labor is defined nested under the square root as a way to address decreasing returns to scale.

The production function for the resource industry is defined as:

$$\Delta_t = \frac{\beta_t}{R_t} - \sqrt{L_t} \quad (1.6)$$

Recall β is the finite quantity of resources in the country. Therefore, the amount of resources the entrepreneur can extract is a function of the amount that have been previous been extracted by the entrepreneur's firm, Δ_k, but also the amount that has been extracted by others, Γ_k. λ_k is included because an increase in the availability of resource rents is likely to cause an increase in resource extraction. Again, labor and capital are defined nested under the square root as a way to provide for decreasing returns to scale.

2. Political Leader

Following the basic form of the model proposed by Caselli and Cunningham (2009) the probability of remaining in power is a function of non-resource development, military/secret police spending, and economic strategy. Increasing resource holdings raises the likelihood of civil war/coup. Thus the function for remaining in power is:

$$v = v(e, t, M, G, \varphi) \tag{1.7}$$

Where t is the tax policy, M is the military/secret police spending, G is public goods spending, and the leader may also claim some or all of the resources in the country as property of the state, defined in the first period to be $\varphi_1 < 1$. Where φ_t is the percentage of available resources the leader claims during each period.

Assume this function takes the form:

$$v = \frac{G_t^a M_t^b}{t_{rt} t_{pt} \varphi_t} \tag{1.8}$$

where *a* and *b* are variables denoting the preferences of the populace and leader respectively. For example, a society based on liberty would prefer private to public goods and for this reason the value of *a* in this scenario would be lower than that of a socialistic society. An example for *b* is a tyrannous leader, who prefers to rule by military strength, would have a larger value than peaceful leaders.[2]

In the first period, the leader is given an exogenously determined revenue stock. For example, the revenue stock can be thought as the national debt/surplus the previous leader has passed along and gives insight into the lasting institutional structure. These funds are then allocated by the leader to spending on public goods, denoted as G_t, which are purchased from the entrepreneurs in the country, military spending for the year, denoted as M_t. Where t denotes the period. The leader may supplement the revenue flow by taxing the industry in the country or by claiming and selling a portion of the resources. Thus, t_{pt} is the manufacturing/production tax rate and t_{rt} is the resource extraction tax rate. Thus the constraint function of the leader is:

$$\alpha_t = \alpha_{t-1} - G_t p_{Gt} - M_t p_{Mt} + t_{rt}\pi_R + t_{pt}\pi_P + \varphi_t \beta_t P_{\beta t} \tag{1.9}$$

3. Theoretical Methodology

This model assumes simultaneity of strategy selection as it is unlikely that neither the political leader nor the entrepreneur has a means of observing each other's behavior prior to their selection of strategy. While the argument can be made that either the political leader or the entrepreneur could delay their action to view the strategy of the other, this type of behavior requires a different modeling technique and diverges from the purpose of this analysis.

The leader does not know when he will concede power and thus shall assume he will govern ad infinitum.[3] Also, it is likely the entrepreneur acts similarly setting strategies such that his firm

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[2] It can be assumed that for the purposes of this model the preferences of both the leader and the society are common knowledge.

[3] Setting a term limit will could diminish Laffer-curve type arguments as the leader will likely have little incentive not to set the tax rate at 100% for the final year. Therefore, by mathematical induction, it is likely setting a term

will last. For this analysis, assume the length of the game is the random variable, k, which is unknown to both the leader and the rest of the country.

This use of a multi-period game necessitates the use of a discount factor. For the purposes of this model a simple way to define the discount factor is the patience the leader or entrepreneurs have regarding the future. On the margin, as the discount factor becomes smaller the actors tend to favor the present in regard to their decisions. Thus, ϕ_i is defined as an exogenously determined discount factor, for each player i, which does not vary over time. ϕ_i is a continuous variable defined over the range (0,1].

4. Solutions

Entrepreneur

Maximizing the entrepreneur's profit function in the production industry yields these results:

$$G_t = {}^{1/p_{Lt}}\!\big/_{2} \tag{1.10}$$

$$L_t = {}^{1}\!/_{4p_{Lt}^2} \tag{1.11}$$

Similarly, maximizing the entrepreneur's profit function in the resource industry yields these results:

$$\Delta_t = {}^{\beta_t^2 p_{\Delta t}}\!\big/_{2p_{Lt}R_t^2} \tag{1.12}$$

limit will skew the results of the entire term. This, however, may not be an issue as the tax rates are contained in the objective function of the leader.

