NATURAL RESOURCE RENTS AND INSTITUTIONAL CHANGE

by

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Brandon Christopher Scarborough

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ABSTRACT

Recent literature argues that nations with abundant natural resources – primarily oil and minerals – tend to grow more slowly comparatively to resource-poor nations. Much of this cross-national variation in economic performance may be explained by the interaction between natural resources and institutional quality. Focusing on the importance of economic institutions in the form of property rights and the rule of law this paper presents an alternative explanation for the diverging economic paths in resource rich nations. Economic rents generated from abundant oil and gas resources may affect institutions or institutional quality. Further, that impact on institutions is itself contingent upon the quality of such institutions during the payoff period of the resource windfalls. The findings suggest that resource wealth has a positive influence on the strength of property rights and the rule of law (and thus**,** by inference on economic growth) in the nations that start out with strong protection of property rights and associated rule of law, but a negative influence in nations that do not. The results appear robust to alternative specifications of the resource variable.

CHAPTER 1

INTRODUCTION

Intuition would suggest that wealth generated from an abundance of natural resources would be beneficial to an economy, catalyzing economic development and prosperity. Economically exploitable natural resources can generate a revenue stream for capital accumulation and investment in infrastructure in addition to improving export diversification and purchasing power over imports. Early developmental economists theorized the importance of natural resources in providing a stimulus for economic growth, notably in poor nations where windfall revenues may be necessary for overcoming capital and foreign exchange constraints[1] (e.g. Rosenstein-Rodan, 1961; Murphy et al., 1989) thus promoting industrialization and export diversity (Viner 1952).

Others have suggested that natural resource abundance may provide an advantage comparatively to countries less endowed with such resource wealth. For instance, Habakkuk (1962) argued that the US surpassed England economically in the 19th century because of the abundant natural resources. Similarly, the Scandinavian countries along with Argentina and Chile, all rich in natural resources, experienced rapid industrial growth and economic prosperity during the late 19th c (Bravo-Ortega & De Gregorio, 2003)

In sharp contrast to the earlier views, there is a growing literature documenting just the opposite, where resource poor countries are outperforming their resource rich

[1] Windfall gains were thought to provide the necessary "big push" for poorer countries to escape depauperate economic conditions.

counterparts. Spain, rich in gold and silver from the New World colonies, lagged behind resource-poor Netherlands during the seventeenth century (Sachs and Warner, 1995). During the nineteenth and twentieth centuries, Russia's economy faltered while Switzerland and Japan, both resource poor, experienced an economic boom[2]. Examples in the last three decades are widespread. The Asian Tigers: Taiwan, Singapore, Hong-Kong, and S. Korea all rely almost exclusively on imported natural resources; however they have significantly outperformed resource rich countries such as Russia, Venezuela, and Nigeria. This relationship is now widely referred to as the "resource curse"[3] , the thesis that resource-rich countries grow more slowly, comparatively to countries without abundant resources.

Casual observation, however, will reveal a number of resource rich countries, for instance, the US, Canada, Norway, and Botswana, among others, that have sustained impressive growth over the past three decades, which would suggest that resource wealth *per se* does not determine whether countries are infected by or immune to the purported curse. In response to such exceptions researchers have shifted their focus to the mechanistic pathway through which natural resource wealth may affect economic growth, specifically addressing the importance of institutional quality and the interactions *among* natural resources, institutions and economic growth[4]. This effort

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[2] Ibid

[3] Auty (1993) is generally credited as the first to use this term in the formal literature.

[4] In much of the literature an interpretation of the terms 'institutions' and 'institutional quality' are often left to reader. North (1981) defines institutions as "a set of rules, compliance procedures, and moral and ethical behavioral norms designed to constrain the behavior of individuals in the interests of maximizing the wealth or utility of principles" (pg. 201-202). In the context of this paper and related research often the terms are defined by the political and economic environment. More specifically, economic institutions may be more representative of the structure of property rights, rule of law, and the presence a market environment that provides economic incentives in a society. Economic institutions determine the

has resulted in a burgeoning literature, building on the existing institutions/growth literature and introducing potential macroeconomic and political implications of natural resource abundance and its impact on institutions and growth.

The role of institutions in promoting economic growth is well documented with widespread theoretical and empirical support for a number of diverse measures of institutional quality, encompassing property rights and the rule of law, political and economic freedoms, political stability, and quality of governance measures. While early research focused primarily on economic dimensions to explain the curse, notably the impact of resources on declining terms of trade, increased revenue volatility and unfavorable changes in exchange rates, more recent works have addressed the importance of institutions in order to better understand the relationship between natural resources and growth.

Not surprisingly, countries with growth-enhancing political and/or economic institutions in general outperform countries with comparatively weak institutions; an association that may help to explain why some resource abundant countries have sustained strong economic growth over time. And while a number of authors have confirmed this association, the transmission pathway through which natural resources may affect economies is still unclear.

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incentives for investment in physical and human capital and ensure the efficient allocation of resources. Political institutions are the foundation from which policy decisions are made, which determine the constraints and incentives of the political agents involved. Examples often include the type of governance, whether democratic, parliamentary, autocratic, etc. and the constraints imposed on key decision makers within the polity. This paper is more concerned with the presence and quality of economic institutions with the understanding that the political environment will affect economic institutions that will in turn impact future political institutions and economic growth.

A relatively new evolving literature is approaching the curse phenomenon from a politico-economic perspective, suggesting resource wealth may impact growth via its impact on institutions. For example, wealth generated from an abundance of natural resources is argued to deter democracy (Ross, 2001; Jenson and Wantchekon, 2004), spawn corruption (Leite and Weidmann, 1999), widen income inequalities (Gylfason and Zoega, 2002), motivate rent-seeking activities (see e.g. Torvik, 2002) and induce sloth (Sachs and Warner, 1995). Further, Sala-i-Martin and Subramanian (2003) argue that the negative impact of natural resources on institutions is the primary cause of poor economic growth among resource-rich nations.

Further exploration of these interactions between natural resources and institutional quality, with a primary focus on property rights and the rule of law, may provide a better understanding of the role of natural resources in a nation's economic performance. Specifically this paper argues that abundant resources, more importantly wealth generated from those resources, may impact institutions or institutional quality; however that impact on institutions is itself contingent upon the quality of such institutions during the payoff period of the resource windfalls. Subsequently, any changes in institutional quality will likely affect economic performance over time.

In many nations the rights to subsurface natural resources are held by the central government. Control of the rights to the resources means control of generated revenue from those resources, subject to any institutional constraints. This is especially relevant for point source resources (e.g. oil and minerals), which are generally concentrated both spatially and in ownership. Furthermore such resources potentially produce large rents

comparatively to other natural resources, for instance timber or agriculture. Petroleum reserves can affect a producer nation's wealth even when the price of petroleum is low if production costs are low enough and during periods of high oil prices, as seen in the 1970s, oil rich nations realized significant increases in wealth. Whether such windfall gains are used to fuel an economy or appropriated for personal gains by political agents will depend on constraints imposed by existing institutions.

It is likely that resource rents are more easily appropriated for personal, rather than national benefit, where institutional quality (e.g. property rights, which provide individual rights without explicit or personal governmental blessing) restricts the discretion of governmental leaders. Therefore political agents with current or prospective access to oil resources may have an incentive to further degrade or suppress improvements to institutional characteristics that would enhance growth but, at the same time, also spread wealth and potentially strengthen political opposition, and thus reduce or threaten access to their personal capture of such rents. Conversely, secure property rights and other aspects of high institutional quality may make it prohibitively costly for leaders to personally capture the large stream of resource rents, or to degrade or disinvest in institutions in order to then procure the resource rents. In the latter case political agents are expected to improve institutional quality when their costs of doing so are outweighed by increased tax and resource revenues from expected efficiency gains in resource use (Deacon and Mueller, 2004) as well as expected economy-wide gains from improvements in institutional quality and or property rights and the rule of law (see e.g. Knack and Keefer, 1995; Rodrick, Subramanian, Trebbi, 2002). In sum,

political agents are expected to maximize their expected gains from governmentally-controlled resource wealth by minimizing the costs to themselves, or maximizing the revenues from investing or disinvesting in institutional quality, thus impacting future institutions and through them, long-term economic performance. When the national treasury is enriched by natural resource wealth, and not protected well by institutional barriers to personal rent-seeking (e.g. looting the treasury or diverting the flow of wealth from resources into personal possession by politicians), then more natural resource wealth enhances the gains from personal rent-seeking by politicians, relative to building the institutions that produce economic growth.

This research is a synthesis and extension of the current resource curse studies. While many authors have presented convincing theoretical and empirical explanations for the resource curse, no single study is inerrant or complete. However, many have made important contributions to the research as is the primary objective of this current work. With the introduction of new measures of institutional quality and improvements in existing measures, notably increased coverage both across countries and over time, it is possible to look at changes in measures of institutional quality over economically important time periods. This is the first study (to my knowledge) that investigates the role of natural resources in *changes* in institutional quality.

The empirical analysis shows the harvest of resource wealth, making substantial income from resource rents, appears to have a positive influence on the strength of property rights and the rule of law (and thus**,** by inference to foster economic growth) in the nations that start out with strong protection of property rights and associated rule of

law, but a negative influence in nations that do not. Thus, the data provide some evidence that the "resource curse" is present when institutions are weak—using protection of property rights, with access by asset owners to the rule of law, as the measure. In cases where this protection is weak at the beginning of the period in question, growth-enhancing institutions are weakened further. In contrast, the resource curse is not present when property rights are strongly protected, with owners having access to and protection afforded by, the rule of law. Good institutions are associated with enhanced economic growth and thus expansion of the tax base, and so are attractive to leaders when their best strategy is to seek economic prosperity and progress for the nation. In that case, resources are a blessing for nations in which property rights are already strong as the revenues accrue.

This study proceeds as follows. A review of the extant relevant 'resource curse' and related literature is presented in the next section tracing the evolution of economic and political theories that have contributed to the understanding of the role of natural resources in institutions and economic growth. Chapter 3 presents the theoretical argument central to this research positing the importance of economic institutions contemporaneous to the production of natural resources. A detailed description of the data and empirical setup is provided in Chapter 4, with specific adjustments to and sources of data included in Appendix 1. The empirical results have been divided into two chapters. Included in Chapter 5 are the results and discussion of the primary empirical estimations as detailed in Chapter 4. Chapter 6 addresses some of the empirical questions left unanswered by the extant literature, as well as the research

presented here, and provides a series of alternative specifications and regression results followed by a brief discussion of those results. Chapter 7 provides a more condensed summary of the empirical findings and the theory central to this paper.

CHAPTER 2

LITERATURE REVIEW

The resource curse and related research has seen substantial attention in the last decade, however the 'curse' phenomenon in one form or another is not new to the literature. Early developmental economists in the 1950s and 1960s suggested that abundant primary products in exports may have detrimental macroeconomic side effects. Prebisch (1950, 1964) argued that developing economies reliant on primary product exports may face deteriorating terms of trade with industrialized countries. Singer (1950) hypothesized that the primary product export sector may have "absorbed what little entrepreneurial initiative and domestic investment there was, and even tempted domestic savings abroad." Therefore many of these nations lack a significant manufacturing sector, which many believe is vital to long term economic development.

Although similar to earlier theories the most widely cited macroeconomic cause for poor economic performance in resource rich nations is the so-called "Dutch Disease" hypothesis or some variation thereof. The term first appeared in *The Economist*, in 1977[5] describing the economic aftermath of Holland's booming natural gas development of the Groningen gas field. The basic premise is that revenue windfalls either from price increases in or discovery of new resources leads to an appreciation of local currency. Inflated exchange rates can squeeze out the non-resource export sector, making it too costly for domestic producers to compete with

[5] *The Economist,* 26 November, 1977 pg. 82.

imports. The economy wide impact may depend on the relative size of the resource sector. Generally, oil and gas industries employ few relative to the industrial or manufacturing sectors; however the revenues streams can be significant. In the case of Holland, which had a diverse economy, the impact on unemployment in the non-resource sector was significant with a nearly four fold increase during the oil boom of the early 1970s (Economist 1977).

