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Abstract

What effect does the threat of expropriation have on resource extraction? Much of the economic literature suggests that uncertainty reduces investment, but the theory of risk-induced extraction suggests the opposite. In this paper, we test this theory in the context of political violence, which poses a real threat of state destabilization and violent expropriation of property rights. Facing this uncertainty, we find that oil producers in the Middle East and North Africa increase oil production in response to political violence. This finding has important negative consequences for the world in terms of climate change and demonstrates a previously untested mechanism through which exhaustible resource supply is flooding the market.

Keywords: Oil production, Political violence, Hotelling rule, Exhaustible resources, Climate change, Risk-induced extraction

"It is a very uncomfortable situation to produce oil with guns and we don't like it."

– Ian McCredie, head of Global Security Services at Shell International.[2]

1. Introduction

How does the market react to the violent threat of expropriation? A growing literature suggests that investment and economic activity slow in the face of rising uncertainty, but this finding may not apply to exhaustible resources such as oil. Faced with the threat to "use it or lose it," oil producers may drill even faster. This paper tests a hypothesis of risk-induced extraction due to "violent Hotelling pressures" and finds evidence to support it. Political violence—and especially that directly targeting the institutions of the state—tends to lead to increased oil production among a population of national oil monopolies in the Middle East and North Africa. When their oil is at risk, resource owners do not wait for the threat to pass. They act: They extract.

The economic logic of risk-induced extraction rests on well-worn foundations. Hotelling (1931) first articulated a decision rule by which owners of exhaustible fossil fuel resources would maximize the net present value (NPV) of all cash flows over the life of their asset. Owners extract reserve resources in order of accessibility, removing the easiest and cheapest first, and they smooth extraction as a function of prevailing discount rates to take full advantage of available returns to capital. Long (1975) extends Hotelling's prediction of owners' behavior into contexts where owners suffer increasing chances of losing their property in future periods, arguing that they will rationally increase short-term output to hedge against uncertain future cash flows.

Sinn (2008) extends the study of risk-induced responses of fixed-resource owners to examine accelerated extraction due to policy threats. Sinn anticipates a "Green Paradox" arising when policymakers signal future carbon taxes, such that interventions planned to reduce

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[2] Quoted in Burns and Catan (2005)

emissions counterintuitively spur additional production of subsoil carbon (Sinn, 2012). In addition to calling attention to a novel driver of production, the Green Paradox literature calls on energy economists to incorporate rates of both carbon extraction and sequestration into global utility models and better attend to feedbacks in the Earth system that magnify long-term impacts of near-term emissions (van der Ploeg, 2013).[3]

While the Green Paradox literature has seen empirical support from longitudinal studies of extractive investments by U.S. oil majors (e.g., Merrill, 2018), the field has restricted its attention to risk-induced extraction based on policy. This has left a gap in the field of energy economics concerning risk-induced extraction based on political violence. We begin to engage this gap in a time of widespread violence in an increasingly unstable Middle East, where civil wars in Syria, Libya, Yemen and Sudan, civil unrest and violence in Egypt, the rise of ISIS, and the fracturing of Iraq have cast a pall of uncertainty over regional resource owners. In sync with rising academic attention to the likelihood that climate stress increases political violence and destabilizes states (Hsiang et al., 2011, 2013; Burke et al., 2015; Kelley et al., 2015; Schleussner et al., 2016; Cattaneo and Peri, 2016), we extend the study of risk-induced accelerations in fossil fuel production to the case of political violence, closing the feedback loop and casting new light on a critical but as of yet under-explored vector of climate forcing.

We advance the violent Hotelling pressure hypothesis that national oil monopolies respond to increasing political violence by increasing production, extracting oil sooner rather than later to leave fewer reserves to rising risks to future expropriation. We test this hypothesis by combining panel data of monthly oil production for a population of national oil monopolies in the Middle East and North Africa with data on the locations, targets, and consequences of every reported instance of political violence from 1996 to 2014. We select national oil monopolies on purpose, as they have significantly less latitude than transnational firms to exit a deteriorating context by liquidating local holdings and moving operations overseas.

