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Oil and property rights

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ABSTRACT

We investigate the role of oil in economic institutions for a sample of 150 countries between 1960 and 2014. We find that higher per capita values of oil production result in weaker economic institutions in the form of lower levels of private property rights protection. This result is robust to alternative instrumental-variable approaches as well as different operationalizations of oil income and production as well as economic institutions. We argue that our finding is indicative of oil interest groups using their economic power to achieve weaker property rights to maintain their economic-political position in society. We also provide evidence that oil induces clientelism, corruption and the repression of dissenting political voices. We argue that this finding is consistent with the idea that oil interest groups translate their outsized economic into political power through these transmission channels to achieve lower levels of property rights protection.

1. Introduction

The question of the socio-political and economic effects of natural resource abundance, especially abundance of *oil*, is hotly debated in the academic literature (for reviews, see, e.g., Torvik, 2009; van der Ploeg, 2011; Nillesen and Bulte, 2014; Ross, 2015; Van der Ploeg and Poelhekke, 2017). For instance, a multitude of studies have examined the effects of natural resources on investment, economic growth and development (e.g., Sachs and Warner, 1995; Rodríguez and Sachs, 1999; Gylfason, 2001; Atkinson and Hamilton, 2003; Mehlum et al., 2006; Frankel, 2012; Cologni and Manera, 2013; Libman, 2013; Apergis and Payne, 2014; Cassidy, 2019), inequality (e.g., Fum and Hodler, 2010; Carmignani, 2013; Bhattacharyya and Williamson, 2016; Farzanegan and Krieger, 2019), governance and democratic development (Jensen and Wantchekon, 2004; Isham et al., 2005; Haber and Menaldo, 2011; Pendergast et al., 2011; Ramsay, 2011; Tsui, 2011; Brooks and Kurtz, 2016), human capital formation (e.g., Cockx and Francken, 2014) and political stability (e.g., Cotet and Tsui, 2013; Nillesen and Bulte, 2014; Wright et al., 2015).

We contribute to this literature by studying the role of abundant oil resources and outsized oil production on a hitherto unappreciated institutional factor: *economic institutions* in the form of (the *protection of*) *property rights*. According to Furubotn and Pejovic (1972: 1139), property rights refer to

> "[…] the sanctioned behavioral relations among men that arise from the existence of things and pertain to their use. Property rights assignments specify the norms of behavior with respect to things that each and every person must observe in his interactions with other persons, or bear the cost for nonobservance, […] [Property rights are] the set of economic and social relations defining the position of each individual with respect to the utilization of scarce resources."[1]

According to this definition, property rights are an important prerequisite for any welfare-maximizing economic activity because they provide self-interested market actors with incentives to utilize scarce resources efficiently. Since these incentives apply to all market participants, strong property rights are fundamental to economic growth and development (e.g., North, 1990; North and Thomas, 1973; North and Weingast, 1989; Olson, 1993; Acemoglu et al., 2001; Claessens and Laeven, 2003; Acemoglu et al., 2005; Acemoglu and Robinson, 2012; for a survey, see Asoni, 2008).

In this paper, we argue that oil has an adverse effect on property

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[1] For a further discussion of the definition of property rights in the institutional-economic literature, we refer to, e.g., Ely (1914), Commons (1924), Coase (1988), Eleftheriadis (1996) and Cole and Grossman (2002).

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rights. Below, we develop our theoretical argument in three steps. First, we show that powerful groups in a society may prefer to forego *general* economic development to secure economic and political power as well as rents for themselves. Second, we argue that oil production is particularly prone to the generation of power and rents for small interest groups associated with the oil sector. Third, we explain why weakening property rights as one important economic institution is a promising strategy for oil interest groups to achieve their private goals. We will empirically test this hypothesis – oil leads to weaker property rights – in the remainder of this paper.

Given that strong property rights foster economic development, it may appear puzzling that societies could favor weaker property rights and thereby forego possible future economic growth. Acemoglu et al.'s (2005) *social conflict view*[2] on institutions offers a starting point why this may nevertheless be the case. Following this view,

> "[…] economic institutions are not always chosen by the whole society […] but by the groups that control political power at the time […]. These groups will choose the economic institutions that maximize their own rents, and the economic institutions that result may not coincide with those that maximize total surplus, wealth or income" (Acemoglu et al., 2005: 427).[3]

Indeed, oil abundance is particularly conducive to the creation of powerful interest groups, which we label as *oil interest groups* in the following. Very generally, these groups encompass all economic actors that have an economic stake in the oil industry, including, e.g., oil producers, shareholders of oil companies, suppliers, transportation and infrastructure businesses and lobbying firms. Zooming in, it is, however, clear that some interest group members are more important. For instance, oligarchs, CEOs and other high-level managers as well as large shareholders in the oil business are expected to be particularly influential, while also being especially interested in and equipped to secure large rents from oil production. By contrast, while ordinary oil workers are part of the oil interest groups as well, they are not expected to be powerful or participate in rent-seeking.[4]

We argue that (also in comparison with other interest groups) the oil interest groups' economic might is disproportionally high – and thus disproportionally influential in affecting economic institutions – for three reasons. First, the high global demand for oil (given its importance as a critical input in industrial development and transportation) combined with the geological concentration of oil deposits (e.g., Cassidy, 2019) implies that oil production creates large incomes for oil interest groups in many countries. Second, the same high volume of global demand for oil also means that the oil industry can domestically exert their economic power in an effective and consistent way even as oil prices tend to be volatile (e.g., Regnier, 2007). Third, the idiosyncrasies of oil production and markets expedite the *concentration of oil income* in relatively few hands, which in turn facilitates the exercise of political influence. This is because oil is a "point resource", i.e., it is "extracted from a narrow geographic or economic base" (Isham et al., 2005: 143), meaning that areas of oil extraction will usually be geographically concentrated within a country and controlled by a small number of economic actors, e.g., state-owned oil companies (e.g., the Saudi-Arabian *Aramco* and the Venezuelan *PDVSA*), oil-producing companies that involve substantial government share-holding and privately-owned supermajors and their shareholders.[5]

Hence, oil interest groups benefit from their concentrated interests and from having access to a particularly valuable resource, implying above average economic power. A small group of persons (oligarchs, CEOs and major shareholder) within these groups especially stands out and interacts prominently with political rulers. This provides them with the possibility to exert political influence and – ultimately – turn economic into political power. This is facilitated by shared interests between politicians, bureaucrats and the oil sector. The latter aspect is a direct implication of Acemoglu et al.'s (2005) social conflict framework, which assumes that economic power from, e.g., oil income, may be used to "buy" political power. For instance, oil interest groups can use their financial resources to purchase political decisions through corruption and political contributions. Politicians and bureaucrats may be responsive to this "buying" of political power due to mundane financial gains from bribes, lobbying or revolving door situations. Furthermore, they may use oil monies to secure their political survival in democracies (e.g., through vote buying in elections) as well as non-democracies (e.g., by distributing oil monies among the security apparatus to reduce the threat of removal).[6] In this way, both politicians and the oil sector secure their respective monopoly of privileges.

When influencing public policy, we argue that oil interest groups aim especially for an institutional setting with a *weak protection of property rights*, resulting in, inter alia, government interference into economic activity (e.g., expropriations), arbitrary (patent) court systems, institutionalized rent-seeking and the like.

Strong property rights lower barriers to market entry and thus facilitate *economic competition*, given that they reduce uncertainty and thus transaction costs (e.g., North, 1990). For instance, strong property rights protection serves as a signaling or commitment device aimed at attracting international investors (e.g., Bond and Samuelson, 1989; Thomas and Worrall, 1994). These aspects may not be in the interest of oil industry incumbents. The oil sector is usually characterized by oligopolistic or even monopolistic markets controlled by state-owned oil companies, private-public partnerships and oil supermajors (Ross, 2012). As these market structures lead to favorable profit structures, oligopolistic or monopolistic market participants have little interest in new competitors entering the market. Deliberately keeping property rights insecure (i.e., signaling that there is a non-negligible expropriation risk for any contender of the incumbent) is thus a promising strategy for economically and political powerful oil interest groups.

Strong property rights are also expected to facilitate *innovation*. The

[2] Acemoglu et al. (2005: 421–428) also offer two alternative hypotheses explaining institutional development: (1) the *incidental institutions view* (where historical events such as different colonial experiences shape present-day economic institutions) and (2) the *ideology view* (where different beliefs of political leaders and elites about property rights lead to different institutional choices). Acemoglu et al. (2005) argue the social conflict view offers a better explanation of institutional development because it allows for deliberate institutional choices by policymakers, even if they may turn out detrimental to parts of society. We therefore also adopt this latter institutional development perspective. Nevertheless, in our subsequent empirical analysis we also accommodate the incidental institutions and ideology views by including appropriate control variables.

