The Price of Oil and Democracy*

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Abstract

This paper revisits the hypothesis that increases in the value of natural resources rents, oil revenues in particular, have a detrimental effect on the level of political freedom in oil producing nations. The starting point for the analysis is that existing results, based on cases studies and the statistical analysis of cross-country relationships, do not establish causation. Two problems are evident in the existing literature. First is the observation that oil prices, and as a consequence oil revenues, are simultaneously determined by changes in political regimes of oil nations. Second, and equally important, there is a real possibility of omitted variable bias in previous analysis. To deal with these issue we present results from instrumental variable regression using estimates of natural disaster damage as an instrument for oil revenues. The causal effect of changes in oil revenues estimated by our IV approach is of the same magnitude as the level of economic development (GDP per capita).

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"Go right to hell, Mr. Blair."– *Hugo Chavez, President of Venezuela*

1 Introduction

With the sharp rise in world oil prices, people are beginning to ask an interesting political question: What effect will the significant increase in the price of oil, and the revenue it is generating for oil exporters, have on the political relationships between countries? Could the volatility lead to more international conflicts? By what mechanism could these price changes influence world politics? While such questions have only begun to be addressed, one potentially important change that may have an effect on international relations is how the growing stream of revenues in oil producing states effects their domestic politics. In a recent article, Friedman (2006) argues for what he calls "the first law of petropolitics." Using data from various sources, Friedman claims there exists a correlation between measures of political freedom in oil producing countries and world oil prices. In particular, examining recent political events in countries like Iran, Russia, Venezuela, and Nigeria, Friedman argues, and presents evidence, that increases in oil prices are correlated with decreases in political freedom. This analysis leads to his definition of the "first law": the price of oil and the pace of freedom move in opposite directions (Friedman 2006).

At some level Friedman's law is a logical extension of well-known findings in the social science literature. There exists a significant body of work in which political scientists and economists have studied the effects of resource wealth on political freedoms and other regime characteristics [cites here]. Many careful case studies also suggest that there exists a causal relationship between resource wealth and political rights and, show in a variety of settings, that the resource rents (revenues) and political freedom are closely related. As Clark (1998, p.65) notes, the discovery of off-shore oil in 1969, along with the boom that resulted from the production shocks of the early 1970s, were instrumental to the consolidation of Marien Ngouabi's non-democratic regime in the Republic of Congo. Similar studies of petro-politics is Venezuela, Gabon, and Cameroon suggest the same result (Van de Walle 1994, Karl 1997, Gardinier 2000)[add bratton-98 to bib file]. In fact, the study of when and how oil impedes

democracy has long been a central research program for scholars with area specialties in the the Middle East (Mahdavy 1970, Beblawi 1987, Chaudhry 1994).

For quite some time, research on the effects of resource rents on politics has been the domain of area specialists and social scientists working with the case study method. Recent studies by Ross (2001), Wantchekon (2004), and Jensen & Wantchekon (2004), however, have taken the rentier hypothesis out of the case study literature and done more broad cross-country analysis. These studies have found that oil wealth and democracy have a robust and inverse statistical association. For example, analyzing panel data across 113 countries from 1971 to 1997 Ross (2001) finds that oil revenues, measured by mineral based fuel export values as a fraction of GDP, have a statistically significant negative correlation with a country's political institutions. Similarly, Wantchekon (2004, p.2) finds that "a crucial determinant of many Third World political regimes is their level of dependence on natural resource revenues." In a second paper Wantchekon, along with Jensen, turns his attention to the subset of African nations and finds a similar result. Jensen and Wantchekon find evidence for the claim that when an executive has discretion over the distribution of resource rents, this has a significant effect on the political regime.

This paper revisits the hypothesis that increases in the value of natural resources rents, oil revenues in particular, have a detrimental effect on the level of political freedom in oil producing nations. The starting point for the analysis is that existing results, based on cases studies and the statistical analysis of cross-country relationships, do not establish causation. Two problems are evident in the existing literature. First is the observation that oil prices, and as a consequence oil revenues, are influenced by changes in political regimes of oil nations, possibly as much as the other way around. For example, it is surely the case that when oil rich countries become more radical (Iran), when leaders consolidate power (Russia and Venezuela), or when civil strife threatens oil delivery (Nigeria), the oil markets react. A premium is paid for oil today when political events in oil producing nations generate the perception of risk to future supplies. In addition to the market mechanism, oil revenues are also more directly the influenced by political choices, and the political environment, in oil

producing nations. How much to drill, how much to sell, and who to sell it to all have effects on oil revenues for these countries and, in most oil producing nations, political conditions affect the decision. This is especially the case where large portions of the oil industry are state owned and run. Second, and equally important, there is a real possibility of omitted variable bias in previous analysis. This concern arise from our inability to measure certain covariates that are believed to be important for explaining political institutions, the recurring problem of data availability on measurable covariates in the developing world, and our limited–though improving–understanding of what determines the kinds of political institutions that arise in various developing countries.