We find increasing political violence exhibits a positive and significant effect on petroleum production of national oil monopolies. We use lagged treatment variables to reveal that this effect is persistent over time, from 6 months to 15 months after the violence occurs. Robustness tests show these results are unlikely to be driven by reverse causality, endogeneity concerns, contagion effects, or military exigency. We confirm the violent Hotelling pressures hypothesis by showing that these effects are driven particularly by attacks against the police and the government, exactly those institutions that uphold secure property rights and mitigate risks of expropriation.

The remainder of the paper is organized as follows. Section II briefly reviews the theory of risk-induced extraction and how it may be applied to political violence through a hypothesis of violent Hotelling pressures. Section III describes our cross-national dataset of oil production and political violence and proposes a methodology to test the theory. Section IV documents our findings, with multiple robustness tests to verify our results. Section V concludes with policy implications and avenues for future research.

2. The theory

2.1. Climate change and the rate of extraction

Climate change is among the most profound challenges of our time. While exacerbating heatwaves, sandstorms, hurricanes, drought, and floods across the globe, climate change threatens to "auto-accelerate" as the saturation of oceanic heat sinks coincides with accelerating feedback loops in the planet's climate system (Intergovernmental Panel on Climate Change, 2014).[4] Runaway climate change threatens wealth and welfare destruction on a global scale within the lifetimes of our college students, who clamor for action to mitigate global greenhouse gas (GHG) emissions (Saad and Jones, 2016; Bendell, 2018). The majority of these emissions arise from fossil fuels that, once taken from the ground, are inevitably sold to market. When their hydrocarbons are broken down to release energy through combustion, their carbon content escapes into the atmosphere. Given the magnitude of the unaddressed problem of global warming (Sanderson and Knutti, 2017), economists must increase attention to dynamics impacting the speed with which owners dig fossil fuels from the earth.

One of the most important metrics by which policy scholars assess the problem of GHG emissions is the rate of extraction of fossil fuels. Once taken from the ground, fossil fuels are sold to the market, and their carbon content escapes into the atmosphere during the release of energy from hydrocarbons during combustion. Thus, economists and sociologists closely attend to those economic and social dynamics that impact the speed with which owners of fossil fuels dig them from the earth.

2.2. The theory of risk-induced extraction

Consider an oil well with a unit price of p_0 upon discovery. Its owner must decide how many units to extract now and how many to leave in the ground to extract at a later time t. If the oil is extracted now, the owner can invest the proceeds at the discount rate r, yielding a continuously compounded value of p_0e^{rt}. In equilibrium, the owner must be indifferent between extracting the marginal unit and waiting for it to appreciate, leading to the famous rule that Hotelling (1931) established in his classic article on "exhaustible resources,"

$$p_t = p_0e^{rt}. \tag{1}$$

Equivalently, one could say that the oil must appreciate at the discount rate,

$$r = \frac{dp}{dt}\frac{1}{p}, \tag{2}$$

or else the owner would have an incentive to shift capital into the more profitable investment.[5]

In a competitive market, the resource owners take this price as given. They can only choose the quantity they extract at a given time,

$$q = f(p, t), \tag{3}$$

in order to maximize the net present value (NPV) of their remaining resource stock, S, until the time T when it is completely depleted,

$$S = \int_t^T q\, dt. \tag{4}$$

Equivalently, we can say that q represents the extraction of S,

$$q = -\frac{dS}{dt}. \tag{5}$$

The higher this rate of extraction, the more difficult it becomes to mitigate climate change. Assuming the typical demand functional

[3] A few pertinent examples include albedo loss from sea ice melt, carbon emissions from boreal forest dieback, and methane releases from warming tundra.

[4] Consider "albedo" (reflectivity) loss from vegetative change in warming boreal forests, methane emissions of melting permafrost, and albedo loss from ice melt (III et al., 2005; Shuman et al., 2011).

[5] The Hotelling rule has a long history of providing valuable insights in the energy economics literature (Dasgupta and Heal, 1974; Kalkuhl and Brecha, 2013). It has not been universally accepted, however; Reynolds and Baek (2012), for example, argue that the discount rate does not affect prices directly because market participants do not have full knowledge of supply and demand in the real world where all reserves are not discovered. They do not predict the effect on production, though, where more recent empirical work suggests that the many firms' behavior is consistent with the rule (Güntner, 2019).

form where $f_p < 0$ and $f_{pp} > 0$, it becomes clear that lower prices accelerate extraction by inducing higher demand—and so, increase the environmental damage.

