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Oil Prices and Real Exchange Rate Movements in Oil-Exporting Countries: The Role of Institutions

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Abstract

Political and legal institutions affect the extent to which the real exchange rates of oil-exporting countries co-move with the oil price. In a simple theoretical model, strong institutions insulate real exchange rates from oil price volatility by generating a smooth pattern of fiscal spending over the price cycle. Empirical tests on a panel of 33 oil-exporting countries provide evidence that countries with high bureaucratic quality and strong and impartial legal systems have real exchange rates that co-move less with the oil price.

Keywords: *Real exchange rate, commodity price, institutions, development*

JEL Classification: F31, Q48, H11.

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1. Introduction

Empirical studies of the growth rates of countries endowed with natural resources have shown the paradoxal finding that countries which are amply endowed with resources tend to grow slower than others (Sachs and Warner, 2005; Auty, 2001; Collier and Goderis 2007a, b). One economic explanation for this paradoxical phenomenon is that the resource exporter's real exchange rate co-moves with highly volatile commodity prices. In price upturns, the real exchange rate appreciates and undercuts the competitiveness of the domestic industry. Lost industry is then difficult to reconstruct when the commodity price falls and over several price cycles, the country loses its non-resource industrial base (see Torvik, 2001 for a discussion of Dutch Disease models). In the case of oil-exporting countries, empirical research on the role of the oil price as a determinant of the real exchange rate has yielded ambiguous and somewhat puzzling results. While strong relationships between the two variables have been found for some countries, weak or even negative relationships have been found for others.

This paper aims to reconcile the mixed empirical evidence regarding the co-movements of the currencies of oil-exporting countries with the oil price. Drawing on insights from models of the political economy of fiscal spending in countries that produce natural resources, I suggest that co-movements are conditional on a country's legal and political institutions. This argument is clarified in a simple theoretical model, where institutions determine the degree of myopia in state spending of oil revenue. By making spending more balanced over the price cycle, particular institutional setups are expected to cut off the fiscal spending mechanism that causes oil price volatility to spill over to the real exchange rate.

A panel of 33 oil exporters for the period 1985-2005 is used to empirically evaluate the claims of the model. The key empirical finding is that the tendency of the real exchange rates of these resource-exporting states to co-move with the oil price is conditional

on their institutions. In particular, high bureaucratic quality and strong and impartial legal systems are found to be conductive toward a more insulated currency. These results indicate that a sound institutional setup can prevent a country from catching the Dutch Disease from a volatile real exchange rate. They also offer an explanation to the ambiguous findings in the empirical literature on real exchange rate determination in oil-exporting countries.

The paper is organized as follows. Section 2 presents previous research on oil prices and real exchange rates while Section 3 discusses political economy models of resource rent spending and institutions. Section 4 lays out the theoretical framework and section 5 provides information on the data and the econometric specification. Empirical results are contained in section 6, and section 7 concludes.

2. Evidence on oil prices, real exchange rates and growth

A fluctuating real exchange rate impairs on economic growth. Sérven and Solimano (1993) find that fluctuations stemming from volatile oil prices are damaging to the non-oil sector and to capital formation. Bagella et al. (2006) give evidence that fluctuations lead to decreases in per capita income. Real exchange rate volatility is one of the central mechanisms in the so-called Dutch Disease. In Neary and van Wijnbergen's (1986) model, a resource rich country may contract this disease when a higher resource price triggers real exchange rate appreciation which, in turn, undercuts the competitiveness of the domestic industry producing traded goods. The reduction in competitiveness causes the tradable goods industry to diminish and the lost industry is difficult to regain in the eventual price downturn. Not only may firms be reluctant to invest in the face of future volatility, they may also have lost their comparative advantages during the period of contraction. The resulting de-industrialization is harmful to

long term growth as the manufacturing industry tends to be more competitive and innovative than other sectors.

Studies of real exchange rate determination in oil-exporting countries have emphasized the importance of real factors such as the terms of trade or the Balassa-Samuelson "productivity hypothesis"[2]. In these studies, terms of trade are commonly approximated by the real oil price (Baxter and Kourparitsas, 2000; Backus and Crucini, 1998), and some have used labels such as "petrocurrency" or "oil currency" to describe the perceived importance of this factor in explaining real exchange rate movements. Empirical evidence has however been inconsistent. While changes in the oil price appear to trigger currency movements in some countries, there seems to be little evidence for that relationship for some of the biggest oil exporters in the world.

Among the studies that document an important role for the oil price real exchange rate determination is Korhonen and Juurikkala's (2007) study a panel of nine OPEC countries [3]. In country-specific contexts, Zalduendo (2006) Koranchelian (2005) and Mongardini (1998) document a key role of the oil price as a trigger of real exchange rate movements in Venezuela, Algeria and Egypt respectively. Several studies also provide empirical evidence in favour of the Russian Rouble being an oil currency (Spatafora and Stavrev, 2003; Oomes and Kalacheva, 2007).

Contrasting these findings, researchers have reported statistically insignificant or numerically weak relationships between the Norwegian Krone and the oil price (Bjørvik et al., 1998; Bjørnland and Hungnes, 2008; Akram 2000; 2004). Similarly, there has been substantial reluctance in labelling the Canadian dollar as a petrocurrency, with researchers again reporting insignificant (Gauthier and Tessier, 2002) or even negative relationships (Amano and van Norden, 1995). Finally, in a study of the world's largest oil exporters,

[2] Rogoff (1996) provides a summary of the multitude of potential explanations offered by researchers to resolve why the speed of mean reversion of real exchange rates is too slow to be consistent with PPP.
[3] Algeria, Ecuador, Gabon, Indonesia, Iran, Kuwait, Nigeria, Saudi Arabia and Venezuela.

Russia, Norway and Saudi Arabia, Habib and Kalamova (2007) find that the oil price influences the movements of the Russian rouble, but that the currencies of major oil producers Norway and Saudi Arabia remain unaffected by price volatility.

In single-country settings, some attempts have been made to find explanations for variations over time in the estimated degree of covariation between real exchange rates and the real oil price. Sosunov and Zamulin (2006) and Issa et al. (2006) point to the relative importance of oil exports in the domestic economy to account for the degree of appreciation following oil price hikes. Habib and Kalamova (2007) informally discuss the potential importance of policy responses and revenue management.

3. Government spending and institutions in oil-rich countries

Government consumption impacts on the real exchange rate through its bias toward nontradables over tradables (De Gregorio et al., 1994; for more recent empirical evidence, see Ricci et al. 2008). In the field of political economy, researchers have documented the tendency of natural resource exporters to overspend and created models of the institutional determinants of fiscal spending decisions.