[3] In general, this view relates the (relative) power of interest groups to aggregate and affect political and institutional choices (Buchanan and Tullock, 1962). For instance, the influence of interest groups on such choices has also been examined in the context of financial development (e.g., Rajan and Zingales, 2003), environmental policy (e.g., Oates and Portney, 2003), foreign aid (e.g., Svensson, 2000; Hodler, 2007) and trade policy (e.g., Grossman and Helpman, 1994).

[4] This is reminiscent of Olson's (1965) *logic of collective action*, according to which small groups with concentrated interests are more successful in extracting rents than larger groups with diffuse benefits (or costs).

[5] Supermajors are the largest publicly traded oil and gas companies such as *BP*, *Chevron*, *Eni*, *ExxonMobil*, *Royal Dutch Shell*, *Total* and *ConocoPhillips*.

[6] These arguments share similarities to some of the theoretical arguments concerning how oil may allow authoritarian rulers to remain in office (e.g., Mahdavy, 1970; Beblawi, 1987; Ross, 2015; Wright et al., 2015; see also the meta-analysis by Ahmadov, 2014).

oil sector itself is characterized by relative economic maturity for which innovation plays only a limited role.[7] However, innovation emerging in non-oil sectors of the economy can directly challenge the oil industry's business model by offering close substitutes to oil (e.g., in form of alternative means of energy production, such as solar or wind power) or reducing demand for oil (e.g., through technologies that promote energy efficiency). In other words, we argue that the oil sector fears disruptive innovation (in the sense of Schumpeterian creative destruction) that makes oil and oil products obsolete. Indeed, there are increasingly strong incentives for innovative domestic as well as foreign market entrants due to increased environmental consciousness and concerns over the role of oil in global climate change and public health. For instance, a 2020 poll reveals that most respondents – at least 60% – in every region of the world say that climate change is a somewhat serious or very serious threat to people in their country in the next 20 years (Gallup, 2020), suggesting that environmental concerns are not merely a phenomenon in rich economies. Clearly, such developments can challenge the economic position of the oil industry, but whether competition between the oil industry and its challengers will materialize depends strongly on whether property rights are secure (e.g., through a sound patent system).

Furthermore, strong property rights facilitate economic diversification and thus, ultimately, the emergence of new powerful interest groups (e.g., Olander, 2019). These new interest groups may not only have economic interests that diverge from those of the oil industry (e.g., concerning taxation, environmental regulation and industrial policy) but may also have the means available to convert their economic might into political power, thus challenging not only the economic but also political position of the oil industry. Indeed, fear of political competition may be a powerful incentive for interest groups such as the oil industry to block innovation and economic diversification (e.g., Acemoglu and Robinson, 2000; Wiig and Kolstad, 2012; Olander, 2019). In other words, besides frustrating economic competition, weak property rights are also expected to prevent *political competition*.[8]

In sum, for oil interest groups there are clear economic and political gains (in the form of reduced innovation and lower levels of economic and political competition) associated with lobbying for weak property rights.[9] For example, such gains can be reaped when weak property rights disincentivize competition in the oil sector (e.g., due to foreign investors), with a lack of competition, in turn, fueling domestic oil prices or lowering labor costs in the oil sector (especially also for high-skilled talent). These benefits are expected to outweigh potential disadvantages from weak property rights. Given their economic and political influence, oil interest groups can afford the private enforcement of their property rights, e.g., by buying off politicians or hiring private security firms (e.g., Sonin, 2003). This allows them to push for weak economic rights without endangering their own economic and political prospects. Here, there are ultimately two major pathways through which oil interest groups can exercise political power – rooted in their outsized economic might from oil – to shape economic institutions in their favor. First, oil interest groups may use their economic power to buy political influence by compensating non-oil interest groups in return for their support for weak economic institutions. This compensation may include systems of *patronage* (e.g., by providing employment, "white elephant" investments contracts etc.) and *corruption* (i.e., by outright bribing important public officials and buying votes). Second, oil interest groups may use their economic power to suppress the political voice of hostile parts of the population, where such hostility may stem from economic, environmental or cultural antagonisms. For instance, this repression may include the financing of violence or counter-propaganda against influential political opponents (e.g., critical journalists; see Beblawi, 1987).

In the following, we test our hypothesis that oil leads to poorer economic institutions, using data for a large sample of 150 countries between 1960 and 2014. Consistent with our expectations, we find evidence that oil income (measured as the per capita value of oil production per country-year observation) results in weaker private property rights. This result is robust to different operationalizations of oil income and production as well as economic institutions. It is also robust to the use of different instrumental-variable approaches, where oil production is instrumented by lagged domestic oil reserves, natural disasters in other oil-producing countries and unexpected domestic oil discoveries, respectively. We also provide evidence that oil leads to increased patronage and political corruption as well as increased pressure on media voices, human right violations and other exclusionary policies. These latter findings are consistent with a social conflict view of institutional choice, where interest groups use their outsized economic influence as "carrots" or "sticks", i.e., to buy off political influence ("carrots") or repress dissenting voices ("sticks") to achieve an institutional outcome that serves their (but not necessarily the social) economic and political interests.

The remainder of this paper is structured as follows. In Section 2, we introduce the data and methodology to examine the oil-property rights relationship. In Section 3 we present our empirical findings. Section 4 concludes.

2. Data and methods

To investigate the role of oil in property rights, we use panel data for 150 countries between 1960 and 2014. The beginning and end of our observation are dictated by data availability; in particular, oil data is only available up to 2014. As for the cross-sectional dimension, we exclude small-island nation states and micro-states due to a lack of data. A list of countries is provided in the Appendix. The summary statistics are reported in Table 1.

2.1. Private property rights

Our main dependent variable measuring a country's quality of economic institutions is an *index of private property rights* drawn from the *Varieties of Democracy Project* (*VDEM*) (VDEM, 2019). Relying on both country-based and subject-based experts, VDEM asks whether and to what extent private property rights (i.e., the right to acquire, possess, inherit and sell private property) are constrained, where limits to this right will be primarily set by the state.[10] In detail, expert opinion may range from stating that virtually nobody enjoys private property rights of any kind to stating that virtually everybody enjoys all kinds of

[7] However, as pointed out by a referee, this is not to say that there has been no innovation within the oil sector in recent decades, e.g., concerning more "unconventional" extraction methods such as fracking and horizontal drilling and increasing depths of offshore drilling.

[8] An argument can be made that concerns about political competition trump those about economic competition at least in some countries. For instance, Acemoglu and Robinson (2000) argue that major economic change (e.g., associated with a change in property rights protection) is usually not blocked by economic losers (i.e., those groups that would lose economic rents due to this change) but by groups whose political power is endangered by it. Indeed, with respect to the case of the oil industry, the subsidization of oil products in countries in which state actors strongly influence the oil sector (e.g., in Venezuela) may suggest that political motives (the protection of political power) are more important than economic concerns (where subsidization would conflict with profit maximization) in these countries.

[9] As suggested by a referee, there is also the possibility that weak property rights are not the consequence of lobbying but emerge when political rulers can earn their income from natural resources (as it can happen in resource-rich countries) and thus do not need to invest into sound property rights and a functioning legal system to raise taxes (e.g., Besley and Persson, 2009).

[10] Additionally, limits to property rights may also be due to customary laws or religious and social norms (e.g., consider limits to property rights for women because of religious customs).

Table 1
Summary statistics.