What happens as property rights become insecure? Imagine, for example, that some exogenous force increasingly threatens the ruling regime. The owner could lose their resource in the future. Sinn (2008) models this regime's ownership of the oil with a survival function, $e^{-\pi t}$, where π is the constant probability of expropriation at any given moment. This threat is an increasing function of the severity of political violence, and it reduces the expected value of the oil asset. If it is extracted now, it can still be invested at r, but if it stays in the ground, its expected return is $r - \pi$. As a result, the owner is only indifferent between extracting and waiting if the asset appreciates at $r + \pi$ to compensate for the added risk,

$$p_t = p_0 e^{(r+\pi)t}. \tag{6}$$

Since higher future prices lead to lower extraction, we know that q will decline faster along this steeper price appreciation path as demand declines more quickly. Yet, S does not change: This is the crucial distinction with exhaustible resources. As Hotelling famously said, "the indefinite maintenance of a steady rate of production is a physical impossibility." Given a relatively fixed S, if less is extracted later, more must be extracted earlier. This prediction motivates our first two hypotheses, which collectively seek to assess the impacts of increasingly severe political violence on extraction:

- **H1.a** - National oil companies will increase production in response to rising *frequency* of political violence.
- **H1.b** - National oil companies will increase production in response to rising *lethality* of political violence.

A growing body of evidence has revealed that increasing insecurity of property rights—from wars, international crises, rare disasters, and other political risks—does indeed have a direct effect on oil prices, but the effect on oil *production* remains an unanswered question for this study to address (Kollias et al., 2013; Chen et al., 2016; Omar et al., 2017; Demirer et al., 2018). Furthermore, previous studies have focused most of their attention at the macro-level of analysis, where global oil prices are set, while our data will allow us to drill down to the micro-level where firm decisions about production are made.

In considering patterns by which these firms confront change in their political environment, it is important to underscore the relatively fixed nature of energy holdings. While national oil monopolies may increase (decrease) the recoverable portion of their stock through technology investment (disinvestment), these firms regularly rely on immobile and illiquid assets to generate profits compared to other industries. These assets include not only their subsoil deposits, but also their specific investments in local political connections, heavy equipment, transportation networks, and refining facilities. Thus, national oil companies should prove particularly vulnerable to violent Hotelling pressures as compared to more mobile organizations with lower fixed capital costs.

As a result, where political conditions subject market actors to an erosion of property rights or higher expropriation risks, deteriorating security is particularly likely to encourage national oil companies to discount the value of their reserve holdings. Where political violence raises the danger of a new authority or cripples the incumbent authority's ability to ensure private property rights, national oil companies should prove particularly apt to foreshorten extraction paths to maximize NPV under a higher risk-adjusted discount rate. To test the implications of this theory, we anticipate that accelerated extraction responses will be associated with violence targeting state institutions specifically tasked with ensuring property rights, such as government and police:

- **H2.a** - National oil companies will increase production in response to rising *frequency* of political violence that targets the police.
- **H2.b** - National oil companies will increase production in response to rising *lethality* of political violence that targets the police.
- **H3.a** - National oil companies will increase production in response to rising *frequency* of political violence that targets the government.
- **H3.b** - National oil companies will increase production in response to rising *lethality* of political violence that targets the government.

This theory of risk-induced extraction runs counter to recent work examining firm incentives to reduce investment in the face of uncertainty. When investments are difficult to reverse, it often makes financial sense for firms to adopt a "wait-and-see" strategy in lieu of potentially imprudent gambles on future conditions. Higher uncertainty increases the option value of future investment to a degree that may exceed the value of a current outlay, particularly when the expected value of future information exceeds the cost of deferring (Bernanke, 1983; Bloom, 2009).

Firms may also rationally postpone investment if they are financially constrained. Constraint may prevent them from borrowing at affordable rates to survive bad states of the world. Under rising uncertainty, credit markets discount firms' collateral and increase credit spreads to hedge against the increased risk of default. As a result, firms may elect to pass on new investments until uncertainty recedes (Christiano et al., 2014).