Over-expansion of the state sector is a standard result in case studies of the economic policy in resource rich countries (Auty, 2001). For oil exporters, Gelb (1986; 1988) summarizes his findings from examining economic policy choices in Algeria, Ecuador, Indonesia, Nigeria, Trinidad and Tobago and Venezuela by noting that: “the most important recommendation to emerge from this study is that spending levels should have been adjusted to sharp rises in income levels more cautiously than they actually were” (Gelb, 1988, p.136).

Two main types of theoretical models have been used to argue for the importance of institutional determinants to the revenue spending decisions in natural resource

producing states. Political economy models of rent-seeking focus on the role of powerful social groups in explaining the common finding of more-than-proportional increases in state redistribution in response to natural resource windfalls. Lane and Tornell (1999) show that institutions interact with resource booms and trigger higher levels of spending, directed to the informal sector. With the right institutional arrangements, namely "a strong legal-political institutional infrastructure" (Lane and Tornell, 1999, p. 22), the incentive structure for the rent-seeking groups is however altered, and spending increases can be avoided. In the rent-seeking model by Mehlum et al. (2006), focus lies on the behaviour of private entrepreneurs, who can choose between rent seeking and productive activities. The model shows that in countries where the institutional framework promotes the profitability of private enterprise, entrepreneurs choose to engage in production rather than in the unproductive extraction of natural resource rents. Empirically, the authors operationalize this institutional environment by an index measuring law and order, bureaucratic quality, and contract enforcement (using the same specification as Knack and Keefer, 1995). Their empirical analysis shows that low institutional quality in this respect interacts with resource revenues and impact negatively on growth, presumably via misdirected and excessive state spending.

A second class of models focus on the role of patronage as a mechanism for excessive state spending of resources in the presence of weak institutions. If accountability of spending decision is lacking, the policy maker can divert resource revenues to shore up political support and achieve re-election. This can be done either by providing state employment to selected groups (Robinson et al., 2006) or by misspending money on inefficient but vote-accumulating "White Elephant" projects (Robinson et al., 2006).

Kolstad (2009) notices that the predictions of the rent-seeking and patronage models differ regarding which type of institutional aspects that can be expected to influence the over-spending of resource windfalls. He sets up a horse race between the two model by empirically

testing how resource revenue affect growth subject to variation in government accountability (from the patronage model) and law and order (from the rent-seeking model). Using the democracy index from the Polity IV dataset as a proxy for the accountability of public funds spending, he opts toward the rent-seeking explanation. The indicator of government accountability loses its statistical significance in the empirical estimation when the rule of law index is included, but not vice-versa.

Eifert et al. (2002) offer a more thorough discussion on the intermediation of institutions in the spending decisions of oil exporters. Drawing on systematic case studies of oil-exporters with varying political systems, they construct a taxonomy of the institutional determinants of pro-cyclical spending behaviour. They list four institutional dimensions that can increase the long-sightedness and balanced nature of an oil state's spending decisions over the oil price cycle by fostering long fiscal policy horizons, increasing the level of transparency and strengthening political stability. These dimensions are i) the stability of the political framework and party systems; ii) the degree of social consensus; iii) the legitimization of authority and the means through which governments (or aspiring governments) obtain and maintain support and iv) the role of state institutions in underpinning markets and the distribution of rents.

4. Theoretical framework

This section contains a stylized model of real exchange rate determination used to motivate the empirical specification of the paper. Consider a small open economy producing oil, a tradable and a non-tradable good. The non-tradable good is consumed domestically by the state and by private consumers, while the tradable good is consumed by domestic and foreign consumers. The oil producing sector is owned by the government and employs a negligible

share of the domestic labor force. Oil and tradables are sold on the world market at exogenously given prices.

4.1 Production

The production of non-tradable ($Y_{N,t}$) and tradable goods ($Y_{T,t}$) at time t is given by $Y_{i,t} = A_{i,t} L_{i,t}^{\alpha}$ where $0 < \alpha < 1$, A_i is a productivity factor, and L_i is the labor input in sector $i = N, T$. Labor is fully flexible which implies that wages equalize between the two sectors and that the exogenous labour supply equals the sum of labor demand $L_t = L_{N,t} + L_{T,t}$. Profit maximization yields the first order conditions $w_t = P_{i,t} A_{i,t} \alpha L_{i,t}^{\alpha-1}$ which can be combined to give an expression for the relative supply of non-tradable and tradable goods as

$$\frac{Y_{N,t}}{Y_{T,t}} = \left(\frac{A_{N,t}}{A_{T,t}}\right)^{\frac{1}{1-\alpha}} \left(\frac{P_{N,t}}{P_{T,t}}\right)^{\frac{\alpha}{1-\alpha}}. \tag{1}$$

4.2 State and private consumption

In each time period, the state's consumption of non-tradables G_t is the sum of income received from taxes and a fraction λ of total oil revenue. Assuming that the income gained from taxes corresponds to a fraction τ of the income of the tradable economy $P_{T,t} Y_{T,t}$, the government's consumption of non-tradables can be expressed as

$$P_{N,t} G_t = \tau P_{T,t} Y_{T,t} + \lambda P_{O,t} M_t \tag{2}$$

where $0 < \lambda < 1$. The state obtains income from taxing the tradable sector and from selling oil (M_t) on the global market at the price $P_{O,t}$[4]. Since oil revenue will not last forever, we interpret the parameter λ as the degree of myopia in revenue spending. A government with a high λ will consume a large share of a sudden oil revenue increase, while a government with low λ will save a larger share of that income, letting a smaller share spill over on the consumption of non-tradables. The share of total oil revenue not spent on non-tradables $(1-\lambda)P_{O,t}M_t$ is invested by the government at the international credit market at the fixed interest rate r. The government's budget constraint is hence such that investment in period $t+1$ will equal income from investment[5], oil revenue and taxes in period *t*, minus the amount spent on non-tradables in the same period.