Variable	N*T	Mean	Std. Dev.	Min.	Max.
Property Rights Protection	6363	0.596	0.266	0.01	0.949
Property Rights Protection (Men)	6363	0.655	1.228	−4.398	2.425
Property Rights Protection (Women)	6363	0.579	1.313	−3.75	2.822
Private Ownership of Economy	6363	0.143	1.322	−4.197	3.295
Rule of Law	6363	0.517	0.315	0.02	0.998
Access to Justice	6363	0.573	0.289	0.01	0.995
Transparent Laws with Predictable Enforcement	6363	0.502	1.575	−3.65	4.17
Oil (=Oil Production p.c., Year, 2000 Value, logged)	6363	2.339	2.846	0	11.119
Oil Reserves (=Oil Reserves Per Capita, logged)	6363	0.19	0.652	0	5.587
Oil Rents	5169	5.747	11.251	0	88.866
Fuel Exports	4622	17.227	28.348	0	193.037
Total Value of Oil Production (logged)	6363	11.53	10.419	0	26.553
Total Oil Production (logged)	6363	8.493	7.805	0	20.239
Infant Mortality (per 100 live births)	6363	0.822	0.784	0.03	4.094
Population Size (logged)	6363	9.227	1.498	4.824	14.116
Democracy	6363	0.499	0.414	0	1
Leftist Government	6363	0.26	0.321	0	1
Civil War	6363	0.176	0.381	0	1
Out-of-Region Natural Disaster Damage (logged)	6363	16.422	1.962	0	19.669
Unexpected Oil Discoveries (logged)	1887	0.006	0.066	−0.167	0.176
Regime Corruption	6363	0.50	0.312	0.01	0.98
Clientelist Party Linkages	6363	0.10	1.426	−3.205	3.509
Distribution of Public Goods	6363	0.566	0.287	0.02	0.985
Media Harassment	6363	0.265	1.658	−3.088	3.985
Human Rights	6363	0.565	0.316	0.02	0.987
Political Exclusion	5942	0.452	0.296	0.01	0.975

property rights. VDEM then uses the raw expert opinion data to provide a representative value of property rights protection per country-year observation, applying item response theory and other forms of rigorous statistical scrutiny to minimize uncertainty and bias (VDEM, 2019).[11] The property rights protection variable can range between zero and one, where higher values correspond to higher levels of property rights protection.

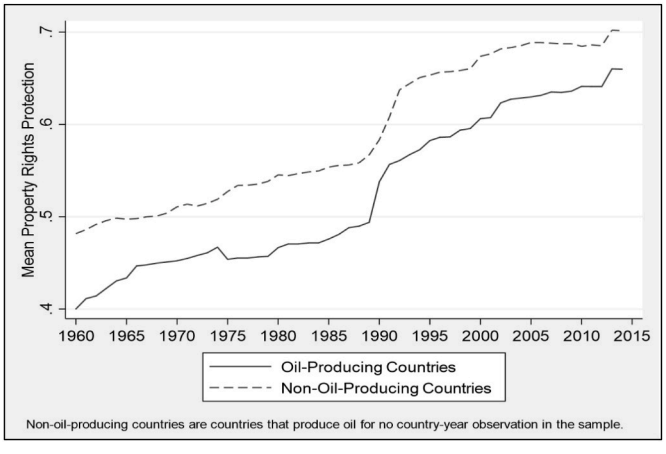

Fig. 1. Property rights protection in oil- and non-oil-producing countries.

Fig. 1 visualizes general trends in property rights protection between 1960 and 2014 in oil- and non-oil-producing countries. While property rights have become stronger in both types of countries over time, property rights protection is on average always weaker in oil-producing countries, providing first – albeit highly tentative – evidence that oil production may indeed negatively correlate with private property rights.

2.2. Oil

Our main oil indicator is the *value of oil production* per capita. This variable measures the country-level production of the number of barrels of oil in a specific year and uses the world-market price of a barrel of oil in year-2000 US-$ to provide a production value that is comparable over time. This variable is subsequently divided by a country's population size to derive a per capita value of oil production. The variable is logged to reduce the influence of extreme values, with unity being added to allow for zero-observations. The oil data are drawn from the dataset of Ross and Mahdavi (2015).

2.3. Empirical model and controls

2.3.1. Model

To examine the effect of oil on property rights protection, we run a series of OLS regressions of the following form:

$$pr\_rights_{it} = \beta * oil_{it-1} + \delta * X_{it-1} + \tau_t + \theta_i + \varepsilon_{it} \quad (1)$$

In equation (1), *pr_rights* is the VDEM private property rights index for country *i* at year *t*. It is explained by *oil*, i.e., a country's (logged) per capita oil production value in the previous year. Besides the error term (ε), we also include a vector of additional controls (X) that we introduce below. Finally, we account for *country-fixed effects* (τ) and *year-fixed effects* (θ), which control for unobserved (time-invariant) heterogeneity as well as common shocks and trends, respectively. Importantly, via the inclusion of country-fixed effects we can control for historical differences in institutional development. This, in turn, allows us to account for the incidental institutions view where historical events such as different colonial experiences shape present-day economic institutions (Acemoglu et al., 2005).

As we also document below (Table 2), the regression residuals from Equation (1) are expected to have heteroskedasticity, serial correlation and cross-sectional dependence. Cross-sectional dependence refers to dependencies across space at a specific point in time; for example, such interdependencies may be due to spill-over effects in form of the cross-border diffusion of property rights. To make statistical inferences, we consequently use standard errors developed by Driscoll and Kraay (1998) which are robust to heteroskedasticity, serial correlation but also to general forms of cross-sectional dependence.

2.3.2. Control variables

As for the vector of controls (X), we consider the influence of *infant mortality* to control for the level of economic development, expecting more developed countries to have stronger property rights. The data on infant mortality comes from the *World Development Indicators* (*WDI*) (World Bank, 2019).[12] We also control for (logged) *population size*; the variable is drawn from the WDI. We expect country size to negatively correlate with property rights. For instance, larger countries are more

[11] See https://www.v-dem.net/for detailed explanation of the methodology.

[12] Infant mortality is strongly negatively correlated with GDP per capita ($r = -0.73$, $p < 0.01$). However, we prefer infant mortality over GDP p.c. as a measure of economic development because the former allows us to maximize the number of observations. As we show below as part of our robustness checks, replacing infant mortality with per capita income does not affect our main findings.

Table 2
Fixed-effects and instrumental-variable fixed-effects estimates.

Sample →	(1a)	(1b)	(2a)	(2b)
	Full Sample: 150 countries, 1960–2014		Oil-Economies: 95 countries, 1960–2014	
Oil $_{t-1}$	−0.004 (0.002)*	−0.034 (0.005)***	−0.003 (0.002)	−0.037 (0.007)***
Infant Mortality $_{t-1}$	−0.032 (0.007)***	−0.035 (0.008)***	−0.013 (0.007)**	−0.026 (0.009)***
Population Size $_{t-1}$	−0.067 (0.005)***	−0.071 (0.005)***	−0.063 (0.009)***	−0.076 (0.010)***
Democracy $_{t-1}$	0.196 (0.008)***	0.188 (0.007)***	0.241 (0.013)***	0.232 (0.012)***
Leftist Government $_{t-1}$	−0.123 (0.013)***	−0.129 (0.013)***	−0.168 (0.020)***	−0.168 (0.018)***
Civil War $_{t-1}$	−0.012 (0.006)**	−0.015 (0.005)***	−0.014 (0.007)**	−0.019 (0.006)***
First-Stage Regression Results				
Oil Reserves $_{t-10}$		1.092 (0.147)***		0.865 (0.126)***
Infant Mortality $_{t-1}$		0.002 (0.048)		−0.229 (0.126)*
Population Size $_{t-1}$		0.052 (0.143)		−0.168 (0.181)
Democracy $_{t-1}$		−0.238 (0.067)***		−0.271 (0.072)***
Leftist Government $_{t-1}$		−0.216 (0.131)*		−0.058 (0.153)
Civil War $_{t-1}$		−0.074 (0.066)		−0.122 (0.078)
First-Stage F-Statistic [Oil Reserves $_{t-10}$]		55.56		47.00
Anderson-Rubin (AR) 90% Confidence Intervals		[-0.043; −0.025]		[-0.049; −0.025]
AR Wald Test (Pr.>χ^2)		(0.00)***		(0.00)***
Group-Wise Heteroskedasticity Wald Test (Pr.>χ^2)	(0.00)***	(0.00)***	(0.00)***	(0.00)***
Test for Autocorrelation in Panel Data (Pr.>F)	(0.00)***	(0.00)***	(0.00)***	(0.00)***
Pesaran Test for Cross-Sectional Dependence (p-value)	(0.00)***	(0.00)***	(0.00)***	(0.00)***
Number of Observations	6363	6363	4016	4016

Notes: Dependent variable is always the VDEM property rights index. OLS- and IV-estimates reported. Country-fixed and year-fixed effects always included. The test for cross-sectional dependence is due to Pesaran (2004). Driscoll-Kraay standard errors in parentheses. *p < 0.1, **p < 0.05, ***p < 0.01.

likely to host the production of goods and services within their borders, thus being less dependent on international trade (e.g., Frankel and Romer, 1999; Olsson and Hansson, 2011). A lack of dependence on trade, in turn, may increase the likelihood that governments expropriate the production and assets of foreign and domestic firms (i.e., to weaken property rights), given that these governments "can more easily find internal substitutes for internationally traded goods and also typically have a stronger power to solve international disputes to their own short term advantage" (Olsson and Hansson, 2011: 618). Furthermore, we control for *democracy*, using a (continuous) democracy measure from the *CSVMDI Democracy Dataset* introduced in Gründler and Krieger (2016).[13] Inter alia, we include this covariate because oil abundance tends to correlate with authoritarianism (e.g., Ross, 2012). Additionally, we account for the *incumbency of leftist governments*, i.e., governments with socialist or communist leanings. We expect leftist governments to favor lower levels of property rights protection, in line with the hypothesis that "depicts right-wing parties as strong believers in the importance of free markets and leftist parties as advocates of market control and state intervention" (Castro and Martins, 2021: 74). Controlling for government ideology also allows us to account for the ideology view of institutional differences of Acemoglu et al. (2005) that we alluded to in the introduction. The data on left-wing incumbency comes from the VDEM dataset. Finally, we control incidences of *civil war*, given the potentially strong association between oil and civil unrest (e.g., Cotet and Tsui, 2013). The data are from the *Uppsala Conflict Data Program*, which defines a civil war as an armed contest between an organized group and a government with at least 25 battle deaths per year (Gleditsch et al., 2002).

