Corruption and Oil: Evidence from Panel Data*

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Abstract

It has been argue that issues of corruption may be particularly relevant in the context of natural resources, as natural resource exploration is an extremely high rent activity likely to foster rent-seeking behavior. The existing literature on natural resources and corruption suffers from omitted variable bias. This paper re-examines the effect of natural resource abundance on corruption using panel data estimation as well as new measures of resource endowments. I find evidence indicating that both oil extraction and mineral income is associated with more corruption. The adverse impact of oil on corruption is present both in democratic and nondemocratic countries.

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1. Introduction

Sachs and Warner (1995) made a major contribution when they found a negative association between natural resource abundance and growth in a large cross-country study. A substantial number of papers have since Sachs and Warner considered the natural resource curse hypothesis from different points of view. Ross (2001) and Collier and Hoeffler (2005) focus on the negative associations between resource abundance and the stability and quality of the political system. From a qualitative angle, historians, political scientists, and economist generally agree that the presence of abundant natural resources (especially minerals) leads to rent-seeking behavior and corruption, thereby decreasing the quality of government (e.g. Auty, 2001; Leite and Weidmann, 1999; Isham et al., 2004). For example, Sala-i-Martin and Subramanian (2003) find that corruption, weak governance, rent-seeking, plunder, etc. is a problem intrinsic to countries that own natural resources such as oil and minerals. Isham et al. (2005) argue that the problem is specific to what they call "point source" resources such as oil, minerals, and plantation crops, while natural resource exports that are "diffuse" do not seem to have the same consequences. According to Ross (2001) one explanation to why oil might hinder democracy, is what he call the rentier effect. The argument is that when a government earns significant and direct ”rent” from a natural resource, it hinders the development of representative politics by removing the need to collect taxes effectively. When governments derive sufficient revenues from the sale of oil, they are likely to tax their population less heavily, and the public in turn will be less likely to demand accountability from – and representation in – their government.

The past decade has seen an exponential growth in cross-country studies on corruption. Issues of corruption may be particularly relevant in the context of natural resource abundance, as natural resource exploration is an extremely high rent activity likely to foster rent-seeking behavior. Leite and Weidmann (1999) argues that the associated increase in rent-seeking opportunities may help to explain Sachs and Warner (1995)‘s paradoxical finding of a negative relationship between natural resource abundance and long-run economic growth. The problem arises from the possible impact of windfall gains on rent seeking behavior. Theoretically the effect of rents on corruption is ambiguous. Higher rents mean that bureaucrats can extract more rents from firms they control, but it also means that it is more valuable for the public to avoid corruption and, thus, more likely that the public will to try to control the bureaucrats (Ades and Di Tella, 1999). However, Ades and Di Tella states that there are indeed examples of a positive connection between rents and corruption:

> *Consider, for example, the case of Nigeria in the 1970's. When compared to other, non-oil-producing countries in the region, like Togo, Nigeria provides what is almost a natural experiment for the hypothesis that rents cause corruption. After the oil shock, observers noted that Nigeria's oil income created extraordinary opportunities for corruption (1999, p. 982).*

Ades and Di Tella (1999) quotes the following clause from the Economist of August 4, 1984:

> *Oil and corruption go together. Nigeria's oil account for about 80% of government revenue. The official price of crude increased 17-fold in eight years from about $2 a barrel in 1973-4 to $34 by the end of 1981. Nigeria went on construction and importing spree: Parties and party officials grew rich.*

More recently, similar claims have been made for a broad group of countries. At the launch of the Transparency Internationals Corruption Perception Index 2004, Peter Eigen (Chairman, TI) said:

> *As the Transparency International Corruption Perception Index shows, oil-rich Angola, Azerbaijan, Chad, Ecuador, Indonesia, Iran, Iraq, Kazakhstan, Libya, Nigeria, Russia, Sudan, Venezuela and Yemen all have extremely low scores. In these countries, the oil sector is plagued by revenues vanishing into the pockets of western oil executives, middlemen and local officials* (Transparency International, 2004, p. 2)

BBC news (2004) report on this launch with the headline “Oil wealth can cause corruption” (BBC news October 20, 2004). Along similar lines Jeffrey D. Sachs states that:

> *[T]he data show that corruption is highest in oil and gas-producing countries. In general, natural resources like oil, gas, diamonds, and other precious minerals breed corruption, because governments can live off of their export earnings without having to compromise with their own societies. The natural resources are therefore not only a target of corruption but also an instrument of holding power. Many foreign companies, intent on cashing in, fuel the pathology of corrupt regimes by peddling in bribes and political protection* (Sachs, 2005. Project Syndicate).

Other minerals also generate substantial rents, and have in similar ways been claimed to fuel corruption. The rents are largely captured by states via export taxes, corporate taxes, and state-owned enterprises. More than most industries, mining rely on a high level of public consent in order to continue its activities since states tend to exercise a significant degree of control over access to and exploitation of mineral resources. In the mining sector, large sums of money flow from the companies to governments in the form of royalties, taxation, and other payments. Great discretionary power lies in the hands of those responsible for collecting and distributing these revenuers, as well as those who grant the license and monitor the operations at both the permitting and the operation phase (MMSD, 2001).

In this paper I examine the validity of the claim that natural resources like oil and minerals increase corruption. This question has been investigated by others – e.g. Sala- i- Martin and Subramanian, 2003; Isham et al., 2005; Ades and Di Tella, 1999; Leite and Weidmann, 1999. I extend this literature in two dimensions. First, I use panel data estimation techniques and second, I use different measures of resource endowment. There are several reasons why the existing literature on natural resources and corruption may be problematic. Common among the existing literature is that they use export shares or export data to measure natural resource abundance. Export shares are perhaps not the best measure of the incentive to be corrupt that resources introduce. One reason may be that a country may have a comparative advantage in resource production, e.g. oil, but also in some other good, while another country has a comparative advantage only in oil. Total oil rents or production, for contesting or controlling may be the same in both countries, but the export share would be higher in the latter country. Therefore, in this paper, I use natural resource variables that are (at least partly) unrelated to export structure. In this paper natural resources are either measured as the unit rent (price less extraction costs) times the extracted amount (in gross national income or per capita), as the extracted quantity per capita, or as reserves per capita.

Also, this paper uses panel estimation techniques to deal with the possibility of omitted variables. One concern is that earlier results reflect the influence of variables not included in the regressions that affect both corruption and export structure (natural resource abundance). In the latest years, it has been argued that insights regarding economic variables and institutional quality suffer from omitted variable bias. E. g. Acemoglu et al. (2008) find little support for the hypothesis that income causes democracy when country fixed effects are included, and Acemoglu et al. (2005) find no evidence indicating that a given country (with its other characteristics held constant) is more likely to become more democratic as its population becomes more educated. The argument is that the earlier literature looks at the cross-sectional correlation between income and institutional quality and education and institutional quality rather than the within variation, and hence existing inference may be driven by omitted factors.