Turning next to the consumers in the economy, these actors own the firms, get income in the form of wages and profits, pay taxes and derive utility from consumption of non-tradable and tradable goods. To simplify the model, it is assumed that consumers are restricted from borrowing on the credit market. The budget constraint of consumers is

$$P_{N,t}Y_{N,t} + (1-\tau)P_{T,t}Y_{T,t} = P_{N,t}C_{N,t} + P_{T,t}C_{T,t}. \tag{3}$$

Assuming Cobb-Douglas utility with weights γ and $1-\gamma$, a fraction γ of total consumer expenditure is spent on non-tradables, i.e.

$$P_{N,t}C_{N,t} = \gamma(P_{N,t}C_{N,t} + P_{T,t}C_{T,t}). \tag{4}$$

[4] The IMF (2007) reports the ratios of oil revenues to total fiscal revenues as five year-averages for the 2000-20005 period for several of the countries included in this study, namely Algeria (70.5), Angola (79.8), Azerbaijan (33.3), Cameroon (27.7), Colombia (10.0), Congo (Brazzaville) (69.9), Equatorial Guinea (85.2), Gabon (60.1), Indonesia (30.3), Iran (65.5), Kazakhstan (25.1), Kuwait (74.7), Libya (80.2), Mexico (33.3), Nigeria (78.9), Norway (24.0), Oman (83.4), Qatar (68.4), Russia (19.5), Saudi Arabia (83.1), Sudan (49.8), Trinidad and Tobago (36.4), UAE (66.1), Bolivia (20.9).

[5] Where investment in the first period is set to zero.

We can now derive an expression for the relative *demand* for tradables and non-tradables. This is achieved by combining the budget constraints for the state, and for consumers, substituting for $C_{N,t}$ using the equilibrium condition for the market for non-tradable goods[6] and by expressing all terms in the equation as shares of the size of the economy for non-tradable goods by dividing them with $P_{T,t}Y_{T,t}$. After some algebra, we get that

$$\frac{Y_{N,t}}{Y_{T,t}} = \frac{1}{1-\gamma}\left[\gamma(1-\tau)+\tau+\lambda\left(\frac{P_{O,t}M_t}{P_{T,t}Y_{T,t}}\right)\right]\frac{P_{T,t}}{P_{N,t}} \tag{5}$$

4.3 The Foreign Economy

Production technology, private consumption and the labor market in the foreign economy are identical to that in the domestic economy, but the foreign economy lacks an oil sector. Using * to denote the foreign economy, we can derive analogous equations (1')-(5').

4.4 Real Exchange rate Determination

The real exchange rate of the oil-exporting economy (Q_t) is defined as the foreign price of a domestic basket of consumption relative to the foreign price of a foreign basket of consumption $Q_t = E_t P_t / P_t^*$, where * denotes the foreign economy and E_t is the price of domestic currency. An increase in Q_t hence implies real appreciation. We assume that the domestic and foreign price levels are geometric averages of the prices of traded and non-traded goods with weights $1-\gamma$ and γ respectively. We can then write the aggregate price

[6] $Y_{N,t} = C_{N,t} + G_t$

level such that $P_t = P_{N,t}^{\gamma} P_{T,t}^{1-\gamma} = P_{T,t}\left(P_{N.t} / P_{T,t} \right)^{\gamma}$ and the real exchange rate expression can be rewritten as

$$Q_t = \frac{E_t P_t}{P_t^*} = \frac{E_t P_{T,t}}{P_{T,t}^*} \left(\frac{P_{N,t} / P_{T,t}}{P_{N,t}^* / P_{T,t}^*} \right)^{\gamma} \tag{6}$$

where the law of one price is assumed to hold for the tradable good so that $P_{T,t}^* = E_t P_{T,t}$. Next, equations (1) and (5), describing the relative demand and supply of tradable and non-tradable goods, are combined for both the domestic and the foreign economies. This enables us to derive the price ratios for tradable and non-tradable goods in the two economies, and inserting these ratios into (6) gives the following equation for the real exchange rate of the oil-producing country:

$$Q_t = \left[\frac{A_{T,t} / A_{N,t}}{A_{T,t}^* / A_{N,t}^*} \right]^{\gamma} \left[\frac{\gamma(1-\tau) + \tau + \lambda \dfrac{P_{O,t} M_t}{P_{T,t} Y_{T,t}}}{\gamma^*(1-\tau^*) + \tau^*} \right]^{\gamma(1-\alpha)} . \tag{7}$$

The first factor $\left[\frac{A_{T,t} / A_{N,t}}{A_{T,t}^* / A_{N,t}^*} \right]^{\gamma}$ is the standard Balassa-Samuelson effect (Balassa, 1964; Samuelson, 1964) whereby a positive shock to productivity in the domestic tradable goods sector will lead to real appreciation of the domestic currency. The key conclusion to be drawn from examining equation (7) is that the effect of an increase in the oil price on the real

exchange rate is conditional on the degree of myopia in the government's spending of oil revenue, λ. We can think of this parameter as the institutional setting in which the policy maker operates and which creates the incentives for his or her rational spending choice.

5. Empirical specification and econometric issues

The next step is to construct an empirical specification of the real exchange rate equation (7). The key parameter of interest λ, is assumed to depend on a vector of governance characteristics $X_{j,i,t}$ according to

$$\lambda_{i,t} = \sum_{j=0}^{K} \beta_j X_{j,i,t}$$

where the sub-script i denotes the country, and j = 1, 2,...,K indicates legal and political institutions that influence the spending behaviour of the policy maker. The first element in the vector $X_{j,i,t}$ is set to one to test the unconditional effect of oil dependency on the real exchange rate (as argued by Issa et al. 2006; Sosunov and Zamulin, 2006). A Taylor approximation of (7), where some terms have been set to zero in accordance with the theoretical expectation, yields the test equation

$$Q_{i,t} = \alpha_0 + \alpha_2 PR_{i,t} + \sum_{j=0}^{K} \beta_j S_{i,t} X_{i,t,j} + \varepsilon_{i,t} \qquad (8)$$

In this equation, $Q_{i,t}$ is the log real exchange rate in country i at time t, PR denotes the log of the productivity differential between traded and non-traded goods relative to the rest of the

world, S represents the relative size of the oil sector in the domestic economy and ε is a random disturbance term.

Institutional data is obtained from the Political Risk Services, a private company that assesses economic and political risk across a large number of countries. These data were introduced as institutional measures in economic research by Knack and Keefer (1995) and are now widely used (e.g. Hall and Jones, 1999; Acemoglu et al., 2001). Eight variables are chosen to reflect the key aspects of the oil-exporting country's legal and political institutions, namely 1) Bureaucratic Quality: the bureaucracy's autonomy from political pressure, its strength and expertise to govern so as to avoid drastic changes in policy or interruptions in government services; 2) Corruption: the degree to which officials demand or accept illegal payments; 3) Democratic Accountability: how responsive the government is to its people, measured by the type of governing system and ranging from alternating democracy to autarchy; 4) Government Stability: the government's ability to stay in office and to carry out its declared program(s); 5) Investment Profile: the composite risk from contract expropriation, profits repatriation and payment delays; 6) Law and Order: the strength and impartiality of the legal system and the degree of popular observance of the law; 7) Military in Politics: the degree of involvement of unelected military officials in running the state; 8) Socioeconomic Conditions: a summary index consisting of the three sub-components unemployment, poverty and consumer confidence.

