The Oil Curse: A Survey with Some Emphasis on Regions

by

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NATURAL RESOURCE CURSE CLAIM:

LARGE ENDOWMENT OF OIL AND MINREALS REDUCES LONG-TERM GROWTH RATES

MAIN TRANSMISSION MECHANISM STRESSED IN RECENT LITERATURE:

DELETERIOUS EFFECT OF NATURAL RESOURCES ON INSTITUTIONS

MAIN CULPRIT: "POINT-SOURCE" RESOURCES SUCH AS OIL

THE BASIC LOGIC OF THE NATURAL RESOURCE CURSE IS THAT NATURAL RESOURCES GENERATE RENTS, AND WHEN THE AMOUNT OF RENT POTENTIALLY AVAILABLE FOR REDISTRIBUTION INCREASES, THE EFFORTS TO OBTAIN THAT RENT (I.E., RENT-SEEKING EFFORTS) INCREASE TOO.

MORE SPECIFICALLY, FIGHTING FOR A SHARE OF RENTS BECOMES MORE ATTRACTIVE THAN PRODUCING NEW WEALTH → MORE OF SOCIETY'S RESOURCES SHIFT INTO RENT-SEEKING AND IF NON-RENT-SEEKING ACTIVITIES PRODUCE POSITIVE EXTERNALITIES, ECONOMIC GROWTH DECLINES.

AN EXAMPLE OF A FORMAL MODEL: MEHLUM ET AL. (EJ, 2006)

Mehlum, Halvor, Karl Moene, and Ragnar Torvik, "Institutions and the Resource Curse," *Economic Journal* 116:508:1–20.

Mehlum et al.'s model sketch: There is a fixed number of entrepreneurs in the economy, $N = n_P + n_G,\ n_P = \alpha N$, with each choosing between being a "**producer**" or a "**grabber**." Total rent $= R$. Grabber's payoff $= \pi_G = sR/N$; producer gets $\lambda sR/N$ of rent, where $\lambda \epsilon [0,1]$ is "institutional quality" (, i.e., grabbers get $\geq$ rent than producers) and $\frac{\partial s}{\partial n_G} < 0$.

Two production technologies: "modern" (IRS with fixed costs, low MC, positive profit) and "fringe" (no fixed costs, high MC, zero profit). Labor $= L, w = 1$. Producer's production profit, $\pi(n_P)$, increases in n_P (because total income and demand ↑). Producer's total profit is $\pi_P = \pi(n_P) + \lambda\pi_G$.

If λ is low and R is high, there are grabbers in equilibrium where $\pi_P = \pi_G$ implying that $\pi_P(1-\lambda) = \pi(n_P)$, and total income, $Y = \frac{N\pi(n_P)}{1-\lambda} + L \rightarrow R \uparrow$ implies that $n_G \uparrow$ and $n_P \downarrow \rightarrow Y \downarrow$, i.e., there is "resource curse." It occurs because $R \uparrow$ shifts some producers into rent grabbing and reduces the positive externality generated by producers. Here the conclusion is that only countries with weak institutions (low λ) suffer from a resource curse.

ANOTHER ARGUMENT FOR THE DELETERIOUS EFFECT OF NATURAL RESOURCES ON INSTITUTIONS:

NATURAL RESOURCE WEALTH MEANS THAT THE GOVERNMENT DOES NOT NEED MUCH TAX REVENUE AND, THEREFORE, IT BECOMES UNACCOUNTABLE TO THE PEOPLE AND HAS NO INTEREST IN MAINTAINING GOOD PRODUCTIVE INSTITUTIONS.

THE OPPOSITE ARGUMENT IS THAT NATURAL RESOURCES BRING IN THE POSSIBILITY FOR THE GOVERNMENT TO IMPROVE ITS FUNCTIONS WITHOUT TAXING PEOPLE AND BUSINESSES TOO MUCH. THIS IS PARTICULARLY IMPORTANT IN POOR COUNTRIES THAT MAY NOT EVEN HAVE THE ADMINISTRATIVE CAPACITY TO TAX → A COUNTRY, PARTICULARLY A RELATIVELY POOR COUNTRY, CAN IMPROVE ITS INSTITUTIONS WITHOUT HAMPERING THE GROWTH OF THE PRIVATE SECTOR.

THERE IS ALSO A **DUTCH DISEASE** ARGUMENT THAT NATURAL RESOURCE WEALTH LEADS TO CURRENCY APPRECIATION, MAKING THE COUNTRY'S MANUFACTURING EXPORTS NON-COMPETITIVE AND, THEREFORE, DESTROYING THE COUNTRY'S MANUFACTURING BASE.

THIS MAY BE BAD FOR THE ECONOMY OVERALL IF MANUFACTURING SECTOR PRODUCES POSITIVE EXTERNALITIES THAT THE RESOURCE SECTOR DOES NOT PRODUCE.

THE ASSUMPTION THAT MANUFACTURING PRODUCES POSITIVE EXTERNALITIES AND RESOURCE SECTOR DOES NOT IS HIGHLY QUESTIONABLE, PARTICULARLY IN LIGHT OF THE FACT THAT THE RESOURCE SECTOR IS NOWADAYS RATHER SOPHISTICATED TECHNICALLY.