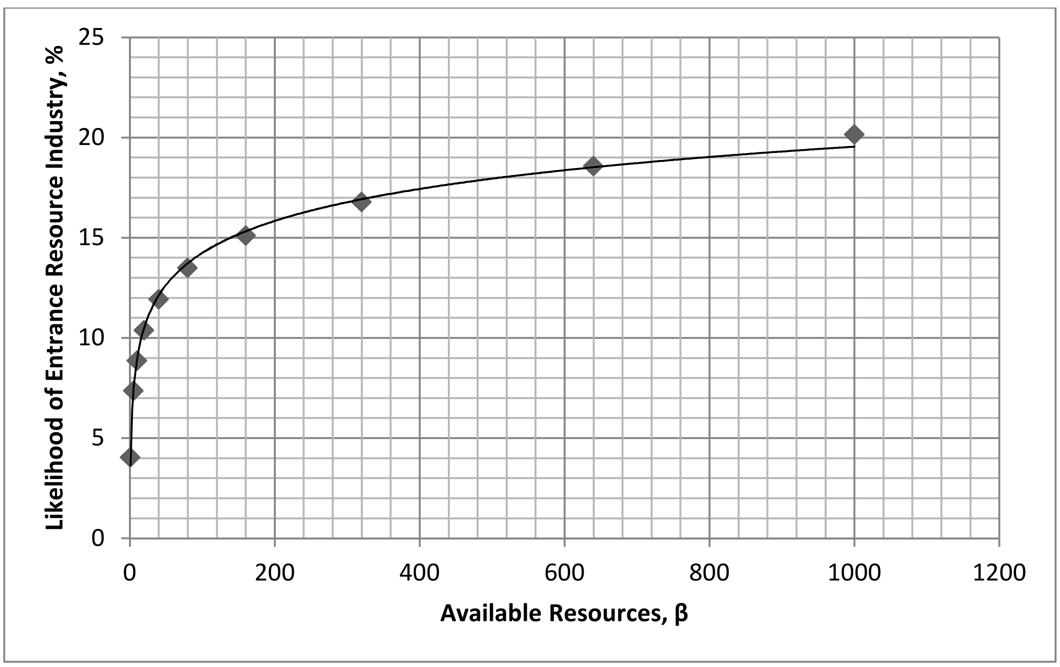
$$L_t = \beta_t^2 p_{\Delta t}^2 / 4R_t^2 p_{Lt}^2 \quad (1.13)$$

These solutions can then be substituted into the expected profit function, equation 1.4, to determine the optimal mixed strategy for the entrepreneur. Taking the derivative of this function with respect to X_t yields the best response function for the entrepreneur, shown below[4]:

$$BR_X = \frac{\beta_t^2 p_{\Delta t}^2(\phi^{j+1} - \phi)}{4(\phi - 1)R_t^2 p_{Lt}\lambda} \quad (1.14)$$

The best response function shows that as the amount of resources increases the value of X_t also increases. Table 1 shows the likelihood the entrepreneur enters the resource industry, in a given period, as the amount of resources increases, ceteris paribus.

Table 1: Resource Effects on Industry Entrance

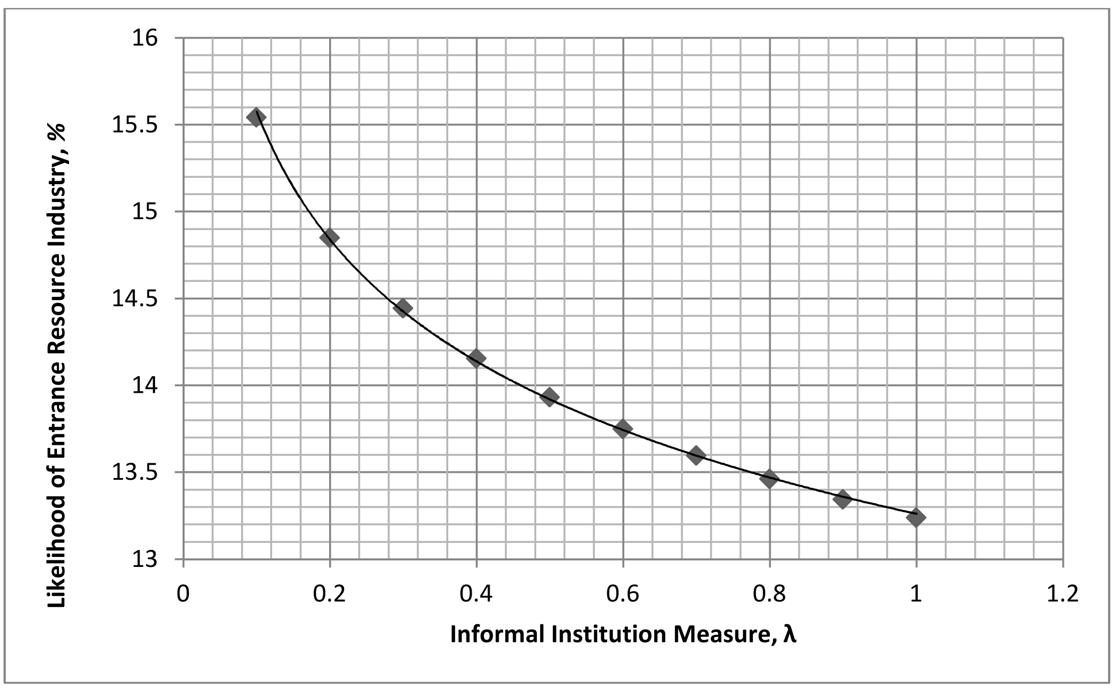


[4] The results are presented in this fashion as a pure solution for *X* was unobtainable.

This makes it easily identifiable that as the quantity of resources increases the likelihood of entrepreneurs entering the resource industry. It also shows exponential relationship between the quantity of resources and the likelihood of entrance.

It is also necessary to determine the effect that informal institutions, λ (quantifying the ease of rent capture), have on the decisions of the entrepreneurs. The best response function for X_t shows that as λ decreases (i.e. rent capture becomes easier and more lucrative) the likelihood of entrepreneurs entering the resource industry becomes higher. Table 2 graphically depicts this relationship.