Resources are of obvious reasons not measured in absolute quantity in cross-country regressions. What is of relevance is the value of the natural resource sector compared to the rest of the economy – the relative importance of natural resources. Over the past decade, a distinguished body of empirical literature has emerged in support of arguments that institutional form and quality are deeply embedded in history and geography (Acemoglu, Johnson and Robinson, 2001, 2002, 2003; Easterly and Levine, 2002). Acemoglu, Johnson and Robinson (2001, 2002) have documented that mortality rates faced by Europeans and population density at the time of colonization were major determinants of European colonization strategy, and subsequent institutional and economic development paths. Thus, in countries with extractive institutions, the only profitable economic activity might be resource extraction. If there is a natural resource to be exploited, it will be, even though other sectors suffer from a lack of secure property rights and bad infrastructure. Therefore, omitted factors that determine the quality of institutions could also determine the level of resource dependency. Because of initial conditions, countries are both heavily dependent on their resource sector and corrupt. If this is so, natural resources do not cause corruption, but the two are correlated due to omitted variables. I deal with this by controlling for country and time fixed effects in panel regressions covering the period 1982-2006 for up to 132 countries. Both pooled OLS estimation and fixed-effects estimation indicate that minerals and oil are associated with more corruption in government. The adverse impact of oil and minerals on corruption is present both for democracies and nondemocratic countries.

The paper is organized as follows: Section 2 review the literature on natural resource abundance and institutions, Section 3 describes the dataset used and my empirical strategy. Section 4 presents the empirical results and Section 5 concludes.

2. Natural Resources and Institutional Quality

A number of papers have over the last decade argued that the natural resource environment influences different aspects of institutional quality. Ross (2001) use pooled time-series cross-national data from 113 states between 1971 and 1997 and find that oil and non-fuel mineral wealth impedes democratization. Jensen and Wantechekon (2004) present empirical evidence suggesting a robust and negative correlation between the presence of a sizable natural resource sector and the level of democracy in Africa. They show that natural resource dependent economies are more likely to be authoritarian, exhibit higher levels of government spending, are associated with worse governance, and where more likely to lead to breakdown in democracy after the third wave of democratic transitions in the 1990s. Tsui (2010) exploits variation in the timing and size of oil discoveries to identify the impact of oil wealth on democracy. He finds that discovering oil significantly decreases a country's 30-year change in democracy, as measured by the Polity Index. He also finds evidence indicating that the negative impact of oil discovery is bigger the less democratic the country was before if found oil.

Auty and Gelb (2001) likewise concluded that point resources such as minerals, have a particularly strong association with destabilizing social tension, while Murshed (2004) suggests that point resources retard democratic and institutional development. Bulte, Damania and Deacon (2005) find that point resources are typically associated with less productive social institutions (lower government effectiveness and rule of law scores). Isham et al. (2005) compute four export indexes (Manufactures; Diffuse; Point source; Coffee and Cocoa) to capture countries reliance on different sources of export revenues. Controlling for other potential determinants of governance, they find that point source and coffee and cocoa exporting countries do poorly across an array of governance indicators, including corruption. Countries with natural resource exports that are diffuse are not found to have the same strong effect on governance indicators.

Sala-i-Martin and Subramanian (2003) find that exports of fuel and natural gas and ores and minerals have a negative impact on growth via their deleterious impact on institutional quality, including corruption. They stress that the natural resource curse only holds for mineral - and particularly oil - abundance, and not agricultural products and food (all measured by their respective export shares). Leite and Weidmann (1999) use data on exports of fuel, minerals, agriculture, and food products and find that the extent of corruption depends on natural resource abundance. Fuel and ores are consistently related to worse scores of corruption, whereas agriculture and food exports are associated with better scores. Ades and Di Tella (1999) use the proportion of total exports accounted for by fuels, minerals, and metals as a measure related to rents for domestic firms. They find that this variable is significantly related to more corruption for the period 1980-1983. When country and year fixed effects are included, the fuel and mineral export variable becomes insignificant.

Bhattacharyya and Hodler (2009) study how natural resources can feed corruption and how this depends on the quality of the democratic institutions. They find that resource rents are positively associated with corruption only in countries for which the net democracy score POLITY2 is 8.5 or less. This study does not distinguish between different natural resources and rely primarily on the log per capita rent from energy, minerals and forestry. When country dummies are included, the effect of natural resources on corruption and the interaction term between democracy and natural resources becomes insignificant, implying that the results are mainly due to cross-country variation. However, it is not surprising given that the explanatory variables change only slowly over time, and that the time dimension of their data matrix is much smaller relative to the cross-section dimension.

There is also evidence that natural resource abundance considerably increase the potential of violent civil conflict. E.g. Collier and Hoeffler (2002) show that natural resources increase the chances of civil conflict. Civil conflict, of course, is an extreme manifestation of institutional collapse and this literature is therefore suggestive of a role for natural resources in affecting institutional quality more generally.

Although there are several authors that support the view that natural resource abundance is a curse for institutional quality, there is no absolute consensus. Brunnschweiler and Bulte (2008) challenge the findings of the resource curse, and dispute that abundant resources lead to bad institutions or slow growth. Their finding is that the chain of causality appears opposite to the traditional view: bad institutions are associated with high scores on the (Sachs and Warner) resource abundance indicator. Contrary to the result that resource abundant countries tend to suffer from worse institutions, they find that countries with certain institutional designs fail to develop significant non-resource sectors and thereby make them dependent on primary sector extraction. Properly accounting for resource wealth (as opposed to resource abundance) they find that resources are a blessing for both institutional and economic development. Also Brunnschweiler (2008) challenge the so-called resource curse. Using new measures of resource endowment, natural capital per capita, she finds no evidence of a negative effect of natural resources on institutional quality.

3. Data and Econometric Specification

A common definition of public corruption is the misuse of public office for private gain. Corruption defined this way would capture, for example, the sale of government property by government officials, bribery and embezzlement of government funds (Svensson, 2005). Corruption is not the same as rent-seeking, although the terms are often interchanged. Measuring corruption across countries is a difficult task, both due to the secretive nature of corruption and the variety of forms it take. No definition of corruption is completely clear-cut. Three types of corruption measures have been exploited in the literature. The first type, used initially by Knack and Keefer (1995) and Mauro (1995), is based on indicators of corruption assembled by private risk-assessment firms. Of these, the corruption indicator published in the International Country Risk Guide has become the most popular, due to better coverage across time and countries (Svensson, 2005). The second set is averages of ratings reported by a number of perception-based sources. The Corruption Perception Index produced by Transparency International is within this set. Third, Kaufmann, Kraay and Mastruzzi (2003) derive a complementary measure, Control of Corruption, based on a larger set of sources. They have a broader definition of corruption and include most cross-country indices reporting ranking of countries on some aspect of corruption. However, since corruption reflects an underlying institutional framework, different forms of corruption are likely to be correlated[1].

The emphasis in this paper is on public corruption. My measure of corruption (*corruption in government*) is the International Country Risk Guide (ICRG) corruption index. This index has been used by Ades and Di Tella (1999), Persson, Tabellini and Trebbi (2003), Leite and Weidmann (1999), and Svensson (2005), among others. It is released by Political Risk Services; a private think tank specialized in international political and economic country-risk assessment. I combine two datasets from ICRG in order to maximize the number of years in the analysis. The IRIS-3 dataset contains data for the period 1982-1997, and the Researcher Dataset (ICRG T3B) contains data for the period 1984 -2007. The IRIS Dataset was originally constructed in 1993 by Steve Knack and Philip Keefer for the IRIS Center at the University of Maryland, based on data obtained from the International Country Risk Guide. Knack produced subsequent issues of the data for an ongoing series of working papers from the IRIS Center. The index is based on the opinion of a pool of country analysts. Corruption in Government range in value from 0-6, with higher values indicating "better" ratings. Lower scores indicate "high government officials are likely to demand special payments" and that "illegal payments are generally expected throughout lower levels of government" in the form of "bribes connected with import and export licenses, exchange controls, tax assessment, police protection, or loans". The ICRG Researcher's Dataset provides annual averages of the components of ICRG's Political Risk Ratings, as published in the International Country Risk Guide since 1984. Average ratings are provided for all countries covered by ICRG from 1984 through the last full calendar year. Combining these two datasets gives corruption in government from 1982 to 2006.