Similarly, Nankani (1979) suggested that mineral rich nations faced different economic challenges from predominately agricultural nations. Nations with a strong mineral economy were less likely to invest in non-resource sectors, which left their economy prone to the detrimental impacts from resource price volatility and inflationary pressures.

The more formal curse literature seems to begin with Auty's (1993) examination of mineral rich developing nations and economic growth. His findings suggested that mineral rich countries not only were unable to benefit from their resource endowments but may be inferior to resource-poor nations; likely inspiring the term 'resource curse'. Jeffrey Sachs and Andrew Warner (1995) in an oft-cited seminal empirical study found similar results. From a sample of 97 countries, they found a significant negative correlation between natural resources (as the share in GNP of primary product exports) and GDP growth (1970-1989). They argue the results are robust as their measure of natural resources remains significant after holding a number of variables constant including: initial GDP, trade policy, investment rates, terms of trade volatility, inequality, and the effectiveness of bureaucracy. Interestingly they note that some

resource intensive countries sustained strong growth over the 1970-89 period, however they equate their performance to trade policy and manufacturing sector success.

Through a series of similar papers Sachs and Warner (1997, 1999, and 2001) subjected their data to numerous specifications, yet came to similar conclusions. Like much of the extant literature at the time, they concluded that price volatility and some variation of the Dutch disease where the culprits of poor economic performance and argued that abundant natural resources may crowd out growth catalyzing activities, namely the manufacturing sector. Further, Sachs and Warner (1997) found little evidence to suggest that resource abundance was associated with lower savings and investment rates and there was little direct evidence that omitted geographical or climatic variables either explain the curse or are the results sensitive to alternative measures of resource intensity[6]. Although included in a number of regressions there is little discussion of the role of various institutional factors in explaining cross-national variation in growth.

Similarly Matsuyama (1992) suggests that positive externalities in the form of learning-by-doing are only present in the manufacturing sector. Wealth shocks from natural resource discoveries or price increases creates excess demand for non-traded goods raising input costs and wages, which in turn stifles the manufacturing sector that uses such inputs. In effect the manufacturing sector can no longer compete on the international market and economic growth slows.

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[6] They control for a number of geographical variables thought to be strong growth determinants (see Gallup, Sachs and Mellinger, 1999) including: percent of land area within 100km of the sea, kilometers to the closest major port, the fraction of land area in the geographic tropics and a falciparam malaria index from 1966. Distinguishing mineral from agricultural resources in their measure of resource intensity does not eliminate the evidence for the resource curse (Sachs and Warner, 2001).

Substantial theoretical and empirical confirmation of the resource curse hypothesis can be found in a number of other works (e.g. Auty, 1993, 2001; Gelb, 1988; Glyfalson, Herbertsson and Zoega, 1999; among others). Sala-i-Martin (1997) and Doppelhofer, Miller and Sala-i-Martin (2000) classify natural resources as one of the ten most robust variables in empirical studies on growth. And while this literature confirms a negative correlation between natural resources and economic growth there is less consensus on the mechanism through which natural resource intensity may impair economic performance. The literature addressing potential causal mechanisms is broad and diverse however there does appear to be some empirical and theoretical consolidation surrounding three theories of particular interest: 1) the consequences of rents and rent-seeking behavior, 2) the relationship between resource abundance or dependence and regimes, and 3) the impact of natural resources on institutional quality.

As mentioned hydrocarbon and mineral resources are typically state owned, therefore revenues ultimately accrue to the government. In the case of oil and gas during the 1970s, revenues would have been substantial. Events following the Arab oil embargo in 1973 sent world oil prices surging, generating significant oil revenues for many nations. The major oil producing countries would realize a nearly 400% increase in per barrel prices only months following the embargo and a nearly 8-fold increase during the 1970s before prices dropped significantly the following decade. Such windfalls 'inevitably invite greater government intervention' (Stevens, 2003 p17) which only exacerbates the generation of rents (Krueger, 1974). In nations without abundant natural resources wealth must be created, while nations with economically exploitable

natural resources wealth is acquired through expended effort in gaining access to resource wealth, rather "trying to divide the existing pie rather than to create a larger one" (Stiglitz, 2003, pg. 2).

It is not surprising that huge revenues often flowing to a relatively small group of individuals would inspire rent-seeking behavior. In the context of the resource curse phenomenon it is thought that rent-seeking behavior may impact growth as incentives to compete for rents dissuades more productive activities and lures entrepreneurial from the non-resource sectors.

Leite and Weidmann (1999) conclude that rent-seeking behavior from windfall gains may spawn corruption, which subsequently may impact economic growth. From a sample of 72 countries they found natural resources (capital intensive resources such as fuel and ores) tend to induce higher levels of corruption and corruption in turn is corrosive to a nation's economic capacity[7]. Similarly, Khan (1994) attributes Nigeria's poor economic performance to corruption induced by the oil boom.

Tornell and Lane (1999) and Torvik (2002) arrive at similar conclusions from separate 'rent-seeking' approaches. During the flow of revenues from resource windfalls in economies with multiple powerful groups, such groups will vie for rents, causing declines in investment as effort is directed toward the resource sector leading to declining economic performance over time (Tornell and Lane 1999). Similarly Torvik (2002) suggests that profitable rent seeking diverts entrepreneurial activity away from

[7] There is much debate on the role of corruption in economic performance. The literature is broad and theoretically diverse from Coasean models of efficiency gains though bribery that potentially improves prospects for growth to the other extreme where corruption becomes crippling to an economy. Leite and Weidmann (1999) provide a thorough review of the literature.

more productive activities. Likely, the losses from the production sector or non-resource sector are greater than the income gains from profitable rent seeking activities, therefore producing economy-wide declines in economic efficiency.

Others have found a strong association between natural resources and civil wars. Collier and Hoeffler (1998) present empirical support for this correlation; however they find that the threat of civil war varies with the level of natural resource dependence. Low levels or initial increase in resources increase the threat of civil uprisings "due to the taxable base of the economy constituting an attraction for rebels wishing to capture the state" (571). High levels of natural resources may provide governments sufficient revenues to ward off any threats to the state through increased military and protective expenditures thus decreasing the occurrence of civil wars. Along a similar thread Deacon and Mueller (2004) suggest that authoritarian nations such as Saudi Arabia may suppress civil strife through small transfers of wealth to the masses.

Others, for example Fearon and Laitin (2003) and de Soysa (2002) find that oil rich nations are more likely to experience civil wars, while Fearon (2004) suggests that contraband resources like diamonds and illicit drugs may lengthen civil conflicts. Ross (2003) provides a thorough review of the literature and presents similar findings from a sample of 13 resource-rich nations. However he notes that the causal mechanism linking natural resources and civil war are complex and still not fully understood. Further the strong empirical relationship, though consistent across studies, is potentially spurious or due to endogeneity and deserves future work.

Another strand of the literature has focused on the association of natural resources, primarily oil and minerals to regime type. Central to this literature is a theory of the repressive influence of abundant natural resources, suggesting that dependence on such resources may deter democracy and even perpetuate autocratic regimes. Using Sachs and Warner's primary exports in GDP measure of natural resources and a measure for authoritarianism from Polity III dataset Wantchekon (1999) suggests that the probability of a nation being authoritarian increases with its dependence on natural resources in its economy. Theoretically the presence of abundant rents provides the incumbent a comparative advantage over any opposition eventually leading to one-party dominance[8].

Dalmazzo and de Blasio (2003) suggest that resource shocks and foreign aid only perpetuate autocratic policies by providing elites incentives not to reform. Abundant 'unearned income' streams suppress the need for investment consequently impacting growth. Dilution of one-party dominance would likely increase the national surplus, however the self-interested government would lose its capacity to extract from it, therefore the presence of abundant rents are thought to perpetuate authoritarian rule.

The relationship between natural resources and authoritarianism is also evident among African nations. Oil-rich countries (petro-states) such as Algeria, Libya, Gabon, Cameroon, Congo (DR), and Nigeria are typically authoritarian and have resisted transition to more democratic polities over the past two decades. Conversely many

[8] Wantchekon provides two different scenarios with a similar authoritarian outcome. In the first scenario the rule of law is strong and the threat of civil unrest is low, permitting the "strategic" use of resource revenues to improve tenure and support while eventually condensing into one-party dominance. In a second example the rule of law is weak and the incumbent uses resource rents to suppress or convert the opposition while building military and security to quell threats from the populace.

resource-poor nations, for instance, Benin, Mali, Senegal, and Madagascar have since successfully transitioned to more democratic regimes. Jenson and Wantchekon (2004) contribute this pattern to the abundance of or lack of appropriable resource rents. Using panel data for 39 African nations for the years 1970-1995 they find a strong positive correlation of natural resources and authoritarian regimes. They argue that "executive discretion over resource rents leads to less political liberalization (transition to democracy) and a greater likelihood of democratic breakdown (consolidation of democracy)" (817).

Ross (2001) finds similar results for a broader set of nations and provides three potential causal mechanisms to explain the pattern of non-democratic regimes in many oil-rich nations. First, a 'rentier effect' exists, in which oil-rich countries can suppress pressures of accountability through low tax rates and patronage. Second, resource wealth provides government the financial capacity to fund military and internal security for protection against popular pressures and to ensure authoritarian rule. Thirdly, Ross argues there is a 'modernization effect' which suggests that natural resource dependent economies fail to develop the social and cultural characteristics that tend to produce democratic governments[9].

Support for oil's anti-democratic effects appears strong, however democracy *per se* is neither sufficient nor necessary for economic growth and there is still much debate on the role of democracy in economic performance (see Barro, 2000; Helliwell, 1994; Shen, 2002). Conversely, there is a substantial literature promoting the importance of

[9] Social and cultural characteristics include: occupational specialization, urbanization, and higher levels of education.

institutions and the role of certain institutional components in economic growth. And while invariably it is the polity that determines the existence and 'quality' of such institutions, the presence of abundant 'unearned income' from natural resources may alter the incentives for institutional change, subsequently affecting economic growth.

As many authors in the more recent curse literature have discovered, consideration of institutional quality may help to explain much of the divergence in economic performance across countries. It appears that many nations endowed with abundant natural resources are similarly endowed with poor quality of institutions. The usual suspects, Nigeria, Saudi Arabia, Venezuela, and Mexico among others are considered resource-rich yet have faltered economically.

The role of institutions in promoting economic growth is well documented in the literature. There is widespread theoretical and empirical support for the theory that economic growth depends on a number of diverse characteristics of institutional quality encompassing property rights and the rule of law, political and economic freedoms, political stability, and quality of governance (Gwartney, Lawson and Holcombe, 1999, Rodrik, Subramanian and Trebbi, 2002, Gwartney, Holcombe and Lawson, 2004). There is still much debate, however, on the individual importance of each component measure of institutional quality in determining growth. There is also debate on how well institutional quality can be measured.

Early works by North and Thomas (1973) and North (1981) stressed the role of the security of property rights and the rule of law in improving economic conditions and fostering growth. Knack and Keefer (1995) found empirical support for the role of

property rights in economic growth both directly and indirectly through the impact on investment. Scully (1988), using Gastil's (1982) political rights and civil liberties index as a measure of the quality of institutions, found that politically free societies that promote private property rights and free markets grew at three times (2.73 to 0.91 percent annually) the rate compared to countries in which these freedoms were absent. More recent results confirm the role of property rights and the rule of law in promoting economic efficiency and growth (e.g. Heitger, 2004; Svensson, 1998; Torstensson, 1994).

Although a large literature supports the importance of good institutions in promoting growth, there is still debate on the capacity of certain measures to correctly reflect the quality of such institutions. Further, many of the existing measures may be "conceptually unsuitable" for the purpose of explaining growth (Glaeser et al., 2004). Recently devised instrumental variables and new measures of institutions have addressed some of these concerns and furthered the ability of scholars to discern the important role of institutions in promoting economic growth.