2.4. Endogeneity

Potentially, estimates from Equation (1) suffer from endogeneity bias. This bias may be due to measurement error, omitted variables and simultaneity. With respect to simultaneity, while we argue that oil results in poor economic institutions, the opposite may also be true. That is, weak property rights may disincentivize innovation, economic-political competition and long-run investment and thus lead to a resource-extraction heavy economy. In other words, dependence on natural resource income could be a symptom of poor economic institutions rather than their cause.

Consequently, the OLS estimates from Equation (1) may be biased downwards due to simultaneity if sound economic institutions reduce the overall economic importance of oil in a country's economy. Similarly, attenuation bias because of measurement error in the main explanatory variable (per capita oil income) will also bias OLS estimates towards zero, leading us to potentially underestimate the effect of oil on property rights protection.

To reduce the influence of endogeneity bias and provide estimates of the effect of oil on property rights that can be interpreted c*ausally*, we estimate a series of two-stage instrumental-variable (IV) OLS estimations of the following form:

$$oil_{it} = \alpha * oil\_res_{it-10} + \pi * X_{it}^{'} + \tau_t + \theta_i + \varepsilon_{it} \quad (2a)$$

$$pr\_rights_{it} = \beta * \widehat{oil_{it-1}} + \delta * X_{it-1} + \tau_t + \theta_i + \varepsilon_{it} \quad (2b)$$

In the first stage (2a), we explain oil by our instrument, the *ten-year lag of per capita oil reserves* in the country of interest (*oil_res*), before using the first-stage results to estimate the effect of oil on property rights, with the former now being instrumented by oil reserves (indicated by $\widehat{oil}$), in the second stage (2b). The oil reserve data are drawn from Haber and Menaldo (2011). Oil reserves are also used as instrumental variables in several studies estimating the effect of oil on institutional outcomes, including, e.g., Haber and Menaldo (2011), Wright et al. (2015) and Brooks and Kurtz (2016).

In general, a variable constitutes a valid instrument for an endogenous explanatory variable if (1) it is sufficiently correlated with the

[13] A main advantage of this dataset is that it uses machine learning tools for pattern recognition, which allows avoiding simplistic assumptions about the functional relationship between regime characteristics and democracy (Gründler and Krieger, 2016: 88–91). As we show below in our robustness checks, using an alternative measure of democracy, however, does not matter to our empirical conclusions.

endogenous explanatory variable (instrument relevance) and (2) it is not correlated with the error term in the explanatory equation (instrument exogeneity).

Considering *instrumental relevance*, the argument is straightforward: larger oil reserves will lead to higher (future) oil production (e.g., Pickering, 2008; Cotet and Tsui, 2013). Indeed, the bivariate correlation between both variables is satisfactorily high and positive ($r = 0.61$, $p < 0.01$), pointing to instrument relevance.

In terms of *instrument exogeneity*, to the extent that oil reserves depend on the size of oil deposits (i.e., sub-surface pools of hydrocarbons contained in rock formation), oil reserves are clearly exogenous. However, the main threat to our identification strategy emerges from the fact that the extent of oil reserves also depends on past oil exploration and extraction. Several studies point to the role of weak political institutions and political instability in undermining oil production and exploration (e.g., Bohn and Deacon, 2000; Bøe et al., 2019; Cust and Harding, 2020; Merrill and Orlando, 2020; see also Ross, 2015: 243). For instance, political risk is expected to be negatively related to oil exploration, given the inherent riskiness of the oil exploration business (as the potential for commercialization of oil exploration is a priori unknown) and the long time-horizons involved (Bøe et al., 2019). If past oil reserves (i.e., the 10-year lag of oil reserves as our instrument) correlate with past political and economic shocks (such as past political conflict disincentivized oil exploration), the exclusion restriction is violated if these past shocks exert an independent effect on present-day property rights. For instance, strong political institutions may have incentivized oil exploration in the past (e.g., Cust and Harding, 2020) and may have simultaneously led to stronger property rights in the present given institutional path dependence (e.g., Acemoglu et al., 2005).

Considering such threats to our identification strategy, below we report three ways to probe the robustness of our instrumental-variable approach. First, we run additional models where we control for past economic, political or demographic shocks that may be correlated with our instrument as well as present-day property rights and thus affect the exclusion restriction. Second, we relax the assumption of perfect instrument exogeneity by means of the plausibly exogenous instrument framework of Conley et al. (2012). This framework allows for violations of the exclusion restriction and an examination of the bounds of the true effect of oil on property rights. Third, we use two alternative instruments for oil: (1) economic damage from natural disasters in out-of-region oil-producing countries, following Ramsay (2011) and (2) changes in oil reserves due to unexpected oil discoveries, following Cotet and Tsui (2013). The rationale behind both instruments is described below in more detail.

3. Empirical results

3.1. Main results

Our baseline OLS- and IV-results are reported in Table 2. For all specifications, several diagnostics indicate that the regression residuals are affected by heteroskedasticity, autocorrelation and cross-sectional dependence; these diagnostics thus indicate that it is indeed appropriate to use Driscoll-Kraay standard errors for statistical inference, as these standard errors are robust to these issues.

In the OLS-setting, we find that oil has a negative effect on property rights protection. This speaks to our main hypothesis that oil is damaging to the quality of economic institutions. However, this effect is no longer statistically significant when we only focus on a sample of those 95 countries that have produced oil during our period of observation.

In the IV-setting, the adverse effect of oil on property rights is more pronounced and statistically significant for both the full and reduced sample that only considers oil-producing countries. While we cannot directly compare the OLS- and IV-estimates (as the local average treatment effect from the IV-approach will differ from the average treatment effect from the OLS-approach), the IV-estimates nevertheless suggest that the OLS-estimates are downward biased, e.g., due to classical measurement error or simultaneity. In terms of effect sizes and economic significance, the OLS-estimates imply that a 10% increase in oil income is associated with a 0.04 points reduction of the VDEM property rights index (if this index is scaled from zero to 100). Concerning the IV-estimates, the same increase in oil income implies a 0.34 points reduction of the VDEM property rights index.

Considering the quality of the IV-estimates, the associated diagnostics are always satisfactory. As expected, past oil reserves predict the present-day value of per capita oil production, with the associated first-stage *F*-statistic easily surpassing the usual rule of thumb of $F<10$ that would signal instrument weakness. However, this rule of thumb has received some criticism for being anti-conservative, meaning that instrument may be weak even if $F > 10$ (e.g., Lee et al., 2020). Thus, we also rely on *weak-instrument robust inference* (Stock et al., 2002). In detail, we report the Anderson-Rubin test (Anderson and Rubin, 1949), which is robust to arbitrarily weak instruments (Lee et al., 2020). Additionally, we report the Anderson-Rubin confidence intervals associated with each IV-regression. As reported in Table 2, the result from weak-instrument robust inference conform to our baseline IV-results and thus strengthen confidence in the IV-estimates.

As for the controls, the results are as expected and consistent with earlier studies (e.g., Olsson and Hansson, 2011; Ross, 2012; Castro and Martins, 2021). First, higher levels of economic development (indicated by lower infant mortality) coincide with better property rights protection, pointing to a virtuous circle of economic and institutional development. Second, population size is negatively related to private property rights. This is in line with Olsson and Hansson (2011) who also find that larger populations are associated with weaker institutions. Third, democratic institutions lead to better property rights protection, pointing to a beneficial relationship between democratic and economic liberalism. Fourth, a greater emphasis on state interventionism may explain why leftist governance is linked to weaker property rights. Fifth, there is a negative effect of political instability (indicated by incidences of civil war) on property rights protection. For instance, this may be due to state weakness resulting in an inability to enforce property rights.