The data on natural resources are from the World Development Indicators, the World Bank Adjusted Net Savings dataset (also called the genuine savings dataset) and Energy Information Administration (EIA). *Mineral rent*, *energy rent*, *gas rent, hard coal rent, oil rent per*

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[1] The correlation between Control of Corruption (from 2002) and the Corruption Perceptions Index (from 2003) is 0.97 and the correlation between Control of Corruption or the Corruption Perceptions Index and the corruption scores from the International Country Risk Guide (from 2001) is 0.75 (Svensson, 2005).

capita and *oil quantity* are from the World Bank's data set on genuine savings (adjusted net savings). The data set represents a comprehensive attempt at estimating the value of natural resource extraction. It covers 149 countries, both developed and developing, over the period 1970 to 2006. Energy rent consists of oil, gas and coal, whereas mineral rent encompass bauxite, copper, iron ore, lead, nickel, phosphate rock, tin, zinc, gold and silver. Both *mineral rent* and *energy rent* are measured as percentage of Gross National Income (GNI). The value of natural resource extraction is generally computed as unit rent, that is price minus average extraction cost, times the amount of resource extracted. For minerals, the unit rent is computed as the world price of the resource minus mining, milling, benefication, melting and transportation to port costs minus a normal return to capital. For oil, gas and coal, the unit rent is the world price minus lifting costs. For some resources, such as natural gas, where, strictly speaking, there is no single world price, a shadow world price is computed as the average free-on-board price from several points of export. Compared to the commonly used primary exports variable the data have a number of advantages. First, rents from production represent a more comprehensive measure of the relative economic importance of natural resources than export, for judging arguments about state capacity. Natural resources can be harmful to state capacity because of the enormous rents they generate so it might be better to measure these rents directly, rather than indirectly with exports data. Second, the data are explicitly focused on a clear set of natural resources (de Soysa and Neumayer, 2007).

Oil quantity is measured as the oil production volume (in metric tons) per capita. The *oil quantity* variable has several advantages compared to the *energy rent* variable. First, it is not directly related to GDP and hence less likely to be subject to the reverse causality of corruption causing changes in gross domestic product. Second, the energy rent variable is perhaps too broadly defined. Oil is less diffuse than gas or coal, and the markets for it more global. Therefore, the incentives to contest the rights to oil might be higher than for gas or coal. Third, in a world with big changes in the oil price, the current value of resource extraction might be a poor measure of the activity in the resource sector, and future rents. An expanding resource sector – new discoveries, new participants entering the sector and new licenses being issued – might be of importance when determining corruption. The *oil quantity* variable, in its original form, only contains values for oil extracting countries. Countries that do not produce oil have missing values for this variable. Therefore, missing values are replaced by zero if the country does not produce oil domestically in this period[2]. *Oil reserves* are proved reserves of crude oil per capita in thousand barrels. The data on proved reserves are from Energy Information Administration (EIA). The advantage of using reserves is that it is less influenced by political decisions.

The third category of natural resources, *agriculture*, is from the World Development Indicators. *Agriculture* represent agriculture, value added (% of GDP). Agriculture value added corresponds to ISIC divisions 1-5 and includes forestry, hunting, and fishing, as well as cultivation of crops and livestock production. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs.

Earlier empirical work has identified a number of economic variables that correlate with corruption. To take account of economic development, I consider the logarithm of GDP per capita, *lgdp*. GDP per capita, is gross domestic product divided by midyear population. Data are in constant 2000 U.S. dollars and obtained from the World Development Indicators. Restricted market and political competition has been suggested to influence corruption (e.g. Djankov et al., 2002; Svensson, 2005; Leite and Weidmann, 1999). Earlier literature has suggested that trade restrictions generate rents and rent-seeking activities, e.g. attempts to evade tariffs, efforts at premium seeking when agents compete for premium fetching licenses, revenue seeking when agents try to appropriate a share of revenues from import restrictions, and tariff seeking when agents lobby for protectionist tariffs (Leite and Weidmann, 1999). Thus, the degree of openness to foreign trade could be a factor in determining the level of rent-seeking activities, or the extent of corruption. Variables that capture restriction in the marketplace include openness to external competition from imports (Ades and Di Tella, 1999) and the extent of regulation of entry of start-up firms (Djankov et al., 2002). I include *trade* as a measure of openness, and to account for the extent of regulation of entry, I include the number of business days it takes to

[2] See http://www.sv.uio.no/econ/personer/vit/siljeasl/des%202010%20Descriptive%20statistics.pdf for detailed Variable Description and Descriptive Statistics of the data.

obtain legal status (*days to obtain legal status*). The latter is a measure of the time it takes to obtain legal status to operate a firm in 1999 (the data is from Djankov et al., 2002)[3].

On the political side, a free press provides greater information than a government-controlled press to voters on government and public sector misbehavior, including corruption (Besley and Burgess, 2002). To account for press freedom, I include the freedom of media index (*freedom of media*). The freedom of media index is the score of four criteria "Laws and regulations that influence media content," "Political pressures and controls on media content," "Economic influence over media content, and " "Repressive actions" for print and broadcast media. Higher scores indicate less press freedom (the data is from Freedom House).

The cost of undertaking and combating violent appropriation might affect corruption. Violence might be a substitute for corruption as a tool for appropriation. There are no variables that directly measure the use of violent appropriation, but I include two different variables that to some extent capture the use of violence or the ability to use or fight violence. The first is *absence of violence* and the second is *military in politics.* The first measures perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism, and the second measures the risk of military participation in government.

Svensson (2005) shows that corrupt countries have significantly lower levels of human capital stock, proxied by years of schooling of the total population aged over 25. To take account of human capital, I consider the average years of schooling of the total population aged over 25 between 1980 and 2000 (*schooling*). Data on years of schooling are from Barro and Lee (2000). Swamy et al. (2001) show, using cross-country data, that corruption is less severe where women hold a larger share of parliamentary seats and senior positions in the government bureaucracy, and comprise a larger share of the labor force. To control for the gender effect, I include the female labor force participation rate (*female participation rate*). Data on female labor force participation is from World Development Indicators.

[3] Svensson (2005) shows that the (log of) Number of Business Days to Obtain Legal Status is positively correlated with corruption.

Democratic countries might have better systems of checks and balances to fight corruption and the abuse of power. Also, in democratic countries, voters can hold their elected representatives accountable at the polls and punish corruption and misbehavior of their representatives. In nondemocratic countries, this is not the case. Also, a permanent position in power may help maintain 'patronage and corruption' reputations and relations. On the other hand, in political stable administrations, bureaucrats face less chance of dismissals and have more opportunity for long-run advancement in their careers, which provides an incentive to build an open and honest reputation for a career development (Pellegrini and Gerlagh, 2008). There are therefore alternative and contra dictionary hypotheses on whether corruption is discouraged or fostered by political stability. To capture the possibility that corruption might be determined differently in democracies and non-democracies, I include the polity score (*polity)*. The score of democracy is computed by subtracting the institutional autocracy score from the institutional democracy score (the data is from the Polity IV project).