Using mortality rates during European colonization in the sixteenth century as an instrument for institutional quality, for example, Acemoglu, Johnson, and Robinson (2001) conclude that institutions have a large and significant relationship to per capita incomes. The level of risk (mortality rates) colonizers faced during the sixteenth and seventeenth centuries dictated the quality of institutions that were put in place. Therefore, one could infer that better institutions were developed in regions that, *ex post*, exhibited low mortality risk. Conversely, in regions of higher risk, the colonizers

were more likely to adopt more extractive policies and forgo the investment of quality institution- building. The quality of these institutions is thought to persist even today and in areas where better institutions were present, statistically higher incomes developed.

Sokoloff and Engerman (2000) found similar results when looking at the diverging paths of development in New World societies of North and South America and the social effects of plantation economies of scale.[10] Hall and Jones (1999), using the fraction of the population speaking English and Western European languages as a proxy for institutional quality, conclude that the quality of institutions helps explain the cross-country differences in output per worker.

While central to this current research, a more explicit consideration of the relationship between natural resources and institutional quality has only recently surfaced in the literature. For example, Sala-i-Martin and Subramanian (2003) suggest resource abundance, in particular oil and minerals, may be detrimental to growth through its influence on institutional quality. In a series of regressions using various specifications and combinations of natural resources they find that resources do not impact growth directly, however their results reveal an empirically significant negative association between fuel and mineral resources as a share of GDP and institutions proxied for by a current rule of law index. They extend these results to explain

[10] Sokoloff and Engerman looked at the relative factor endowments, such as favorable climate and soils, readily available slaves, mineral riches, of North and South America during European colonization. In South America a relatively small elite gained access to these 'resources' which lead to widespread inequality in incomes and political rights. This elite had little incentive to invest in public goods, such as education. In contrast North America was dominated by small family farms that grew grains and livestock, which were not conducive to economies of scale, nor did they require many slaves. In short they would be more likely to invest in "institutions" that would improve workers skills. Over time this led to more favorable economic conditions and thus higher growth for North America.

Nigeria's poor economic performance, concluding that large oil reserves have negatively influenced that nation's institutions thus affecting long term growth.

A similar work by Isham et al., (2003) suggests that nations with abundant oil and mineral resources have weaker institutions while nations scarce in such resources are likely to have strong institutional capacities. Further, a nation's institutional capacity is a strong and significant determinant of growth for that nation. Central to their research is the economic performance of nations after the oil shocks of the early 1970s comparative to more current measures of institutional quality. They conclude that '[p]oor institutions are deeply rooted', suggesting institutional quality is nonmalleable and that oil and mineral rich nations are destined for poor economic growth.

Mehlum, Moene and Torvik (2002) suggest the capacity for rent-seeking activities depends on the quality of institutions[11]. In institutional settings conducive to rent-seeking behavior entrepreneurial activity is diverted away from growth enhancing productive activities and into economically unproductive rent-seeking. Thus an environment of weak institutions and abundant resources present is argued to provide incentives for unproductive economies in the form of opportunities for rent-seeking. Conversely in nations with strong institutions, the incentives are present for productive activities, thus generating long term economic growth. They find that nations with abundant natural resources in 1970 and poor institutions in the 1990s realized comparatively weaker economic growth than nations with good institutions during the

[11] They use a broad measure of institutional quality taken from Political Risk Services that includes index measures of rule of law, bureaucratic quality, corruption in government, risk of appropriation, and an index to measure government repudiation of contracts.

1990s. Similarly, Boschini et al., (2003) provide empirical evidence to suggest that only resource-rich nations with poor institutional quality will experience weaker economic performance comparatively to similar nations with strong institutions where abundant resources may improve economies.

To summarize there are essentially four findings from the aforementioned literature: 1) natural resources are negatively associated with economic performance, 2) natural resources generate rents and potentially spawn corruption and even civil wars, subsequently affecting economies, 3) oil and mineral resources deter democracies and perpetuate autocratic governance, and 4) natural resources, primarily fuel and minerals are associated with weaker institutions and measures of institutional quality, which likely influence economic performance. With the exception of Mehlum, Moene, and Torvik (2002) and Boschini et al. (2003), much of this literature has concluded or implied that natural resources are equally and adversely detrimental, with a monotonic negative impact on growth, regimes or institutions. However, as mentioned, not all resource-dependent nations are politically corrupt or institutionally weak; further, many of these nations are economically prosperous.

This current research attempts to address these potential shortcomings in the literature using new measures of institutional quality that are capable of time-series estimations of the association of natural resources and institutions. In the 1990s, a new type of composite measure of institutions, designed to indicate an economy's suitability to, or support of, free market activity was developed: the *1995 Index of Economic Freedom* (Johnson and Sheehy, 1995) of the Heritage Foundation, co-published with

the Wall Street Journal; and in parallel, the *Economic Freedom of the World: 1975-1995,* (1996) was developed by Gwartney, Lawson and Block. The latter Economic Freedom of the World (EFW) index originated from a series of conferences beginning in 1985, involving three Nobel laureates and several other world-class economists. These resulted in a number of publications—books and articles—prior to the 1996 publication of the EFW. Follow-on work of the conferees was also under the auspices of the Fraser Institute. Subsequent annual editions of the Fraser EFW report were published, refined and improved in coverage and extended in scope of years by Gwartney and Lawson with the collaboration of institutes from around the world.[12]

Both indexes and their components have been widely used in the recent literature on differences among nations in growth, prosperity, living conditions, income inequality, and environment. Economic freedom has been linked to increased investment, higher income per capita, higher growth rates, increased life expectancies and reduced infant mortality rates, higher adult literacy rates, improved environmental conditions, lower levels of corruption, and highly correlated to political and civil liberties (Gwartney and Lawson, 2004).

The various components of the EFW index do not play identical roles in respect to their relationship to economic growth. Using Granger causality tests, Dawson (2003) finds that the overall level of economic freedom "causes" growth, but that changes in freedom are jointly determined with growth. Secondly, the *Property Rights- Rule of*

[12] The EFW index has been used in a number of previous studies, and a review of both the index and other studies in which it has been used is found in Berggren (2003). The EFW index measures institutional quality in five major areas: (1) size of government, (2) legal structure and security of property rights, (3) access to sound money, (4) exchange with foreigners, and (5) regulation of capital, labor, and business.
The index provides current ratings for 123 countries, but data needed for this paper are available for only about 50 countries going back to 1970. The *Economic Freedom of the World: 2004* edition was used for the current paper.

Law and the *Use of Markets* components of the EFW index appear to be the most significant in determining growth. And finally, "the *level* and *changes* in the size of government are the result of growth, rather than the cause of it."

Carlsson & Lundstrom (2002), using alternative specifications, find that the only robust components in the EFW consistently associated positively with growth are property rights and freedom to use alternative currencies, while increased *size of government* and *freedom to trade with foreigners* components, they say, may actually deter growth. Gwartney, Lawson and Holcombe (1999) explain that Vega-Gordillo & Alvarez-Arce (2003), using the Freedom House measure of political rights and civil liberties index and the Fraser Institute's economic freedom index, conclude that economic freedom fosters growth, but that the impact of political freedoms on growth is less clear. Furthermore, the combined impact of political and economic freedoms on growth is complex and likely contingent upon other country-specific factors.

The Fraser EFW index is used here, in part because its coverage has been extended back to 1970 in 5-year increments[13]. This research uses the *legal structure and security of property rights* component of the Fraser EFW index—which includes a rule of law sub-component—to reach back to the years before the dramatic oil price increases of the 1970s and the disruptions in oil and other markets during that period.

[13] The Fraser index, including the data for past years, is available online at www.freetheworld.com.

CHAPTER 3

THEORETICAL ARGUMENT

It is not difficult to understand why economic institutions help to explain differences in economic growth across nations. Sustained growth in output is the result of a constant flow of entrepreneurial efforts that 1) attract resource inputs to potentially productive projects, 2) deploy those resources efficiently in the projects undertaken, and 3) monitor projects and divert resources quickly from unsuccessful ones, releasing them to those that are potentially more productive. Both innovation and a constant shifting of resources from lower to higher-valued uses are needed to produce continuing economic growth. Any barriers that potentially prohibit or influence the production or exchange of resources will ultimately be realized in the productivity and prosperity of an economy.

Economic growth can be expected in an economy where entrepreneurs have the freedom to innovate and the ability to profit from well-chosen projects that are efficiently conducted, but where they also face the burden of paying the opportunity cost for resources used. A well-functioning market system provides this combination of freedom and accountability, which enables and rewards growth-producing economic activity. To function well, however, any market requires supporting institutions that create and sustain this freedom to take risks but also accountability for those risks on the part of decision makers using these freedoms. These institutions include secure and transferable property rights to resources and to outputs, the rule of law so that all can participate, trust is maintained, and contracts are enforced. In addition, the access to

other markets that reduce costs and increase the value of output is allowed by the freedom of exchange.

There is now a greater knowledge than in the past of the nation-wide benefits of property rights, the rule of law, and other growth-enhancing institutions. Therefore one might expect that in most nations there will be backers for leaders who seek to move a nation's institutions in that direction in order to foster growth and by doing so increase the value of resources. Supporters of such policies should include small business and property owners (DeSoto, 2004). After all, the value of their property or business is at stake; better property rules--more secure, more easily traded--raise value of the resource or the business.

Anderson and Hill (1983) have pointed out that institution-building is costly, and that it will increase when the returns to doing so rise. The benefits to improving growth-enhancing institutions such as property rights protection and access to the rule of law are spread across all private citizens whose resources rise in value with enhanced trading possibilities. Those with rising incomes are more able to become better informed and more politically active. The political leaders, however, if they have been enjoying special access to the treasury for personal gain, may fear the loss of their special access, if citizens outside their regime become better informed, more politically active and wealthier, allowing them to be more politically effective. And when the treasury is richer from income flows from mineral wealth, the leaders have more to lose from the establishment of institutions that strengthen the rights or the political strength of citizens who are not in the current ruling regime.

When sub-surface deposits have a high rental value to a national government, the bounty to the treasury is large. This will increase the power of those who control government, so long as they are unconstrained by institutional obligations to work for growth or other conditions that benefit citizens in general. With a richer treasury, investment by those in power to retain power, or those potentially in power to obtain it for personal gain, will increase. In contrast, for those with neither power nor the serious prospect of capturing it personally, increased resource income does not add to the incentive for investment in gaining control of the treasury. Rather, improvements in institutions that enhance prosperity and the usefulness of their assets are likely to be the preferred outcome from the central government. Political leaders who promise improved institutions may well receive the support of these, the vast majority of citizens, when the citizens understand the role of improved institutions. That support should grow if and as they become wealthier.

The expectations about the connection of mineral riches for the treasury and reduced growth rates are based on the widespread recognition that a nation will be more prosperous if it adopts stronger property rights, the rule of law, and other growth-enhancing institutions (e.g. Gwartney, Lawson and Holcombe, 1999; Gwartney, Holcombe and Lawson, 2004; Rodik, Subramanian, Trebbi, 2002; Torstensson, 1994). Any nation should, on the whole, benefit from moving in this direction. Nations, however, do not make decisions. Political leaders, operating under a variety of constraints, make decisions for nations, including those that change the nation's economic institutions.

Central to this research is the hypothesis that large income streams to central governments from a rich natural resource endowment may stifle the recognition and protection of property rights, the concomitant rule of law, and other growth-enhancing institutions. This is expected when the weakness of those institutions at the beginning of the period of observation indicates that political leaders in the ruling regime, less encumbered by institutions that hinder their plunder, will have the ability to divert resources from the treasury to their own benefit and purposes. Alternatively, if existing institutional arrangements put such income streams effectively off-limits to political leaders' personal grasp, the political leaders will not be able to make such diversions, and thus will have little incentive to maintain control by stifling rather than improving property rights, the rule of law and other growth-enhancing institutions. Political forces within the regime (and outside it) that favor growth and growth-enhancing institutional change will be relatively stronger in the latter case.