3.2. Robustness of instrumental-variable approach

3.2.1. Role of past shocks

The soundness of our instrumental-variable analysis depends on our instrumental variable (the ten-year lag of per capita oil reserves) being both relevant and exogenous. While the first-stage regression results and diagnostics as well as results from the weak-instrument robust inference provide ample support in favor of instrument relevance, the question of instrument exogeneity is less straightforward.

As discussed above, a major threat to our identification strategy comes from the influence of past economic, political or demographic shocks that may (1) be correlated with past oil exploration and extraction efforts (thus correlating with our instrumental variable) and (2) independently determining present-day property rights (thus violating the exclusion restriction). For instance, according to the ideology view of institutions (Acemoglu et al., 2005), leftist leaders may have implemented policies in the past that disincentivized oil exploration and extraction efforts (thus correlating with past oil reserves, our instrumental variable), while still negatively affecting present-day property rights, which would violate the exclusion restriction.

We accommodate such concerns by running additional models where we control for past economic, political or demographic shocks that may be correlated with our instrument and present-day property rights. These past shocks are operationalized as the ten-year lags (i.e., they are measured at the same time as our instrumental variable) of infant mortality, population size, democracy, leftist government incumbency, incidence of civil war, property rights (to account for path dependency in property rights choices) and oil (to consider the influence of past oil

extraction and price developments).

We report our additional estimates in Supplementary Table 1 in the Appendix. Reassuringly, regardless of whether we control for the individual or combined impact of past economic, political, institutional or demographic effects, we always find that higher levels of the value of per capita oil production (instrumented by past oil reserves) reduce private property rights. The size of the estimated coefficients is very similar to our baseline results reported in Table 2, while the IV-diagnostics are always acceptable.

3.2.2. *Plausibly exogenous instrument framework*

Another way to probe the robustness of our IV-estimates is to resort to the plausibly exogenous instrument framework of Conley et al. (2012) and Van Kippersluis and Rietveld (2018). Here, we allow our instrumental variable to also enter the second-stage instrumental-variable regression (i.e., Equation (2b)) with a coefficient γ. In other words, we allow for a direct influence of the ten-year lag of per capita oil reserves on present-day property rights. This means to replace the original assumption of perfect instrument exogeneity of $\gamma = 0$ with minimum and maximum values of γ (γ_{min} and γ_{max}) to examine the bounds concerning the true effect of oil on property rights given plausible violations of the exclusion restriction.

We find suitable values of γ by considering the reduced-form regressions of the effect of past oil reserves on property rights in oil-producing and non-oil-producing countries. As expected, in oil-producing countries past oil reserves negatively correlate with present property rights (Table 3, Panel A). However, there are also countries that have oil reserves but do not produce oil during our period of observation. For these countries, there is a positive relationship between oil reserves and property rights (Table 3, Panel A). This finding is in line with earlier research, suggesting that oil exploration correlates with sound political and economic institutions as well as internal peace (e.g., Bohn and Deacon, 2000; Bøe et al., 2019; Cust and Harding, 2020); these sound conditions, in turn, are expected to favorably affect present economic institutions. This finding and discussion thus suggests that $\gamma > 0$.[14]

Table 3
Reduced-form and plausibly exogenous estimates.

	(1)	(2)
Panel A: Reduced-Form Estimates		
Sample →	Oil-Producing Countries	Non-Oil- Producing Countries
Oil Reserves $_{t-10}$	−0.032 (0.008)***	5.720 (1.459)***
Baseline Controls	Yes	Yes
Number of Observations	4021	2347
Panel B: Plausibly Exogenous Estimates (Conley et al., 2012)		
	95% Confidence Interval	
Oil $_{t-1}$	[-1.117; −0.028]	$\gamma_{max} = 0$, $\gamma_{max} = 1$
Oil $_{t-1}$	[-2.201; −0.028]	$\gamma_{max} = 0$, $\gamma_{max} = 2$
Oil $_{t-1}$	[-4.367; −0.028]	$\gamma_{max} = 0$, $\gamma_{max} = 4$
Oil $_{t-1}$	[-8.701; −0.028]	$\gamma_{max} = 0$, $\gamma_{max} = 8$
Oil $_{t-1}$	[-9.785; −2.278]	$\gamma_{max} = 3$, $\gamma_{max} = 9$
Baseline Controls	Yes	
Number of Observations	6363	

Notes: Dependent variable is always the VDEM property rights index. Instrumental-variable fixed-effects estimates reported. Country-fixed and year-fixed effects always included. Baseline controls are infant mortality, population size, democracy, leftist government and civil war (all lagged by one year). Driscoll-Kraay standard errors in parentheses. *p < 0.1, **p < 0.05, ***p < 0.01.

Experimenting with various plausible values of γ, we find that the confidence intervals associated with the effect of oil (instrumented by oil reserves at *t-10*) on property rights are further from zero (Table 3, Panel B). This implies a stronger (causal) effect relative to our previous estimates where we assumed γ to be equal to zero. That is, allowing for plausibly imperfect instrument exogeneity yields results that are in line with our main results (Table 2). What is more, the results from the plausibly exogenous approach suggest that our previously reported IV-results are rather conservative estimates of the true effect of oil on property rights.

3.2.3. *Alternative instrumental variables*

As a final examination of the robustness of our IV-estimates, we employ alternative instrumental variables. Using alternative instrumental variables for oil is expected to further dispel concerns about instrument validity and adequacy.

First, we use an instrument proposed by Ramsay (2011). He argues that the *economic damage from natural disasters in out-of-region oil--producing countries* is a valid instrument for domestic oil production. Here, "natural disasters" refers to five different types of natural disasters (earthquakes, volcano eruptions, mudslides, floods and windstorms), while "out-of-region economic damage" means the global value of a year's disaster damage in oil-producing countries minus the damage value of a country's own world region (either East Asia and the Pacific; Europe and Central Asia; the Americas; the Middle East and Northern Africa; Sub-Saharan Africa; or South Asia). The data on natural disasters and their economic damage is from the *International Disaster Database*.[15] According to Ramsay (2011: 514), natural disasters in other oil-producing countries will adversely affect oil production in these countries (e.g., by destroying infrastructure or oil extraction capabilities) and thus increase world oil prices, thereby plausibly affecting oil production in non-affected countries. Following Ramsay (2011: 514), we only consider out-of-region economic damage to rule out other effects of foreign natural disasters on local oil production value (e.g., via increased regional instability), thus ensuring that natural disaster economic damage only affects the value of domestic oil production via its effects on oil prices.

Second, we use an instrument proposed by Cotet and Tsui (2013): *unexpected changes in oil reserves* over time. Here, "unexpected changes in oil reserves" are successful oil explorations that are in excess of expected discoveries, conditional upon country-specific oil exploration attempts; for more details on the construction of this variable, see Cotet and Tsui (2013: 70). That is, while Ramsay's instrument exploits exogenous variation in oil due to unexpected oil price changes, the Cotet-Tsui instrument uses exogenous variation due to unexpected oil discoveries. As the data from Cotet and Tsui (2013) is only available between 1960 and 2003 and for a smaller sample of oil-producing countries, we restrict our analysis to this sub-sample when using their instrumental variable.

Table 4 reports our findings when we use these additional instruments, where we either use them as replacements for our baseline instrumental variable (the ten-year lag of a country's oil reserves) or combine them with it. We find that oil continues to cause weaker property rights, regardless of which combination of instrumental

[14] This is because the reduced-form effect of oil reserves on property rights is given by β (the effect of oil reserves via oil at *t+10*; see Equations (2a) and (2b)) and γ (the direct effect of oil reserves). However, for countries that do not produce oil, $\beta=0$, so that the estimated effect only captures γ. See also Conley et al. (2012) and Van Kippersluis and Rietveld (2018) as well as Nunn and Wantchekon (2011) for an application and further discussion of the plausibly exogenous instrument approach.

[15] The data can be accessed here. https://public.emdat.be/.