More thorough descriptions of the institutional variables are provided in Table A2. In the regression analysis below, all institutional indicators are standardized to have a mean of zero and a standard deviation of one.[7]

The remaining variables in equation (8) are constructed as follows. For the real exchange rate Q, the IMF:s CPI deflated real effective exchange rate index is available for 17

[7] The four sub-components of the PRS composite political risk index not included are those measuring external conflict, internal conflict, ethnic tensions, and religious tensions.

of the countries in the sample. For the remaining 16, I calculate real bilateral exchange rate indices vis-à-vis the US[8]. These measures show how the nominal effective exchange rates, adjusted for inflation, in the home country and its trading partners' economies, have moved over a period of time. Under this definition, a higher value of the real exchange rate index implies real appreciation. Next, the real average oil price series P_O is derived by deflating the average price of crude oil in US dollars by the US consumer price index with base year 2000. The real exchange rate measures and the real oil price series are transformed to natural logarithms.

As a proxy for the size of the oil sector in the domestic economy, denoted S in equation (8), I calculate the share of oil exports to GDP by first multiplying volume of net oil exports by the oil price in current USD for each year, and then dividing by total GDP for the exporting country.

A control for the Balassa-Samuelsson effect, corresponding to *PR* in the test equation, is computed by taking the log-difference between the oil exporters' per capita GDP in PPP-based constant 2000 US dollars and per capita GDP in the US. Using this proxy rests on the assumption that the productivity advantage of high income countries is primarily found in the tradable rather than the non-tradable sector.[9] Further variable details are available in Table A2.

The time period 1985-2005 is selected in order to maximize data availability. For this period, data from the EIA on net oil exports is used to identify 38 countries with positive net export values for at least half of the years. Of these countries, Iraq, Turkmenistan and the United Arab Emirates are excluded due to the unavailability of consistent time series

[8] In the sub-sample of 17 countries for which both measures are available, the correlation coefficient between the real effective exchange rate index and the bilateral exchange rate index is 0.78.

[9] Using aggregated production to approximate for productivity differences in traded and non-traded goods in the domestic and foreign economies is standard practise when facing the common problem of data unavailability for the more exact measures. Related research resorting to this method includes studies by Koranchelian (2005) and Korhonen and Juurikkala (2007).

for the real exchange rate or GDP. Furthermore, Brunei and Equatorial Guinea are excluded due to the unavailability of some institutional and political data. In the resulting sample of 33 countries[10], net oil imports are recorded in less than 3 percent of all years. The final panel consists of 551 observations (see Appendix, Table A1 for a record of missing data)

Concerning the choice of econometric model, macroeconomic time series may contain unit-roots, in which case the use of OLS can produce invalid estimates. To choose the appropriate econometric technique, it is therefore important to establish if the macroeconomic time series used, namely the real exchange rate measure ($Q_{i,t}$), the real oil price ($P_{O,t}$), the productivity differential ($PR_{i,t}$) and the ratio of oil exports to GDP ($S_{i,t}$)[11] are stationary or not. Four panel unit root tests are carried out for this purpose. The Levin, Lin & Chu (2002) test is employed to test for a common unit root process in the panel as a whole, while the Im, Pesaran & Shin, the ADF- and the PP-tests allow the AR coefficients to differ between the sampled countries. Table 1 summarizes the results from four panel unit root tests, which show coherent rejection of the null-hypothesis of non-stationarity for all three series and both test types.

The real oil price time series is examined using four different unit root tests (data plot in Appendix, Figure A3). Results indicate a stationary series. The DFGLS and PP tests reject the null of unit root at one and ten percent respectively, while the KPSS test fails to reject the null of stationarity at the one percent level. Thus, according to the unit root test results, the four macroeconomic variables used in the analysis are found to be stationary. This allows estimation using a panel data regression model with country fixed effects, a model which efficiently controls for all unobservable and time-invariant country characteristics.

[10] Algeria, Angola, Argentina, Azerbaijan, Bolivia, Cameroon, Canada, Colombia, Congo (Kinshasa), Congo (Brazzaville), Egypt, Gabon, Indonesia, Iran, Kazakhstan, Kuwait, Libya, Malaysia, Mexico, Nigeria, Norway, Oman, Papua New Guinea, Qatar, Russia, Saudi Arabia, Syria, Trinidad and Tobago, Tunisia, United Kingdom, Venezuela, Vietnam and Yemen

[11] Since exports constitute a share of GDP, the two series are cointegrated by default. The ratio of exports to GDP variable used in this paper, which is restricted to taking on values within the interval 0-1, is hence stationary by definition. This is confirmed by the unit root test results.

Table 1: Panel unit root tests

	Im, Pesaran and Shin	Augmented Dickey Fuller	Phillips-Perron
Real Exchange Rate (Q)	-2.04 (0.02)	82.69 (0.08)	211.71 (0.00)
Productivity Differential (PR)	-1.04 (0.15)	89.04 (0.02)	78.19 (0.11)
Exports to GDP Ratio (S)	5.73 (0.00)	174.65 (0.00)	253.07 (0.00)

Notes: The table reports results of panel unit root tests, all of which test the null-hypothesis of unit root. P-values are reported in parenthesis. The test statistics correspond to the w-stat in Im, Pesaran and Shin's (2003) test together with the Fisher Chi-square statistic in the ADF- and PP-tests for individual unit root processes. Lag-lengths are selected according to the Schwartz criterion and all tests include a constant but no trend.

Figures A1 and A2 show the distributions of the ordinal institutional variables. Regression analysis using a dataset that includes ordinal covariates with relatively few categories calls for caution when choosing an econometric technique. Erroneously treating ordinal variables as continuous may yield misleading results unless the effect of the ordinal variable is linearly related to its categorization (Jöreskog, 1994).[12] If this assumption is accepted, the variable can regarded as being measured on an interval scale where the step between each category on the ordinal variable is equally large. A test is constructed by decomposing the ordinal variables into dummy variables for each category value. For each set of dummy variables $i = 1, 2, ..., N$, the restriction $\beta_1 = \frac{1}{2}\beta_2 = \frac{1}{3}\beta_3 = \frac{1}{4}\beta_4 = ... = \frac{1}{N}\beta_N$ is thereafter tested in an estimated fixed effects model.[13] These tests show that the indicators for Bureaucratic Quality, Corruption, Democratic Accountability, Law and Order, and Investment Profile may be assumed to be ordinal when interacted with the ratio of oil exports to GDP. In contrast, this is not a reasonable assumption for the variables measuring Government Stability, Military

[12] In other words, that a move between categories 0 to 1 on an ordinal variable measuring, for example, bureaucratic quality, leads to the same effect on the dependent variable as a move between categories 5 to 6.
[13] In the ICRG data, countries are sometimes given half points, placing them between two categories. Before restrictions are tested, these observations are sorted into the closest category. Sorting them into the higher or lower category does not affect the conclusions of the restriction tests.

involvement in Politics and Socioeconomic Conditions.[14] The latter variables are hence not treated as measured on an interval scale, but instead transformed into two threshold variables each, one for the top quartile of the distribution, and one for the bottom quartile.