THE EFFECT OF OIL AND OTHER NATURAL RESOURCES ON THE ECONOMY IS AN EMPIRICAL QUESTION

MAIN PAPERS ON THE OIL CURSE:

Sachs and Warner (1995, 2001) claim:

"… a statistically significant, inverse, and robust association between natural resource intensity and growth over the past twenty years."
"[e]mpirical support for the curse of natural resources is not bulletproof, but it is quite strong"

Sala-i-Martin and Subramanian (2003)

"[s]ome natural resources – oil and minerals in particular – exert a negative and non-linear impact on growth via their deleterious impact on institutional quality."

Gylfason, T., and G. Zoega (2002a, b)

"[e]conomic growth is inversely related to natural resource dependence…"

Isham, et al. (2003)

Leite and Weidmann (1999)

and many others

TWO MAIN APPROACHES FOR GENERATING EMPIRICAL EVIDENCE:

- REGRESSIONS OF GROWTH RATES OVER 20-30 YEAR PERIOD ON NATURAL RESOURCE ENDOWMENT

$$\boldsymbol{LOG\left(\frac{y_{i,t+20}}{y_{i,t}}\right) = \beta_0 + \sum_i \beta_i X_i + \gamma N_i + \varepsilon_i}$$

- REGRESSIONS OF INSTITUTIONAL QUALITY (RULE OF LAW, CORRUPTION, ETC.) ON NATURAL RESOURCE ENDOWMENT

$$\boldsymbol{IQ_{i,t+20} = \mu_0 + \sum_i \mu_i X_i + \vartheta_1 Y_{i,t} + \vartheta_2 N_i + \omega_i}$$

PROBLEMATIC ISSUES:

- **LIMITED PERIOD FOR THE DATA**

- **“INITIAL GDP” AS A CONTROL VARIABLE**

- MEASURES OF NATURAL RESOURCES (GDP SHARES VS. PER CAPITA; EXPORTS/GDP)

- ENDOGENEITIES

LIMITED PERIOD PROBLEM:

SLOW GROWTH OF OIL OUTPUT IN MATURE PRODUCERS ➔ SLOW GDP GROWTH (see also Davis, 2011)

Example: an economy with an oil sector and a manufacturing sector with output linear in capital; assume that extracting oil does not require any investment. Then output is

$$Y = \alpha K e^{gt} + R,$$

where R is output of the oil sector,
K is the stock of capital,
g is the exogenous rate of technological progress

Let $k \equiv \frac{\partial K}{\partial t} = bY$.

Then,

$$y = \alpha b e^{gt} + g + (r - g)R/Y,$$

where $y = \frac{\partial Y}{\partial t}/Y$ and $r = \frac{\partial R}{\partial t}/R$.

Relative to an otherwise identical economy, but with $R = 0$ and $r = 0$, the oil producer would grow faster if and only if $r > g$, which is not sustainable in the long run unless relative world prices of oil grow sufficiently fast.

Table 1. Dates of first commercial extraction of oil for major world producers

Country	Year of 1st commercial extraction	Per capita PPP GDP in 1960 (1990 USD)
OPEC		
Algeria	1965	2,088
Indonesia	1883	1,019
Iran	1908	2,154
Iraq	1923	2,735
Kuwait	1938	28,813
Libya	1957	1,830
Nigeria	1960	854
Qatar	1939	33,104
Saudi Arabia	1944	3,719
United Arab Emirates	1965	22,433
Venezuela	1917	9,646
NON-OPEC		
Canada	1920	8,753
Mexico	1901	3,155
Norway	1969	7,204
UK	1918	8,645
US	1859	11,328

Contrast the data on PC GDP in the above table with the following statement by Sachs and Warner (2001):

"casual observation suggests that there is virtually no overlap in the set of countries that have large natural resource endowments – and the set of countries that have high levels of GDP."

ALEXEEV AND CONRAD: EFFECT ON **LONG-TERM GROWTH** CAN BE MEASURED FROM PER CAPITA GDP ***LEVELS***

$$\boldsymbol{Y_{i,2000} = \beta_0 + \sum_i \beta_i X_i + \gamma N_i + \varepsilon_i}$$

ALTERNATIVE MEASURES OF $\boldsymbol{N_i}$ (NATURAL RESOURCE ENDOWMENT) THAT WE USE:

- VALUE OF PER CAPITA OIL OUTPUT IN 2000
- RATIO OF OIL OUTPUT VALUE IN 2000 TO PPP GDP
- PER CAPITA HYDROCARBON DEPOSITS IN 1993
- SHARE OF MINING OUTPUT IN PPP GDP (1990's)
- PER CAPITA MINING OUTPUT (1990's)

Table 2. Effect of Oil Wealth on PC GDP (Dep. Var.: Log of PC PPP GDP in 2000; Large sample)