The wages of government administration may also affect the vulnerability to corruption. Higher government wages imply higher costs when a position is lost, and a cost-benefit analysis suggests that higher wages thereby provide an incentive to restrain from corruption (Treismann, 2000; Pellegrini and Gerlagh, 2008). To capture the possibility that government wages affect corruption I include a variable for *government wage.* The *government wage* variable is obtained by dividing the average wage in the public sector by GDP per capita, and it is from Schiavo-Campo (1998).

I follow two different strategies in order to investigate the relationship between natural resources and corruption. I start out by a simple pooled OLS specification of the following form:

$$(1)\ y_{it} = \alpha + \beta \boldsymbol{x}_{\boldsymbol{it}}^{\prime} + \mathrm{u}_{\mathrm{it}}$$

Countries are indicated by i; time is indicated by t; y is corruption; $\boldsymbol{x'}$ is a vector of explanatory variables; β is the corresponding vector of coefficients to be estimated. Next, I formulate a fixed-effect panel data model.

$$(2)\ y_{it} = \alpha + \beta \boldsymbol{x}_{it}' + \mu_i + \delta_t + \epsilon_{it}$$

All unobserved time-invariant influences captured by the country fixed effects, and common cycles are controlled. Here μ represent individual country effects, capturing cultural and other time-invariant factors, and δ represent time fixed effects. The fixed-effect estimator is based on time variation within each cross-sectional unit only. Exploiting the time variation in the data provides additional information, because it allows me to relax the assumption of conditional independence underlying the cross-sectional estimates. Specifically, (non time-varying) omitted variables jointly determining the corruption levels and the rate of natural resource abundance/dependence are unlikely to cause problems in this panel. Although time variation does not guarantee exogeneity, the fixed effect estimation provides useful information (and a check on the cross-section estimation) regarding the correlation between corruption and natural resources. The fixed-effect estimation allow me to determine if the correlates of corruption hold when controlling for country and year fixed effects, or if they are primary due to omitted variables. For some of the variables described above, there is no variation across time, and hence they are only included in the pooled OLS estimation.

4. Results

My first regression results are reported in Table 1. Table 1 presents the results using corruption as the dependent variable, with a high score – on a 0-6 scale– indicating less corruption. In column (1) I start by only looking at the effects of natural resources on corruption. There is a statistically significant negative effect of all the three measures of natural resource income. But this association may be driven by omitted factors influencing both natural resources and corruption. To tackle this issue in columns 2 – 10, I include several control variables. The negative relationship between *energy rent* and corruption survives in columns (1) to (9) but the magnitude of the coefficient falls. Richer countries have less corruption, consistent with the theories of corruption that argue that institutional quality is shaped by economic factors. The measure of openness (*trade)* is insignificant and indicates that there is no evidence that regulation on foreign trade generates corruption. A higher *female participation rate* is associated with less corruption in government, consistent with Swamy et al. (2001). Higher democracy score is not associated with less corruption, and controlling for democracy score does not change the impact of the other variables. Higher *government wage* is associated with less corruption (column (5)) and higher *schooling* is associated with less corruption (column (6))[4]. More *press freedom* is associated with less corruption in government (column (7)) whereas *absence from violence* is not statistically significantly related to corruption (column (8)). Both more *military in politics* (column (9)) and *days to obtain legal status* (column (10)) are associated with more *corruption in government*. In column (10) the effect of *energy rent* is no longer statistically significant, but this due to the drop in the number of countries in this specification.

Looking at Table 1, the three variables that seem to be rather stable in its effect on corruption is *energy rent*, *lgdp* and *military in politics*. Column (1) to (9) indicate that an increase in *energy rent* by one standard deviation (13.89) is associated with a reduction in the corruption score of about 0.17 to 0.42, which correspond to a worsening of the corruption index of about 17.02 to 36.84 percent of a standard deviation. To put the results from table 1 into perspective, let us focus on Gabon – a energy-rich ($energy_{2006}$=60.85) country with high corruption ($corruption\ in\ government_{2006}$=1). Suppose that Gabon's energy income dropped to zero (while all other explanatory variables remained unchanged), then e.g. column (2) predicts that Gabon's corruption index would increase by about one standard deviation from 1 to almost 2.3.

[Table 1 about here]

[4] I have also included an interaction term between government wage and energy rent and schooling and energy rent (results not shown). There might be reasons to suspect that the effect of energy rent on corruption could be influenced by the level of government wages or the level of schooling. If the negative effect of rent of corruption was lower in countries where government wages was higher, this could be useful for policy. Also, if the negative effect of rent of corruption was lower in countries with higher level of education, this could also be useful for policy. Since neither of these interaction terms turns out statistically significant, I do not discuss this further in the paper.

As discussed earlier cross-country evidence, such as that of Table 1 and in the earlier literature on natural resources and corruption, has a number of shortcomings. It may be problematic to base inference on variation between countries if cross section heterogeneity is large, as is clearly the case in this setting. An F-test for the null that the intercepts for different countries are equal is rejected in all the specifications of Table 1[5].

Panel data have both time series and cross-sectional variation. Because there are multiple observations per year, one can remove year fixed-effects. Thus, any unobserved shocks that affect the entire world (e.g., changes in oil price, technology etc.) can be controlled for. Similarly, country-fixed effects can also be included in the analysis so that comparisons are not made across countries, but only using within-country variation. Again, this allows one to control for differences across countries that are not easily quantified. Norway and United Arab Emirates are clearly very different countries, and they differ along so many dimensions that it is likely very difficult to capture the differences fully using typical covariates. With panel data, country-fixed effects eliminate anything consistent about a country over time, only time-varying characteristics need to be taken into account. Although there is nothing explicitly causal about panel data estimates, by eliminating these important sources of omitted variables, one may obtain coefficients that come closer to representing a causal impact. Fixed effect estimations also have weaknesses. By including country- and year-fixed effects, only the short-term relationship between the variables will be reflected in the parameter estimates. If there is a high degree of correlation in variables over time, there will be little remaining variation with which to identify the coefficients. It is worth mentioning that, by and large, the corruption data vary more across countries than over time in my sample. This is due to the fact that corruption is difficult to measure, and changes over time within countries may be more difficult to detect than differences across countries.

Utilizing panel data, inference can be based on variation across countries and/or variation within countries. Inherent features of different countries that affect corruption in government, which are not captured in any of the included regressors yield biased estimates.

[5] The F value is between 14.07 and 37.67 for the specifications in Table 1. The p value is less than 0.0000 in all specifications of Table 1, strongly suggesting that the data is not pooled.

Inference based on within country variation is less likely to be subject to omitted variable bias. The problem with the within country approach is that resource environment varies considerably more across countries than within countries. Thus basing inference purely on within country variation removes a lot of variation in the data. Random effects estimation is more efficient than fixed effects estimation, and therefore random-effects are preferable, if it is statistically justifiable to do so.