In line with the hypothesis, some studies have shown that income from natural resources discourages growth-enhancing institutions. Deacon and Mueller (2004) suggests that countries with abundant point-source resources (e.g. oil and minerals) tend to evolve institutional characteristics conducive to securing access and control of such resources by those in control of the government. An extension of Sonin (2003) suggests that those with exclusive access to the wealth from resources have an incentive to suppress changes that might threaten this exclusive access, such as improvements in the security of property rights and the rule of law, and they may work for changes that solidify their control or their access, including changes that reduce the growth-enabling

aspects of institutional quality. Depending on their purposes, their degree of control over wealth produced from the resources, and the security of that control, sovereign leaders will weigh the costs and benefits of working to change, either to improve or weaken, institutional quality, especially property rights and the rule of law. In resource-rich countries where institutional quality improves, however, economic prosperity will increase private and public sector revenues including the new mineral wealth (Jones-Luong, 2004) and likely improving tenure security for political leaders.[14]

The following section presents a basic empirical model designed to examine the effects of a decades-long surge of oil income in a number of nations, on property rights and rule of law institutions (and implicitly on economic growth) in those nations, and relate those effects to the presence or absence of growth-enhancing institutions prior to or during the time that the strong income flows augmented the national treasuries.

[14] By improving property rights and the rule of law leaders may in essence be trading rents from resources (plunder) for increased tax revenues from those resources (assuming they are taxed). And although improving the security of property rights and the rule of law represent institutional improvements, increased taxation constitutes an increase in the size of government, an institutional characteristic often considered an inhibitor of economic performance.

CHAPTER 4

DATA AND EMPIRICAL SETUP

Data Description

The purpose of this exercise is to determine whether oil and gas exports are associated with worsening institutions to protect property rights and provide access to the rule of law in the nations producing oil during the 1970 to 2000-2002 period. During the period, oil prices more than tripled in real terms, raising substantially the income flows to (or at least "toward" in cases of revenue diversion to private purposes by individual rulers) the treasuries of nations in which oil, even before the price increases, already constituted a substantial part of national income.

Data for the primary variables of interest are available for 50 countries, limited in each regression by availability of the measure for property rights in 1970[15]. To facilitate testing of the implications of natural resource abundance on changes in the level of property rights over time, contingent on the initial (1970) level of property rights, three separate sets of regressions were run. From the sample of 50 countries, two separate sub-samples were constructed, each containing 25 nations. The first sub-sample includes countries with initially low level of property rights in 1970; the second consists of all countries with a comparatively higher measure of property rights in 1970. Regression results for the former sub-sample are presented in Table 1, and for the latter

[15] Supplemental regressions containing variables *REVCOUP* or *POP100cr* may be further limited due to the availability of such data.

in Table 2. Table 3 shows a set of regression results from the original sample of 50 countries, thus including all countries with initially *low* and *high* levels of property rights in 1970.

The dependent variable in all regressions is the averaged value of the nation's property rights measure for the years 2000, 2001, and 2002[16] (*PRAVG00*) taken from the Fraser Institute's 2004 version of the Economic Freedom of the World Index (EFW). As discussed in Chapter 2, the Index is comprised of five main areas or components: (1) size of government; (2) legal structure and protection of property rights; (3) access to sound money; (4) international exchange; and (5) regulation. The property rights measure used in this study is the Area (2) measure of *legal structure and protection of property rights*. Explanatory variables include: property rights rating in 1970 (*PR70)*, the share of petroleum and natural gas exports in GNI in 1970 (*OIL70)*, absolute latitude from the equator (*ABSLATIT)*, the level of ethnolinguistic fractionalization (*AVELF*), total trade (*OPENk)*, frequency of revolutions and coups (*REVCOUP)*, and the coastal and navigable river population density (*POP100cr)*. Variable details and sources are provided in Appendix 1. Summary statistics including correlation matrices and country lists are reported in Appendices 2-4.

Ratings for the *Legal Stucture and Security of Property Rights* component of the EFW index are scaled 0-to-10 and based on measures of rule of law, security of property rights, independence of the judiciary, and the impartiality of the courts. Higher ratings indicate stronger rule of law, more secure property rights, greater independence

[16] Beginning in 2000 the Economic Freedom of the World index, including its property rights component measure, was calculated yearly, whereas previous data are only available every five years.

in the judiciary and less biased court system. Similarly higher ratings may serve as an indicator of "better" institutions. In order to assess the relationship between natural resources and changes and the measure of institutional quality, a lagged measure of property rights is included in all regressions. The lagged measure for *Legal Structure and Property Rights* (*PR70*), again from the EFW index, is employed as an indicator of the security of property rights and rule of law in 1970, and consequently serves as a measure of the institutional quality prior to the oil booms of the 1970s[17].

Not unlike much of the existing resource curse literature, a measure for natural resources similar to that of Sachs and Warner (1995) is employed here, though with some important modifications. As an indication of a country's relative resource abundance Sachs and Warner calculated the share of exports of primary products in GNP in 1970, which includes both "fuels" and "non-fuel" primary product exports. However the impact of natural resources on institutional quality and growth will likely vary with the type of resource, more importantly the nature of the rents generated from such resources (e.g. Boschini et al., 2003; Deacon and Mueller, 2004). Point source resources such as oil and minerals are generally more concentrated both spatially and in ownership and the rents from oil production, particularly in low production cost countries, may be substantial. Conversely, agricultural and other non-fuel resources are generally more diffuse spatially, and in ownership over such resources, thus decreasing the ability to produce significant rents. Similar to Ross (2001) and Sala-i-Martin and

[17] The 1970 calculation for the property rights component of the EFW Index differs slightly from the 1995-2002 calculated measures. The latter include measures for the impartiality of the courts and the level of judicial independence in addition to measures that capture the security of private property and rule of law. For a detailed description of the composite EFW index or its individual components see Gwartney and Lawson (2004).

Subramanian (2003), among others, this research considers only point source resources, primarily oil and natural gas exports as a share of GNI. A more detailed description, including other minor modifications is included in Appendix 1.

In line with the hypothesis, the estimated coefficient on the oil variable is expected to be negative for nations with initially low measure of property rights and rule of law and positive for the second sub-set of nations with initially high *PR70* measure.

As suggested in the growth literature, latitude or geography may influence economic performance, whether directly through impacts on productivity as a result of unfavorable climatic conditions and disease prevalence (Gallup, Sachs and Mellinger, 1999) or indirectly through the impact of those factors on institutions (Landes, 1998). Rodrik, Subramanian, and Trebbi (2002) in estimating the individual impacts of institutions, geography, and trade on cross-country income levels found that when they controlled for institutions, the direct impact of geography on growth was weak; however they suggest that geography may still impact growth through its impact on institutional quality. Similarly, as in Acemoglu, Johnson, and Robinson (2001), European settlers would be less likely to invest in institution building if faced by widespread disease and unproductive conditions. The temperate zones were judged by most Europeans to have more favorable and productive climatic conditions as well as

decreased exposure and risk of typically equatorial diseases, and they settled in those zones for longer periods of time, making institutional investments as they did so[18].

Findings from La Porta et al., (1999) suggest that higher ethnolinguistic fractionalization is associated with worse property rights and political freedoms. In ethnolinguistically heterogeneous countries leaders may "expropriate (or kill) ethnic losers, restrict their freedom of opposition, and limit the production of public goods" therefore potentially impacting both economic and political freedoms[19].

The remaining control variables are generally considered growth determinants and primarily included to try and capture any unobservable variation from country-specific characteristics that may be driving the results[20]. The first is *OPENk,* measured as the total exports plus imports as a share of real GDP (in constant 1996 $US), is a widely used proxy for the openness of a nation's economy or level of trade liberalization. The second variable, *REVCOUP,* is the number of revolutions and coups per year averaged over the period 1960-1984. This is typically used as a measure of political instability, and thought to be an inhibitor of economic growth[21]. In a similar argument political uncertainty and disorder may impede improvements in certain political and economic institutions. Thirdly, included in some of the regressions is a

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[18] Engerman and Sokoloff (2002) present a similar argument suggesting healthier climates may have contributed to better institutions and economic performance over time.
[19] Ibid.
[20] In addition to the variables included in the following tables, a number of additional regressors often seen in the growth and institutions literature were included in a series of supplemental regressions (results not shown). The variables included: per capita income in 1965; Muslim percentage of the population; primary and secondary school enrollment; life expectancy in 1960; urbanization in 1960; working population in 1970; population density 1970; and a measure of political rights in 1972. The estimated coefficients were generally insignificant and had little impact on the variables of concern.
[21] Bates (2004) suggest that there is evidence that the relationship between political instability and growth is much weaker than often believed, and that economic growth is still possible under conditions of political disorder.

control for the proportion of the economy within 100km of the coast or a navigable waterway. While intuitively important for trade and productivity, nations with a high coastal population may be more likely to adopt growth and trade enhancing institutions, thus it is expected to be positively correlated to the level of property rights and economic institutional quality.

Empirical Setup

The basic regression model for the first and second sets of regressions is as follows:

$$PRAvg00_i = C + \beta_1 PR70_i + \beta_2 Oil70_i + \beta_3 \underline{Z_i} + \varepsilon_i$$

The first set of regressions (Table 1 below) includes a sample of 25 nations with comparatively low measure of property rights in 1970. The dependent variable *PRavg00* for each country *i* is regressed on a constant, a lagged measure of property rights for that nation, their fuel exports (as detailed above) and a vector of controls.

The second set of regressions follows an identical model, however in the second set of regressions (Table 2 below) the sample of 25 countries included are considered to have a high measure of property rights in 1970. The same sequence of regressions containing varied combinations of independent variables is used in estimating the current measure of property rights in both sub-sets of nations.

In the final set of regressions (Table 3) both sub-sets of countries are combined into a 50 country sample. Again the same controls are employed; however an

interaction term is also included. The interaction term provides a rough estimate of the extent to which *Oil70* is associated with *PRavg00* dependent on the initial measure of property rights in 1970 (*PR70).* The basic estimation is similar to the regression model above used in the two sub-samples of countries and is as follows.

$$PRAvg00_i = C + \beta_1 PR70_i + \beta_2 Oil70_i + \beta_3 PR70 * Oil70 + \beta_4 \underline{Z_i} + \varepsilon_i$$

The dependent variable is again a current measure (average of 2000-2002) of property rights and rule of law. Regressors include the 1970 measure of property rights (*PR70*), 1970 fuel exports (*OIL70*), the product of initial property rights and oil exports (*PR70*Oil70*), and a vector of controls.

All sets of regressions follow a similar sequence of included explanatory variables. In Tables 1 and 2, the first regression contains only the lagged property rights and 1970 oil export variables. For the combined sample of nations the first regression also includes the interaction term in addition to *PR70* and *Oil70* variables. Subsequent regressions in each set follow a specific combination of additional control variables.

CHAPTER 5

EMPIRICAL RESULTS

Nations with Initially Low Property Rights

Results from the first set of regressions (initially low property rights countries) are shown in Table 1 below. All regressions include the variables *OIL70* and *PR70*, which remain significant and have the expected signs throughout. Oil resources in 1970 are negatively associated with future levels of property rights for countries that had initially insecure property rights and rule of law, as the theory suggests. Regressions 2 through 7 include various combinations of control variables which others have suggested may impact the formation and quality of property rights and growth. These are included to see whether the basic conclusion from Regression 1 about the effect of oil wealth on property rights development in this set of nations is robust to this change in specification. Adding these variables has only small effects on the size and significance of the estimated coefficients on *OIL70*, indicating that neither the added variables themselves nor factors closely correlated with them were important exclusions from the equation, in estimating the effect of petroleum production revenues on institutions. This increases confidence in the robust nature of the specification in Regression 1.

Table 1. Estimation Results for Nations with Initially *Low* Property Rights in 1970. Oil 1970 Measure.

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Property Rights 1970	0.334	0.307	0.332	0.307	0.324	0.270	0.292
	(1.98)	(2.15)	(1.98)	(2.09)	(2.23)	(1.89)	(1.99)
Oil 1970	-0.109	-0.094	-0.104	-0.094	-0.120	-0.097	-0.095
	-(2.38)	-(2.44)	-(2.30)	-(2.38)	-(2.47)	-(2.59)	-(2.41)
Latitude (ABS)		0.047		0.048	0.050	0.046	0.045
		(3.14)		(2.76)	(3.24)	(3.13)	(2.97)
Ethnolinguistic Frac			-0.994	0.073			
			-(1.15)	(0.09)			
Openk					0.008		
					(0.88)		
Revolutions and Coups						-1.861	
						-(1.97)	
Coastal/River Population							0.005
							(0.67)
Intercept	3.758	2.757	4.090	2.718	2.352	3.393	2.575
	(5.14)	(3.97)	(5.24)	(3.23)	(2.81)	(4.47)	(3.41)
R^2 (adjusted)	0.226	0.448	0.237	0.420	0.442	0.493	0.433
Number of Countries	25	25	25	25	25	24	25

The dependent variable is property rights averaged for the years 2000, 2001, 2002. T-ratios are in parentheses.