Table 2: Informal Institution Effects on Industry Entrance



Political Leader

Solving the leader's objective function constrained by the revenue flow yields these solutions:

$$G_t = -\frac{a(\phi^{j+1}\alpha_t - \phi\alpha_t - j\phi\alpha + j\alpha)}{p_{Mt}(a-3-b)\phi(\phi^j - 1)} \tag{1.15}$$

$$M_t = -\frac{b(\phi^{j+1}\alpha_t - \phi\alpha_t - j\phi\alpha + j\alpha)}{p_{Mt}\phi(b\phi^j - a - b + 3 - 3\phi^j + a\phi^j)} \tag{1.16}$$

$$t_{pt} = -\frac{\phi^{j+1}\alpha_t - \phi\alpha_t - j\phi\alpha + j\alpha}{\pi_{pt}P_t\phi(b\phi^j - a - b + 3 - 3\phi^j + a\phi^j)} \tag{1.17}$$

$$t_{rt} = -\frac{\phi^{j+1}\alpha_t - \phi\alpha_t - j\phi\alpha + j\alpha}{\pi_{rt}R_t\phi(b\phi^j - a - b + 3 - 3\phi^j + a\phi^j)} \tag{1.18}$$

$$\varphi_t = -\frac{\phi^{j+1}\alpha_t - \phi\alpha_t - j\phi\alpha + j\alpha}{\beta_t p_{\Delta t}\phi(b\phi^j - a - b + 3 - 3\phi^j + a\phi^j)} \tag{1.19}$$

While these solutions begin to offer some explanation to the choices the political leader will make, they are not by necessity the key piece to the puzzle. The goal is to determine the marginal effect of resources on the choices of the political leader. To do so necessitates finding the partial derivative of these solutions with respect to the quantity of resources. Resources are only a factor in the solutions for φ_i and t_{ri}, therefore only these results are analyzed.[5] The partial derivatives are presented below:

$$\frac{\partial\varphi_t}{\partial\beta_t} = \frac{\phi^{j+1}\alpha_t - \phi\alpha_t - j\phi\alpha + j\alpha}{\beta_t^2 p_{\Delta t}\phi(b\phi^j - a - b + 3 - 3\phi^j + a\phi^j)} \tag{1.20}$$

$$\frac{\partial t_{rt}}{\partial\beta_t} = \frac{8(\phi\alpha_t - \phi^{j+1}\alpha_t - j\alpha + j\phi\alpha)p_{Lt}}{\beta_t^3 R_t p_{\Delta t}^2\phi(b\phi^j - a - b + 3 - 3\phi^j + a\phi^j)} \tag{1.21}$$

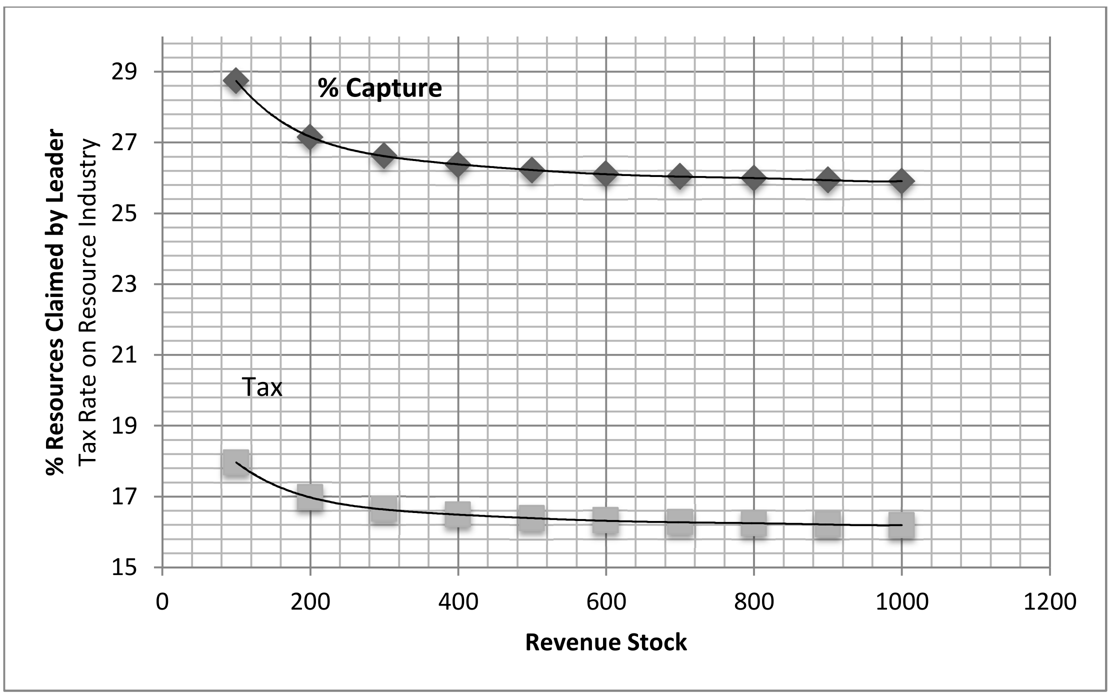
The positive sign on both the partial derivative of t_{ri} and φ_i demonstrates that as the amount of resources increases the tax rate and percentage of resources claimed in that period also increase. Using these variables as indicators for institutional quality, the model predicts a

[5] t_{ri} can be analyzed because we know the profits in the resource industry are a function quantity of resources

decrease in institutional quality as the amount of resources increase. Although because of the nature of the model this decline will be asymptotic.

An interesting result from this model is displayed in Table 3 below. Table 3 shows the marginal effect of an increased initial revenue stock on both the percentage of resources claimed by the leader and the tax rate on the resource industry.