There are a number of strategies one might use to attempt to investigate the causal effects of changes in oil revenues on regime characteristics. One that is particularly appropriate, given the various limitations researchers face, is instrumental variable regression. As is well known by econometricians and political scientists, an explanatory variable is said to be endogenous to the structural equation of interest if it is correlated with the disturbance term. Such correlation can come from many places, like measurement error, variables being omitted from the structural equation, and simultaneous causation (what is sometimes referred to as "endogeneity bias" in the political science literature (King, Keohane & Verba 1994)).[1] Equally well known is that OLS estimation, in the presence of endogeneity, is inconsistent for every explanatory variable. It is also the case that an instrumental variable approach can provide a general solution to this problem in the current setting, if a valid instrument for oil revenues can be found that is not correlated with regime characteristics through other pathways. Our candidate for such an instrument is the "out of region damage" done by five types of natural disasters to oil producing countries. The best argument for our instrument is that an earthquake in Tehran, for example, should have no effect on the regime characteristics of Mexico, other than through its effect on the price of oil. Similarly, a mud-slide in Columbia

[1]The distinction between these three sources of correlation between the explanatory variable and the error term are often fuzzy, at best. However, from an econometric perspective they are simply different sources for the same problem, so we will use the term endogeneity to cover them all.

should have no effect on the regime characteristics of Cameroon, other than through its effect on world oil prices.

Using annual data for oil producing nations between 1968 and 2002 the results from this IV analysis suggest that, within the set of oil producing nations, there is a significant causal effect of increasing oil revenues on regime characteristics. This effect is negative and about 8 times as large as the statistically significant association one finds with ordinary least-squares regression. If we condition on per capita GDP, past political institutions, economic growth, and a number of other variables the effect is robust. The empirical results are consistent with that of Wantchekon (2004), a critical determinant of political regimes in many developing countries is their dependence on rents from oil revenues. Interestingly, the causal effect estimated by our IV approach is of the same magnitude as the level of economic development, that is of GDP per capita. That is, oil revenues are no small factor in determining political institutions.

The paper proceeds as follows. Section 2 reviews the literature on resources and political regimes, fleshing out the story linking oil revenues to political change. In section 3 we discuss our instrument, how it is measure, its strengths and weakness, as well as other variables to be used in our analysis. Section 4 describes a series of OLS regressions and the statistical associations between our variables of interest. Section 5 presents our IV results, interprets them and examines their robustness. Section 6 concludes with comments and the implications of these results for future research on the effect of natural resource revenues on politics.

2 Oil Revenues and Political Freedom

The hypothesis that we put to a test in the analysis that follows is that within the set of oil producing countries, changes in their revenues from this natural resource rent effect political freedom. In particular, we test the hypothesis that when oil wealth grows, democracy suffers. Before turning to the data, however, we first explain why these changes in oil revenue would

lead to less political freedom. Central to our hypothesis test is the theory of the rentier state.

The concept of the rentier state has grown out of a diverse literature on resource endowments and political development. While definitions vary, rentier states are generally understood to be polities that derive a large portion of their revenues from external rents. For example, at various times, and in various places, rents that support such states have come from the sale of copper, diamonds, coffee, and oil. The most commonly cited definition of rentierism is Beblawi (1987), who characterizes such states as ones where the rents are paid by foreign actors, where revenues accrue directly to the state and its leaders, and where most of society is only involved in the distribution or utilization of the profits.

In general, leaders of rentier states are often described as being autonomous or detached from the underlying political dynamics of the country they govern. Why would changes in rents from natural resources influence political regimes? Previous research points to two causal mechanisms, the rentier effect and the contestation effect. Even though the rentier effect and the contestation effect are likely to both occur in any given country we will consider them in turn.

The rentier effect grows out of a literature on taxation and representation. In short, it is argued that taxation is an important factor that leads to institutional change. Starting with Schumpter, and continuing through Tilly (1992) and Ross (2003), scholars argue that the need for revenues by the ruling elite was the impetus behind much of the institutional change in Europe that created representative government (North, Douglass C. & Weingast, Barry R. 1989). In particular, as the cost of running the state increased–largely driven by the demands of war–the leadership was forced to appropriate more and more of their subjects wealth. This increase in state appropriations led to calls for, at least by the existing lower ranked nobles, for say in the decisions of government. Sometimes such demands led to revolution, as in the Glorious Revolution of 1688, that of the 1976 war of independence in America, and the 1789 in France, and eventually compromise.

Rentier states, however, rarely face such a dilemma. In most instances the flow of revenues originates with the state and, in particular,with the leadership. Leaders either own directly

the resources that generate rents or are, by virtue of their control of the state apparatus, control the revenues of "state owned" enterprizes. So rather than being required to collect revenue from the citizens who own assets, they are largely in the business of distributing spoils to those who support their political position. This creates a very different set of incentives between the leadership and their relevant selectorate. Where leaders without revenue rents have to bargain with those that support them in order to stay in power, the selectorate in countries with large resource revenues depend more on the leader's distribution strategies (Bueno de Mesquita, Smith, Siverson & Morrow 2003).