Variable	1	2	3	4	5	6
Hydrocarbon deposits, PC	**.059*** (.016)**			**.051*** (.010)**		
Value of oil output, PC		**.096*** (.023)**			**.086*** (.015)**	
Oil/GDP ratio			**1.51** (.693)**			**1.26*** (.313)**
Absolute latitude	.037*** (.005)	.038*** (.005)	.038*** (.005)			
Ethnolinguistic fractionalization				-170 (.232)	-.455* (.250)	-.436* (.262)
European population	1.34*** (.202)	1.30*** (.202)	1.43*** (.208)	-.054 (.308)	.097 (.286)	.066 (.322)
Latin America	1.02*** (.155)	.926*** (.154)	1.06*** (.171)	.814*** (.134)	.662*** (.135)	.774*** (.151)
East Asia	1.70*** (.334)	1.67*** (.290)	1.77*** (.269)	.572*** (.195)	.594*** (.172)	.618*** (.213)
Rule of law (Instrumented)				1.14*** (.150)	1.02*** (.150)	1.09*** (.165)
Observations	111	118	118	111	117	117
Adj. R-squared	.739	.725	.708	.862	.869	.844

Notes: *** - significant at 1%; ** - at 2%; * - at 10%;
Instruments for Rule of law: absolute latitude, English language speakers; European language speakers

Table 2 (cont). Effect of Oil Wealth on PC GDP (Dep. Var.: Log of PC PPP GDP in 2000; Acemoglu et al.)

Variable	7	8	9
Hydrocarbon deposits, per capita	**.064*** (.013)**		
Value of oil output, per capita		**.131*** (.018)**	
Oil/GDP ratio			**2.57*** (.712)**
Ethnolinguistic fractionalization	.107 (.237)	.227 (.224)	.204 (.217)
Latin America	1.02*** (.126)	1.02*** (.119)	1.15*** (.128)
East Asia	.707*** (.226)	.557** (.244)	.569 (.387)
Rule of law (Instrumented)	1.09*** (.102)	1.14*** (.101)	1.31*** (.095)
Observations	68	69	69
P-value for Hansen J statistic	.978	.988	.907
Adj. R-squared	.865	.890	.831

Instruments for Rule of law: absolute latitude, English language speakers; European language speakers; eq. (5)-(6): absolute latitude, settler mortality

Table 3. The Effect of Mineral Wealth on Per Capita GDP (Dep. var.: Log of per capita PPP GDP in 2000)

	Large sample				Acemoglu et al. sample	
Variable	**1**	**2**	**3**	**4**	**5**	**6**
Mining output, per capita	**.094*** (.028)**		**.062*** (.020)**		**.082*** (.029)**	
Mining/GDP ratio		**2.60* (1.111)**		**1.44* (.846)**		**4.51*** (1.37)**
Absolute latitude	.036*** (.005)	.038*** (.006)				
Ethnolinguistic fractionalization			-.432 (.272)	-.417 (.279)	.288 (.237)	.216 (.241)
European population	1.38*** (.187)	1.49*** (.209)	.081 (.316)	.022 (.357)		
Latin America	.941*** (.161)	1.05*** (.170)	.690*** (.158)	.748*** (.161)	1.06*** (.152)	1.10*** (.159)
East Asia	1.63*** (.333)	1.73*** (.304)	.574*** (.179)	.561** (.223)	.625** (.259)	.467 (.301)
Rule of law (Instrumented)			1.04*** (.173)	1.12*** (.180)	1.19*** (.107)	1.30*** (.101)
Observations	117	117	117	117	69	69
P-value for Hansen J statistic			.222	.494	.533	.404
Adjusted R-squared	.711	.700	.843	.826	.817	.811

Notes: *** - significant at 1% level; ** - significant at 2% level; * - significant at 10% level

Table 4. The Effect of Interaction between Institutions and Natural Resources on PC GDP (large sample; dependent variable: Logarithm of PC PPP GDP in 2000)

Variable	1	2	3	4	5
Hydrocarbon deposits, per capita	.056*** (.014)				
Value of oil output, per capita		.101*** (.021)			
Oil/GDP ratio			1.14* (.678)		
Mining/GDP ratio				1.64 (1.14)	
Mining output, per capita					.072** (.028)
Rule of law (fitted values)	1.14*** (.189)	1.08*** (.202)	1.15*** (.218)	1.13*** (.238)	1.19*** (.236)
(Rule of law)* Natural resources	-.041*** (.012)	-.065*** (.017)	-.834 (.913)	-1.53 (2.20)	-.053*** (.019)
Observations	111	117	117	117	117
Adj. R-squared	.783	.770	.754	.745	.756

Notes: *** - significant at 1% level; ** - significant at 2% level; * - significant at 10% level.