When data is collected at country level, spatial dependence of observations can arise. This is because the observed units are not randomly selected from a large population, which increases the likelihood of correlation between outcomes from adjacent units. To address this concern, covariance matrixes are estimated using the spatial correlation consistent covariance matrix estimator devised by Driscoll and Kraay (1998). This estimator is also robust for heteroskedasticity and autocorrelation, the other two main sources of inconsistent estimates in panel data estimation.

6. Estimation results

Table 2 displays estimates of equation (8) using a panel data model with country fixed effects. Looking first at the top row, we see that the coefficient on the productivity differential is positive and highly significant. A higher productivity in the oil producer's traded goods sector vis-à-vis that of the foreign economy triggers appreciation, which is consistent with the Balassa-Samuelson effect. In row two we find the parameter for oil dependency variable. It is positive and statistically significant at the one percent level, indicating that a higher rate of oil exports relative to total GDP yields appreciation of the real exchange rate.

The remaining rows of the table contain the parameter estimates for the institutional variables interacted with the resource wealth measure. Four of the eight variables are statistically significant and enter with the expected signs. By comparing the coefficient sizes, we can determine their order of importance for the oil price real exchange rate

[14] P-values of the Wald tests are as follows, Bureaucratic Quality: 0.25; Corruption: 0.16; Democratic accountability 0.21; Investment Profile: 0.48; Law and Order: 0.24; Military in Politics: 0.02; Socioeconomic Conditions: 0.00; Government Stability: 0.08.

relationship. The largest coefficient corresponds to the indicator of bureaucratic quality. To interpret the negative sign of this parameter, we recall that all institutions are measured so that higher values indicate stronger legal and political settings, and that the indicators are normalized with mean zero. The effect on the real exchange rate from the oil price will run via the un-interacted oil dependency variable and through each of the institutional interaction terms. We can thus interpret each interaction parameter as to how it contributes to this combined effect. In this sense, the negative parameter estimate in the case of bureaucratic quality shows that countries with bureaucratic quality below the mean (negative values), will have correspondingly larger appreciation pressure from an increasing oil price. On the contrary, countries with positive values on bureaucratic quality will have the appreciation triggered via the oil dependency variable mitigated by their institutional strength. In sum, the results show bureaucracy plays an important role providing a spending framework that disincentives rent seeking and sudden shifts in spending policy.

The second most important institutional variable is the index of law and order. Analogous to bureaucratic quality, the negative sign on the interaction term including this index shows that countries with strong legal systems can better insulate their currencies from oil price volatility. We can interpret this relationship as follows. High-quality legal systems can create and enforce clear guidelines for the distribution of resource rents, and thereby reduce rent-seeking behaviour among special interest groups.

Next, we focus on the role of military involvement in the political system. This variable has negative and significant parameter estimates both for countries with high military involvement and low military involvement. In the case of low involvement, the negative effect is in accordance with theory. Low military involvement corresponds to high political accountability and is therefore expected to be conductive toward more responsible revenue spending. In the case of high military involvement, the effect disappears in the robustness

check excluding African countries (see Table A3, Column 3). Possibly, high military involvement is associated with more government stability and a reduction of business risk in the often highly volatile political systems on the African continent.

The last significant institutional variable is the one measuring socioeconomic conditions. In the total sample, the results show that bad conditions, that is, a high level of poverty and unemployment, is associated with more real exchange rate appreciation following an oil price upturn. This result is in accordance with Eifert et al.'s (2002) conjecture that a lower degree of social consensus and, in particular, high social disparities, reduces the ability for governments to set long-term spending horizons and the popular influence over oil revenue spending. Finally, the estimation results suggest that the effect of the oil price on the currencies of oil-exporters is not conditional on the remaining institutional variables: corruption, democratic accountability, investment profile, or government stability.

In column 2, Table 2, we exclude the non-significant variables from column 1 and conclude that the estimation results remain largely unaltered. Further robustness tests are carried out by examining the effect of excluding Western countries, Middle Eastern countries and African countries respectively. Reported in Table A4 in Appendix, we see that the results are reasonably robust to these changes. An exception is the parameter on the interaction of oil wealth and bad socioeconomic conditions which falls out of the model when excluding either the African or Middle Eastern countries.

Table 2 Effects of the oil price on real exchange rates, conditional on legal and political institutions

	(1)	(2)	Predicted Sign
Productivity Differential	0.605*** (.144)	0.634*** (.128)	+
Ratio of Oil Exports to GDP	0.204*** (.089)	0.144*** (.038)	+
Institutional variables interacted with the ratio of oil exports to GDP			
Bureaucratic Quality	-0.178*** (.044)	-0.176*** (.039)	-
Corruption	0.027 (.068)		-
Democratic Accountability	-0.016 (.032)		-
Investment Profile	-0.017 (.014)		-
Law and Order	-0.156*** (.049)	-0.168*** (.038)	-
Low Government Stability	0.017 (.024)		+
High Government Stability	0.031 (.043)		-
High Military Presence in Politics	-0.064*** (.020)	-0.057*** (.015)	+
Low Military Presence in Politics	-0.056** (.024)	-0.063*** (.020)	-
Bad Socioeconomic Conditions	0.048* (.025)	0.047* (.025)	+
Good Socioeconomic Conditions	0.036 (.032)		-
R-squared	0.20	0.19	

Notes: The dependent variable is the combined time series of the real effective exchange rate and bilateral real exchange rate index variables in logs. Institutional variables are measured so that higher values indicate stronger/better institutions, and are standardized with mean zero and standard deviation one. The estimation includes country-specific fixed effects, and Driscoll-Kraay standard errors are reported in parenthesis: *, significant at 10%; **, significant at 5%, *** significant at 1%.