Another important factor that lead to the development of representative nation states in the west, discussed by Spruyt (1996), is the close, and in many respects dependent, relationship between the leadership of the central state and the localities (cities). Both Spruyt and Tilly see this connection as an important factor leading to the development of nation states, and eventually political representation. Rentierism turns this relationship upsidedown. Where in the European circumstance the central state required the cooperation of the localities, providing them with manpower, food, and money, in the rentier state leaders create a dependence on the distribution of the state's resource wealth among the various localities and local leaders.

The view that taxation plays an important role in the development of representative government is further investigated in the modern period and the relationship appears robust. While Huntington (1991) views taxation as being central to the development of demand for representative government, other scholars –such as Ross (2003) and Bates & Lien (1985)– hypothesize that government spending decision in light of the level of taxation are important. In either case, rentierism undermines this mechanism of regime change.

Complimentary to the indirect effect of resource revenues on the political freedoms in a given country, some authors have argued there also exists a contestation or "repression" effect of resource wealth. As the value of being in command of the state apparatus increases, groups and individuals not part of the ruling coalition will have greater incentive to overthrow existing leaders, if they are not well protected. The value of controlling the state also creates

Table 1: Descriptive Statistics

Variable	Mean	σ	Min	Max	Observation
Log oil revenues (constant 2000 US dollars)	9.63	1.69	2.317	13.710	1610
GDP growth	1.82	6.48	-27.099	76.563	1459
Log GDP per capita (constant 2000 US dollars)	7.81	1.48	4.528	10.877	1447
Polity IV	-.99	7.75	-10	10	1513
Democracy score	3.45	4.22	0	10	1480
Constrain on Executive	3.67	2.37	1	7	1480
Log out of region damage estimates (constant 1995 US dollars)	15.39	1.44	8.202	17.751	1534
Latitude (absolute value)	25.916	17.767	.650	67.470	1824
Constraint on Executive 1900	1.78	1.586	1	7	1558

an incentive for those in power to defend their position. Therefore, leaders are likely to be more inclined toward repressing citizens and building large armies and internal police forces. Clark's (1998) research on the Republic of Congo illustrates such a situation, as does the recurring conflict over power in Nigeria.

3 Data and Descriptive Statistics

Table 1 provides descriptive statistics for the key variables of interest. The columns report the mean, standard deviation, min, max, and number of observations respectively. These statistics are summary statistics for the 48(!) countries reported by BP's statistical review as having produced some non-negligible amount of oil for at least some subset of the years between 1968 and 2005. The values for the GDP per capita and oil revenues are reported in constant 2000 US dollars. GDP per capita and GDP growth are from the 2005 World Bank Development Indicators. Oil revenues for a given country are generated by the product of the average daily spot price of crude oil, as reported by BP's statistical review 2005, (in constant 2000 Us dollars) and the given country's annual production for that year (in thousands of

barrels).

Also reported are summary statistics for three different measures of political regimes. The Polity IV composite democracy-autocracy score is the dependent variable that is the focus of our analysis. It is created by subtracting the Polity autocracy score from the democracy score, giving the variable a range from -10 to 10, with -10 being the least democratic and 10 being the most democratic. The democracy score variable is then just the 11 point democracy scale that makes up part of the Polity composite score. Finally, the constraint on the executive variable is a measure of the political power of the executive, also from the Polity project, and ranges from 1 to 7. A score of 7 implies a very constrained executive, while a score of 1 implies an executive who faces little institutional opposition. In our analysis, these measures of democracy are all normalized so that the scores lie between 0 and 1.

Other variables used in the following analysis and described in table 1 are the constraint on the executive in 1900 and the latitude of a country. Following Acemoglu, Daron, Johnson, Simon & Robinson, James A. (2001) the constraint on executive in 1900 is intended to capture long run political institutions. Like AJR, we use the constraint on executive score for all countries reported by the Polity data set. If a country has no 1900 score on this variable, and the country was a colony in 1900, we give that country the lowest score, a 1. The latitude variable is take from The Center for International Developments physical geography and population database and is the absolute value of the latitude of the geographic center of the country.

We also report descriptive statistics for our proposed instrument, out of region disaster damage for oil producing nations. The disaster data comes from the Emergency Disaster Data Base managed by the Center for Research on the Epidemiology of Disasters at Universit Catholique de Louvain - Ecole de Sant Publique in Brussels. The damage estimates are taken from various public sources and are deflated so that they are in constant 1995 US dollars. Included in the disaster estimate totals are 5 classes of disasters. Damage totals represent damage from earthquakes, slides, windstorms and hurricanes, volcanos, and waves and surges. While data is available on additional classes of disasters, these types of disasters

were chosen for two reasons. First, unlike industrial and transportation accidents, famines, and epidemics, the damage from these classes of natural disasters unlikely to be correlated with regime type or quality. In fact, many of the most severe natural disasters in the five class considered occur in the developed world (e.g., the United States and Japan), while famines and epidemics almost never occur in these developed countries.[2]

4 OLS Estimates

Table 2 reports the ordinary least-squares regression of the normalized Polity IV composite score on the log of oil revenues and a series of controls. The regression is for the equation

$$y_{it} = \alpha + \beta R_{it} + \gamma \mathbf{X}_{it} + \epsilon_{it} \tag{1}$$

where y_{it} is country i's polity score in year t, $\mathbf{X}_{it}$ is a vector of "control" covariates, and ϵ_{it} is a random disturbance. Generally, our interest will focus on the parameter β, the effect of oil revenues on democracy.