Table 4
Alternative instrumental-variable estimates.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sample →	Full Sample: 150 countries, 1960–2014		Reduced Sample: 54 oil-economies, 1960–2003				
Oil $_{t-1}$	−0.165	−0.039	−0.039	−0.033	−0.038	−0.038	−0.049
	(0.026)***	(0.006)***	(0.008)***	(0.015)**	(0.007)***	(0.007)***	(0.010)***
Infant Mortality $_{t-1}$	−0.049	−0.036	−0.020	−0.022	−0.020	−0.020	−0.021
	(0.012)***	(0.008)***	(0.011)*	(0.011)*	(0.010)*	(0.010)*	(0.011)*
Population Size $_{t-1}$	−0.088	−0.072	−0.130	−0.126	−0.129	−0.129	−0.141
	(0.020)***	(0.006)***	(0.029)***	(0.030)***	(0.028)***	(0.028)***	(0.032)***
Democracy $_{t-1}$	0.156	0.187	0.208	0.210	0.208	0.208	0.205
	(0.016)***	(0.008)***	(0.018)***	(0.019)***	(0.018)***	(0.018)***	(0.019)***
Leftist Government $_{t-1}$	−0.155	−0.130	−0.190	−0.180	−0.190	−0.190	−0.193
	(0.021)***	(0.013)***	(0.017)***	(0.018)***	(0.016)***	(0.016)***	(0.015)***
Civil War $_{t-1}$	−0.029	−0.016	−0.006	−0.005	−0.006	−0.006	−0.008
	(0.011)***	(0.005)***	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Instruments	Out-Des	Oil Res + Out-Des	Oil Res	Unexp Disc	Oil Res + Unexp Disc	Oil Res + Unexp Disc	Oil Res + Unexp Disc + Out-Des
First-Stage F-Statistic	20.76	59.53	36.06	11.16	18.63	18.63	30.56
AR Wald Test (Pr.>χ^2)	(0.00)***	(0.00)***	(0.00)***	(0.04)**	(0.00)***	(0.00)***	(0.00)***
Hansen Test (Pr.>χ2)		(0.12)			(0.89)	(0.89)	(0.27)
Number of Observations	6363	6363	1887	1954	1887	1887	1887

Notes: Dependent variable is always the VDEM property rights index. Instrumental-variable fixed-effects estimates reported. Country-fixed and year-fixed effects always included. Oil Res = Oil reserves (t-10). Out-Des = Out-of-region economic damage from natural disasters in oil-producing countries (t-1). Unexp Disc = Unexpected oil discoveries (t-1). Driscoll-Kraay standard errors in parentheses. *p < 0.1, **p < 0.05, ***p < 0.01.

variables we employ. Indeed, the alternative instrumental variables yield results that are similar to our baseline instrument both in terms of statistical significance and effect size. This suggests that our initial IV-findings are not driven by the choice of a particular instrumental variable. Here, the IV-diagnostics are always satisfactory. Furthermore, using a combination of instruments allows for tests of overidentifying restrictions (Hansen's *J*-statistic). These tests also indicate that the instruments are valid (i.e., uncorrelated with the error term), which further raises confidence in our IV-estimates.

3.3. Further robustness checks

3.3.1. Changes to the baseline model

Having provided substantial evidence that our IV-strategy is sound, we run additional analyses to further probe the robustness of our empirical findings. We begin by considering various changes to our baseline model.

First, we replace the infant mortality rate with a country's (logged) per capita income as an alternative measure of economic development. The data are from the WDI. Second, we replace the Krieger-Gründler democracy measure with an index of electoral democracy from the VDEM dataset. Third, we add regional trends to the baseline model.[16] Oil production tends to correlate within specific world regions (e.g., the Middle East), so it is worthwhile to assess the robustness of our findings to the inclusion of regional trends. Fourth, instead of using annual data, we examine the effect of oil on property rights over a maximum of 11 consecutive 5-year averages. This approach may be useful given the relative persistence of the dependent variable and many of the covariates. Finally, we consider the role of potentially "bad controls". That is, while infant mortality, democracy, leftist governments and civil war are – as discussed above – likely confounders of the oil-property rights relationship, they may also constitute transmission channels from oil to weaker property rights. For example, oil may affect political stability (e.g., Cotet and Tsui, 2013); in turn, conflict may affect property rights protection. Alternatively, one may argue that these controls are not strictly exogenous, e.g., due to case-control bias. For instance, weak property rights – as an outcome of oil – may eventually adversely affect infant mortality and the quality of democratic institutions. In any case, the inclusion of "bad controls" is expected to increase asymptotic bias. To assess the influence of "bad controls", we therefore consider various models where we drop potentially suspect controls, also running a model that foregoes the inclusion of all control variables.[17]

We report our robustness checks in Supplementary Table 2. Reassuringly, regardless of which variant of the baseline model we consider, we always find that oil causes weaker private property rights, speaking to the robustness of our main results. The IV-diagnostics are also always sound.

3.3.2. Additional covariates

Next, we introduce additional control variables into our baseline model. In detail, we now also account for the inflow of *development aid* (to assess potential foreign influence on domestic economic institutions), *economic growth* (given the potential relationship between economic crises and economic reforms), *mineral rents* (to differentiate between oil and non-oil resource income), *trade openness* (to account for the role of economic globalization), *government size* (as a measure of public redistribution) as well as a *lagged dependent variable* as another way of controlling for omitted variables. Information on data sources and variable operationalizations is provided in Supplementary Table 3 in the Appendix. This table also reports our empirical results. Adding the aforementioned covariates does not change our main finding of a negative impact of oil on private property rights.

3.3.3. Sub-sample analysis

Furthermore, we analyze whether the oil-property rights relationship is due to a specific sub-sample of countries or years. Thus, we

[16] Regional trends are operationalized as the interaction between a set of regional dummies and the year fixed-effects. The regional dummies are for East Asia and the Pacific; Europe and Central Asia; the Americas; the Middle East and Northern Africa (MENA); sub-Saharan Africa; and South Asia.

[17] In addition to the exclusion of "bad controls," we could also try to remedy some related concerns through the use of additional instrumental variables for potentially suspect controls. While it is beyond the scope of this paper to explore this latter approach in more detail, in Supplementary Table 2 we report an IV-regression where (in addition to oil income) infant mortality, democracy, leftist governments and civil war as instruments are instrumented by their second and third lags. Here, the results conform to our main regression results, while the associated diagnostics (e.g., concerning over-identification) are sound.

consider the following sub-samples. First, we drop from our analysis the OECD (members before 1990) and MENA countries, respectively. While many MENA countries are well-known for their exceptionally high levels of oil production, OECD countries enjoy particularly high levels of property rights protection (while usually not being resource-rich). Disregarding these countries therefore ought to make our analysis less vulnerable to potential outliers. Second, we restrict our analysis to the 1974–2014 period (to emphasize the increasing importance of oil in revenue generation after the first oil shock) and to the 1991–2014 period (to account for the increasing economic liberalization of many countries after the end of the Cold War), respectively. Finally, we only consider countries with a per capita oil income of less than 500 US-$ to restrict the influence of extreme outliers in the value of per capita oil production.[18]

As shown in Supplementary Table 4 in the Appendix, running analyses for these various restricted samples produces findings that are very much in line with our baseline results reported in Table 2. That is, oil continues to exert a negative, statistically significant and economically substantive effect on the extent of private property rights.

3.3.4. Alternative measures of oil

Potentially, our results are affected by the choice of the main explanatory variable for oil. In this sub-section, we therefore consider alternative measures. As shown in the Appendix (Supplementary Table 5), these alternative oil variables rather strongly correlate with each other and our main explanatory variable (the logged value of per capita oil production).

In detail, we use *oil rents as a share of GDP*, with the data coming from the WDI. This variable is used in many studies on the political and economic consequences of oil since it is readily available and captures the net value of oil extraction. Oil rents per GDP, however, could also be thought of as a measure of dependence rather than of abundance. More problematically, results could also be determined by the sensitivity of the denominator (GDP) to other factors that are unmeasured in the model but related to the outcome.[19] Another measure often used in empirical research are *fuel exports as a share of exports*, with the data being drawn from the WDI. Again, while this variable is readily available, it may be biased due to domestic consumption, which reflects, in turn, the level of industrial development. Finally, five further variables are variants of our original oil measure; these variables are all derived from the dataset of Ross and Mahdavi (2015). Since differences in per capita oil production might generate more noise rather than clarity, we first create a simple *dummy variable* that is equal to unity when there is any oil production for a given country-year observation. The second variable measures *total oil production in 2000 prices* but does not account for population size to consider whether population growth is influential. The third variable is *total oil production in barrels*; i.e., this variable neither considers population growth nor price effects to help us check whether such effects may influence our estimates. Furthermore, we use total oil production per capita but do not logarithmize this variable. Lastly, instead of log-transforming the total oil production per capita variable, we apply the inverse hyperbolic sine transformation; this transformation approximates the log transformation, while being defined for zero-valued observations (e.g., Burbidge et al., 1988).[20] These latter two oil measure variants are used to check whether log-transforming our original oil variable provides misleading results.

As reported in Table 5, using these variables in our baseline IV-regression framework, we find that oil – regardless of how it is operationalized – leads to weaker private property rights protection. This suggests that our previously reported main findings (Table 2) are not due to the choice of a specific oil variable.