Distance from the equator has a positive and highly significant correlation to current levels of the property rights, yet has little impact on the magnitude and significance of the estimated coefficient on *Oil70*. As suggested in the literature, nations farther from the equator are generally associated with having stronger institutions and better economic performance.

As mentioned in the previous section La Porta et al., (1999) found a negative association between the level of ethnic fractionalization and a measure of property

rights[22]. Results from regression 3 support their findings, although the predicted negative impact is only significant at approximately the 75% confidence level. Considering their findings the estimated coefficient on *PR70* would be expected to change with the inclusion of *AVELF;* however it appears that the correlation between the two variables is only significant for current measures of property rights. The correlation between *AVELF* and the 1970 measure of property rights among initially low *PR70* nations is relatively small (-0.058) compared to its correlation to the current measure of property rights (-0.203). When controlling for latitude, the impact of ethnolinguistic fractionalization on current property rights becomes not statistically different from zero. The statistically significant negative correlation (-0.43) between latitude and ethnolinguistic fractionalization may help to explain this.

Controlling for the openness of the economy reduces the negative impact of oil on future property rights, but the estimated positive influence of an open economy on current property rights is insignificant at the normal levels (P-value = 0.116).

As expected, increased frequency of revolutions and coups between 1960 and 1984 among initially weak property rights nations has a significant and negative impact on current levels of property rights. However the simple correlation between the *REVCOUP* variable and *PR70 and PRAVG00* is relatively small; -0.15 and -0.35, respectively. The variable controlling for the density of coastal and navigable waterway populations had an effect on the development of property rights that was not statistically

[22] Their measure of property rights is from the *1997 Index of Economic Freedom* produced by the Heritage Foundation.

different from zero and had little impact on the magnitude and significance of the oil variable.

In sum, the results support the hypothesis that higher oil resources in 1970, and the resulting revenues to the national governments were detrimental to future levels of property rights for this subset of countries having initially weak property rights and rule of law. The negative association of petroleum and 2000-2002 property rights is robust when controlling for a number of explanatory variables and the magnitude of the oil impact is relatively consistent.

Nations with Initially High Property Rights

Presented in Table 2 are the results from the second sub-sample of 25 countries—those with initially higher levels of property rights in 1970, the beginning of the period in question. As in the first set of regressions (countries with initially low level of property rights), eight regressions are employed to test the impact, primarily of oil, and other explanatory variables in explaining changes in property rights since 1970. The additional control variables are the same ones added in Table 1, for the same reasons.

Table 2. Estimation Results for Nations with Initially *High* Property Rights in 1970. Oil 1970 Measure

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Property Rights 1970	0.377	0.360	0.356	0.351	0.345	0.343	0.357
	(1.19)	(1.31)	(1.26)	(1.32)	(1.24)	(1.21)	(1.20)
Oil 1970	0.295	0.313	0.246	0.277	0.293	0.310	0.305
	(1.28)	(1.56)	(1.18)	(1.41)	(1.44)	(1.52)	(1.42)
Latitude (ABS)		0.031		0.023	0.034	0.031	0.031
		(2.84)		(1.95)	(2.92)	(2.78)	(2.70)
Ethnolinguistic Frac			-2.343	-1.496			
			-(2.50)	-(1.52)			
Openk					0.003		
					(0.79)		
Revolutions and Coups						-1.053	
						-(0.47)	
Coastal/River Population							0.002
							(0.22)
Intercept	5.233	4.020	5.865	4.735	3.883	4.191	3.864
	(2.15)	(1.86)	(2.67)	(2.21)	(1.78)	(1.88)	(1.60)
R^2 (adjusted)	0.083	0.305	0.259	0.347	0.293	0.279	0.264
Number of Countries	25	25	25	25	25	25	24

The dependent variable is property rights averaged for the years 2000, 2001, 2002. T-ratios are in parentheses.

For nations with high initial property rights in 1970, the magnitude of the estimated coefficient on property rights 1970 is similar to the result above, for the nations with low Property Rights in 1970, and the sign is as expected. However, the coefficient is not statistically significant (p-values range from 0.2 to 0.24). This is not surprising when noted that among the nations with weak property rights, above, property rights 1970 took on values ranging from 1.15 to 6.16, a range of 5.01; for the sample of nations with higher property rights 1970 values, those values ranged only

from 6.47 to 8.35, a range of less than 2.0 points. A smaller variance on an independent variable is associated with a smaller level of confidence in the estimate of the effect of the variable.

Oil resources in 1970 are indicated to have a consistently positive effect on end-of-period property rights, although the estimator is only significant at the 75 to 86% confidence level. These results suggest that in countries with initially high measure of property rights, oil resources may improve the level of property rights over time. One source of the positive impact may well be that better property rights and higher growth generate more wealth over time and higher-valued capital assets. The owner of each asset, other things equal, is a natural supporter of better institutions, in order to make those assets still more valuable. The value of protecting those assets—and the value of property rights to those assets—has increased as well. Given the positive impact of property rights on economic growth, oil resources appear to be a "blessing" rather than a "curse" to such countries with initially strong property rights and rule of law ratings.

The variable controlling for latitude is again statistically significant and correctly signed in all regressions. In addition, its inclusion improves the confidence level of the oil variable and provides a better fit to the equation. The only other statistically important variable is ethnolinguistic fractionalization which as expected has a negative impact on property rights (regression 3 and 4).

Controlling for openness of the economy, revolutions and coups, and coastal and navigable waterway population density has little impact on the other variables.

Although the signs are as expected the coefficient estimates are not statistically different from zero.

As in the first sub-sample of countries, the results are in line with the theoretical model; however, some caution should be exercised in the interpretation of these results, given the level of significance in the explanatory variables. Still, the results suggest that the association of resource rents and future property rights is contingent upon the initial level of property rights, and for this group of nations the relationship is positive as hypothesized.

Nations with Initially Low or High Property Rights

The final set of regressions is presented in Table 3. The sample includes all countries from the first and second sets of regressions: a combined sample of countries with initially *low* or *high* property rights in 1970 is included. In addition to the original list of independent variables, an interaction term (*PR70 * Oil70*) is included. The prediction is that oil resources are only detrimental to future property rights in countries with initially low measure of property rights; therefore a positive coefficient on the interaction term is expected.

Table 3. Estimation Results for Nations with Initially *High* and *Low* Property Rights in 1970. Oil 1970 Measure

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Property Rights 1970	0.669	0.480	0.624	0.481	0.451	0.397	0.443
	(7.87)	(6.24)	(7.57)	(6.22)	(5.83)	(4.99)	(5.30)
Oil 1970	-0.535	-0.581	-0.525	-0.575	-0.581	-0.562	-0.582
	-(2.09)	-(2.84)	-(2.17)	-(2.80)	-(2.90)	-(2.91)	-(2.82)
PR70 * Oil70	0.094	0.110	0.094	0.109	0.107	0.106	0.111
	(1.61)	(2.37)	(1.70)	(2.33)	(2.34)	(2.41)	(2.36)
Latitude (ABS)		0.047		0.043	0.049	0.044	0.045
		(5.20)		(4.30)	(5.54)	(5.23)	(5.00)
Ethnolinguistic Frac			-1.640	-0.430			
			-(2.50)	-(0.69)			
Openk					0.006		
					(1.71)		
Revolutions and Coups						-2.002	
						-(2.59)	
Coastal/River Population							0.007
							(1.26)
Intercept	2.749	2.279	3.430	2.490	2.102	3.122	2.058
	(5.16)	(5.24)	(5.98)	(4.67)	(4.79)	(5.99)	(4.35)
R^2 (adjusted)	0.701	0.809	0.732	0.807	0.817	0.850	0.808
Number of Countries	50	50	50	50	49	49	49

The interaction term PR70*Oil70 has been included. The dependent variable is property rights averaged for the years 2000, 2001, 2002. T-ratios are in parentheses.

Regression 1 includes the two primary variables of concern, *Oil70* and the interaction term (*PR*Oil70*), as well as the lagged property rights variable. Regressions 2 through 7 all include an additional explanatory variable, or combination thereof, identical to the corresponding equation in the first two sets of regressions. The effects from the oil variable and the interaction term are significant to highly significant and

correctly signed in regressions 2 through 7 and significant to the 89% confidence level in regression 1.

As the theory suggests, the impact of natural resources on institutions is contingent on the security of property rights and the rule of law concurrent with resource production. In the final set of regressions above, the interaction variable *PR70*Oil70* will provide an estimate of the interdependent relationship between initial property rights measure and oil in their respective association with the future level of property rights. More specifically, to evaluate the marginal impact of oil resources in 1970 on the current measure of property rights one must use the coefficient estimates from each regression equation to calculate the value for the partial derivative of *PRavg00* with respect to *Oil70* (Equation 1 below).

$$\text{Equation 1:} \quad \frac{\delta(PRavg00)}{\delta(Oil70)} = \beta_3 + \beta_4(PR70)$$

As an example, Algeria's measure of property rights in 1970 was 3.76. Utilizing estimated coefficients from regression 2 (Table 3), the second equation below estimates the marginal impact of *Oil70* on current levels of property rights for Algeria. The coefficient estimate for *Oil70* is added to the product of the coefficient estimate on the interaction variable and the property rights measure for Algeria in 1970. The results suggest that an additional unit increase in oil in 1970, given thee low level of property rights and rule of law in place, would decrease future property rights by -0.197[23].

[23] Algeria's oil exports in 1970 were 14.94 percent of GNI, while the measure of property rights decreased by 0.94 between 1970 and 2000-2002.

Equation 2: $$\frac{\delta(PRavg00)}{\delta(Oil70)} = -0.581 + 0.110 * (3.76) = -0.167$$

Expanding on the above example, Figure 1 (below) illustrates the marginal impact of *Oil70* on *PRavg00* for various levels of initial property rights. The figure reveals a critical level of property rights in 1970 (approximately 5.69) where an

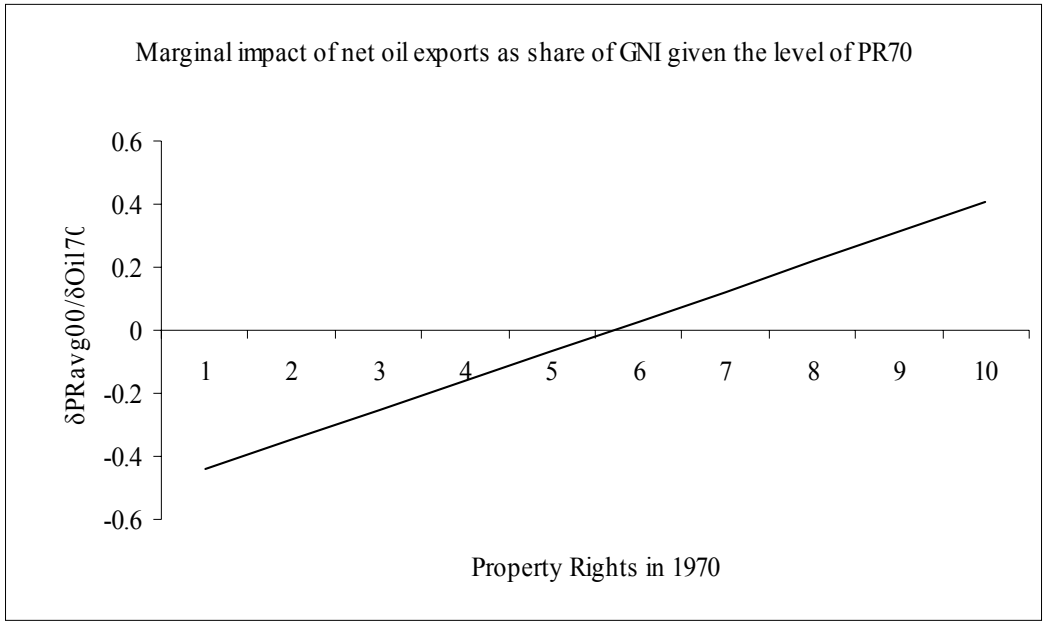

Figure 1. The impact of additional Oil Exports as a share of GNI in 1970 on the level of current Property Rights measure, conditional on the initial (1970) level of Property Rights.

additional unit of oil would no longer be detrimental to future levels of property rights. Similarly, this suggests that the marginal impact of oil on future property rights is negative for countries with an initial measure of property rights below 5.69.