Column 1 shows the statistical association between the log of annual oil revenues and the polity composite score. The negative effect is statistically significant and a movement from one standard deviation below the mean to a standard deviation above induces a about a 1 point change in the composite score.

Many scholars, like Helliwell (1994), Geddes (1999), and Acemoglu & Robinson (1996), have argued that wealth, in terms of per capita income, levels of economic growth, previous political institutions, or some combination of the three have a direct effect on domestic

[2]Also excluded from the natural disaster estimates are damages due to floods, as too prevalent and difficult to geo-spatially locate (Peduzzi, Dao & Herlod 2005). Also, unlike heat waves and insect infestations, the five classes of natural disasters included in the analysis are more likely to effect the supply chain of crude oil, and hence oil prices. The out of region nature of this variable is constructed by dividing the world into 5 regions: the Americas, Europe, Asia, North Africa and the Middle East, and sub-Saharan Africa. For each country, the out of region disaster damage is the sum of the disaster damage in that year for the four regions not containing their state. (This variable is discussed further below.)

Table 2: OLS: Measures of political freedom on oil revenues

	World oil producers' political freedom measures Pooled OLS: 1968–2002			
Independent variables	Polity IV	Polity IV	Polity IV	Polity IV
Log oil revenues	-.0142	-.033	-.032	-.023
	(.0064)	(.0051)	(.005)	(.005)
Log GDP per capita	—	.1166	.118	.047
		(.0072)	(.007)	(.009)
GDP growth	—	—	-.001	-.001
			(.002)	(.002)
Constraint on executive 1900	—	—	—	.109
				(.005)
Constant	.602	-.11	.128	.138
	(.062)	(.074)	(.075)	(.072)
Wu-Hausman p-value	$< .001$	$< .001$	$< .001$	$< .001$
Number of observations	1385	1277	1267	1149
R^2	.0038	.1709	.1737	.3285

	Democracy Score	Constraint on Executive
Log oil revenues	-.026	-.018
	(.005)	(.005)
Log GDP per capita	.077	.058
	(.010)	(.009)
GDP growth	-.0001	-.0004
	(.002)	(.002)
Constraint on Executive 1900	.118	.098
	(.005)	(.005)
Constant	-.199	.005
	(.077)	(.076)
Number of observations	1149	1149
R^2	.3875	.2917

political institutions. To control for these potential effects columns 2-4 report regression results with variables: log GDP per capita, GDP growth, and the constraint on the executive in 1900. The coefficients on the set of control variables are consistent with prior research. Per capita GDP has a substantial positive association with higher polity scores. GDP growth has a negative statistical association, consistent with the claim that when there is strong economic growth, or lack of an economic crisis, there is less demand for accountability for the leadership. There is also a substantial positive correlation between previous regime characteristics, captured by the measure of constraints on the executive in 1900, and the current characteristics of political institutions. The statistical association between log oil revenues and political institutions remains remains significant, negative, and there is little change in the size of its coefficient across regressions, while in each case the sign and size of the coefficients in the control set are consistent with previous research. Finally, columns 5 and 6 in the lower panel of Table 2 replicate the results in the upper panel using the alternative measure of political institutions, i.e., the 10 point democracy score and the current measure of the constraint on the executive. The direction and magnitude of the effects are consistent with the coefficients found in the upper panel.

The results in Table 2 show a weak correlation between oil revenues and polity scores within the set of oil producing nations. However, there are a number of important reasons for being skeptical of the causal inferences. First, less democratic countries often are less stable both in terms of domestic policy and the possibility of political unrest. This risk can effect oil markets, and in expectation of these risks, oil markets often react by bidding up the price of oil. Or possibly, oil prices could rise in expectation of these changes producing truly spurious results. Evidence of this simultaneous causation is shown in the Wu-Hausman test. The p-value, reported at the bottom of panel A rejects the null hypothesis of the exogeniety of oil revenues at levels far beyond normal significance tests. Equally important, there are likely many omitted variables that determine the political environment in a country that are correlated with their oil revenues, such as economic inequality. Both of these problems could be solved if we had an instrument for oil revenues. Such an instrument must be important

for determining oil revenues, but have no direct effect on a country's polity score. Below we argue that the out of region disaster damage from 5 classes of natural disasters is a plausible instrument for oil revenues.

5 IV Results: Natural Disasters and Oil Revenues

Given the potential for simultaneous causation and omitted variable bias in our (or any) OLS regression analysis of resource rents on political institutions, we need a source of exogenous variation in oil revenues to estimate the causal effect. A useful strategy to try to identify the effect of oil revenues is through instrumental variable analysis. For the rest of this paper we propose that certain types of natural disasters provide such an instrument. The validity of this source of exogenous variation rests on the premise that: (1) Some natural disasters are relevant for oil revenues. This means that natural disasters in oil producing countries influence the price of oil and, therefore, oil revenues. (2) There exist natural disasters, which are possibly 'far away"– i.e., that occur in countries outside of a country's home region– that have no independent (direct) effect a country's political institutions, other than possibly through increases in returns from the resulting changes in world oil prices.