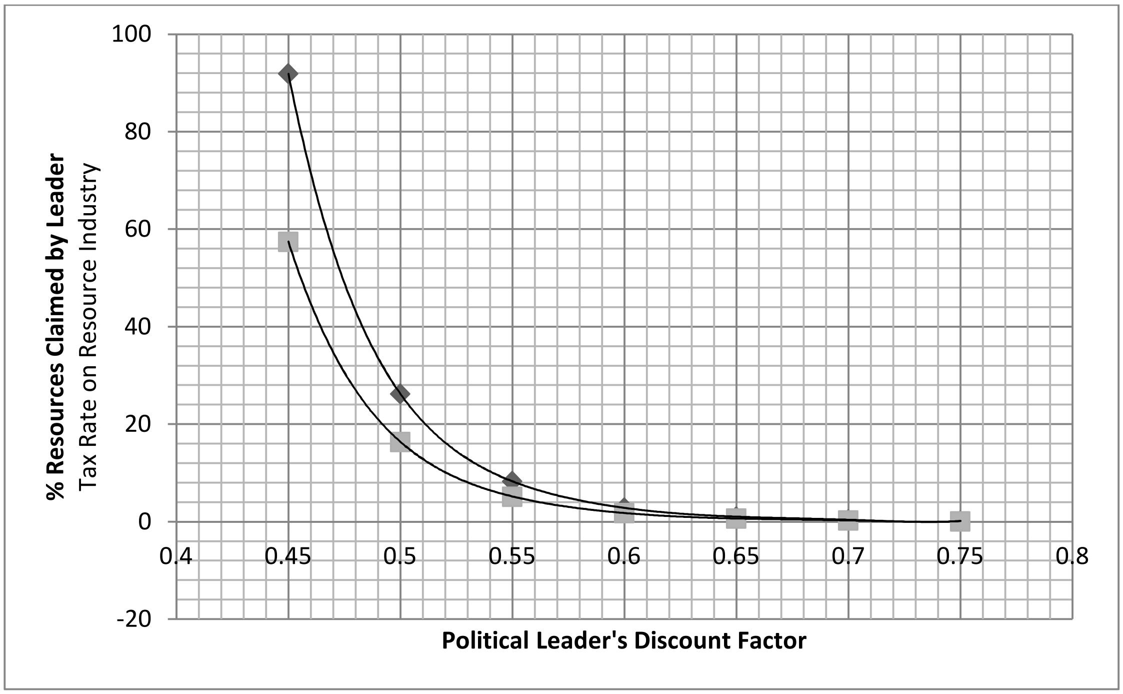
Table 3: Revenue Stock Effects on Institutional Quality



The graph above shows that as the revenue stock, the budgetary situation passed on to current leader, increases both the percentage of resources claimed and the tax rate on the resource industry decrease. This result can be explained by the path dependence that the research of Rodrik (2000) proposes, hence good policy decisions by the previous leader are correlated with good decisions by the current leader. Similarly, good policy decisions by the leader early on lead to good policy decisions in the future and vice versa.

Another conclusion that can be drawn from this model is the effect of the discount factor of the leader on that leader's behavior. Table 4 shows this relationship.

Table 4: Revenue Stock Effects on Institutional Quality



This result shows that as the leader's discount factor decreases, thus as the leader values the future less, the propensity to increase tax rates or the amount of resources claimed is increased. For example, imagine a leader faced with an upcoming war. In this instance if the leader does not have the funding to win the war, the future would not matter to them. For that reason the leader changes his behavior to increase his likelihood of winning the war and remaining in power.

The model has demonstrated that increases in resources provide the incentive for both the political leader and the entrepreneur to engage in behavior that is unlikely to help the country. The political leader has the incentive to decrease the quality of institutions and the entrepreneur has the incentive to decrease the likelihood of locating in value-added industry.

While these results on their own demonstrate how resources could be considered a curse, the combination of the results shows how the curse becomes worse over time. The leader has the incentive to decrease the quality of institutions because of the resources. By doing so the leader seeking to remain in power must offset this decline by either a) appeasing the population by giving public goods or b) increasing the military strength for protection. As time passes the leader will need to continue to offset the decline in institutions and must continue decreasing the quality of institutions.

However, we also know that resources provide the incentive for the entrepreneur to enter the resource industry more frequently. This incentive is strengthened as the quality of institutions decline and rent seeking behavior becomes more lucrative. Considering that the leader is likely to continue to decrease the quality of institutions, the entrepreneur increases the likelihood of entering the resource industry.

B. Empirical Testing

1. Data

The empirical portion of this paper seeks to confirm these hypotheses, that resources coupled with poor formal and informal institutions are the true cause for the resource "curse." To perform these tests data on resources, institutions, growth rates is necessary, in addition to the necessary controls. The data set represents a cross-section of 169 countries in a time-series panel for 5 years, 2005-2009.[6]

As with any empirical testing with developing countries the availability of data is always the primary issue. The choice of time frame reflects this issue. Only very recently have

[6] A full list of countries is presented in Appendix 1.

organizations like the World Bank and the International Monetary Fund (IMF) began to collect robust data on the topics necessary to carry out my empirical testing. Increasing the time frame results in the loss of many developing countries, which would bias the results of the testing as only more developed countries would be included. The time frame also accommodates the use of data from the World Bank's Country Policy and Institutional Assessment (CPIA). Unfortunately, this dataset became publicly available in 2005, limiting the duration of the time series.

The data also diverges from the standard resource curse data set used by Sachs and Warner (1995a, 199b,1999) and others. There are two reasons for this divergence. The first is that the data used by Sachs and Warner does not include the proper variables to test my hypothesis. The second is the quality and overuse of the data used by Sachs and Warner. Also, using updated data allows the application of the model to current times and the recent past.