[Table 2 about here]

Table 2, presents the results using random-effects (RE, column 1) and fixed-effect (FE, column (2 – 6)). Column (1) reports the random-effect results on corruption in government, including only the natural resources variables. As seen from column (1) both *energy rent*, and *mineral rent* are statistically significant, but the Hausman test results rejects the random-effect assumption[6]. Column (2) repeats the specification of column (1), using fixed-effect estimation. As seen from column (2) the results do not change considerably for *energy rent* or *mineral rent,* but agriculture now becomes significantly positively related to corruption. In column (3), I include income (*lgdp*) and openness (*trade*) as controls. Perhaps surprisingly, income and is positively correlated with corruption in the panel regressions (although it is negatively related in the cross-section). This is consistent with corruption having a pro-cyclical nature (Braun and Di Tella, 2004). The openness variable is also significantly related to higher corruption in the panel regressions. Several earlier empirical studies (e.g. Treisman, 2000; Ades and Di Tella, 1999) have been stressing the positive correlation between trade openness and low corruption levels, and been advising opening up the economy as a means to decrease corruption. My study seems to indicate that in spite of this cross section correlation, opening up an economy might actually increase corruption. This result has also been found by Ahrend (2002). He hypothesize that more trade could simply mean more possibilities of bribe extraction (at customs, to obtain permits or lower tariffs, etc.) and thus lead to increases in corruption.

[6] A random effect specification of column (2) – (7) is also rejected by the Hausman test, at all relevant levels of significance.

Columns (4) include control for the level of democracy and indicate that higher democracy score is not associated with better ratings of corruption. This result is not that surprising given that democracy changes only slowly over time and that the time dimension of the data matrix is much smaller relative to the cross-section dimension. Higher female participation rate is not associated with corruption (column 5), but higher *military in government* is associated with more corruption (column 6). When year fixed effects are included, the only variables that remain statistically significant are *mineral rent* and *military in government* (column 7). Most of the year dummies (not shown) are statistically significant; indicating that year fixed effects should be included. In all specifications of Table 2, *mineral rent* is statistically significantly correlated with corruption scores. A one (within country) standard deviation increase in mineral (2.38) corresponds to an reduction of the corruption score of about 0.07, which is equivalent to a worsening of the corruption index of about 9.33 percent of a (within country) standard deviation.

Surprisingly, *energy rent* is not statistically significant when year fixed effects are included. What does this mean? Is energy production really unrelated to corruption within countries, or is it the case that the value of energy production in GNI is a poor measure for determining the effect on corruption? Perhaps the energy rent variable is too broadly defined. Oil is less diffuse than gas or especially coal, and the markets for it more global. Therefore, the incentives to contest the rights to oil might be higher than for gas or coal. In Table 3, I include oil rent, gas rent and coal rent separately, to see if this can explain the fact that energy rent is insignificant. Column (1) indicates that this is not the case. None of the energy variables are statistically significant. There is a lot of missing variables for gas and coal, and column (1) only includes 57 countries. Therefore, in column (2), I drop gas rent and coal rent, but this does not change the fact that oil rent is statistically insignificant. In column (3), I include oil rent per capita instead of oil rent in GNI, but again this does not change the fact that oil rent is insignificant. Column (4), include an interaction term between oil rent per capita and (log of) GDP per capita, but again there is no effect of oil.

[Table 3 about here]

In real terms, the oil price drastically decreased in the period 1982-1998 (with the exception of a price peak in 1991 with the invasion of Kuwait) and then increased again between 1999 and 2006. Figure 1 displays the crude oil prices per barrel from 1982 to 2006 in 2007 USD[7]. A lot of the within country variation in oil rent is due to the change in the oil price in this period, and the trend is quite similar for all countries that produce oil. Energy rents are therefore not a good proxy for energy production. With the oil price varying so much in this period, many countries will be measured to be less (more) oil intensive, even if production has increased (decreased) quite a lot in this period. It is plausible that the size of the oil sector, the number of participants in the energy sector, and the extracted quantity, is of importance for corruption. It seems reasonable that a falling oil price will not necessarily reduce corruption, if the size of the sector is unchanged or increasing.

[Figure 1 about here]

In Table 3, column (5) to (9), I therefore include the quantity of oil extraction per capita instead of oil rent. Contrary to the oil rent variable, oil quantity per capita is associated with more corruption in government. The results of the other variables are similar to the results in Table 2. A one (within country) standard deviation increase in *oil quantity* (1.82) corresponds to an worsening of the corruption score of about 0.05, which is equivalent to about 6.59 percent of a (within country) standard deviation. To put the results into perspective, let us focus on Qatar this time. Qatar is an oil-rich (*oil quantity*$_{2006}$=52.68*)* country with high corruption (*corruption in government*$_{2006}$=2.5). Suppose that Qatar's oil production dropped to zero (while all other explanatory variables remained unchanged), then e.g. column (5) predicts that Qatar's corruption index would increase by about 1.2 from 2.5 to 3.7 which is about the same corruption score as Belgium.

Column (9) include an interaction term between oil quantity per capita and (log of) GDP per capita, and indicate that as countries get richer the effect of oil on corruption gets smaller. Higher GDP per capita, for a given resource environment, indicate less resource dependence.

[7] The oil price numbers are from BP Statistical Review of World Energy 2008.

This can explain the fact that as countries get richer they are less susceptible to the corrupting influence of oil. However, rich countries do not escape the negative effect of oil on corruption. The direct effect of oil on corruption is -0.346, and the interaction effect is 0.031. This means that one would need a (log of) GDP per capita level of 11.611 in order to cancel the direct effect of oil, which is higher than the maximum observed in the data[8].

As mentioned earlier, there are reasons to believe that the determinant of corruption might be different in democracies and non-democracies. Of course, there is also the possibility that natural resource wealth impede the development of democratic institutions. As discussed in the introduction, several studies claim that certain resources hinder democracy (e.g. Ross, 2001; Tsui 2010; Jensen and Wantechekon, 2004; Aslaksen 2010). The question is extremely important and it has implications also for the findings in this study. Since the focus here is on corruption, I do no attempt at explaining differences in democracy in this study. Instead I ask if the effect of oil and minerals on corruption is different for countries at different levels of democracy, taking their democracy status as given. To capture the possibility that corruption might be determined differently in democracies and non-democracies, I first re-estimate the model with interaction terms between resource environment and democracy score, and secondly I re-estimate the model separately for different types of countries. Countries are classified as non democratic if the polity score was zero or negative in 1982, countries are classified as having a medium level of democracy if the polity score was strictly positive but lower that the maximum level of 10 in 1982, countries are classified as having a high level of democracy if the polity score was at the maximal level of 10 in 1982 and countries are classified as new if they were not independent (no polity score) in 1982. The results are displayed in Table 4[9].

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[8] I have deleted one country at a time using the full model specification of column (8) to make sure that the results are not driven by one single country. The highest absolute value of the estimated effect of oil quantity is -0.035 (when dropping United Arab Emirates) and the lowest absolute value of the estimated effect of oil quantity on corruption is -0.024 (when dropping Gabon), and the affect is always statistically significant.

[9] See http://www.sv.uio.no/econ/personer/vit/siljeasl/des%202010%20Descriptive%20statistics.pdf Table A.2 for descriptive statistics for resource environment separately for these four groups of countries.

[Table 4 about here]

In column (1) I include an interaction term between democracy score (polity) and oil quantity, but the interaction term turns out statistically insignificant. This specification is similar to the approach in Bhattacharyya and Hodler (2009), but they use a different democracy variable, different measures of natural resources and the results are based on between country variations. A specification with an interaction term between democracy score and oil quantity in a pooled OLS framework, where inference is based on between country variation (a regression similar to column (1) of Table 4, but without including country dummies), is in line with Bhattacharyya and Hodler (2009). In the cross section, countries with higher levels of democracy are less susceptible to the corrupting influence of oil, with an estimated interaction coefficient of 0.0026, significant at 1% (results not shown). What column (1) of Table 4 indicate is that changes in democracy (within countries) does not affect the within country effect of oil on corruption – more oil is associated with more corruption, and changes in democracy does not affect this association.