Based on these conditions, we use the out of region disaster damage estimates for 5 classes of natural disasters as an instrument for oil revenues. The choice of which types of disasters to use as our instrument was made with attention to the the exclusion restriction described above (2). We were also concerned that the disaster be as easy as possible to identify and to locate geo-spatially. So, instead of casting a broad net we focused on earthquakes, volcanos, slides, waves and surges, and windstorms (e.g., hurricanes, typhoons, etc.). To satisfy the exclusion restriction, we need to worry about possible direct effects of these 5 types of natural disasters. First, one would not want to include a country's own natural disaster damages in the instrument, as disasters at home can lead to the declaration of a state of emergency, with emergency executive powers being evoked.

Second we may also worry about the direct effect of geographically "near by disasters."

For example, a disaster in a country might produce a significant population of displaced persons. In the search for shelter, food, and water these displaced people may floe across one, or multiple, boarders in search of relief. This could lead other states in the region to tighten boarder controls, increase internal policing, or activate the military in response. Therefore, to satisfy the exclusion restriction, we only want to consider the effects of natural disasters that occur "far enough" away. We operationalize "far away" by dividing the world into 5 regions: Europe, the Middle East and North Africa, sub-Saharan Africa, Asia, and the Americas. We cast the American net more broadly than other regions because of the historic relationship between the United States and states in South and Central America.

Last, we require that our instrument is relevant. Intuitively the instrument seems relevant. Additionally, the first stage regression, shown below, finds a statistically significant correlation between the out of region disaster damage estimates and oil revenues. There is, however, a more technical requirement for relevance. That is, we will need to verify whether or not our disaster damage instrument is "weak."

In the analysis we present statistics to test the strength of our proposed instrument. In almost every case the instrument satisfies the Stock & Yogo (2002) criteria for rejecting the null of weak instrumentation. Our results, however, are often close to the threshold. This is likely because the disaster data is aggregated at the country level, but there is no guarantee that the damage in question affected the oil supply chain. This suggest that it may be useful, in future work, to improve the instrument by geo-spatially locating the disaster data and only including damage estimates for events influencing oil regions of a country.

Given the small effect of oil revenues on political institutions found in the OLS regression, it is reassuring that the reduced form regression of out of region disaster data on the polity IV composite score produces the expected results. The results are presented in Table 3. The relationship between disaster damage and polity scores is as expected, negative and statistically significant. Our identification strategy claims that this effect is capturing the effect of changes in oil revenues on political institutions. The relationship in the reduced form equation is robust to conditioning on other controls.

Table 3: Reduced Form OLS

	World oil producers political freedom measures Reduced form regression with HAC standard errors			
Independent variables	Polity IV	Polity IV	Polity IV	Polity IV
Log out of region disaster damage	-.047	-.035	-.037	-.018
	(.008)	(.007)	(.008)	(.008)
Log GDP per capita	—	.103	.105	.039
		(.010)	(.01)	(.012)
GDP growth	—	—	.001	-.001
			(.002)	(.001)
Constraint on Executive 1900	—	—	—	.109
				(.007)
Constant	1.164	.218	.196	.251
	(.118)	(.156)	(.155)	(.146)
Number of observations	1385	1277	1267	1166
R^2	.031	.168	.1712	.3209

In sum, the exclusion restriction for our instrumental variable regression is that, conditional on the included control variables, the disaster damage inflicted on oil producing countries out of a given oil producer's home region has no direct effect on that country's polity score other than through the disaster's effect on oil prices.

In Table 4, the first stage regression, presented in the lower panel, shows that our instrument is working in the way we suggest. The coefficient is positive, statistically significant, and robust to various controls. Also reported at the bottom of the upper panel is the Cragg-Donald statistic for weak instrumentation. Stock & Yogo (2002) derive a set of critical values for the Cragg-Donald statistic that tests when the nominal 5% TSLS t test for the hypothesis that $\beta = 0$ has the size potentially exceeding 15%. The value for a single endogenous righthand side variable that is exactly identified is 8.96. In every TSLS regression reported in table 4, the Cragg-Donald statistic exceeds this critical value and we can reject the null hypothesis. Only in the regression in column (2) exceeds the critical value for the possibility of exceeding the 10% level.[3]

[3]Using a conditional likelihood ratio test, which is robust to weak instruments (Murray 2004), asymptotic