The data included in this study is obtained from multiple sources. Institutional measures are obtained from the World Bank CPIA, an annual study[7] that is made up of 16 indicators coming from four main clusters of data: economic management, structural policies, social inclusion, and public sector management and institutions. Additional institutional measures were obtained from Transparency International's Corruption Perceptions Index (CPI) which aggregates multiple surveys and studies and reports the level of corruption in each country. This scores measures institutions on a scale where the lower the number the better the institutions are.[8]

Data on levels of resources was obtained from the U.S. Department of Energy's Energy Information Administration (EIA) which publishes country level data on petroleum, natural gas,

[7] Made publicly available starting in 2005.
[8] A full description of the CPI methodology is provided in Appendix 2

electricity, coal, nuclear, and renewable and alternative fuel sources. While these measures do not directly measure the total amount of available resource, it misses things like gold, minerals, etc., it does provide ample data of energy resources which are often cited by previous resource curse literature (Krugman, 1987; Sala-i-Martin, Subramanian, 2003; etc.).

The IMF provides the country level financial data needed which includes growth rates and other financial controls. To complete the data set controls are obtained from the World Bank's list of indicators, which includes a measures of ores and metals available to supplement the EIA resource data. The complete list of variables are presented in Table 5 below.

Table 5: Variable Names and Summary Statistics

Variable Names	Mean	Min	Max
Total Oil Supply	498.5771949	0	11096.30789
Total Oil Value	33444.02759	0	1031126.832
Natural Gas Reserves	36.38185207	0	1680
Natural Gas Value	252.4674488	0	14599.2
Coal Production	41861.40726	0	3362049.647
Value of Coal Production	2031683.578	0	201151430.4
Total Energy Resources	42212.98599	0	3365106.373
Total Value of Resources	2056515.602	0	201295005.9
CPI	6.0	0.3	10
Consumer price index (2005 = 100)	493.9003739	98.34031	293318.0234
Cost of business start-up procedures (% of GNI per capita)	69.5959799	0	6375.5
Cost to export (US$ per container)	1307.645327	335	5497
GDP per capita (constant 2000 US$)	7213.061246	107.0322	56624.72787
Cost to import (US$ per container)	1512.642766	317	6150
Military expenditure (% of GDP)	2.114355736	0	11.81519818
Net taxes on products (current US$)	28091542057	0	9.632E+11
Industry, value added (% of GDP)	32.07366	7.698	95.696

2. Econometric Models

The proposed econometric models seek to test the conclusions from the theoretical section. These hypotheses include the effect of resources on the formal institutions of a country and the location and concentration of industry. To do so I estimate these models:

$$Institions_{it} = \beta_0 + \beta_1(resource\ intensity_{it}) + (X_{it})\beta_k + \xi_i + \delta_t + u_{it} \qquad (2.1)$$

$$Industry\ Concentration_{it} = \beta_0 + \beta_1(resource\ intensity_{it}) + (X_{it})\beta_k + \xi_i + \delta_t + u_{it} \quad (2.2)$$

where β_i are the estimated coefficients, X_{it} is a matrix of control variables, ξ_i is the country specific error component, δ_t is the time specific error component, and u_{it} is the error term.

In testing the first of the hypotheses the dependent variable used is censored. For the CPI data, which measures institutions in equation 2.1, the upper limit is 10 which is the highest level of corruption. To account for this the model is estimated using both OLS and the Tobit procedures presented by Tobin (1958).

With any panel data set it is necessary to properly specify the type of error component the regression will have. A Hausman test confirms the superiority of the fixed effects model estimated with OLS and error terms have been specified for both a time and country components.[9] For models in which Tobit estimation techniques were used random effects model have been estimated. Random effects have been used with the Tobit estimation to prevent potential bias in estimation.[10] The specification error, which would result in inflated standard

[9] For results of the Hausman test see Appendix 3.

[10] Bias does not come as a result of misspecification but rather the inexistence of a sufficient statistic to condition the fixed effects in the maximum likelihood procedure.

errors, is a safer alternative to the potential bias that may occur with the fixed effects estimation procedures.

3. Results and Analysis

The results of the estimation of model 2.1 with both OLS and Tobit procedures are presented in Table 6.[11]

Table 6: Estimation Results (Model 2.1) Resource Effects on Institutions

Variable	OLS	Tobit
Value of Resources	1.63E-13	1.79E-13
Import Costs	0.000463***	0.000417***
Consumer Price Index	-0.00344**	-0.00266***
Military Expenditure (per capita)	-0.0689**	-0.053**
GDP (per capita, real)	-0.0000584*	-0.000155***
R-squared	0.6845	0.3797
Observations	621	621
* significant at 10%, ** at 5%, and *** at 1%		

The main result from Table 6 is the positive coefficient estimate for the effect of resources. The key is not the magnitude of the estimate but simply whether the estimate is positive or negative. It is unlikely that the magnitude is of much importance as it is difficult to measure what exactly an *x* increase in institutions would be.

The theoretical model demonstrated that an increase in resources is associated with an increase in tax rates, which are used as an indicator for the quality of formal institutions. In this case as well, the CPI scores are also used as an indicator for the quality of formal institutions and again, empirically, the result holds. This work demonstrates that increased amounts of resources are associated with lower quality institutions. Like previous researchers have shown (Rodrik,

[11] Pseudo R squares are reported for Tobit estimation and constants are not reported in this and all future tables. For robustness resource quantities were included instead of value these results are reported in Appendix 4.