3.3.5. Alternative measures of economic institutions

Finally, we assess whether our results hold when we employ alternative measures of the quality of economic institutions as dependent variables.

For one, we use six such measures from the VDEM Dataset. As shown in the Appendix (Supplementary Table 6), they strongly and positively correlate with each other and with our main dependent variable, suggesting that they indeed capture (related) aspects of the quality of economic institutions. Concerning these six measures, we, first, consider the effect of oil on *property rights for men* and *property rights for women*. Similar to our main dependent variable, these variables indicate how large the share of men/women is that enjoy the right to private property, with the state potentially limiting those rights. Given the influence of religious and cultural factors on women empowerment (e.g., in oil-rich MENA countries), it ought to be interesting to consider differential effects of oil on property rights along gender lines. Second, we use a variable measuring *private ownership of the economy*. It gauges the degree to which the state owns and controls capital in the industrial, agricultural and service sectors. We expect high levels of state ownership to coincide with low levels of private ownership and weak private property rights. Finally, the flip-side of sound property rights is a *sound legal-judicial system* that allows for contract and property rights enforcement. Consequently, we also employ three indicators measuring the quality of the legal system. These indicators measure the *transparency and predictable enforcement of laws* (i.e., the consistency and arbitrariness of the creation and enforcement of laws), *access to justice* (i.e., access to a fair trial without risk to personal safety) and the overall *rule of law* (a composite index that accounts for access to justice and transparency and enforcement of the law, but also for judicial accountability and judicial corruption).

For another, we draw two additional measures of property rights protection from non-VDEM sources. First, we use data from the *International Country Risk Guide* (*ICRG*).[21] This dataset offers (1) a variable measuring risk assessment associated with contract viability, expropriation and other dangers to investment security and (2) a variable indicating the strength and impartiality of the legal system as well as the prevalence of crime. By means of principal component analysis, we construct a measure of property rights protection using these two variables and subsequently regress this property rights measure on oil and the controls.[22] Second, as another alternative dependent variable, we use the variable "Protection of Property Rights", which indicates how well property rights are protected and defined by the law, from the *Fraser Institute Economic Freedom Dataset*.[23] Note that the coverage of both alternative datasets is considerably smaller than the VDEM Dataset. With the International Country Risk Guide data, we have available annual data for the 1984–2014 period for 123 countries. With the Fraser

[18] This approach excludes twenty-three countries from our sample including, e.g., Algeria, Angola, Iran, Iraq, Kuwait, Norway, Saudi Arabia, the United Arab Emirates and Venezuela.

[19] In contrast, our main explanatory variable (oil production per capita) is less likely to suffer from the denominator problem because other unmeasured factors do not affect population as much as they might affect GDP (see also Ross, 2012).

[20] For a variable y, this transformation is equal to $\log\left(y + (y^2+1)^{\frac{1}{2}}\right)$.

[21] See https://www.prsgroup.com/explore-our-products/icrg/.

[22] The two ICRG variables rather strongly correlate with each other ($r = 0.48$, $p < 0.01$), making a principal component analysis feasible. Combining them into one index by means of a principal component analysis facilitates interpretation by allowing us to disregard those aspects of both ICRG variables that share little association with our idea of the institution of property rights (such as the occurrence of crimes against the person). As a robustness check, we consider the effect of oil on the two original ICRG variables as alternative dependent variables. We find that oil also has a negative and statistically significant effect on these variables.

[23] The data are available at https://www.fraserinstitute.org/studies/economic-freedom. The variable "Protection of Property Rights" is a sub-component from the "Legal System and Property Rights" area of the Fraser dataset.

Table 5
Alternative measures of oil.

Oil Variable →	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Oil Rents (% of GDP)	Fuel Exports (% of Exports)	Oil Production Dummy Variable	Total Value of Oil Production	Total Oil Production	Total Oil Production Per Capita (No Logs)	Total Oil Production Per Capita (IHS)
Oil Variable $_{t-1}$	−0.006	−0.005	−0.628	−0.019	−0.025	−9.128	−0.017
	(0.002)**	(0.002)***	(0.106)***	(0.002)***	(0.003)***	(3.227)***	(0.002)***
Infant Mortality $_{t-1}$	−0.038	−0.034	−0.026	−0.029	−0.032	−0.041	−0.031
	(0.009)***	(0.010)***	(0.013)**	(0.010)***	(0.010)***	(0.008)***	(0.010)***
Population Size $_{t-1}$	−0.016	−0.007	0.007	−0.024	−0.028	−0.097	−0.035
	(0.013)	(0.019)	(0.017)	(0.008)***	(0.007)***	(0.012)***	(0.007)***
Democracy $_{t-1}$	0.155	0.161	0.207	0.196	0.194	0.199	0.198
	(0.016)***	(0.007)***	(0.009)***	(0.007)***	(0.007)***	(0.008)***	(0.007)***
Leftist Government $_{t-1}$	−0.070	−0.024	−0.118	−0.124	−0.122	−0.122	−0.124
	(0.019)***	(0.017)	(0.017)***	(0.014)***	(0.013)***	(0.014)***	(0.014)***
Civil War $_{t-1}$	−0.030	−0.027	−0.020	−0.019	−0.021	−0.011	−0.019
	(0.008)***	(0.006)***	(0.009)**	(0.006)***	(0.006)***	(0.006)*	(0.007)***
First-Stage F-Statistic	9.34	10.13	11.46	25.52	22.65	10.13	23.46
AR Wald Test (Pr.>χ^2)	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***
Number of Observations	5169	4622	6366	6366	6366	6363	6363

Notes: Dependent variable is always the VDEM property rights index. Instrumental-variable fixed-effects estimates reported. IHS=Inverse hyperbolic sine transformation. Country-fixed effects and year-fixed effects always included. Driscoll-Kraay standard errors in parentheses. *p < 0.1, **p < 0.05, ***p < 0.01.

Institute data, we have data for 145 countries between 1970 and 2014, where this data is only available at 5-year intervals. When using these two datasets, for comparison we therefore also report regression results utilizing our usual VDEM property rights measure for a correspondingly reduced sample.

In Table 6, we report our findings when employing the alternative dependent variables. We find that oil causes weaker property rights for men and women (with little difference between both measures), a lower extent of private ownership of the economy and a lower quality of the legal-judicial system (regardless of how this quality is indicated). Furthermore, we also find that oil is detrimental to property rights when we use variables drawn from other datasets. In sum, this suggests that our main results are not due to the choice of a specific dependent variable.

3.4. Exploration of transmission channels

We have provided robust evidence that more oil means weaker property rights. We argue that this is consistent with a social conflict view of institutions, where potent groups (in our case, oil interest groups) use their economic power to exert outsized political influence to choose the economic institutions that safeguard their own economic and political position (Acemoglu et al., 2005). Above, we argued that oil income may enable oil interest groups to push for weaker property rights by means of "carrots and sticks", i.e., by (1) buying political influence by means of patronage and corruption as well as (2) repressing the voice of other political groups opposing the goals of the oil interest groups. In this sub-section, we explore whether we find support for these mechanisms in the data.

To indicate the buying of political influence, we use three variables from the VDEM Dataset that indicate the extent of *regime corruption* (indicating the amount of corruption due to executive embezzlement as well as executive, judicial and legislative bribes), *political clientelism* (measuring the extent to which political parties employ clientelist politics, e.g., by rewarding voters with goods, jobs or cash) and the equality of the *distribution of basic public goods* such as health and education.

To indicate the repression and punishment of opposite political voices, we extract three additional VDEM variables that measure the extent of *media harassment* (indicating threats of libel, imprisonment or violence by powerful non-governmental actors against legitimate journalistic activities), *human rights violations* (measuring the use of political killings and torture by government agents) and the *exclusion of political groups* from public services and government employment.

We regress these six potential transmission variables on oil and the baseline controls, employing our usual IV-approach. As shown in Table 7, we find evidence that oil results in higher levels of political corruption and clientelism and a more unequal distribution of public goods as well as increased media harassment, weaker human rights and more political exclusion. That is, our results indeed tentatively suggests that income from oil is used to provide "carrots", i.e., systems of patronage and corruption oil interest groups use to buy political influence and favors, as well as "sticks", i.e., the repression of alternative political voices. For example, oil interest groups may use their economic power to finance media repression to strengthen their position in public policy discourse, e.g., by means of privately organized legal action against the press. In line with our main argument, these "carrots" and "sticks" can be considered means by which oil interest groups convert their economic into political power to shape economic institutions in their favor. Finally, however, we must emphasize that the results of Table 7 are not only consistent with our main argument. For instance, they are also consistent with theory and evidence on the role of oil in authoritarianism and non-democratic rule (e.g., Mahdavy, 1970; Beblawi, 1987; Ross, 2015; Wright et al., 2015). Hence, additional research is clearly necessary to identify the mechanisms underlying the oil-property rights relationship more clearly.