The remaining results from Table 3 are generally consistent with results from the previous two sets of regressions. Ethnolinguistic fractionalization has a negative and statistically significant association with current levels of property rights (regression 3). This result is consistent with findings by La Porta et al. (1999) suggesting lower levels of property rights and political freedoms are typical in more ethnolinguistically heterogeneous nations. This variable becomes insignificant when also controlling for latitude (regression 4), again potentially due to the strong negative correlation between absolute latitude and *AVELF* (-0.505).

The measure for the openness of the economy is estimated to have a positive and statistically significant association with future levels of property rights. Although there is only a weak correlation between openness and *PRavg00 and PR70* (-0.0035 and -0.045, respectively), this relationship is likely more complex. Arguably the development of property rights and trade may be simultaneous. The improvement of property rights or other growth enhancing institutions may promote economic activity, as mentioned, therefore increasing the benefits from trade. Similarly the openness of trade may improve economic activity thus increasing the returns from improvements in property rights and the rule of law.

The coefficient on the frequency of revolutions and coups variable is negative, as expected, and statistically significant. The regime of a nation rife with political unrest and instability probably lacks the incentives for investment in the protection of property rights and must concentrate instead on simply staying in control. Svennsson (1998) suggest that in unstable nations, policy makers would be irrational to reform the

legal system and improve protection of property rights, because doing so would reduce discretionary spending and the capacity to fund their constituency.

Controlling for coastal and navigable waterway population density again has little effect on the variables of concern, and on the fit of the model.

CHAPTER 6

SUPPLEMENTAL EMPIRICS

As in any cross-national study a number of econometric concerns will arise, as is the case in the resource curse studies and this current research. This section will briefly discuss some of the concerns and attempt to address them through the use of alternative specifications.

Net Exports of Oil Measure

There are a number of nations with little or no proven oil or gas reserves thus relying on imports for their energy needs. Among these nations some have developed oil and gas refining and related industries giving these countries the capacity to export, or in this case re-export fuel and related products. Rents generated from the direct extraction and production of oil resources is likely much greater, and more likely to impact future institutions and growth than revenues from the re-exports of refined oil and oil byproducts in countries that lack oil and gas reserves. The World Bank and similar data sources do not differentiate between exports from direct production and re-exports originally from extra-national reserves. Sachs and Warner (1995), and others that have followed their methodology, used net exports for Singapore and Trinidad, two major re-exporters of fuel products. The methodology here extends this modification to all countries in order to adjust for other re-exporting nations such as Kenya, Denmark, and The Netherlands. Further, to reflect only positive net exporters of oil, nations with

negative net exports (i.e. net importers) are given a value of zero while the value for net exporters is the net export value of fuels as a share of GNI. A series of regressions similar in format to that of the preceding section are presented below in Tables 4, 5, and 6.

Table 4. Estimation Results for Nations with Initially *Low* Property Rights in 1970. OilNet 1970 Measure

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Property Rights 1970	0.322	0.296	0.321	0.295	0.302	0.260	0.284
	(1.83)	(2.04)	(1.83)	(1.99)	(2.03)	(1.76)	(1.90)
OilNet70	-0.081	-0.081	-0.077	-0.082	-0.090	-0.079	-0.080
	-(1.86)	-(2.27)	-(1.77)	-(2.23)	-(2.15)	-(2.25)	-(2.20)
Latitude (ABS)		0.051		0.053	0.053	0.050	0.050
		(3.40)		(3.09)	(3.32)	(3.34)	(3.23)
Ethnolinguistic Fractionalization			-0.944	0.206			
			-(1.06)	(0.25)			
Openk					0.004		
					(0.43)		
Revolutions and Coups						-1.708	
						-(1.75)	
Coastal/River Population							0.004
							(0.51)
Intercept	3.707	2.644	4.021	2.536	2.440	3.221	2.500
	(4.87)	(3.78)	(4.94)	(3.02)	(2.84)	(4.14)	(3.26)
R^2 (adjusted)	0.158	0.431	0.163	0.405	0.408	0.458	0.411
Number of Countries	25	25	25	25	25	24	25

The *OilNet70* variable is *Net* exports of fuels as a share of GNI. The dependent variable is property rights averaged for the years 2000, 2001, 2002. T-ratios are in parentheses.

Table 5. Estimation Results for Nations with Initially *High* Property Rights in 1970. OilNet 1970 Measure

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Property Rights 1970	0.483	0.463	0.439	0.439	0.482	0.456	0.471
	(1.53)	(1.91)	(1.58)	(1.92)	(1.94)	(1.82)	(1.81)
OilNet70	0.102	1.607	0.531	1.616	1.898	1.589	1.599
	(0.16)	(2.64)	(0.93)	(2.82)	(2.46)	(2.52)	(2.51)
Latitude (ABS)		0.051		0.042	0.053	0.051	0.052
		(4.03)		(3.32)	(4.02)	(3.89)	(3.87)
Ethnolinguistic Fractionalization			-2.697	-1.680			
			-(2.74)	-(1.94)			
Openk					-0.002		
					-(0.63)		
Revolutions and Coups						-0.419	
						-(0.20)	
Coastal/River Population							0.003
							(0.31)
Intercept	4.531	2.375	5.364	3.264	2.292	2.455	2.082
	(1.85)	(1.21)	(2.46)	(1.72)	(1.15)	(1.20)	(0.97)
R^2 (adjusted)	0.016	0.418	0.241	0.486	0.401	0.390	0.389
Number of Countries	25	25	25	25	25	25	24

The *OilNet70* variable is *Net* exports of fuels as a share of GNI. The dependent variable is property rights averaged for the years 2000, 2001, 2002. T-ratios are in parentheses.

This modification substantially reduces the number of nations showing positive fuel exports, consequently reducing the amount of variation in the oil variable for oil exporting nations[24]. The results however are consistent with the regressions in Tables 1-3 possibly suggesting that only the major oil exporting nations are driving much of the results in this study and in the rest of the literature.

[24] Out of the original sample of 50 countries ten are net exporters of fuel and related products as a share of GNI. The values range from 22.21% in Venezuela to 0.17% in South Africa.

Table 6. Estimation Results for Nations with Initially *High* and *Low* Property Rights in 1970. OilNet 1970 Measure

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Property Rights 1970	0.701	0.494	0.653	0.495	0.470	0.413	0.453
	-(8.54)	-(6.74)	-(8.16)	-(6.70)	-(6.30)	-(5.39)	-(5.67)
OilNet70	-0.701	-0.889	-0.746	-0.889	-0.858	-0.882	-0.928
	-(1.81)	-(2.94)	-(2.03)	-(2.92)	-(2.86)	-(3.07)	-(3.05)
PR70*OilNet70	0.137	0.184	0.150	0.184	0.174	0.183	0.193
	-(1.55)	-(2.66)	-(1.78)	-(2.64)	-(2.53)	-(2.78)	-(2.78)
Latitude (ABS)		0.050		0.047	0.052	0.048	0.049
		-(5.64)		-(4.75)	-(5.85)	-(5.68)	-(5.47)
Ethnolinguistic Fractionalization			-1.660	-0.390			
			-(2.49)	-(0.64)			
Openk					0.000		
					-(1.38)		
Revolutions and Coups						-1.920	
						-(2.48)	
Coastal/River Population							-0.010
							-(1.38)
Intercept	2.561	2.127	3.271	2.317	1.967	2.928	1.880
	(4.84)	(5.11)	(5.67)	(4.50)	(4.59)	(5.77)	(4.14)
R^2 (adjusted)	0.685	0.811	0.717	0.809	0.815	0.833	0.811
Number of Countries	50	50	50	50	50	49	49

The interaction term PR70*Oil70 has been included. The OilNet70 variable is Net exports of fuels as a share of GNI. The dependent variable is property rights averaged for the years 2000, 2001, 2002. T-ratios are in parentheses.

1975 Measure of Oil Exports

Throughout the curse and related literature researchers have typically used the 1970 measure of natural resources to represent a nation's resource endowment[25]. For studies on the importance of oil and related resources, 1970 seems like a logical base

[25] Prior to 1970 natural resource data are available for only a limited number of nations.

year to assess the impacts from the ensuing oil shocks. There are, however, a number of petro-rich nations today that produced little or no oil in 1970. North Sea oil and natural gas was first discovered in the 1960s, though measurable production did not begin until after 1970. Other nations, for instance Malaysia, Ecuador, Thailand and Australia produced little or no oil until the early 1970s. Similarly for a number of existing producers (e.g. Saudi Arabia, China, and United Arab Emirates) production increased significantly in the during the 1970s. Among the nations that either began production or increased production after 1970, some may have been responding primarily to the rise in price following the Arab oil embargo in 1973. This may suggest that the added production, produced only after oil prices had risen, may have brought low levels of rents, per unit of oil sold. That is, they may have been higher-cost resources, only marginally viable at lower prices, and thus produce a smaller net benefit.

Therefore 1970 natural resource data may not accurately reflect the importance of oil and related resources for a number of nations. The availability of data for this current study affords the opportunity to test whether resource dependence in 1975 yields similar results.

As in the initial empirical setup a sample of 50 nations was split into two sub-samples of either ‘low’ or ‘high’ measures of property rights and the rule of law in 1975. The empirical specification is as before except a 1975 measure of property rights and fuel resources is used in place of the 1970 data. The results are presented below in Tables 7 through 9.

Table 7. Estimation Results for Nations with Initially *Low* Property Rights in 1975. Oil 1975 Measure

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Property Rights 1975	0.573	0.578	0.589	0.575	0.369	0.488	0.539
	(2.00)	(2.77)	(2.09)	(2.69)	(1.88)	(2.14)	(2.59)
Oil 1975	-0.104	-0.073	-0.094	-0.074	-0.055	-0.069	-0.075
	-(3.24)	-(2.99)	-(2.86)	-(2.94)	-(2.48)	-(2.79)	-(3.12)
Latitude (ABS)		0.061		0.063	0.062	0.059	0.058
		(4.52)		(4.07)	(5.27)	(4.28)	(4.24)
Ethnolinguistic Frac			-1.361	0.255			
			-(1.32)	(0.29)			
Openness					1.652		
					(2.79)		
Revolutions and Coups						-1.046	
						-(0.99)	
Coastal/River Population							0.009
							(1.27)
Intercept	3.773	2.045	4.124	1.922	2.015	2.623	1.732
	(3.78)	(2.49)	(4.05)	(2.04)	(2.82)	(2.60)	(2.04)
R2 (adjusted)	0.316	0.637	0.339	0.620	0.725	0.636	0.647
Number of Countries	25	25	25	25	25	25	25

The Oil 1975 variable is exports of fuels as a share of GNI in 1975. The dependent variable is property rights averaged for the years 2000, 2001, 2002. T-ratios are in parentheses.

The regressions produced expected results, consistent with the theory and previous results, though with some exceptions. The estimated association of *Oil75* and *PRavg00* was as expected and in line with previous results - negative and statistically significant for the sub-set of nations with initially (1975) low measure of property rights. The same association for nations with initially high level of property rights was again as expected (positive), although not significant.