2000, etc.) the lower the quality of institutions the less likely countries are to experience economic growth. This is one potential explanation for why resources are correlated with slow or negative growth.

While not including major results, the estimated coefficients of the control variables can be theoretically justified. It makes sense that an increase in import costs is correlated with a decrease in quality of institutions. Similarly, increases in GDP per capita and the consumer price index being correlated with increases in institutions seem easily plausible.

The unexpected results from Table 6 were the estimate coefficient of military expenditure. Increasing the military expenditure, ceteris paribus, is likely associated with decreases in economic freedom. Anecdotally, it seems likely that decreases in economic freedom would be then associated with decreases in institutional quality. However, it is likely that the countries with larger economies are driving this result. The larger economies are correlated with institutional quality and the size of the economy allows for the increase in expenditure.

The unfortunate result is that the coefficient estimate for the value of resources was not statistically significant. This led to the conclusion that it was not the aggregate resource values, but rather individual resource effects that potentially drive the "curse." To test this hypothesis the total resource value was broken down into the values of specific commodities; oil, natural gas, and coal.

Disaggregating the resource measures used in Table 6 and re-estimating model 2.2 provide these results, shown in Table 7.

Table 7: Estimation Results (Model 2.1) Disaggregated Resource Effects on Institutions

Variable	OLS	Tobit
Oil Value	0.000000647	0.00000116***
Natural Gas Value	1.71E-13	1.81E-13
Coal Value	-6.03E-11	-7.43E-11
Import Costs	0.000457***	0.000409***
Consumer Price Index	-0.00342**	-0.00297***
Military Expenditure (per capita)	-0.0348**	-0.0511**
GDP (per capita, real)	-0.0000586*	-0.000158***
R-squared	0.6574	0.3876
Observations	621	621
* significant at 10%, ** at 5%, and *** at 1%		

When the resources are disaggregated the effects of the individual resources can be determined. As many would expect, the positive coefficient estimate tends to confirm that the resource "curse" is most likely to present itself when considering oil. Oil is relatively easy to find, produce, and ship and the vast majority of the world uses petroleum products in some form or another. The value of oil is also much greater than the other resources. While it is difficult to compare the values of the resources because of the varying measurements of quantity, the average value of oil stock is around 175 times larger than the natural gas or coal stocks. Considering the previous political economy literature (Acemoglu, (2003); Robinson (2006); Caselli and Cunningham (2009)) and the ease of production and value of oil makes it evident why oil is the main factor when considering the resource curse.

The coefficient estimate on natural gas is also positive, although lacking statistical significance in both estimations, and could also be a contributor to the resource curse. Although the production is more difficult and the value less than that of oil, natural gas is still a widely used commodity and can be considered as a potential cause of the resource curse for the same reasons as oil.

Unexpectedly, the coefficient estimate on coal is negative, although again it also lacks statistical significance. The simplest explanation for the coefficient on coal being negative is that it is the least valuable of the three resources considered and also the easiest to use. Given the choice it is likely that a political leader would choose to produce and sell one of the other resources because of their value.

The results from the control variables are similar in magnitude and maintain the same signs as estimated with an aggregated resource figure. The explanations are the same as reported above.

To test the hypothesis that resources value-added production model 2.2 is estimated using OLS procedures, the results are presented in Table 9.

Table 8: Estimation Results (Model 2.2) Resource Effects on Industry Concentration

Variable	OLS	Tobit
Value of Resources	-2.09E-12	-7.85E-13
Export Costs	-0.000943	-0.000827*
Military Expenditure (per capita)	-1.238***	-0.904***
GDP (per capita, real)	-0.000502	-0.0000933
Cost of Business Start-up	0.00344*	0.00228
Net Taxes on Products	-3.96E-12	-7.08E-13
R-squared	0.1347	0.1952
Observations	505	505
* significant at 10%, ** at 5%, and *** at 1%		

The key result in Table 8 is the negative sign on the coefficient estimate of the value of resources. Again the magnitude of the result is not of great importance, as again it is difficult to interpret. Recall the conclusion of the theoretical model, an increase in the amount of resources led to the entrepreneur choosing to enter the resource industry more often. The negative coefficient estimate of the value of resource begins to confirm this conclusion.

The coefficient estimates of the control variables also have the sign that theory would predict. Exports costs, military expenditures, and taxes all reduce the incentive of entrepreneurs to produce value-added goods and the coefficient estimates reflect this. The two unexpected results are the estimates of GDP and cost of business start-up. However, it is likely that GDP is negative because this measure does not include value-added services and much of the larger economies have high percentages of service imports and exports. For examples, services account for around 90% of the GDP of the United Kingdom. The positive estimate on cost of business start-up can be explained because the additional start-up costs are relatively small compared to the costs of entry (plant, machinery, etc.). For other industries that do not bear the high entry costs the increase start-up costs could dissuade entry.

Once again the coefficient estimate of value of resources lacks statistical significance. This forces the consideration of the individual values of resources themselves and not the aggregated values. To do so the results from Table 8 are re-estimated using variables for the values of the individual resources. The results are reported in Table 9.