THE EFFECT OF MINERAL WEALTH ON INSTITUTIONS

EFFECT OF "INITIAL GDP" AS A CONTROL VARIABLE:

OIL RAISES GDP → IN 1970 KUWAIT HAD MUCH GREATER PER CAPITA GDP THAN FRANCE, BUT WAS IN-BETWEEN JORDAN AND FRANCE IN TERMS OF INSTITUTIONS → CONTROLLING FOR INITIAL GDP LEADS TO A NEGATIVE COEFFICIENT ON OIL

COMPARISON OF FRANCE AND KUWAIT IN TERMS OF PER CAPITA GDP AND INSTITUTIONAL QUALITY

	GDP PER CAPITA 1970	RULE OF LAW 1998	CONTROL OF CORRUPTION 1998	GOVERNMENT EFFECTIVENESS 1998
FRANCE	12,115	1.44 (0.18)	1.75 (0.18)	1.64 (0.23)
KUWAIT	41,357	1.16 (0.24)	1.07 (0.18)	–0.01 (0.31)

Note: standard errors are in parentheses

ALEXEEV AND CONRAD'S APPROACH:

FIRST, ESTIMATE $\widehat{\boldsymbol{Y}}$:

$$\boldsymbol{Y_{i,1970} = \beta_0 + \sum_i \beta_i X_i + u_i \rightarrow \widehat{Y} = b_0 + \sum_i b_i X_i}$$

WHERE $\boldsymbol{X_i}$ ARE ABSOLUTE LATITUDE, EUROPE, LATIN AMERICA, EAST ASIA

$$\boldsymbol{\widehat{Y} = 6.8 + 0.03 \times ABSLAT + 1.17 \times EUROPE + 0.83 \times LATAM + 0.49 \times EAST}$$

Adj. R^2 = 0.55; No. obs. = 118

NOTE THAT $CORR(N_i, Y_i) >> CORR(N_i, \hat{Y}) \approx 0$

THEN, A&C CONTRAST

$$\boldsymbol{IQ_{i,2000} = \mu_0 + \sum_i \mu_i X_i + \vartheta_1 Y_{i,1970} + \vartheta_2 N_i + \omega_i}$$

AND

$$\boldsymbol{IQ_{i,2000} = \mu_0 + \sum_i \mu_i X_i + \vartheta_1 \widehat{Y} + \vartheta_2 N_i + \omega_i}$$

WHERE $\boldsymbol{IQ_{i,t}}$ – INSTITUTIONAL QUALITY ("RULE OF LAW" INDEX, ETC.)

Table 5. The Effect of Oil Wealth on the Rule of Law (ethnic and linguistic controls only; large sample)
(Dependent variable: Rule of law index for year 2000)

Variable	1	2	3	4	5	6
Hydrocarbon deposits, per capita	**-.042** (.017)**	**-.005 (.017)**				
Value of oil output, per capita			**-.068** (.026)**	**-.012 (.027)**		
Oil/GDP ratio					**-1.33** (.536)**	**.003 (.666)**
GDP 1970, per capita	**.570*** (.090)**		**.552*** (.091)**		**.569*** (.103)**	
GDP 1970, per capita, fitted		**.508*** (.173)**		**.466*** (.169)**		**.473*** (.160)**
Observations	112	**112**	118	**118**	118	**118**
Adj. R-squared	.717	**.623**	.710	**.617**	.712	**.616**

Notes: robust standard errors are in parentheses; *** - significant at 1% level; ** - significant at 2% level; * - significant at 10% level

Table 6. The Effect of Oil Wealth on the Rule of Law (settler mortality included as a control variable; Acemoglu et al. sample; dependent variable: Rule of law index for year 2000)

Variable	1	2	3	4	5	6
Hydrocarbon deposits, per capita	**-.042** (.019)**	**-.020 (.020)**				
Value of oil output, per capita			**-.076** (.030)**	**-.018 (.030)**		
Oil/GDP ratio					**-1.70*** (.402)**	**-.687 (.515)**
GDP 1970, per capita	**.496*** (.103)**		**.521*** (.117)**		**.482*** (.111)**	
GDP 1970, per capita, fitted		**.343 (222)**		**.328 (.229)**		**.291 (.222)**
Settler mortality	-.241*** (.090)	-.340*** (.117)	-.231** (.089)	-.335*** (.113)	-.202** (.086)	-.329*** (.111)
Absolute latitude	.015 (.009)	.012 (.011)	.014 (.009)	.011 (.012)	.011 (.010)	.011 (.011)
Observations	69	69	70	70	70	70
Adj. R-squared	.622	.499	.601	.490	.616	.495

Notes: *** - significant at 1% level; ** - significant at 2% level; * - significant at 10% level.

Table 7. The Effect of Mineral Wealth on the Rule of Law (Dependent variable: Rule of law index)

	Large sample				Acemoglu et al. sample			
Variable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Mining/GDP ratio	**-1.20**	**.357**			**-.3.19****	**-.797**		
	(1.60)	**(1.31)**			**(1.26)**	**(1.40)**		
Mining output, per capita			**-.044**	**.003**			**-.049**	**.012**
			(.031)	**(.030)**			**(.038)**	**(.037)**
GDP 1970, per capita	**.483*****		**.493*****		**.485*****		**.472*****	
	(.103)		**(.093)**		**(.117)**		**(.128)**	
GDP 1970, per capita, fitted		**.493*****		**.475*****		**.306**		**.281**
		(.158)		**(.170)**		**(.223)**		**(.231)**
Settler mortality					-.182**	-.324***	-.219**	-.334***
					(.089)	(.111)	(.087)	(.112)
Observations	118	118	118	118	70	70	70	70
Adj. R-squared	.690	.617	.693	.617	.604	.489	.583	.487

Notes: *** - significant at 1% level; ** - significant at 2% level; * - significant at 10% level