In column (2) I include an interaction term between democracy score (polity) and mineral rent. The interaction sign has the expected sign and it is statistically significant. However, the magnitude of the interaction term is not big enough to cancel the direct effect of minerals on corruption, even for countries at the highest level of democracy. The effect of mineral rent on corruption for countries with the highest level of democracy is given by -0.043 (*direct effect*) + 0.004 (*indirect effect)* * 10 (*maximum level of democracy)* = -0.003. In column (3) I include both interaction terms, and the results are similar to the ones in columns (1) and (2). What columns (1) – (3) suggest is that changes to better democracy has a positive effect on the effect of minerals on corruption, but not on the effect of oil on corruption. Bhattacharyya and Hodler (2009) find that the relationship between resource abundance and corruption depends on the quality of the democratic institutions, but they do not distinguish between oil and other resources, and therefore probably pick up the fact that better democracy reduces the negative effect of other (than oil) resources on corruption.

What about the level effect of democracy? Does more democratic countries respond differently to (within country) changes in resource environment? Columns (4) – (7) estimate the effect separately for the four groups of countries. In non democratic countries and countries at the high levels of democracy, both oil quantity and mineral rent is associated with more corruption in government. Among countries at medium level of democracy, neither the oil variable nor the mineral variable is statistically significant. This is not surprising if we look at the summary statistics for this group, because this group of countries has both lower levels of oil and minerals compared to non democracies and countries with high level of democracy, and less within county variation. In new countries, oil quantity is not associated with more corruption, but mineral rent is (again, this might be due to lower levels of oil and less within country variation in this group). Again, remember that these results indicate how changes in oil (within countries) correspond to changes in corruption (within country), for different groups of countries.

In Table 5, I replace oil production with oil reserves, which are presumably more exogenous than production. Although investment in geological exploration might affects this variable, it is less likely that the current political environment have much effect on known reserves. As can be seen from Table 5, the results are in line with those obtained when using oil production.

[Table 5 about here]

One potential concern might be that oil quantity is determined by unobserved variables that are correlated with corruption in government. If underlying (time varying) factors influence both decisions to produce more oil or and public corruption, this is a problem for the analysis. One might associate corruption with higher discount rates and, therefore, agitation for higher production. This is perhaps less of a concern for non OPEC member countries than for OPEC countries. In 2000, non-OPEC countries account for about 56% of the world's oil production, but only 22% of its proven reserves (OPEC Annual Statistical Bulletin, 2008). Non-OPEC countries have tended in recent decades to develop reserves quickly and produce them more or less at full capacity (Oil and Energy Trends, 2006). Therefore, in Table 6, I include non-OPEC members and OPEC members separately.

[Table 6 about here]

Oil quantity is associated with more corruption in both group of countries but the effect is, as expected, larger in OPEC countries. Oil reserves are associated with more corruption only for non OPEC members, which could indicate that it is primarily when reserves get operated that it maps into corruption.

Could the results obtained so far be driven by atypically high or low values in any one single year? I repeat the regressions using three-year averages of the dependent and all independent variables for the period 1983-2006 to reduce the impact of atypically high or low rates in any one single year[10]. Also, I include lagged values of the dependent variable, to take into account the persistency of institutional quality. There might be reasons to believe that institutional quality is somewhat persistent over time. Including lagged values of corruption on the right hand side capture persistence in corruption, but it introduces econometric problems in estimating the equations. Lagged values of corruption are mechanically correlated with the error term, so the standard fixed effects estimation is not consistent. I use the two-step system GMM estimator to deal with this problem which has been proved to perform better than the first-difference estimator in Monte Carlo simulations when variables are persistent (see Blundell and Bond, 1998). The so-called "System GMM" estimator stacks together the equation in first differences and the equation in levels in a system of equations and employs both lagged levels and differences as instruments. With "internal instruments" I also control for a weak form of exogeneity in the oil variables and mineral rent by assuming that they can be affected by current and past realizations of corruption, but are uncorrelated with future unpredictable changes in corruption (the error term). The results are displayed in Table 7.

[Table 7 about here]

[10] Since inference is based on within country variation, countries are dropped if there are less than two observations for that specific country.

The results using fixed effect estimation (columns 1 and 3) are quite similar to the ones obtained when using yearly data – higher oil quantity, larges reserves, more mineral rent, and more military involvement in politics are associated with more corruption, whereas a higher female labor participation rate is associated with less corruption. Not surprising, the coefficients are smaller when using GMM (columns 2 and 4) as they only indicate the short term effect. The point estimate of oil quantity is -0.012, implying that an increase in oil quantity per capita by one standard deviation reduces the steady-state value of corruption by 0.37, which is about 26 percent of a standard deviation in corruption. The point estimate of oil reserves is -0.016, implying that an increase in oil reserves per capita by one standard deviation reduces the steady-state value of corruption by 0.25, which is about 17.7 percent of a standard deviation in corruption[11]. Although the point estimates are quite small, the results imply a large effect on corruption for countries with substantial oil wealth and oil production. Suppose e.g. that Kuwait's oil production dropped to zero (while all other explanatory variables remained unchanged), then the results predict that the steady-state value of corruption for Kuwait would increase by about 2.3 from 2 to 4.3.

5. Conclusion

This paper has presented new empirical results on natural resource abundance and corruption. Evidence from pooled OLS show that energy rent is associated with more corruption in government, but this effect is not present when country and year fixed effects are included. I have argued that oil production might do better than oil rent in capturing the effect of oil on corruption. The fixed effect estimation indicate that, other things equal, both oil quantity, oil reserves and mineral rent is associated with more corruption in government. The adverse impact of oil and minerals on corruption is found to be present both for democratic and nondemocratic countries, among OPEC member countries and non OPEC member countries. As pointed out by Isham et al. (2005) these results might be stultifying for policymakers. It is hard to imagine how a policymaker interested in fighting corruption can change what is here identified as one possible cause of high corruption. Optimistic and constructive proposals can be

[11] The long-run effect is calculated as (coefficient/(1−(coefficient of lagged corruption)))

found, however, such as those made by *The Economist* (2003) and Sala-i-Martin and Subramanian (2003), among others. They suggest making publicly available all revenues and expenditures associated with natural resource rents. This is a necessary first step toward a more accountable system for the management of revenues in resource-rich countries.