Table 9: Estimation Results (Model 2.2) Disaggregated Resource Effects on Industry Concentration

Variable	OLS	Tobit
Value of Oil	-0.00000426	0.0000109**
Value of Natural Gas	-2.03E-12	-8.72E-13
Value of Coal	-0.0000000372***	-0.0000000404***
Export Costs	-0.00149**	-0.00132**
Military Expenditure (per ca	-1.213***	-0.8491***
GDP (per capita, real)	-0.00037	-0.0000905
Cost of Business Start-up	0.00278	0.00186
Net Taxes on Products	-2.7E-12	-7.06E-12
R-squared	0.1607	0.2
Observations	505	505
* significant at 10%, ** at 5%, and *** at 1%		

When broken down the results of the OLS estimates are similar to the estimates when the resources were aggregated. Each resource has an estimated negative coefficient, thus each resource is correlated with a decline in value-added production if these estimates are true. This result would also help confirm the results of the theoretical model.

However, if the Tobit estimates are true the estimate of oil has a positive sign. While the other resource estimates remain negative, the positive sign on the oil estimate is necessary to investigate, especially since it was the major factor in the estimated deterioration of institutional measure. Considering the Tobit estimate is correct, the most likely cause for the oil estimate to be positive is the fact that oil is the most likely resource to be refined. Refining raw oil into any of the petroleum by-products would add towards the value-added production. An increase in the quantity and value of the oil reserves makes it more likely refinement would take place. The other resource estimates remain negative because it is unlikely that either would be refined, adding nothing to the value-added production.

The control variables maintain the signs as estimated with aggregated resource variable. Their magnitudes are slightly different, but the explanations are the same as presented above.

IV. Implications

The majority of the implications of this research lie in the conclusions of the theoretical model, while the empirical testing is used to confirm the application of these conclusions to the real world. The main conclusions from the theoretical model are that resources negatively affect the institutions and the concentration of value-added industry in a country.

The application of these results leads to questioning what good institutions are and how to implement them. Countries that have large amounts of resources but have high quality institutions, for example Canada and Norway, do not experience the resource curse. It is the countries that do not have good institutions that experience the curse.

In order to prevent the resource curse the institutions of countries must be changed. However, both previous research and this paper demonstrate that there is path dependence to institutional quality. If policies can be made that will break the path dependence and restart the institutional structure the question becomes what are qualities of good institutions? These qualities are hard to determine and previous research has done a poor job defining them. Defining the characteristics of good institutions and what these characteristics actually do is a necessity for future research. The results of this analysis and any other like it cannot be applied without first determining these qualities.

The rest of the extensions for future research are in the political economy explanation. The adaptation of a similar model to different objectives of the political leader is necessary. It is easy to argue that the goal of the political leader is not to remain in power but for some other goal. For example, the leader may seek to maximize the value of being in power (monetary gains), be a benevolent leader and promote the welfare of citizens, or be a leviathan leader and maximize the power of government. While it seems unlikely that the objective of the leader will change the outcomes of the analysis it is necessary to prove that this is the case.

V. Conclusion

The purpose of this paper was two-fold. The first was to provide a more accurate depiction of the resource curse by combining two theoretical explanations, political economy and rent seeking. The second was to empirically test the results that were derived from the theoretical model.

The theoretical model provides two main conclusions that resources negatively affect the institutional quality and decrease the incentive for entrepreneurs to enter value-added industries. Using tax rates and claims to resources as an indicator for the institutional quality as the amount of resources increase in the country the political leader has the incentive to increase both. The decrease in institutional quality, shown by previous research, causes the growth prospects of the country to decline. When this occurs the political leader is forced down the slippery slope of increasing the revenues, either by taxes or by selling off claimed resources, to appease the citizens by providing public goods or by employing a more powerful military to keep the leader in power.

The entrepreneur also has the incentive as resources rise to decrease the likelihood of entering in a value-added production industry. Again, previous research shows that a decrease in the value-added industry is a detriment to the growth prospects of the nation. Also, as the quality of informal institutions declines the incentive for rent seeking increases further decreasing the likelihood of the entrepreneur entering in value-added production industry.

By accounting for both explanations this paper demonstrates the vicious cycle that resources represent to the growth prospects of a nation. The resources provide the incentive for both the political leaders and the entrepreneurs to engage in behavior that negatively affects the growth prospects of the nation. When this behavior begins it is difficult to stop. The leader is forced to continue the deterioration of the institutional quality. The reduction in institutional quality is met with the increased incentive for the entrepreneur to engage in rent seeking behavior and the vicious cycle continues.

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Appendix 1:List of Countries

Afghanistan	Dominica	Latvia	Romania
Albania	Dominican Republic	Lebanon	Russia
Algeria	Ecuador	Lesotho	Rwanda
Angola	Egypt	Liberia	Saudi Arabia
Argentina	El Salvador	Libya	Senegal
Armenia	Equatorial Guinea	Lithuania	Serbia
Australia	Eritrea	Luxembourg	Seychelles
Austria	Estonia	Macau	Sierra Leone
Azerbaijan	Ethiopia	Macedonia	Singapore
Bahrain	Finland	Madagascar	Slovakia
Bangladesh	France	Malawi	Slovenia
Barbados	Gabon	Malaysia	Somalia
Belarus	Gambia, The	Maldives	South Africa
Belgium	Georgia	Mali	Spain
Belize	Germany	Malta	Sri Lanka
Benin	Ghana	Mauritania	Sudan
Bhutan	Greece	Mauritius	Suriname
Bolivia	Guatemala	Mexico	Swaziland
Bosnia and Herzego	Guinea	Moldova	Sweden
Botswana	Guinea-Bissau	Mongolia	Switzerland
Brazil	Guyana	Montenegro	Syria
Bulgaria	Haiti	Morocco	Tajikistan
Burkina Faso	Honduras	Mozambique	Tanzania
Burundi	Hong Kong	Burma (Myanmar)	Thailand
Cambodia	Hungary	Namibia	Timor-Leste (East T
Cameroon	Iceland	Nepal	Togo
Canada	India	Netherlands	Trinidad and Toba
Cape Verde	Indonesia	New Zealand	Tunisia
Central African Rep	Iran	Nicaragua	Turkey
Chad	Iraq	Niger	Turkmenistan
Chile	Ireland	Nigeria	Uganda
China	Israel	Norway	Ukraine
Colombia	Italy	Oman	United Arab Emira
Comoros	Jamaica	Pakistan	United Kingdom
Congo (Kinshasa)	Japan	Panama	United States
Costa Rica	Jordan	Papua New Guine	Uruguay
Cote dIvoire (IvoryC	Kazakhstan	Paraguay	Uzbekistan
Croatia	Kenya	Peru	Venezuela
Cuba	Korea, South	Philippines	Vietnam
Cyprus	Kuwait	Poland	Yemen
Czech Republic	Kyrgyzstan	Portugal	Zambia
Denmark	Laos	Qatar	Zimbabwe
Djibouti			