Table 8. The Effect of Oil and Mineral Wealth on Corruption (Dep. var.: Index of control of corruption, 2000)

Variable	1	2	3	4	5	6	7	8	9	10
Hydrocarbons, PC	**-.014**	**.014**								
	(.015)	**(.013)**								
Value of oil output, PC			**-.060****	**-.008**						
			(.023)	**(.019)**						
Oil/GDP ratio					**-1.12****	**.111**				
					(.442)	**(.363)**				
Mining/GDP ratio							**-.554**	**.814**		
							(1.25)	**(.829)**		
Mining output, per capita									**-.022**	**.019**
									(.027)	**(.025)**
PC GDP 1970	**.498*****		**.578*****		**.579*****		**.517*****		**.528*****	
	(.100)		**(.088)**		**(.093)**		**(.103)**		**(.099)**	
PC GDP 1970, fitted		**.765*****		**.800*****		**.804*****		**.814*****		**.803*****
		(.167)		**(.153)**		**(.154)**		**(.155)**		**(.157)**
Observations	110	110	113	113	113	113	113	113	113	113
Adj. R^2	.732	.756	.738	.740	.734	.740	.720	.743	.721	.742

Notes: *** - significant at 1% level; ** - significant at 2% level; * - significant at 10% level.

COMPARISON OF BELARUS, RUSSIA, AND UKRAINE IN TERMS OF PER CAPITA GDP AND INSTITUTIONAL QUALITY

	PPP GDP per capita, 2004 US$	Rule of law 2004	Control of corruption 2004	Government effectiveness 2004
BELARUS	6,970	–1.31	–0.91	–0.93
RUSSIA	9,902	–0.70	–0.72	–0.21
UKRAINE	6,394	–0.83	–0.89	–0.67

A&C CONCLUSIONS:

GIVEN THE DATA AVAILABLE SO FAR, NATURAL RESOURCES, INCLUDING OIL:

- DO NOT REDUCE LONG-TERM GROWTH RATES

- DO NOT MAKE INSTITUTIONAL QUALITY SIGNIFICANTLY WORSE

RECENT DEVELOPMENTS:

(1) FIXING AN ECONOMETRIC PROBLEM CAUSED BY USING GENERATED REGRESSORS (MINOR);

(2) THE OIL CURSE AND THE ECONOMIES IN TRANSITION;

(3) USE OF PANEL DATA TO TEST FOR THE EFFECT OF OIL ON ECONOMIC GROWTH (EGOROV ET AL. 2009, AREZKI AND BRUCKNER 2009, AND BRUCKNER ET AL. 2011);

(5) EBA ANALYSIS.

Egorov et al.: free media provide info about bureaucrat's performance, but increase the probability of autocrat's demise; empirics: controls for per capita GDP and has other econometric problems (endogeneities and autocorrelation);
Arezki and Bruckner: oil rents increase corruption (for some reason, simply a change of oil rents is used, rather than per capita or per GDP; also, "non-oil GDP" is a control in system GMM (only FE without controlling for GDP); also, no tests for system GMM instrument properties);
Bruckner et al.: oil price shocks ($\theta \times OilPrice$, where θ =export-imports) improve democracy scores of oil exporters (sort of contradicting Arezki and Bruckner) but worsen democracy in oil importers; while this result is questionable, oil price shocks have a robust positive (negative) effect on GDP of exporters (importers)

CONCLUSIONS

- LARGE ENDOWMENTS OF OIL/MINERALS DO NOT LOWER LONG-TERM ECONOMIC GROWTH, ALTHOUGH THEY MAY DISTORT THE RELATIONSHIP BETWEEN GDP AND INSTITUTIONAL QUALITY

- BECAUSE OF THIS DISTORTION, THE NEGATIVE EFFECT OF LARGE ENDOWMENTS OF "POINT-SOURCE" RESOURCES ON INSTITUTIONS CLAIMED IN THE LITERATURE IS MOSTLY DUE TO THE USE OF INITIAL GDP VALUES AS CONTROL VARIABLES

Most literature on the “oil curse” is based on country-level comparisons, presumably because of better data availability and because some of the transmission mechanisms such as the Dutch Disease can be most readily analyzed at the country level

One difficulty with using country-level data, however, is that countries differ greatly along many dimensions (history, culture, geography, institutional quality and macroeconomic policies)

Some of these differences are time-invariant and can be accounted for by fixed effects, but this is not true with respect to all of them

A few recent papers have focused on the regional level:

US (Papyrakis and Gerlach, 2007; James and Aadland, 2011);
China (Fang, et al., 2009)
Russia (Desai, 2005; Lugovoy et al., 2007, and Freinkman and Plekhanov, 2009)
Regional level analysis offers advantages, because even in large countries differences among regions in history, culture, and institutions, not to mention the effects of macroeconomic policies, are usually not as great as differences among countries

BUT, regions belong to the same country leading to economic and institutional quality convergence, blurring some of the differences that would have otherwise existed if the regions were separated by meaningful international borders → downward bias in the observable effects of natural resources, although this is not necessarily an econometric problem