4. Conclusions

We analyze the relationship between oil and weak economic institutions for a sample of 150 countries between 1960 and 2014. We find that higher levels of the per capita value of oil production cause weaker private property rights. Inter alia, this main result is robust to different instrumental-variable approaches as well as different operationalizations of oil income and production as well as economic institutions.

Our main finding is consistent with the social conflict view of institutional choices of Acemoglu et al. (2005), where powerful interest groups push for those economic institutions that safeguard their own political position and maximize their own economic rents but not necessarily aggregate wealth. For our analysis, we argue that oil income gives disproportionate economic power to oil interest groups. These groups use this economic power to influence institutional choices. They are interested in (relatively) weak property rights as weaker rights,

Table 6
Alternative measures of economic institutions.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent Variable →	Property Rights (Men)	Property Rights (Women)	Private Ownership of Economy	Transparent Laws with Predictable Enforcement	Access to Justice	Rule of Law	ICRG: Property Rights	VDEM: Property Rights (ICRG Sample)	Fraser Institute: Property Rights	VDEM: Property Rights (Fraser Sample)
Oil $_{t-1}$	−0.129 (0.029)***	−0.168 (0.025)***	−0.230 (0.077)***	−0.199 (0.059)***	−0.042 (0.009)***	−0.058 (0.015)***	−1.725 (0.734)**	−0.096 (0.046)**	−0.354 (0.124)***	−0.021 (0.010)**
Infant Mortality $_{t-1}$	−0.250 (0.040)***	−0.100 (0.053)*	−0.115 (0.043)***	−0.047 (0.036)	0.003 (0.006)	0.052 (0.005)***	−0.421 (0.201)**	−0.046 (0.014)***	−0.057 (0.094)	−0.011 (0.015)
Population Size $_{t-1}$	−0.561 (0.044)***	−0.352 (0.040)***	−0.686 (0.099)***	−0.124 (0.072)*	−0.090 (0.007)***	−0.052 (0.011)***	0.697 (0.218)***	−0.015 (0.012)	−0.420 (0.199)**	−0.057 (0.012)***
Democracy $_{t-1}$	0.888 (0.046)***	0.807 (0.032)***	0.898 (0.054)***	1.683 (0.071)***	0.374 (0.010)***	0.316 (0.010)***	−0.018 (0.168)	0.178 (0.029)***	0.943 (0.126)***	0.240 (0.015)***
Leftist Government $_{t-1}$	−0.839 (0.062)***	−0.513 (0.062)***	−1.194 (0.099)***	0.243 (0.052)***	0.014 (0.012)	0.073 (0.012)***	−0.152 (0.114)	−0.073 (0.022)***	0.431 (0.092)***	−0.080 (0.022)***
Civil War $_{t-1}$	−0.088 (0.020)***	−0.071 (0.023)***	0.041 (0.036)	−0.113 (0.023)***	−0.042 (0.006)***	−0.023 (0.005)***	−0.149 (0.137)	−0.012 (0.011)	−0.324 (0.061)***	−0.018 (0.012)
First-Stage F-Statistic	60.13	60.13	60.13	60.13	60.13	60.13	19.27	19.27	6.09	6.09
AR Wald Test (Pr.>χ^2)	(0.00)***	(0.00)***	(0.02)**	(0.01)**	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***
Number of Observations	6512	6512	6512	6512	6512	6512	3487	3487	969	969

Notes: Instrumental-variable fixed-effects estimates reported. Country-fixed effects and year-fixed effects always included. ICRG=International Country Risk Guide. Models (9) and (10) use data averaged over 5-year intervals. Driscoll-Kraay standard errors in parentheses. *p < 0.1, **p < 0.05, ***p < 0.01.

Table 7
Potential transmission channels.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable →	Corruption	Clientelist Party Linkages	Public Goods Distribution	Media Harassment	Human Rights	Political Exclusion
Oil $_{t-1}$	0.048	0.123	−0.027	0.109	−0.046	0.024
	(0.013)***	(0.024)***	(0.011)**	(0.045)**	(0.008)***	(0.009)**
Infant Mortality $_{t-1}$	−0.095	0.009	0.006	0.114	−0.025	−0.012
	(0.007)***	(0.035)	(0.007)	(0.049)**	(0.014)*	(0.006)**
Population Size $_{t-1}$	−0.016	0.361	0.057	0.415	−0.070	0.071
	(0.011)	(0.055)***	(0.009)***	(0.087)***	(0.006)***	(0.012)***
Democracy $_{t-1}$	−0.110	−0.589	0.069	−2.130	0.484	−0.322
	(0.014)***	(0.052)***	(0.007)***	(0.061)***	(0.011)***	(0.010)***
Leftist Government $_{t-1}$	−0.176	−0.301	0.089	0.054	0.081	0.014
	(0.014)***	(0.071)***	(0.009)***	(0.060)	(0.015)***	(0.016)
Civil War $_{t-1}$	0.031	−0.068	−0.019	0.020	−0.081	0.020
	(0.006)***	(0.057)	(0.004)***	(0.044)	(0.006)***	(0.006)***
First-Stage F-Statistic	55.57	55.57	55.57	55.57	55.57	55.30
AR Wald Test (Pr.>χ^2)	(0.00)***	(0.00)***	(0.01)**	(0.06)*	(0.00)***	(0.01)**
Number of Observations	6363	6363	6363	6363	6363	5942

Notes: Instrumental-variable fixed-effects estimates reported. Country-fixed effects and year-fixed effects always included. Driscoll-Kraay standard errors in parentheses. *p < 0.1, **p < 0.05, ***p < 0.01.

ultimately, curtail innovation as well as economic and political competition. Given the economic and technological maturity and market structure of the oil sector, this opposition to innovation and economic competition is rational from the oil interest groups' perspective as it will maximize their present and future access to rents. Moreover, lower property rights impede economic diversification and thus the emergence of political competition, also making it likelier that oil interest groups retain their outsized political power. At the same time, oil income permits the purchase of private property rights protection, allowing oil interest groups the luxury of advocating for the restriction of economic rights without endangering their own economic-political prospects.

We also provide some evidence that oil translates into increased political clientelism, corruption, exclusionary policies and the repression of dissenting media and political voices. Potentially, these are pathways through which the outsized economic power of oil interest groups materializes in the political realm.

Incidentally, our analysis sheds some light on deeper institutional factors behind many of the observed negative effects of resource abundance (which are often explained as a Dutch disease effects). For instance, the unfavorable relationship between oil and economic growth may also be – partly – rooted in comparatively weak property rights resulting from oil abundance. At the same time, there are several avenues for future research to further examine the oil-property rights relationship. For instance, it may be interesting to study the eventual consequences of weak property rights and whether these consequences conform to the wishes of oil interest groups, e.g., concerning reduced economic and political competition, innovation as well as increased private investment into property rights enforcement. Similarly, one could study whether ownership structures in the oil sector matter, differentiating between the property rights effects of an oil sector dominated by private local elites, government enterprises or international private oil companies. For instance, various economic actors may differ in their motives for pushing for weak property rights, with some actors (e.g., state-aligned oil interest groups) aiming for retaining their political position rather than economic rents. As another avenue of future research, heterogeneous effects in the oil-property rights nexus could be examined. For instance, sound democratic institutions may matter, limiting the means of oil interest groups to shape economic policy (e.g., through oversight and transparency measures), implying that the eventual effect of oil on property rights could depend on a country's political foundations (see also Robinson et al., 2006). At the same time, in non-democratic settings political rulers may have stronger incentives to create "concentrated interests" with the oil sector, e.g., as income from oil allows non-democratic rulers to forego economic growth which could otherwise cause alternative sources of market-based political power to emerge.

Given the economic and political advantages of self-interested oil interest groups that favor weak property rights, there are no easy solutions to overcome the variant of the institutional resource curse examined in this study. Indeed, if the remedy to this curse is the diversification of oil-rich economies, where diversification requires expanding economic rights and encouraging innovation and entrepreneurship, our results are rather bad news. However, while internal institutional progress may be blocked by powerful interest groups, international shocks (e.g., scientific and technological advances, a pandemic etc.) may also modify the balance of economic and political power in ways that weaken oil interest groups. For example, global climate change – especially given the adverse role oil plays in it – may constitute such a shock in the coming decades.

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Declaration of competing interest

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Data availability

Data will be made available on request.

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Appendix A. Supplementary data

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