Table 4: 2SLS: Disaster instrument on Polity IV scores

	World oil producers political freedom measure			
	Second stage 2SLS: HAC standard errors			
	Polity IV	PolityIV	Polity IV	Polity IV
Independent variables	(1)	(2)	(3)	(4)
Log oil revenues	-.437	-.265	-.27	-.152
	(.181)	(.095)	(.099)	(.084)
Log GDP per capita	—	.187	.189	.089
		(.034)	(.035)	(.031)
GDP growth	—	—	-.003	-.004
			(.003)	(.003)
Constraint on executive 1900	—	—	—	.094
				(.013)
Constant	4.672	1.557	1.6	1.084
	(1.75)	(.687)	(.725)	(.618)
Cragg-Donaldson Statistic	12.00	17.20	15.86	11.90
	Log oil revenues			
	First Stage			
	(1)	(2)	(3)	(4)
Log out of region disaster estimates	.1084	.132	.112	.117
	(.038)	(.036)	(.036)	(.037)
Log GDP per capita	—	.316	.31	.328
		(.05)	(.051)	(.051)
GDP growth	—	—	-.015	-.022
			(.008)	(.008)
Constraint on executive 1900	—	—	—	-.01
				(.056)
Constant	7.961	5.054	5.194	5.47
	(.593)	(.687)	(.686)	(.735)
Number of observations	1385	1277	1267	1166
R^2	.0086	.073	.0758	.0769

The TSLS estimates of equation (1) are also presented in the upper panel of Table 4. Log oil revenues (R_{it}) is treated as endogenous and modeled by

$$R_{it} = \mu + \theta log D_{it} + \delta \mathbf{X} + \nu_{it} \tag{2}$$

where D_{it} is the out of region disaster damage for country i at time t, $\mathbf{X}_{it}$ is a set of control variables from equation (1). The exclusion restriction implies that D_{it} does not appear in equation (1).

The top panel reports coefficients on log oil revenues, as well as those on the control variables, with heterosketastistic and autocorrelation consistent (HAC) standard errors [cite White ?81]. The effect of log oil revenue, reported in column (1), is -.437 and is much larger than the association found in the OLS regression in Table 2. Columns (2) and (3) show that, controlling per capita GDP and GDP growth, the coefficient on log oil revenues is still negative and significant with an estimated effect of about -.27. Finally column (4) shows that when controlling for institutional legacy, using the constraint on the powers of the executive in 1900, the effect of log oil revenues is negative and significant.

In each of these cases, the effect of changes in oil revenues is on the order of the association found between polity scores and per capita GDP. It is also interesting to note that, while GDP growth has a negative sign–as found in other research (Helliwell 1994), its effect is consistently small compared to GDP per capita and log oil revenues and is never statistically significant. This suggests that the role played by economic growth shocks in other parts of the world is taken over by the shocks to oil revenues in oil producing states.

95% intervals and t-tests were performed and in every case the lower bound of the confidence interval was further from zero (in the negative direction) than the one implied by inverting the t-test in Table 4. The Anderson-Rubin statistic, which is also heteroskedastic and autocorrelation consistent, but has poorer coverage than the CLR, produced the same significance results.

Table 5: 2SLS: Measures of regimes on disaster instrument

	World oil producers political freedom measures	
	Second stage 2SLS	
Independent variables	Democracy Score	Constraint on Executive
Log oil revenues	-.155	-.126
	(.087)	(.084)
Log GDP per capita	.120	.094
	(.033)	(.031)
GDP growth	-.002	-.003
	(.003)	(.003)
Constraint on executive 1900	.102	.085
	(.014)	(.012)
Constant	.739	.791
	(.638)	(.613)
Cragg-Donald Statistic	12.12	12.12
	Log oil revenues	
	First Stage	
Log out of region disaster estimates	.119	.119
	(.038)	(.038)
Log GDP per capita	.333	.333
	(.052)	(.052)
GDP growth	-.020	-.020
	(.008)	(.008)
Constraint on executive 1900	-.099	-.099
	(.056)	(.056)
Constant	5.378	5.378
	(.744)	(.744)
Number of observations	1149	1149
R^2	.0775	.0775

5.1 Robustness

The validity of the inferences from two stage least-squares depends on the assumption that out of region disaster estimates have no direct effect on political institutions, that is they are are exogenous. Although this working hypothesis has face validity, here we substantiate it further by controlling for other variables that could plausibly be correlated with natural disasters and political institutions and verify that the results are robust to these changes. We further examine the quality of the TSLS results by considering alternative measures of institutional legacy, running the analysis on subsamples of the population of oil producing countries, and using log of known oil reserves as an alternative instrument. Overall, we find that our results change remarkably little.

First we focus on a few variables that could be correlated with disasters and politics. The first such variable is latitude. Given the prevalence of topical storms in disaster data sets, that a particularly active storm year could induce correlation between the out of region disaster damage estimates and the number and severity of such disasters in the ones home region. This could be problematic, particularly in the tropics. We also present results where we control for the top 5 oil producers, measured as having the highest average annual oil output between 1968 and 2002, to verify that the results are not driven by these largest oil countries. We also include a set of results with a Cold War dummy to account for the change in the geopolitical climate after 1989.