LET ME EXAMINE THE IMPACT OF NATURAL RESOURCE WEALTH ON ECONOMIC GROWTH, GOVERNMENT BUDGETS, AND INSTITUTIONS IN RUSSIA'S REGIONS IN THE 2000'S

Relative to the existing papers on this issue I will use:

More recent data, namely, for 2000-2009

- particularly important in the case of Russia, because of a substantial reform of Russia's fiscal federalism arrangements

Panel estimation approach where feasible (FE, BE, and GMM)

Novel measure of the importance of natural resources to regional economies (regional mineral tax collections)

Main results:

Little evidence of a resource curse in Russia's regional data

If anything, there is positive association between natural resource wealth and GRP

Negative effects are found only with respect to the impact on investment risk indices, and these effects are weak statistically and small numerically

Main difficulty: Scarcity of regional institutional quality measures for the entire period

The Data

The city of Moscow is excluded.

Mineral tax collections (total): Log of one plus per capita mineral tax collections in the region in 2000 rubles

Mineral tax (НДПИ) is a royalty assessed based on gross value of the minerals extracted; main component: tax on hydrocarbons

Tax rates differ depending on the mineral, presumably to reflect different size of rents for different minerals

Examples of rates: 4% on peat and brown coal; 4.8% for “standard ores of ferrous metals;” 8% for the non-ferrous metals

Mineral tax on hydrocarbons

Oil: 16.5 % during 2002-2005; later, according to the following formula:

RUB419 × K per ton, where
K = (USD Price of Urals/barrel – 9) × P/261; P = USD/RUB
Base: quantity in the pipeline

Tax holiday and depletion factor were added for some oil fields in 2007

Natural gas: specific rate in rubles adjusted from time to time

Mineral tax collections (regional share): share of the tax that was assigned to the regional budget. These shares remained constant over the years for all minerals (40/60 Feds/Region), except for hydrocarbons

Table 1. Allocation of the mineral tax (%)

	2002		2003		2004		2005
Oil							
Federal share	80	74.5	80	74.5	85.6	81.6	95
Regional share	20	5.5	20	5.5	14.4	5.0	5
Okrug share		20		20		13,4	
Natural gas							
Federal share	80	74.5	80	74.5	100	100	100
Regional share	20	5.5	20	5.5			
Okrug share		20		20			

Hydrocarbon tax (total and regional shares): Log of one plus per capita oil and natural gas component of the mineral tax

Mineral tax (total or regional)/GRP; Hydrocarbon tax (total or regional)/GRP: ratio of the respective tax to GRP

Extractive industries share in GRP: ratio of the regional extractive industries output to GRP

Per capita extractive industry output: Log of one plus per capita output of extractive industries in the region

Population: Log of regional population

Per capita GRP: Log of per capita GRP

Index of investment risk: Source: Expert magazine; represents an average value of different aspects of investment risk (political, social, economic, crime, etc.); higher values of the index represent higher investment risk

Carnegie institutional quality index: Overall index of institutional quality calculated by the Carnegie Center for 2000-2004 as an average of 10 different institutional characteristics; higher values of the index represent higher institutional quality

Carnegie corruption index: The corruption component of the above Carnegie institutional quality index

Table 1A. – Descriptive statistics (not in logs)

	Mean	Standard deviation	Minimum	Maximum	Number of observations
Per capita mineral tax (total; rubles)	5,608	27,944	0	319,305	655
Per capita mineral tax (regional share; rubles)	541	2,778	0	23,270	655
Mineral tax (total)/GRP	0.014	0.030	0	0.169	629
Per capita hydrocarbon tax (total; rubles)	5,447	27,908	0	319,208	655
Per capita hydrocarbon tax (regional shr.; rubles)	445	2,328	0	22,615	655
Hydrocarbon tax (total) /GRP	0.012	0.030	0	0.169	629
Extractive industries/GRP (%)	9.51	15.22	0	77.4	562
PC extract. ind. output (rubles)	6,477	20,494	0	182,148	478
Investment risk index	1.125	0.373	0.723	4.541	577
Carnegie index (overall)	28.56	6.31	17	45	87
Carnegie corruption index	2.76	0.681	1	5	87
Per capita GRP (rubles)	45,754	35,553	5,761	304,087	628
Population (thousand)	1,644	1,283	41.3	6,733	656

Table 1B. Pairwise correlations of main natural resource wealth measures

	PC min. tax (total; rubles)	PC min. tax (reg. share; rubles)	Min. tax (total) /GRP	PC carbon tax (total; rubles)	PC carbon tax (reg. shr.; rubles)	Carbon tax (total) /GRP	Extracting industries /GRP (%)
PC mineral tax (total; rubles)	1.000						
PC mineral tax (reg. share; rubles)	.897	1.000					
Mineral tax (total)/GRP	.693	.566	1.000				
PC hydrocarbon tax (total; rubles)	.796	.496	.733	1.000			
PC hydrocarbon tax (reg. shr.; rubles)	.779	.513	.800	.965	1.000		
Hydrocarbon tax (total)/GRP	.629	.469	.986	.730	.804	1.000	
Extracting industries/GRP (%)	.658	.655	.557	.516	.550	.490	1.000