We can now use the estimation results to draw some conclusions about the performance of individual oil-exporters. Figures 1 and 2 show the average country scores for the indicators of bureaucratic quality and law and order. Importantly, although perhaps not surprisingly, the western mature democracies Norway, Canada, and the UK have the highest average scores on both indicators, while predatory and non-democratic African regimes record the lowest. In the case of law and order, the high scores of Middle Eastern states are also noteworthy. In particular, Saudi Arabia places fourth after the western democracies.

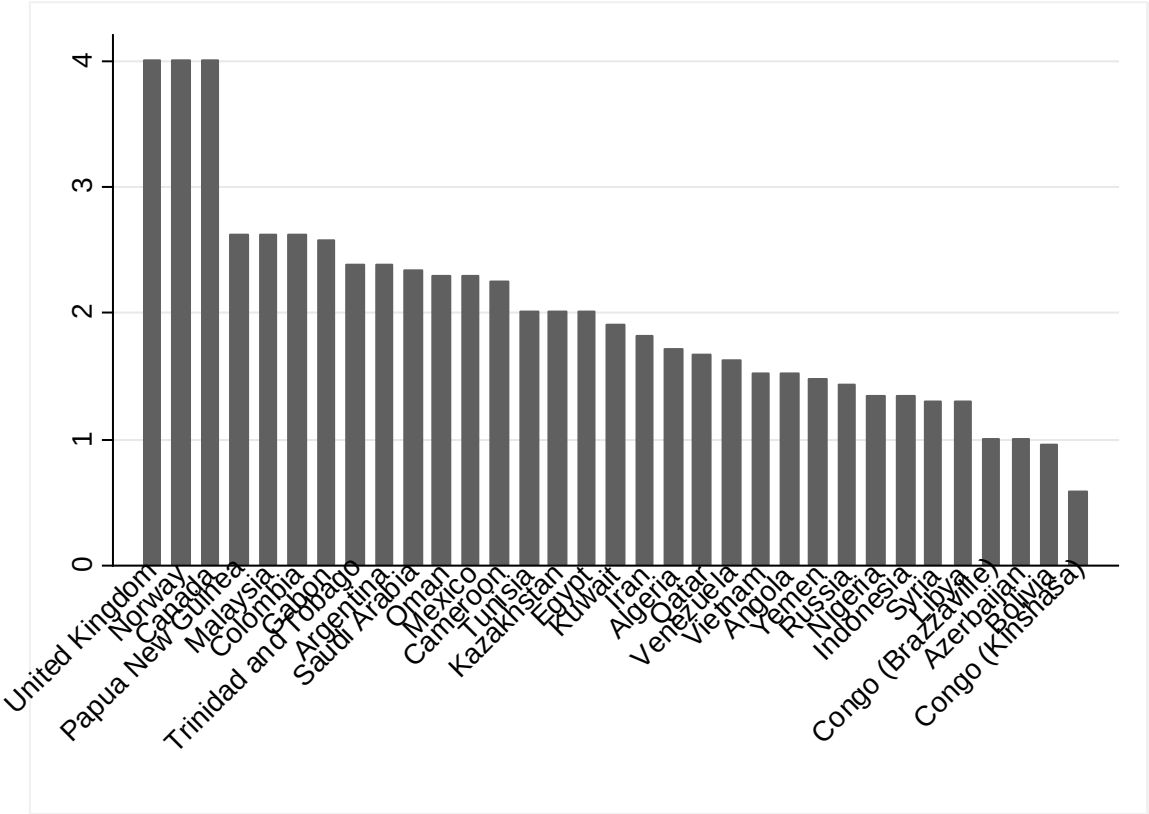

Figure 1 Average Bureaucratic Quality score by country, 1985-2005

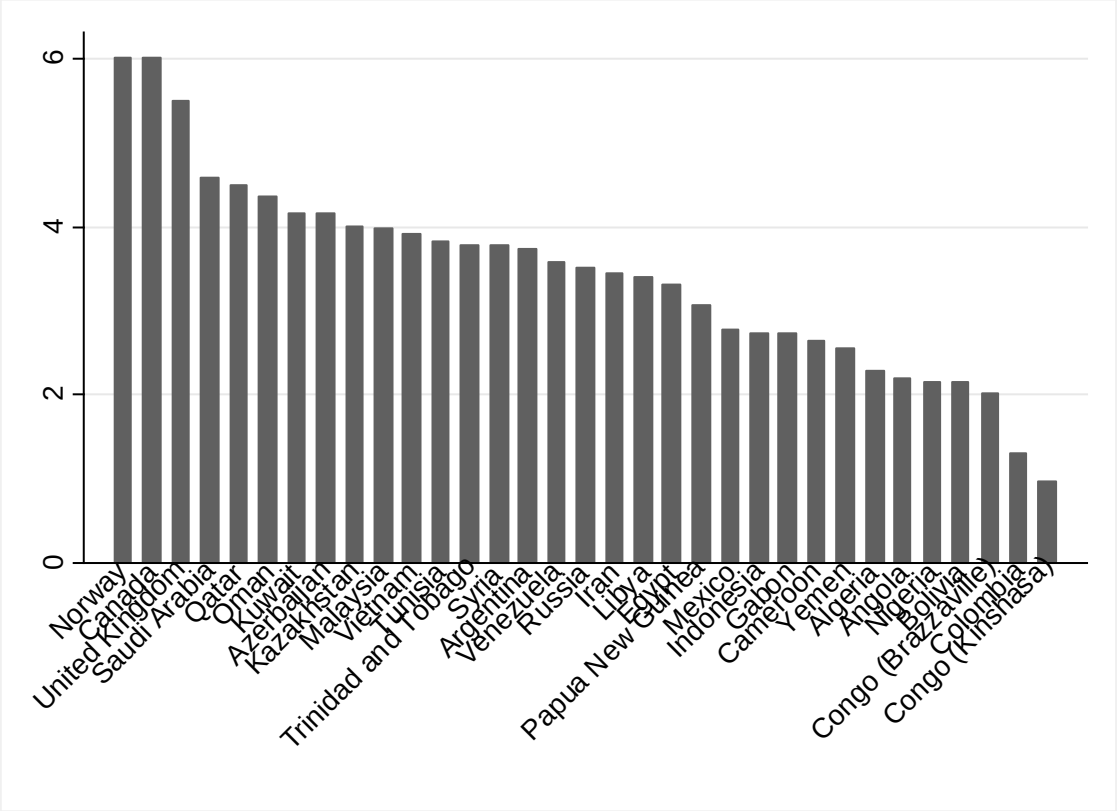

Figure 2 Average Law and Order score by country, 1985-2005

7. Conclusions

This paper highlighted the role of good political and legal institutions for the relationship between the oil price and the real exchange rates of oil-exporting countries. A simple theoretical model was derived in which the effect of oil price movements on the real exchange rate of an oil-exporting economy depended on the degree of myopia in government spending of oil revenue. The empirical relevance of eight governance indicators, believed to affect the spending behaviour of governments, was evaluated on a panel of 33 oil exporters for the period 1985-2005.