Another possible problem for our analysis is the measure of institutional legacy. Recall that we constructed the relevant variable by using the 1900 constraint on the executive score from the Polity IV data base and then, like Acemoglu, Daron, Johnson, Simon & Robinson, James A. (2001), we gave any country that was a colony in 1900 the lowest score. As scholars, like Engerman & Sokoloff (2004), argue: the most important institutional legacy may not be related to the powers of the executive in 1900. To explore the possibility that this different measure of institutional legacy may influence our results, we present a number of different specifications of our model. First, we use a dummy for the "West," defined to be the United States, Canada, Norway, Denmark, Great Britain, and Russia, and then include dummy

variables for Sub-Saharan Africa and the Middle East and North Africa to capture broad differences in the political histories of oil rich nations. Because (LaPorta, de Silanes, Shleifer & Vishny 1996) argue for the importance of colonial origin, we also specify models where we use a country's colonial experience as a measure of institutional experiences. Controls for the experience of being an excolony and the identity of colonial powers are used and have no substantial effect on our previous results.

One instance where the control variables matter is when the Middle East and North Africa dummy is included in the analysis. In this case the conditional effect of the first stage instrument of the two stage least squares (out of region disaster damage) becomes weak and estimates are, therefore, less reliable. This suggests that the the average of the within estimates for the effect of out of region disaster damages, where "within" is with respect the Middle East and North Africa and the rest of the world, on oil revenues is not as strong. A conjecture as to why this is may be the case relates to the discussion of the short-comings of the disaster instrument generally. The measure is weakened by the fact that the disasters are aggregated at the national level and the damages do not necessarily represent an actual or significant disruption to oil supplies. Yet given the clear intuition linking the instrument to the oil revenues, we believe that a more accurate measure of disaster damages effecting the relevant oil producing regions of the world would solve this problem.

In Table 7 we further explore the robustness of our result by running the analysis on subsamples of the data. In the subsamples the effect of oil revenues is consistently negative. As one would expect, the standard errors in the subsamples are larger and in the case of the world without the west and former British colonies the instrument is weak. The weakness of the instrument in these cases has two effects. First, if there is even a small amount of correlation between our instrument and the disturbance term in the structural equation the coefficients will be biased in the direction of the OLS estimates(Bound, John, Jaeger, David A. & Baker, Regina M. 1995). Second, the weakness of the instrument can effect the actual size of the $t-$tests under the normal approximation. While the instrument is not as weak

Table 6: IV regression with additional controls

	World oil producers political freedom measure:Polity IV						
	Second stage 2SLS						
	Original IV estimates	Latitude	Top 5	Cold War	Top 5 & Latitude	West	West & Middle East
Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log oil revenues	-.152	-.176	-.167	-.328	-.194	-.271	-.114
	(.084)	(.097)	(.111)	(.154)	(.126)	(.093)	(.09)
Log GDP per capita	.089	.08	.088	.146	.079	.105	.091
	(.031)	(.029)	(.031)	(.055)	(.029)	(.033)	(.023)
GDP gwoth	-.004	-.005	-.004	-.008	-.005	-.005	-.003
	(.003)	(.003)	(.003)	(.004)	(.003)	(.003)	(.002)
Constraint on Executive 1900	.094	.087	.088	.073	.079	—	—
	(.013)	(.016)	(.022)	(.026)	(.026)		
"West" dummy	—	—	—	—	—	.542	.35
						(.067)	(.055)
Sub-Saharan Africa dummy	—	—	—	—	—	—	—
Middle East and N. Africa dummy	—	—	—	—	—	—	-.35
							(.073)
Excolony	—	—	—	—	—	—	—
"Top 5" oil producer	—	—	.181	—	.239	—	—
			(.299)		(334)		
Latitude (absolute value)	—	.003	—	—	.003	—	—
		(.002)			(.002)		
Cold war dummy	—	—	—	-.249	—	—	—
				(.061)			
Constant	1.084	1.321	1.232	2.491	1.508	2.182	.915
	(.618)	(.736)	(.877)	(1.152)	(1.018)	(.685)	(.678)
Number of observations	1166	1166	1166	1132	11.66	1166	1166
Cragg-Donald Statistic	11.90	9.84	8.72	7.61	7.43	15.85	7.10

	West & Africa	French Colony	British Colony	British & French Colony	Colonies & Latitude	Excolony
	(8)	(9)	(10)	(11)	(12)	(13)
Log oil revenues	-.225	-.188	-.219	-.166	-.180	-.269
	(.078)	(.07)	(.078)	(.06)	(.062)	(.085)
Log GDP per capita	.077	.147	.172	.144	.136	.188
	(.027)	(.023)	(.027)	(.02)	(.021)	(.032)
GDP growth	-.005)	-.001	-.004	-.002	-.002	-.003
	(.002)	(.002)	(.002)	(.002)	(.002)	(.07)
French Colonial dummy	—	-.452	—	-.347	-.343	—
		(.069)		(.058)	(.061)	
British Colonial dummy	—	—	.403	.326	.334	—
			(.047)	(.036)	(.037)	
Latitude (absolute value)	—	—	—	—	.002	—
					(.001)	
Excolony dummy	—	—	—	—	—	.003
						(.07)
"West" dummy	.537	—	—	—	—	—
	(.056)					
Sub-Saharan Africa dummy	-.247	—	—	—	—	—
	(.061)					
Constant	2.0	1.189	1.15	.920	1.066	1.591
	(.585)	(.538)	(.564)	(.459)	(.474)	(.578)
Number of observations	1166	1166	1166	1166	1166	1166
Cragg-Donald Statistic	18.06	21.74	17.74	22.72	21.89	21.75