Estimation results

The effect on per capita GRP

$$PC\ GRP_{it} = \alpha Resource_{it} + \beta Population_{it} + \delta_i + \gamma_t + \varepsilon_{it}$$

where δ_i's represent region fixed effects, γ_t's denote time dummies

Estimates are for 2002-2009 and 2005-2009 for mineral tax variables, and for 2004-2009 for share of extractive industries in GRP

Fixed effects regressions adjusted for AR(1) and between effects regressions with a dummy variable for the region being an autonomous republic

Table 2. – Fixed effects; dependent variable: Log Per capita (PC) GRP

	2002-09	2005-09	2002-09	2005-09
PC Mineral tax (total)	.039*** (.013)	.056*** (.015)	-	-
PC Mineral tax (regional share)	-	-	.027** (.014)	.053*** (.016)
Population	-8.82** (4.26)	-7.91 (5.83)	-8.37* (4.32)	-7.80 (5.86)
R-square (within)	.295	.421	.285	.415
No. regions	78	78	78	78
No. Obs.	464	310	464	310

All equations are performed in first differences

Table 3. – Between effects; dependent variable: Log PC GRP

	2002-09	2005-09	2002-09	2005-09
PC Mineral tax (total)	.096*** (.021)	.090*** (.022)	-	-
PC Mineral tax (regional share)	-	-	.164*** (.027)	.173*** (.028)
Population	.108* (.064)	.107 (.067)	.130** (.059)	.136** (.060)
Republic	-.281** (.120)	-.341*** (.123)	-.290*** (.110)	-.345*** (.111)
R^2 (between)	.347	.293	.448	.421
No. regions	78	78	78	78
No. Obs.	620	389	620	389

Table 4. – Between effects; dependent variable: PC GRP (not a log)

	2002-09	2005-09	2002-09	2005-09
Mineral tax/GRP (total)	167,128 (123,625)	159,334 (123,624)	-	-
Mineral tax/GRP (reg. share)	-	-	2,680,120*** (937,066)	2,838,744** (1,187,475)
Population	3.99 (2.82)	4.67 (3.11)	4.52* (2.70)	5.49* (3.01)
Republic	-12,567 (8,736)	-13,819 (9,596)	-14,750* (8,282)	-15,190 (9,201)
R^2 (between)	.080	.083	.151	.129
No. regions	78	78	78	78
No. Obs.	620	389	620	389

Fixed effects regressions resulted in statistically insignificant coefficients

Table 5. – Extractive industries share regressions for PC GRP (2004-2009)

Estimation method →	Fixed effects	Fixed effects	Between effects	Between effects
Dependent variable →	PC GRP	Log (PC GRP)	PC GRP	Log(PC GRP)
Extractive industries output/GRP (%)	1005*** (102)	-	2,285*** (220)	-
PC Extractive industries output	-	.003 (.007)		.105*** (.019)
Population	-393 (126)	-6.96 (5.97)	3.94** (1.94)	.128** (.062)
Republic	-	-	-17,141*** (5,822)	-.295** (.112)
R^2 (within/b/w)	.445	.388	.619	.387
No. regions	78	78	78	78
No. Obs.	310	310	466	466

Fixed effects: natural resource endowment positively and statistically significantly affects GRP

The economic importance of resource endowment is relatively small with point estimates of elasticity ranging between .027 and .056 for the mineral tax

For extractive industries, the elasticity of GRP with respect to the share of extractive industries in GRP calculated at the mean values is 0.21. The coefficient of PC output of extractive share is insignificant.

These results suggest that during 2002-2009, rents from mineral resource extraction accrued mostly to the central government

Between effects: shows somewhat stronger impact of natural resource endowment on GRP; the impact is positive and statistically significant for all natural wealth measures and elasticities for the mineral tax are more than twice the size of those in fixed effects regressions

Basic regressions from now on:

$$Y_{it} = \mu GRP_{it} + \alpha Resource_{it} + \beta Population_{it} + \delta_i + \gamma_t + \varepsilon_{it}$$

where Y_{it} = regional budget expenditure or a measure of its structure, or an indicator of institutional quality of the region; fixed effects, between effects regressions for investment risk; cross-sectional regressions for Carnegie indices

One important issue: whether to control for GRP

On one hand, controlling for GRP is a good idea, because GRP determines many aspects of regional government performance; on the other hand, GRP may be endogenous with all of our dependent variables and because GRP is positively related to natural resource wealth, part of the effect of this wealth may act via GRP and as a result the coefficient of the measure of natural resource wealth may not correctly identify its overall impact

In general, controlling for GRP isolates the effect of natural resources relative to other regions with the same GRP; not controlling for GRP reflects the full impact of natural resources

The impact of natural resources on regional budget expenditures and their structure

Dependent variables: per capita budget expenditures (in constant year 2000 rules), and shares of regional budget spent on (i) regional administration; (ii) education; (iv) social policy; or (v) healthcare, arts, and sports.