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Table 1 Pooled OLS

	1	2	3	4	5	6	7	8	9	10
energy rent	-0.030	-0.021	-0.017	-0.015	-0.015	-0.014	-0.017	-0.014	-0.012	-0.006
	(0.006)***	(0.007)***	(0.007)***	(0.006)**	(0.009)*	(0.007)**	(0.005)***	(0.007)**	(0.007)*	(0.011)
mineral rent	-0.042	-0.021	-0.023	-0.022	-0.019	-0.022	0.001	-0.000	-0.007	-0.004
	(0.018)**	(0.013)	(0.010)**	(0.011)**	(0.018)	(0.019)	(0.021)	(0.021)	(0.021)	(0.019)
agriculture	-0.044	0.016	0.010	0.008	0.020	0.019	0.033	0.032	0.036	0.022
	(0.006)***	(0.007)**	(0.006)	(0.006)	(0.007)***	(0.009)**	(0.013)**	(0.012)**	(0.013)***	(0.016)
lgdp		0.642	0.624	0.581	0.783	0.695	0.573	0.537	0.536	0.299
		(0.083)***	(0.069)***	(0.076)***	(0.089)***	(0.094)***	(0.115)***	(0.122)***	(0.122)***	(0.142)**
trade		-0.001	-0.001	-0.002	-0.001	-0.001	-0.001	-0.001	-0.002	-0.001
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
female participation rate			0.018	0.017	0.010	0.007	-0.003	-0.005	-0.005	-0.001
			(0.004)***	(0.004)***	(0.004)**	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)
polity				0.009	0.006	0.001	-0.037	-0.035	-0.035	-0.033
				(0.009)	(0.010)	(0.011)	(0.017)**	(0.016)**	(0.015)**	(0.019)*
government wage					0.045	0.050	-0.034	-0.032	-0.038	-0.046
					(0.027)*	(0.042)	(0.046)	(0.045)	(0.048)	(0.055)
schooling						0.094	0.067	0.063	0.037	0.020
						(0.052)*	(0.044)	(0.044)	(0.044)	(0.055)
press freedom							-0.018	-0.017	-0.016	-0.018
							(0.006)***	(0.005)***	(0.005)***	(0.007)***
absence of violence								0.127	0.041	0.151
								(0.145)	(0.145)	(0.178)
military in politics									0.142	0.178
									(0.055)**	(0.063)***
days to obtain legal status										-0.006
										(0.003)*
r2	0.259	0.406	0.448	0.447	0.538	0.576	0.568	0.575	0.584	0.604
Countries	132	131	131	123	87	72	72	72	72	53
Observations	2640	2598	2598	2443	1742	1498	830	830	830	636

NOTE: Pooled OLS estimates. Dependent variable is corruption in government. A content term is included in all specifications (not reported). Huber robust standard errors are in parentheses. Regression disturbance terms are clustered at the country level. The symbols ***, **, and * denote significant at the 1%, 5% and 10% respectively.

Table 2: Fixed Effects

	RE 1	FE 2	FE 3	FE 4	FE 5	FE 6	FE 7
energy rent	-0.014	-0.011	-0.009	-0.009	-0.009	-0.007	-0.000
	(0.005)***	(0.005)**	(0.005)*	(0.005)*	(0.005)*	(0.005)	(0.005)
mineral rent	-0.040	-0.032	-0.030	-0.033	-0.033	-0.034	-0.028
	(0.013)***	(0.016)*	(0.017)*	(0.016)**	(0.016)**	(0.016)**	(0.013)**
agriculture	0.010	0.028	-0.005	-0.006	-0.006	-0.003	-0.007
	(0.007)	(0.009)***	(0.011)	(0.011)	(0.011)	(0.010)	(0.008)
lgdp			-0.927	-0.880	-0.888	-1.147	-0.458
			(0.261)***	(0.269)***	(0.267)***	(0.261)***	(0.302)
trade			-0.005	-0.006	-0.006	-0.006	-0.002
			(0.002)**	(0.003)**	(0.003)**	(0.002)**	(0.002)
polity				0.004	0.004	-0.006	0.015
				(0.012)	(0.012)	(0.011)	(0.011)
Female participation rate					0.001	0.002	0.018
					(0.009)	(0.010)	(0.011)
military in politics						0.190	0.151
						(0.047)***	(0.046)***
Year fixed effects	No	No	No	No	No	No	Yes
r2_w	0.037	0.045	0.103	0.098	0.098	0.152	0.313
Hausman chi2(3)	101.77						
Prob>chi2	0.000						
Countries	132	132	131	123	123	122	122
Observations	2640	2640	2598	2443	2443	2302	2302

NOTE: Dependent variable is corruption in government. Random effects (RE) and Fixed effects (FE). A constant term is included in all specifications (not reported). Huber robust standard errors are in parentheses. Regression disturbance terms are clustered at the country level. The symbols ***, **, and * denote significant at the 1%, 5% and 10% respectively.

Table 3: Different Energy Measures

	1	2	3	4	5	6	7	8	9
oil rent	-1.331	-0.144							
	(1.788)	(0.643)							
oil pop			0.000	-0.000					
			(0.000)	(0.000)					
oil pop lgdp*				0.000					
				(0.000)					
oil quantity					-0.023	-0.023	-0.028	-0.028	-0.346
					(0.008)***	(0.008)***	(0.010)***	(0.010)***	(0.168)**
*oil quantity * lgdp*									0.031
									(0.016)*
gas rent	-3.887								
	(3.572)								
coal rent	13.715								
	(11.756)								
mineral rent	-0.024	-0.039	-0.038	-0.039	-0.039	-0.039	-0.034	-0.035	-0.035
	(0.027)	(0.013)***	(0.013)***	(0.013)***	(0.013)***	(0.013)***	(0.013)***	(0.012)***	(0.012)***
agriculture	-0.006	-0.009	-0.009	-0.009	-0.008	-0.007	-0.005	-0.006	-0.006
	(0.013)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)	(0.008)	(0.008)
lgdp	-0.389	-0.306	-0.331	-0.336	-0.266	-0.162	-0.324	-0.324	-0.351
	(0.491)	(0.284)	(0.287)	(0.288)	(0.290)	(0.295)	(0.321)	(0.309)	(0.308)
trade	-0.004	-0.001	-0.001	-0.001	-0.001	-0.002	-0.001	-0.001	-0.001
	(0.004)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
polity						0.018	0.009	0.015	0.015
						(0.012)	(0.011)	(0.011)	(0.011)
military in politics							0.150	0.144	0.143
							(0.045)***	(0.045)***	(0.045)***
Female participation rate								0.021	0.021
								(0.011)*	(0.011)*
r2_w	0.346	0.261	0.262	0.262	0.263	0.260	0.308	0.318	0.320
Countries	57	131	131	131	131	123	122	122	122
Observations	1208	2569	2569	2569	2569	2419	2282	2282	2282

NOTE: Fixed effects (FE) estimates. Dependent variable is corruption in government. A constant term and year fixed effects are included in all specifications (not reported). Huber robust standard errors are in parentheses. Regression disturbance terms are clustered at the country level. The symbols ***, **, and * denote significant at the 1%, 5% and 10% respectively.

Table 4: Countries at different levels of democracy

	All countries	All countries	All countries	Non democratic countries	Medium level of democracy	High level of democracy	New countries
	1			2	3	4	5
oil quantity	-0.027 (0.010)**	-0.027 (0.010)**	-0.027 (0.010)**	-0.029 (0.012)**	-0.253 (0.247)	-0.020 (0.010)*	-0.150 (0.124)
mineral rent	-0.035 (0.012)***	-0.043 (0.015)***	-0.043 (0.015)***	-0.034 (0.010)***	0.040 (0.035)	-0.035 (0.014)**	-0.078 (0.043)*
*Oil_q*polity*	-0.001 (0.001)		-0.000 (0.001)				
*Mineral*polity*		0.004 (0.002)**	0.004 (0.002)**				
polity	0.015 (0.011)	0.007 (0.010)	0.007 (0.010)				
r2_w	0.318	0.328	0.328	0.290	0.427	0.526	0.742
Countries	122	122	122	62	21	22	17
Observations	2282	2282	2282	1251	448	415	179

NOTE: Fixed effects (FE) estimates. Dependent variable is corruption in government. Agriculture, lgdp, trade, military in politics, female participation rate, a constant term and year fixed effects are included in all specifications (not reported). Huber robust standard errors are in parentheses. Regression disturbance terms are clustered at the country level. The symbols ***, **, and * denote significant at the 1%, 5% and 10% respective.