Table 7: IV Regression in Subpopulations

	World oil producers political freedom measures :sub-populations 1968–2002			
Independent variables	World w/o West	World w/o Sub-Saharan Africa	World w/o top 5 oil producers	Former British Colonies
Log oil revenues	-.08	-.136	-.158	-.137
	(.094)	(.079)	(.103)	(.065)
Log GDP per capita	.003	.087	.092	.144
	(.038)	(.032)	(.029)	(.024)
GDP growth	-.004	-.003	-.004	-.012
	(.002)	(.003)	(.003)	(.005)
Constraint on executive 1900	.145	.086	.072	.056
	(.037)	(.014)	(.027)	(.028)
Constant	.92	.974	1.147	.88
	(.686)	(.58)	(.832)	(.515)
Number of observations	982	1016	1069	290
Cragg-Donald Statistic	8.56	12.24	9.56	6.51

as others, for example the F-statistic[4] on the first stage regression in Acemoglu, Daron, Johnson, Simon & Robinson, James A. (2001) is 4 for the important specification including current health conditions, the estimates in these columns should be viewed as less reliable than the others.

Finally, we consider a second, though less plausible, instrument: known oil reserves. While it seems possible that initial findings for reserve levels are exogenous to the political institutions in a an oil producing country, the subsequent finds are likely correlated with both previous findings, expectations that have grown from scientific consensus regarding the geological prospects of unexplored regions, and decisions that shape political institutions are influenced by these expectations. Relevance, on the other hand, is obvious.

Table 8 shows the results of the TSLS regression of three different measures of political institutions on oil revenues using known oil reserves as an instrument. The results split the difference between the OLS estimates and the TSLS estimates presented in Table 4. They are negative and statistically significant and, like previous results, the effects of oil revenues is on the scale of the effects of per capita GDP.

[4]Cragg-Donald and first stage F-Statistics for the excluded instruments are the same for exactly identified models.

Table 8: Alternative instrument- Log known oil reserves: 1980–2002

	World oil producers political freedom measure		
	Second stage 2SLS		
	Polity IV	Democracy score	Constraint on Executive
Independent variables	(1)	(2)	(3)
Log oil revenues	-.061	-.066	-.049
	(.011)	(.011)	(.011)
Log GDP per capita	.056	.091	.068
	(.015)	(.017)	(.015)
GDP growth	.002	.003	.004
	(.002)	(.002)	(.002)
Constraint on executive 1900	.114	.124	.104
	(.008)	(.009)	(.008)
Constant	.459	.1	.104
	(.132)	(.137)	(.129)
Cragg-Dolanld Statistic	2571.1	2550.66	2550.66
	Log oil revenues		
	First Stage		
	(1)	(2)	(3)
Log of known oil reserves	.703	.708	.708
	(.02)	(.021)	(.021)
Log GDP per capita	-.028	-.026	-.026
	(.03)	(.031)	(.031)
GDP growth	.005	.006	.006
	(.005)	(.005)	(.005)
Constraint on executive 1900	.131	.132	.132
	(.024)	(.024)	(.024)
Constant	5.36	5.305	5.305
	(.273)	(.277)	(.277)
Number of observations	815	802	802
R^2	.775	.779	.2610

6 Conclusion

Many economists and political science have argued that natural resource wealth has a detrimental affect on political institutions. Several careful case studies and significantly fewer cross-national studies have documented this statistical association. In this paper, we attempt to address two problems that exist in previous work. The first problem is that oil revenues can be influenced, through changes in oil prices, by actual or expected changes in the political institutions of oil producing nations. This "simultaneous causation" makes identifying the effects of changes in the rents associated with oil, as a natural resource, on institutions. Second, there is little agreement in the existing literature about what determines institutional configurations within countries. In this paper we investigate one part of the institutional story, the relationship between taxation and representation, in attempt to understand how natural resource wealth might influence the political development in resource rich countries. But clearly, there are many other parts to the institutional story and factors that influence which institutions develop in various countries. Thus, there is a real risk that any standard statistical analysis might include bias induced by one or more omitted variables.

The instrumental variable approach taken in this paper solves both problems by concentrating on one well defined relationship and a very specific hypothesis: increases in oil revenues has negative effects on the political institutions of oil producing nations. As such, we test a specific causal hypothesis that should be true–even among the set of oil producing nations–if the argument linking taxation and representation is correct. With this narrow focus it is then possible to identify believable sources of exogenous variation in oil revenues that allow us to identify the causal effect in question. The analysis suggests that there is a negative relationship between oil rents and political institutions that is significant in the set of oil producing nations. Conditioning on various other variables, such as GDP per capita, GDP growth, colonial history, previous regimes scores, and latitude, the relationship is robust.

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