Table 8. Estimation Results for Nations with Initially *High* Property Rights in 1975. Oil 1975 Measure

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Property Rights 1975	0.396	0.344	0.420	0.350	0.185	0.316	0.382
	(1.85)	(1.77)	(1.93)	(1.73)	(0.86)	(1.75)	(1.77)
Oil 1975	0.250	0.155	0.233	0.154	0.111	0.122	0.138
	(1.68)	(1.11)	(1.54)	(1.08)	(0.79)	(0.96)	(0.95)
Latitude (ABS)		0.038		0.037	0.035	0.036	0.037
		(2.46)		(2.22)	(2.30)	(2.60)	(2.34)
Ethnolinguistic Frac			-1.197	-0.241			
			-(0.86)	-(0.18)			
Openness					1.062		
					(1.19)		
Revolutions and Coups						-7.140	
						-(2.36)	
Coastal/River Population							0.010
							(0.94)
Intercept	5.371	4.219	5.464	4.266	4.640	4.783	3.173
	(3.96)	(3.22)	(3.99)	(3.12)	(3.47)	(3.91)	(1.89)
R2 (adjusted)	0.140	0.300	0.130	0.267	0.287	0.408	0.294

In the combined sample (Table 9) the estimated coefficient on *OIL75* was negative and significant in all regressions. As in other specifications an interaction term was included in the combined sample of countries and again the estimated coefficient is positive, though not always significant at the usual levels.

Table 9. Estimation Results for Nations with Initially *High* and *Low* Property Rights in 1975. Oil 1975 Measure

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Property Rights 1975	0.663	0.506	0.606	0.503	0.359	0.401	0.448
	(5.67)	(5.33)	(5.44)	(5.26)	(3.54)	(3.94)	(4.42)
Oil 1975	-0.338	-0.241	-0.412	-0.266	-0.218	-0.251	-0.279
	-(2.27)	-(2.06)	-(2.90)	-(2.17)	-(2.00)	-(2.24)	-(2.43)
PR75 * Oil75	0.066	0.048	0.093	0.055	0.044	0.053	0.058
	(1.58)	(1.45)	(2.30)	(1.59)	(1.45)	(1.67)	(1.81)
Latitude (ABS)		0.055		0.051	0.053	0.051	0.050
		(5.62)		(4.57)	(5.87)	(5.45)	(5.21)
Ethnolinguistic Frac			-2.162	-0.523			
			-(2.74)	-(0.70)			
Openness					1.443		
					(2.90)		
Revolutions and Coups						-2.104	
						-(2.29)	
Coastal/River Population							0.013
							(2.25)
Intercept	3.668	2.537	4.414	2.794	2.498	3.406	2.033
	(6.01)	(4.93)	(6.98)	(4.40)	(5.22)	(5.51)	(3.80)
R2 (adjusted)	0.583	0.750	0.635	0.747	0.788	0.774	0.770
Number of Countries	50	50	50	50	49	49	49

The interaction term PR75*Oil75 has been included. The Oil 1975 variable is exports of fuels as a share of GNI in 1975. The dependent variable is property rights averaged for the years 2000, 2001, 2002. T-ratios are in parentheses.

As mentioned, the measure of natural resources most often found in the literature is either as per Sachs and Warner (1995) or some derivation thereof; however there has been little discussion of its inherent problems[26]. Of primary concern is the

[26] Robinson, Torvik, and Verdier (2003) suggest that resources are endogenous although they do not offer a solution.

potential endogeneity of natural resources[27]. A number of authors have suggested that political and economic institutions can impact natural resource use and extraction rates, for instance whether a natural resource is 'over' or 'under' exploited will depend on the nature of the resource as well as the institutional environment. Robert Deacon and his colleagues[28] argue that capital intensive resources generally require better economic institutions for development and extraction; therefore poor institutional quality may actually increase conservation of such resources. Conversely, more diffuse resources like timber and agriculture are more likely to be overexploited where institutional quality is poor (e.g. weak protection of property rights and rule of law) due to relative ease of extraction where little capital investment or effort is often needed[29]. Along a related thread, the political environment may too influence resource extraction rates and use. Windfalls from resource booms are thought to lead to a "feeding frenzy" by political factions as they compete for rents ultimately overexploiting the resource (Lane and Tornell, 1995). Similarly, leaders facing unsure tenure security may overuse resources for either personal gain or to improve their potential for remaining in office.

Given these considerations nations with poor political and economic institutions might be expected to 'inefficiently' extract and allocate their natural resource

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[27] I would like to thank Dino Falaschetti (personal communication) for originally noticing the potential problem of endogenous resources. One solution would be to calculate a derived supply function from some exogenous resource shock, for instance the introduction of the automobile. While another solution is to find an instrumental variable that accurately reflects the abundance of resources, yet is exogenous to institutional quality. Unfortunately, this research has not succeeded in finding an appropriate means to measure or calculate resource endowments that is likely indeterminate of institutions.

[28] See for example: Bohn and Deacon, 2000; Bulte, Damania, and Deacon, 2003; and Deacon and Mueller, 2004.

[29] Bates (2004) presents an interesting argument suggesting that the quality of institutions or stability of a nation may in essence be irrelevant for the development of certain resources. Political leaders may promise private property rights, not to the entire economy, but to specific investors, whether individuals, industries, or firms, for development of resources and their own personal gain.

endowment. For nations with a relatively underdeveloped non-resource sector even small changes in resource extraction or production would directly and significantly impact GDP. However the reason for a failing non-resource sector may be primarily the result of poor economic institutional quality. Therefore a nation's measure of natural resources as a share of GDP may be less indicative of their natural resource endowment and more reflective of the lack of a non-resource sector, which is likely a result of that nation's poor institutions.

Value of Net Oil Exports

One potential solution would be to eliminate GDP (or GNI) from the measure of resources, leaving only the export value of resources. Following this methodology yields similar results for the combined sample of 50 nations (Table 10, below), where the estimated coefficients of interest are correctly signed and highly significant throughout the series of regressions. However, when splitting the sample into initially 'low' and 'high' property rights nations the coefficients on the oil variable in the respective sets of regressions is correctly signed, although insignificant (results not shown). The reason for this seems likely to be the reduced sample size. There are only ten nations with positive export values.

Table 10. Estimation Results for Nations with Initially *High* and *Low* Property Rights in 1970. OilValue 1970 Measure

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Property Rights 1970	0.701	0.528	0.655	0.529	0.503	0.458	0.485
	(8.40)	(6.82)	(8.08)	(6.80)	(6.31)	(5.55)	(5.72)
OilValue70	-0.959	-0.763	-0.961	-0.781	-0.803	-0.686	-0.819
	-(2.71)	-(2.60)	-(2.87)	-(2.64)	-(2.73)	-(2.38)	-(2.75)
PR70*OilValue70	0.203	0.161	0.206	0.165	0.169	0.145	0.174
	(2.67)	(2.56)	(2.86)	(2.60)	(2.69)	(2.34)	(2.72)
Latitude (ABS)		0.046		0.042	0.048	0.044	0.044
		(4.81)		(3.88)	(5.00)	(4.78)	(4.56)
Ethnolinguistic Frac			-1.752	-0.518			
			-(2.54)	-(0.76)			
OpenK					0.004		
					(1.25)		
Revolutions and Coups						-1.760	
						-(2.05)	
Coastal/River Population							0.008
							(1.34)
Intercept	2.492	1.996	3.213	2.251	1.845	2.694	1.727
	(4.66)	(4.42)	(5.54)	(3.99)	(3.98)	(4.88)	(3.48)
R^2 (adjusted)	0.68	0.78	0.71	0.78	0.78	0.80	0.78
Number of Countries	50	50	50	50	50	49	49

An interaction term PR70*OilVal70 is included. Dependent Variable: Property Rights (Averaged for the years 2000, 2001, 2002). OilValue70 is in $100 Millions (US)

In addition to the reported results, Granger Causality tests were run for the whole sample as well as for the individual sub-sets of countries in order to determine the direction of "causality" between property rights measure and natural resources. The results do not prove causation; no econometric test does. Rather, the results suggest precedence between and two variables. For instance if the test confirms that "X

Granger causes Y", then X precedes Y or is 'temporally related' to Y[30]. The results from the test suggest that oil resources in 1970 (measured as the export value of fuel as a share of GNI in 1970) 'Granger cause' contemporaneous property rights for all groups of countries for which data are available.

[30] A variable X is said to Granger cause Y if the following two conditions hold. The lagged values of X add significantly to the predicted contemporaneous values of Y in a regression formed from lagged values of both X and Y. Secondly, the converse must not hold, for instance lagged values of Y must not help to predict current values of X in an estimation containing both lagged variables of X and Y.

CHAPTER 7

SUMMARY AND CONCLUSIONS

There exist good theoretical reasons to believe that petroleum wealth, when large rents flow to the treasury from producing or exporting it, will worsen the institutions in those nations where the institutions that foster growth and prosperity -- the same institutions that generally increase the accountability of the nation's rulers -- are missing. In contrast, for nations with growth enhancing institutions in place similar income flows to the treasury potentially lead to improvements in institutions. The regression analyses, run with several alternative specifications that yield similar results, support this theory. For nations with poor property rights and a rule of law prior to the oil booms of the 1970s, a dependence on oil exports is clearly associated with a worsening of such institutional components over time. Comparatively, oil-rich nations with initially strong measure of property rights and rule of law realized on average improvements to their respective institutions

During the 1970 to 2000-2002 period, petroleum prices more than tripled in real terms, raising substantially the income flows to the treasury, in nations for which petroleum, even before the price increases, constituted a substantial part of national income. In nations for which petroleum was more important, in the subset of nations with initially low property rights, institutions deteriorated relative to nations where petroleum was less important. Theoretical expectations were that resource rents are more easily appropriated for decision-makers' personal, rather than national benefit,

where institutional quality (property rights and the rule of law), is poor. In that situation, political agents with current or prospective access to natural resources may have an incentive to further degrade or to suppress improvements to institutional characteristics that would reduce or threaten access to their personal capture of such rents. Conversely, secure property rights and high institutional quality may make it prohibitively costly for leaders to ignore or degrade institutions in order to procure resource rents. In such cases, political agents are expected to improve institutional quality when their costs of doing so are outweighed by increased revenues from expected efficiency gains in resource use as well as expected economic gains from improvements in institutional quality and or property rights and the rule of law. In addition when institutions are strong, petroleum income might generate more investment, creating more assets whose owners would demand added institutional quality to enhance their assets' value.

The regression analyses do lend support to the hypothesis. However, it is important to keep in perspective the limits of what has been demonstrated. The fact that many regressions have adjusted R^2s well below 1.0 means that the equations specified, which included the initial level of property rights, can explain at best about 80 percent of the variation in the end-of-period property rights measures. Clearly, there is more work to be done in explaining how and why property rights, the rule of law, and other growth-enhancing institutions are developed. Further, the determinants of institutional factors are unarguably numerous and still not fully understood. These simple analyses have done only a little to attempt to bring in the role of culture, for example, which may well influence the way in which political leaders and others in fact respond to a given

change in the incentives they face. What is the role of democracy in the strengthening (or sometimes, the weakening) of property rights and the rule of law? What role is played by education of the many sorts that are available? The answers to these and other pertinent questions could, at least in principle, alter the interpretation of the results presented here.