Appendix 2: CPI Methodology

The Corruption Perceptions Index (CPI), published by Transparency International, is an annual data set that ranks countries and politician based on their perceived level of corruption. The CPI is a composite index that aggregates data on the same phenomenon in order to create the most reliable measure possible. Data for the CPI comes from 10 sources which are listed below:

1. Africa Development Bank- Country Policy and Institutional Assessments 2009 (AFDB 2009)
2. Asian Development Bank -Country Performance Assessment Ratings 2009 (ADB 2009)
3. Bertelsmann Foundation- Bertelsmann Transformation Index (BF 2009)
4. Economist Intelligence Unit -Country Risk Service and Country Forecast 2009 (EIU 2010)
5. Freedom House -Nations in Transit 2009 (FH 2010)
6. Global Insights, formerly World Markets Research Centre- Country Risk Ratings 2009 (GI 2010)
7. Institute for Management Development - World Competitiveness Report 2009 and 2010 (IMD 2009 and IMD 2010)
8. Political and Economic Risk Consultancy, Hong Kong - Asian Intelligence 2009 and 2010 (PERC 2009 and PERC 2010).
9. World Economic Forum - Global Competitiveness Report 2009 and 2010 (WEF 2009 and WEF 2010)
10. World Bank - Country Policy and Institutional Assessments for IDA Countries (WB 2009)

In addition to collecting this data Transparency International completes two surveys to add robustness. The first is a business people opinion survey and the second is an assessment completed by expert analysts. Questions that may be asked in these surveys are similar to the following:

1: Has the government implemented executive anticorruption initiatives?

2: In your country, how commonly do the following firms pay bribes to public servants or public officials? (domestic and foreign firms)

Appendix 3: Hausman Test Results

Ho: Difference in Coefficients not Systematic		
	Chi Squared	Prob > Chi Square
Table 6	13.21	0.0103
Table 7	13.17	0.0219
Table 8	42.86	0
Table 9	89.44	0

Appendix 4: Robustness Check for Empirical Testing

Table 10: Estimation Results (Model 2.1) Resource Effects on Institutions

Variable	OLS	Tobit
Quantity of Resources	3.57E-13	5.53E-13
Import Costs	0.000467***	0.000419***
Consumer Price Index	-0.00346**	-0.00266***
Military Expenditure (per capita)	-0.069**	-0.053**
GDP (per capita, real)	-0.0000591*	-0.000155***
R-squared	0.686	0.3792
Observations	621	621
* significant at 10%, ** at 5%, and *** at 1%		

Table 11: Estimation Results (Model 2.1) Disaggregated Resource Effects on Institutions

Variable	OLS	Tobit
Oil Quantity	0.0000149	0.00000158***
Natural Gas Quantity	3.53E-13	6.3E-13
Coal Quantity	-7.74E-09	-6.9E-09
Import Costs	0.000467***	0.00042***
Consumer Price Index	-0.00345**	-0.00267***
Military Expenditure (per capita)	-0.0695**	-0.0613**
GDP (per capita, real)	-0.0000593*	-0.000158***
R-squared	0.6789	0.3871
Observations	621	621
* significant at 10%, ** at 5%, and *** at 1%		

Table 12: Estimation Results (Model 2.2) Resource Effects on Industry Concentration

Variable	OLS	Tobit
Quantity of Resources	-1.03E-11	-4.19E-12
Export Costs	-0.000947	-0.000831*
Military Expenditure (per capita)	-1.238***	-0.904***
GDP (per capita, real)	-0.000489	-0.0000934
Cost of Business Start-up	0.00341*	0.00227
Net Taxes on Products	-3.91E-12	-7E-13
R-squared	0.1334	0.1952
Observations	505	505
* significant at 10%, ** at 5%, and *** at 1%		

Table 13: Estimation Results (Model 2.2) Disaggregated Resource Effects on Industry Concentration

Variable	OLS	Tobit
Oil Quantity	-0.00000426	0.00219**
Natural Gas Quantity	-1.02E-11	-3.56E-12
Coal Quantity	-0.00000016***	-0.00000176***
Export Costs	-0.00143**	-0.00117**
Military Expenditure (per capita)	-1.198***	-0.899***
GDP (per capita, real)	-0.000354	-0.000102
Cost of Business Start-up	0.00247	0.00189
Net Taxes on Products	-2.7E-12	-7.79E-12
R-squared	0.16	0.2012
Observations	505	505
* significant at 10%, ** at 5%, and *** at 1%		