Table 5: Oil Reserves

	Pooled OLS	**RE**	**FE**
	(1)	(2)	(3)
oil reserves	-0.036	-0.019	-0.011
	(0.007)***	(0.003)***	(0.004)***
mineral	-0.023	-0.032	-0.026
	(0.015)	(0.012)***	(0.013)**
agriculture	0.011	0.006	-0.003
	(0.006)*	(0.007)	(0.008)
lgdp	0.472	0.315	-0.514
	(0.062)***	(0.079)***	(0.282)*
trade	-0.000	-0.001	-0.001
	(0.001)	(0.001)	(0.002)
military in politics	0.213	0.159	0.161
	(0.043)***	(0.038)***	(0.041)***
female	0.017	0.013	0.011
	(0.004)***	(0.006)**	(0.010)
r2	0.588		0.315
r2_w		0.293	0.315
Hausman chi(7)		310.73	
Prob>chi2		0.000	
Countries		130	130
Observations	2370	2370	2370

NOTE: Dependent variable is corruption in government. Pooled OLS, Random effects (RE) and Fixed effects (FE). A constant term and year fixed effects are included in all specifications (not reported). Huber robust standard errors are in parentheses. Regression disturbance terms are clustered at the country level. The symbols ***, **, and * denote significant at the 1%, 5% and 10% respectively.

Table 6: Non OPEC and OPEC members

	All countries (1)	Non OPEC (2)	OPEC (3)	All countries (4)	Non OPEC (5)	OPEC (6)
oil quantity	-0.028 (0.010)***	-0.031 (0.012)***	-0.060 (0.022)**			
oil reserves				-0.010 (0.004)**	0.030 (0.012)**	-0.014 (0.008)
r2_w	0.318	0.324	0.642	0.307	0.313	0.595
Countries	122	115	7	122	115	7
Observations	2282	2146	136	2234	2098	136

NOTE: Fixed effects (FE) estimates. Dependent variable is corruption in government. Mineral rent, agriculture, lgdp, trade, polity, military in politics, female participation rate, a constant term and year fixed effects are included in all specifications (not reported). Huber robust standard errors are in parentheses. Regression disturbance terms are clustered at the country level. The symbols ***, **, and * denote significant at the 1%, 5% and 10% respectively

Table 7: Three Year Averages

	FE (1)	GMM (2)	FE (3)	GMM (4)
OIL QUANTITY	-0.023	-0.012		
	(0.012)*	(0.006)**		
OIL RESERVES			-0.043	-0.016
			(0.006)***	(0.004)***
CORRUPTION LAGGED		0.741		0.647
		(0.057)***		(0.056)***
MINERAL RENT	-0.045	-0.007	-0.033	-0.006
	(0.019)**	(0.010)	(0.018)*	(0.012)
AGRICULTURE	-0.011	0.010	-0.005	0.011
	(0.010)	(0.004)***	(0.011)	(0.004)***
LGDP	-0.450	0.178	-0.530	0.214
	(0.404)	(0.043)***	(0.401)	(0.043)***
TRADE	-0.001	0.000	-0.001	-0.000
	(0.002)	(0.001)	(0.002)	(0.001)
POLITY	0.012	0.007	0.011	0.008
	(0.013)	(0.005)	(0.014)	(0.005)
MILITARY IN POLITICS	0.153	0.021	0.140	0.035
	(0.053)***	(0.027)	(0.052)***	(0.026)
FEMALE PARTISITATION RATE	0.024	0.001	0.018	0.004
	(0.011)**	(0.002)	(0.011)	(0.002)
r2_w	0.367		0.340	
Hansen		0.309		0.099
Diff Hansen		0.752		0.218
AR(1)		0.000		0.000
AR(1)		0.390		0.390
Countries	119	119	119	119
Observations	667	628	642	614

NOTE: Uppercase letters refers to three year averages. Dependent variable is corruption in government. FE refers to fixed effect, and GMM refers to two-step system GMM estimation. The values reported for the Hansen test are the p-values for the null hypothesis of instrument validity. The Diff Hansen reports the p-value for the validity of the additional moment restrictions required by the System GMM. The values reported for AR(1) and AR(2) are the p-values for first and second order autocorrelated disturbances in the first differences equations.

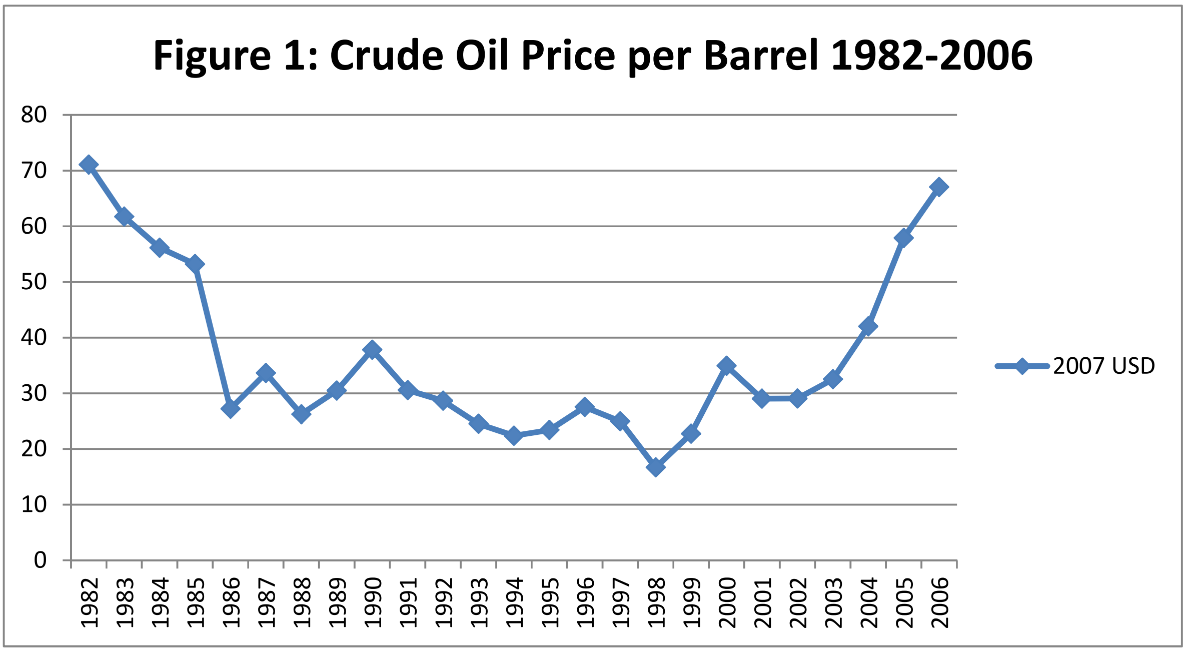
Figure 1: Crude Oil Price per Barrel 1982-2006
80
70
60
50
40
30
20
10
0
1982
1983
1984
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1987
1988
1989
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2007 USD