The main empirical finding is that the co-variation between the oil price and the real exchange rates of the sampled oil exporters is conditional on political and legal

institutions. In particular, currencies in countries with strong bureaucracies and legal systems are less affected by oil price changes. This finding is in line with political economy models of rent-seeking (Mehlum et al. 2005; Tornell et al., 1999) but adds to the literature by highlighting the importance of the inter-linkage between government spending decisions and the real exchange rate.

There are several implications of the empirical results presented in this paper. First, they suggest that oil-exporting countries with sufficiently strong institutions can avoid the resource curse associated with a volatile real exchange rate. Secondly, the results provide an explanation for the ambiguous evidence in the empirical literature on real exchange rate determination in oil-producing economies. They indicate that the lack of strong positive price effects, even in the cases of heavily oil-dependent economies such as Norway, Canada or Saudi Arabia, may be the consequence of favourable institutional characteristics in these countries.

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Appendix A. Descriptive statistics and robustness checks

Table A1 Missing data for continuous variables

	Real Effective Exchange Rate	Real Bilateral Exchange Rate	Productivity Differential	Ratio of Oil Exports to GDP
Congo (Kinshasa)				85-94
Algeria				97-2001
Iran				91,92
Argentina	X			
Egypt	X			
Indonesia	X			
Mexico	X			
Congo (Brazzaville)	X	97		
Angola	X	85-89		
Syria	X	03,04,05		
Kuwait	X		90,…,94	
Oman	X	85-99	2005	2005
Vietnam	X	85-94,04		85-95
Qatar	X		X	84-93,00,01
Libya	X	2005	X	88,89
Yemen	X	-89	-89	-89

Note: Intervals indicate years for which data is missing, while an “X” indicates unavailability for all years.

Table A2 Variable descriptions and sources

Real Effective Exchange Rate Index (Q): CPI deflated real effective exchange rate index, base year 2000 = 100 (in logs). Source: IFS, IMF.

Real Bilateral Exchange Rate Index (Q): Real bilateral exchange rate index vis-à-vis the United states, base year 2000 = 100 (in logs). Source: WDI, WB.

Real Oil Price (P): Average oil price in current USD deflated by US CPI, base year 2000 = 100 (in logs). Source: IFS, IMF.

Productivity Differential (PR): Log-difference between GDP per capita in PPP-based constant 2000 USD in the country and per capita GDP in the US. Source: WDI, WB.

Ratio of Oil Exports to GDP (S): Ratio of net oil exports (Source: EIA), multiplied by the average oil price (Source: IFS, IMF), to total GDP (Source: WDI, WB).

From Political Risk Services

Bureaucratic Quality (0-4): Bureaucratic strength and expertise to govern without drastic changes in policy or interruptions in government services. Autonomy of the bureaucracy from political pressure and the existence of mechanisms for recruitment and training of bureaucrats.

Corruption (0-6): Corruption within the political system, specifically excessive patronage, nepotism, job reservations, 'favour-for-favours', secret party funding, and suspiciously close ties between politics and business.

Democratic Accountability (0-6): Responsiveness of the government to its people, where points are awarded based on types of governance rated from the lowest number of points to the highest as i) alternating democracy, ii) dominated democracy, iii) de-facto one-party state, iv) de jure one-party state, and v) autarchy.

Government Stability (0-12): Sum of: government unity (0-4); legislative strength (0-4); and popular support (0-4).

Investment Profile (0-12): Sum of: contract viability/expropriation (0-4); profits repatriation (0-4); and payment delays (0-4).

Law and Order (0-6): Sum of: strength and impartiality of the legal system (0-3) and popular observance of the law (0-3).

Military in Politics (0-6): Military involvement in politics, grading instances of involvement ranging from those caused by internal or external threat to a full-scale military regime.

Socioeconomic Conditions (0-12): Sum of: unemployment (0-4); consumer confidence (0-4); and poverty (0-4).

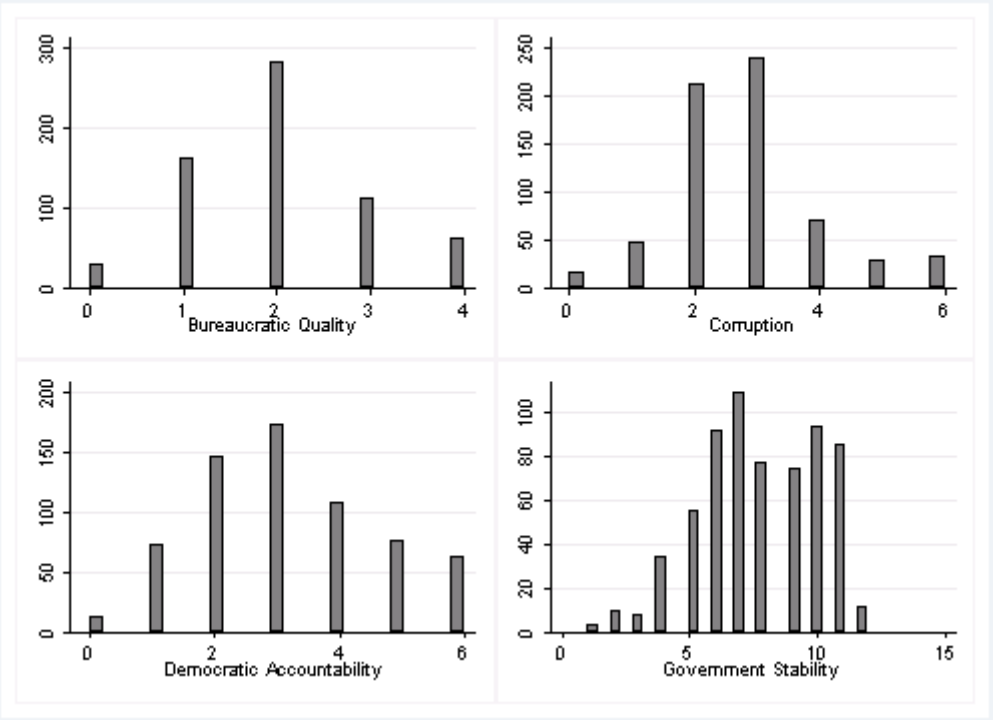

Figure A1 Distributions of ordinal variables, Bureaucratic Quality, Corruption, Dempcratic Accountability and Government Stability