Fixed effects: There is a positive relationship between regional budget expenditures and measures of natural resource abundance in some specifications, but it is very small numerically

Between effects: positive associations with measures of resource wealth; strongly statistically significant although not large numerically
We do not control for GRP here because of potentially significant endogeneities and unavailability of reasonable instruments; system GMM does not seem to work here

The results suggest that the federal government has been mostly successful during the 2000's in extracting from regional budgets additional rents generated due to natural resource price increases after 2002, but that part of the pre-2002 rents might still accrue to the regions

Also, no consistently statistically significant associations are found between mineral tax collections (overall or regional) and the components of regional budgets listed above, controlling for GRP

Conclusion: natural resource rich regions do not seem to have budget structures that are different on average from budget structures of other regions with similar GRP

The effect on investment risk index

Fixed and between effects: when we do not control for PC GRP, neither mineral tax collections nor extractive industries output significantly influence investment risk index; only in one between effects specification (share of total mineral tax collections) the relevant coefficient was statistically significant and then only at 10% level

When we control for PC GRP things change significantly (Table 6 provides some illustrative between effects estimates), but PC GRP may be endogenous with investment risk → we use system GMM (Arellano-Bond) – Table 7

Table 6. – Investment risk index; mineral tax collections (**between effects**)

	2002-2009			
Mineral tax (total)	.051*** (.015)	.023 (.015)	-	-
Mineral tax (total)/GRP	-	-	3.14*** (1.16)	2.29* (1.20)
Per capita GRP	-.295*** (.074)	-	-.228*** (.069)	-
Population	-.147*** (.043)	-.173*** (.046)	-.155*** (.044)	-.178*** (.046)
Republic	.036 (.082)	.134 (.085)	.032 (.085)	.106 (.087)
R^2 (between)	.372	.235	.345	.248
No. regions	78	78	78	78
No. Obs.	536	536	536	536

Table 7. – The effect of natural resources on investment risk (system-GMM)

	(1)	(3)	(5)	(6)
PC Mineral tax (total)	.282** (.140)	-	-	-
Mineral tax (total)/GRP	-	-.034 (.033)	-	-
PC Extractive industries	-	-	.178* (.104)	-
Extractive industry/GRP	-	-	-	.048* (.026)
PC GRP	-.895* (.538)	-.610 (.616)	-1.22* (.722)	-1.30** (.632)
Population	-.652** (.261)	.040 (.212)	-.368** (.180)	-.340* (.192)
p-value for AR(2) test	.302	.164	.441	.983
p-value for Hansen J stat.	.506	.113	.134	.271
No. regions	78	78	78	78
Observations	446	446	398	398

The effect on Carnegie indices

While the reliability of the investment risk index is questionable, it is the only institutional quality index that is available to us for panel data analysis

We can, however, use Carnegie indices in cross-sectional regressions

We use two indices: the overall index and the index of corruption

Again, these regressions are estimated with and without controlling for GRP. We view the specifications that do not control for GRP as more sensible

Results

Mineral tax: negative (i.e., associated with higher corruption) and significant at 10% level in one of the regressions for corruption index when controlling for GRP

Extractive industries shares (Table 8): no statistically significant effect on institutional quality when we do not control for GRP, and negative and statistically significant effect when GRP is included, suggesting that regions rich in natural resources have institutional quality that is similar to other regions on average, but worse institutions than the regions that are comparable in terms of GRP, but whose development was not based on natural resources

Note: GRP is probably endogenous with institutions

Conclusion: there is no statistically significant association between natural resource wealth and the two Carnegie indices we analyze

Table 8. – Institutional quality; extractive industries/GRP (Carnegie indices)

	Overall index	Overall index	Corruption	Corruption
Extractive industries/GRP	.060 (.043)	-.183*** (.060)	.003 (.005)	-.014* (.008)
Per capita GRP	-	8.18*** (1.38)	-	.595*** (.209)
Population	2.68*** (.873)	1.79** (.751)	.019 (.098)	-.084 (.113)
Republic	-4.05** (1.78)	-1.76 (1.74)	-.276 (.283)	-.109 (.279)
R^2	.243	.448	.027	.112
No. Obs.	77	77	77	77

Conclusions

Little evidence of a resource curse based on Russian regional data, although there is some evidence that resource rich regions have worse institutions (investment risk) than other regions with comparable PC GRP

Even when results consistent with a "curse" are statistically significant, the economic effect is small

Positive effect of resource wealth on GRP: the results here are similar to those obtained by Lugovoy et al. (2007) for Russia and Fang et al. (2009) for China, but are different from the results of James and Aadland, (2001), and Papyrakis and Gerlach (2007) for the US. Given that the US has stronger institutions that Russia and China, this would contradict Mehlum et al. (2006) who argue that natural resource wealth is more likely to be a "curse" in countries with weak institutions than in those with strong institutions. However, these results are consistent with the empirical results of Alexeev and Conrad (2009) who argued for a possibility of an opposite relationship

The difference between fixed effects and between effects results in regressions with per capita GRP as a dependent variable suggests that perhaps the federal center has been able to extract the incremental rents that resource rich regions in Russia generated after 2002. The "base rents," i.e., the level of resource rent appropriation that existed in Russia's regions prior to 2002 seems to have been preserved. In other words, the Russian federal center has managed to appropriate virtually all rents that resulted from natural resource price increases after 2002. (This implication is contingent on the assumption that no omitted variables bias the results of between effects regressions, among other potential problems)