APPENDICES

APPENDIX A

VARIABLE DESCRIPTIONS AND SOURCES

Table 11. Data Descriptions and Sources

ABSLATIT:	A country's absolute latitude. Source: Barro (1996).
AVELF:	Average value of five different indices of ethnolinguistic fractionalization. Its value ranges from 0 to 1. The five component indices are: (1) index of ethnolinguistic fractionalization in 1960, which measures the probability that two randomly selected people from a given country will not belong to the same ethnolinguistic group (the index is based on the number and size of population groups as distinguished by their ethnic and linguistic status); (2) and (3) probability of two randomly selected individuals speaking different Languages; (4) percent of the population not speaking the official language; and (5) percent of the population not speaking the most widely used language. Source: Easterly and Levine (1997). The ethnolinguistic fractionalization measure for Iran is from Alesina et al., (2003).
OIL70:	*Oil70* is the 1970 export value of SITC section 3 (mineral fuels) as a percentage of GNI in 1970. There are a number of countries without measurable oil and gas reserves, however these countries may still export 'fuels' or fuel byproducts, generally from value added refining operations. Both fuel exports and GNI are measured in current US$. Section 3 fuels comprise Petroleum, petroleum products and related materials; Gas, natural and manufactured; Coal, coke and briquettes; and Electric current. Source World Bank, "World Development Indicators" online version (WDI hereafter) (Washington, D.C.: World Bank, 2004). In addition, the following modifications or substitutions were made. Belgium: Data are from the Energy Information Administration (EIA) based on 1980 and proven reserve data. Denmark: 1971 data. Germany: 1971 data. Hong Kong: 1968 data. Iceland: no measurable fuel exports until 1988 and oil and gas production in 2001(est.) was 0bbl/day (CIA Factbook online, 2004). Kenya: 1976 data. Luxembourg: data are from 1980 EIA; Singapore: net fuel exports.
OIL75	1975 export value of SITC section 3 fuels as a percentage of GNI in 1970. See *OIL70* description for details. The following modifications or substitutions were made: Germany (FRG) fuel data are from UNSD Comtrade, GNI data are from WDI Indicators Online; Kenya: 1976 data; Belgium: data are from the EIA based on 1980 proven reserve data; Iceland: no measurable fuel exports until 1988 and oil and gas production in 2001(est.) was 0bbl/day (CIA Factbook online, 2004). Kenya: 1976 data. Luxembourg: data are from 1980 EIA; Singapore: net exports of fuel in 1975. Source: WDI online 2004.
OILnet70	The *net* export value of SITC section 3 fuels as a percentage of GNI in 1970. Nations with negative net exports (net importers) are given a value of zero. Source: WDI Online, 2004.
OilValue70	The value in $100 million (current $US) of net exports of SITC section 3 Fuels. Source WDI Online, 2004.

OpenK: Exports plus Imports as a share of real GDP per capita (Laspeyres) in constant prices. Represents total trade as a percentage of GDP. Source: Heston, Summers, and Aten (2002).

POP100cr: The proportion of the population in 1994 within 100km of the coastline or ocean-navigable river. Source: Gallup, Sachs, and Mellinger (1999). The following substitution was made in the data. Iceland: data are from CIESIN et al., 2000.

PR70: Legal System & Property Rights measure in 1970. Economic Freedom of the World Index (Gwartney and Lawson, 2004)

PR75 Legal System & Property Rights measure in 1975. Economic Freedom of the World Index (Gwartney and Lawson, 2004)

PRAVG00: Legal System & Property Rights measure averaged for the years 2000, 2001, and 2002. Source: Economic Freedom of the World Index (Gwartney and Lawson, 2004), available online at www.freetheworld.com.

REVCOUP: Number of revolutions and coups per year, averaged over 1960-84. Source: Banks (1997).

APPENDIX B

SUMMARY STATISTICS AND CORRELATION MATRICES

Table 12. Summary Statistics

Summary Statistics. All countries with initially *LOW* level of property rights in 1970

Variable	Obs.	Mean	Median	Maximum	Minimum	Std. Dev.
PRAVG00	25	4.788	4.687	7.475	2.411	1.415
PR 1970	25	4.039	4.381	6.155	1.147	1.507
Oil 1970	25	2.953	0.128	22.419	0.000	5.595
Latitude (ABS)	25	22.810	25.274	45.415	0.513	14.495
Ethnolinguistic Frac.	25	0.337	0.294	0.857	0.000	0.294
Openness	25	45.20	38.24	130.97	8.19	32.03
Revolutions & Coups	24	0.242	0.200	0.960	0.000	0.225
POP100CR	25	57.920	56.000	100.000	6.000	31.212

Summary Statistics. All countries with initially *HIGH* level of property rights in 1970

Variable	Obs.	Mean	Median	Maximum	Minimum	Std. Dev.
PRAVG00	25	8.293	8.554	9.359	6.140	0.934
PR 1970	25	7.766	8.033	8.347	6.468	0.600
Oil 1970	25	0.452	0.231	3.989	0.000	0.821
Latitude (ABS)	25	42.871	47.408	63.892	1.355	14.469
Ethnolinguistic Frac.	25	0.192	0.145	0.831	0.003	0.176
Openness	25	57.60	40.32	218.05	10.87	51.43
Revolutions & Coups	25	0.031	0.000	0.280	0.000	0.073
POP100CR	24	85.458	94.000	100.000	37.000	18.559

Summary Statistics. All Coutries with initally *LOW* or *HIGH* property rights in 1970.

Variable	Obs.	Mean	Median	Maximum	Minimum	Std. Dev.
PRAVG00	50	6.540	6.653	9.359	2.411	2.131
PR 1970	50	5.903	6.312	8.347	1.147	2.198
Oil 1970	50	1.702	0.205	22.419	0.000	4.155
Latitude (ABS)	50	32.840	35.546	63.892	0.513	17.553
Ethnolinguistic Frac.	50	0.265	0.176	0.857	0.002	0.250
Openness	49	51.40	40.17	218.05	8.19	42.86
Revolutions & Coups	49	0.134	0.040	0.960	0.000	0.196
POP100CR	49	71.408	82.000	100.000	6.000	29.079

Table 13. Correlation Matrices

Correlations of Independent and Dependent Variables for countries with initially *LOW* level of property rights in 1970

	PRAVG00	PR70	OIL70	ABSLATIT	AVELF	OPENK	REVCOUP
PR70	0.291						
OIL70	-0.393	0.098					
ABSLATIT	0.519	0.002	-0.093				
AVELF	-0.203	0.058	0.057	-0.434			
OPENK	-0.229	-0.027	0.588	-0.215	0.450		
REVCOUP	-0.348	-0.148	-0.036	-0.051	0.153	0.014	
POP100CR	0.179	0.104	0.039	0.103	-0.287	0.442	-0.120

Correlations of Independent and Dependent Variables for countries with initially *HIGH* level of property rights in 1970

	PRAVG00	PR70	OIL70	ABSLATIT	AVELF	OPENK	REVCOUP
PR70	0.306						
OIL70	0.333	0.295					
ABSLATIT	0.477	-0.006	-0.015				
AVELF	-0.480	-0.063	-0.102	-0.442			
OPENK	0.018	-0.034	0.271	-0.444	0.227		
REVCOUP	-0.136	-0.126	-0.074	-0.011	-0.161	0.006	
POP100CR	0.085	0.125	0.156	-0.050	-0.548	0.079	0.098

Correlations of Independent and Dependent Variables for all countries with an initially *LOW* or *HIGH* level of property rights in 1970

	PRAVG00	PR70	OIL70	ABSLATIT	AVELF	OPENK	REVCOUP
PR70	0.798						
OIL70	-0.415	-0.217					
ABSLATIT	0.705	0.500	-0.232				
AVELF	-0.415	-0.260	0.136	-0.513			
OPENK	-0.004	0.045	0.344	-0.240	0.288		
REVCOUP	-0.587	-0.526	0.138	-0.337	0.250	-0.306	
POP100CR	0.493	0.482	-0.120	0.323	-0.454	0.529	-0.331

APPENDIX C

COUNTRY AND VARIABLE DATA

Table 14. Country and Variable Data

Countries with a Low measure of Property Rights in 1970 (N=25)

	ΔPR 70-avg00	PRavg00	PR 1970	Oil 1970	Abslatit	AVELF	Openk	Rev-Coup	Pop-100cr
Chile	5.20	6.35	1.15	0.00	33.55	0.05	27.7	0.20	53
Egypt	3.99	5.14	1.15	0.48	30.00	0.02	53.6	0.16	99
Peru	2.69	4.04	1.36	0.11	11.79	0.43	25.0	0.28	56
Pakistan	1.37	3.56	2.19	0.05	31.17	0.62	84.1	0.32	9
Colombia	0.62	3.44	2.82	1.05	4.79	0.06	21.0	0.00	28
Ecuador	0.09	2.91	2.82	0.06	2.06	0.33	38.2	0.56	60
Nigeria	0.30	3.43	3.13	5.97	6.54	0.86	63.5	0.52	34
Algeria	-0.94	2.81	3.76	14.94	36.72	0.29	96.4	0.12	71
Argentina	0.34	4.09	3.76	0.03	36.68	0.18	8.2	0.96	30
Morocco	2.40	6.16	3.76	0.05	33.59	0.35	43.8	0.08	63
Tunisia	2.99	6.75	3.76	3.59	36.82	0.07	68.2	0.00	82
India	1.84	5.91	4.07	0.03	25.27	0.74	12.9	0.12	38
Indonesia	-0.93	3.45	4.38	3.75	6.56	0.69	42.0	0.28	96
Turkey	0.31	4.69	4.38	0.02	41.20	0.16	14.4	0.31	54
Venezuela	-1.97	2.41	4.38	22.42	9.84	0.05	74.3	0.32	82
Iran	1.22	5.91	4.69	11.95	35.38	0.76	83.8	0.24	6
Kenya	-0.97	3.72	4.69	5.24	0.51	0.83	131.0	0.05	6
Mexico	-0.68	4.02	4.69	0.13	16.76	0.17	20.9	0.00	30
Philippines	-0.59	4.11	4.69	0.26	13.92	0.72	35.3	0.44	100
Greece	0.23	5.76	5.53	0.06	38.06	0.08	16.4	0.20	97
S. Korea	0.34	6.19	5.84	0.00	37.00	0.00	14.9	#N/A	96
Malaysia	0.27	6.11	5.84	2.97	3.27	0.61	76.9	0.04	91
Thailand	0.38	6.22	5.84	0.03	13.77	0.36	42.8	0.44	40
Brazil	-1.10	5.05	6.16	0.04	19.56	0.06	9.2	0.12	37
Italy	1.32	7.47	6.16	0.62	45.42	0.04	25.5	0.04	90

Countries with High measure of Property Rights in 1970 (N=25)

	ΔPR 70-avg00	PR-avg00	PR70	Oil70	Abslatit	AVELF	Openk	Rev-Coup	Pop-100cr
Israel	1.19	7.66	6.47	0.00	32.08	0.33	55.8	0.00	98
Sweden	2.38	8.85	6.47	0.00	59.28	0.07	42.8	0.00	70
Finland	2.26	9.36	7.09	0.00	60.21	0.11	42.5	0.00	63
Iceland	1.86	8.96	7.09	0.00	63.89	0.10	70.8	0.00	99
Portugal	0.51	7.61	7.09	0.00	38.82	0.00	37.7	0.28	91
Spain	-0.32	6.77	7.09	0.00	37.40	0.27	15.9	0.08	67
France	0.12	7.52	7.41	0.00	48.86	0.15	23.8	0.00	90
South Africa	-0.85	6.56	7.41	0.17	29.13	0.83	53.8	0.04	37
Hong Kong	-0.54	7.18	7.72	0.00	22.70	0.24	99.5	0.00	100
Norway	0.78	8.50	7.72	0.00	59.98	0.07	62.4	0.00	88
Singapore	0.83	8.55	7.72	1.50	1.36	0.32	218.1	0.00	100
Taiwan	-1.58	6.14	7.72	0.00	25.26	0.26	40.3	0.05	100
Australia	1.26	9.29	8.03	0.00	32.22	0.11	21.1	0.00	83
Japan	-0.55	7.48	8.03	0.00	35.71	0.01	10.9	0.00	97
New Zealand	0.96	9.00	8.03	0.00	36.89	0.15	32.4	0.00	99
United Kingdom	1.15	9.19	8.03	0.00	51.51	0.11	33.4	0.24	100
Denmark	1.10	9.34	8.24	0.00	55.72	0.03	40.0	0.00	100
Belgium	-0.44	7.91	8.35	0.00	50.84	0.36	83.2	0.00	99
Canada	0.49	8.83	8.35	0.25	43.73	0.38	37.1	0.00	69
Germany (FRG)	0.52	8.86	8.35	0.00	48.16	0.04	32.7	0.08	95
Ireland	0.08	8.43	8.35	0.00	54.61	0.09	62.9	0.00	93
Luxembourg	0.20	8.55	8.35	0.00	49.78	0.22	207.2	0.00	#N/A
Netherlands	0.93	9.27	8.35	0.00	51.87	0.06	66.1	0.00	100
Switzerland	0.48	8.82	8.35	0.00	47.41	0.31	38.1	0.00	46
United States	0.34	8.69	8.35	0.00	34.36	0.21	11.5	0.00	67

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