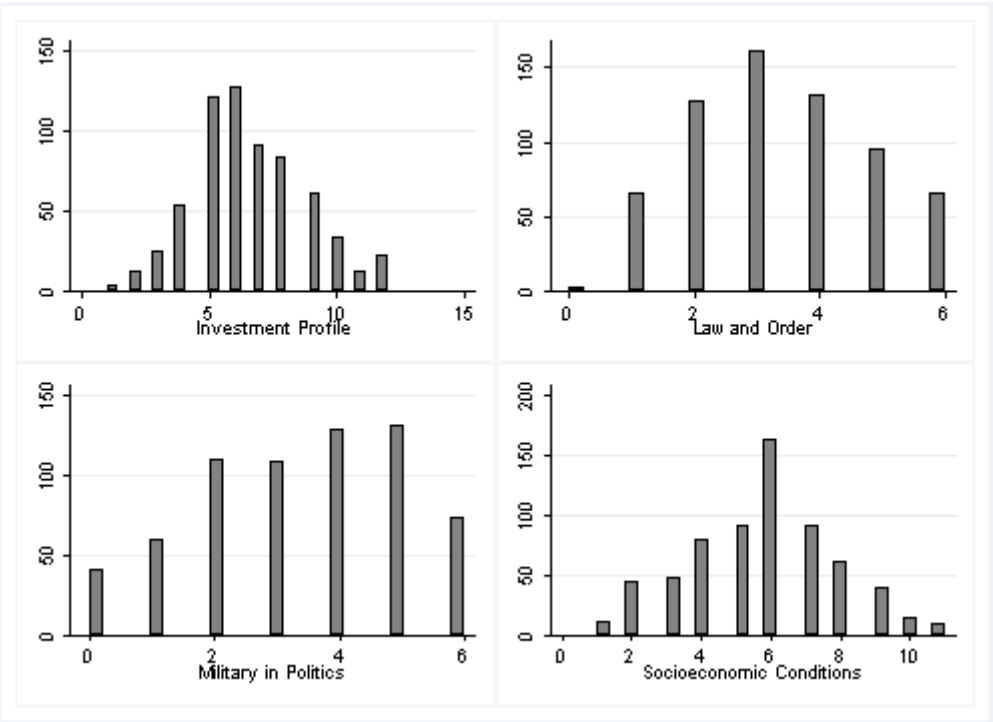

Figure A2 Distributions of ordinal variables, Investment Profile, Law and Order, Military in Politics and Socioeconomic Conditions

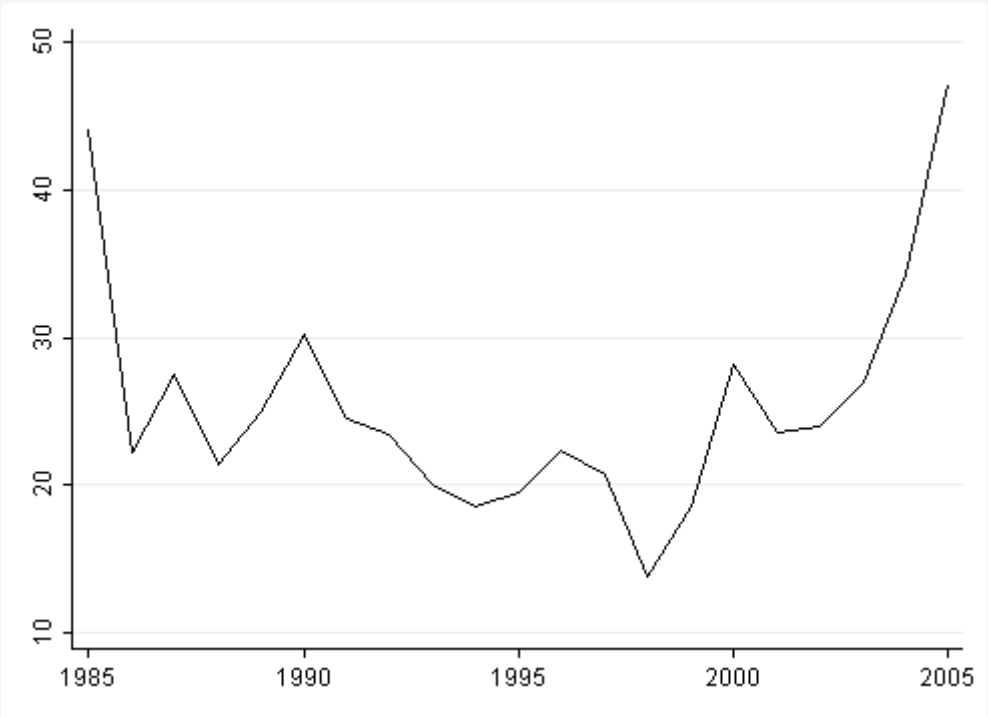

Figure A3 Real oil price, 1985-2005

Table A3 Robustness to regional exclusion: Western countries, Middle East, and Africa

	Excluding United Kingdom, Norway, and Canada (1)	Excluding Egypt, Iran, Kuwait, Oman, Saudi Arabia, Yemen (2)	Excluding Algeria, Cameroon, Congo (Brazzaville), Congo (Kinshasa), Gabon, Libya, and Nigeria (3)
Productivity Differential	0.635***	0.333*	0.472***
	(.127)	(.178)	(.167)
Ratio of Oil Exports to GDP	0.143**	0.179***	0.044*
	(.059)	(.033)	(.028)
Institutional variables interacted with the ratio of oil exports to GDP			
Bureaucratic Quality	-0.176***	-0.150***	-0.210***
	(.039)	(.064)	(.033)
Law and Order	-0.168***	-0.135***	-0.089***
	(.039)	(.052)	(.033)
High Military Presence in Politics	-0.061***	-0.070***	-0.025
	(.015)	(.021)	(.019)
Low Military Presence in Politics	-0.063**	-0.012	-0.132***
	(.022)	(.033)	(.024)
Bad Socioeconomic Conditions	0.048*	0.026	0.067
	(.026)	(.033)	(.040)
R-squared	0.22	0.11	0.19
N	488	452	421

Notes: The dependent variable is the combined time series of the real effective exchange rate and bilateral real exchange rate index variables in logs. Institutional variables are measured so that higher values indicate stronger/better institutions, and are standardized with mean zero and standard deviation one. The estimation includes country-specific fixed effects, and Driscoll-Kraay standard errors are reported in parenthesis: *, significant at 10%; **, significant at 5%, *** significant at 1%.