To our knowledge, none of these theories have been tested in the context of exhaustible resources such as oil. However, evidence suggests that political violence represents an important source of uncertainty in fossil fuel markets. Violence impedes the free flow of business by breaking supply chains, disrupting key operations, scaring off customers, and raising capital costs (Czinkota et al., 2010). Political violence decreases firms' survival rates and pushes them to prioritize short-term operational planning over more comprehensive strategic efforts (Hiatt and Sine, 2014). More generally, violence undermines the system of property rights and the rule of law that support the transition from elite-dominated natural states to more efficient market economies (North, 1990).

Oil companies take the risk of state destabilization seriously, crediting political violence for having "led to a booming industry in private security companies," as well as forcing companies to shut down operations and evacuate staff when violence becomes too severe (Burns and Catan, 2005). Lambrechts and Blomquist (2016) provide further evidence that oil companies have been taking "political-security risk" more seriously in recent years, dedicating an increasing proportion of firm resources to risk mitigation and physical security.

In contrast to models of strategic risk management, and in line with our analysis of violent Hotelling pressures, we anticipate that rising levels of political violence in the environment will drive national oil companies to accelerate the extraction of fossil fuels. Furthermore, we expect firm responses will be strongest when violence is both more frequent and more severe, and when that violence targets public institutions tasked with the enforcement of property rights.

3. Data and methods

3.1. Production, violence, and the monopolies of the Middle East and North Africa

Our hypotheses of violent Hotelling pressures suggest we should see oil monopoly countries increasing production after events of more severe political violence, proportional to the frequency and lethality of the events. In preparing empirical tests, we define political violence as politically-motivated violence by non-state actors (Martin, 2010; Richardson, 2006). Building on the classic approach of Davis and Weinstein (2002), Brakman et al. (2004), and Dell and Querubin (2018), we operationalize the frequency and lethality of political violence based respectively on the number of violent attacks during a

Table 1
World proven oil reserves: MENA vs. World.

Country	2012	2013	2014	2015	2015 (%)
Saudi Arabia*	265,850	265,789	266,578	266,455	17.85%
Iran*	157,300	157,800	157,530	158,400	10.61%
Iraq*	140,300	144,211	143,069	142,503	9.55%
Kuwait*	101,500	101,500	101,500	101,500	6.80%
UAE*	97,800	97,800	97,800	97,800	6.55%
Libya*	48,472	48,363	48,363	48,363	3.24%
Qatar*	25,244	25,244	25,244	25,244	1.69%
Algeria*	12,200	12,200	12,200	12,200	0.82%
Oman	5500	4974	5151	5306	0.36%
Egypt	4400	4400	4400	4400	0.29%
Syria	2500	2500	2500	2500	0.17%
Total Region	861,066	864,781	864,335	864,671	57.93%
Examples of leading U.S.-based firms for comparison:					
ExxonMobil	10,714	10,113	11,823	12,954	0.87%
Chevron	4353	6455	4285	4262	0.29%
ConocoPhillips	3358	3267	3330	2778	0.19%
Total World	1,478,753	1,489,352	1,490,465	1,492,677	100.00%

Notes: Proven oil reserves in million barrels listed for all countries in Middle East and North Africa (MENA) where monthly oil production data are available, as well as leading U.S.-based firms and total world proven reserves for comparison. Upper panel data retrieved from 2016 OPEC Annual Statistical Bulletin. Lower panel data retrieved from *Oil and Gas Journal*. Countries with an asterisk (*) are members of OPEC.

given period (*attacks*) and the number of deaths inflicted by those attacks on their targets (*kills*), testing our hypotheses by estimating the impact of violence on monopolies' oil *production* in the following period. We proceed to test our hypotheses with data on political violence and national oil monopoly production in the region of the Middle East and North Africa (MENA).

MENA provides a perfect context in which to conduct our analysis for several reasons. First, the MENA states hold more than 57% of global reserves. Further, oil production within the region is generally well reported by the Organization of Petroleum Exporting Countries (OPEC), among whom the largest deposits lie in Saudi Arabia and neighboring Iran, Iraq, Kuwait, and UAE, as well as Libya and Qatar. Table 1 reports an illustrative snapshot of reserve data for the region with useful comparisons to leader US energy majors.

Second, we focus on the MENA region because it suffers from high levels of political violence, providing an appropriate context in which political violence presents material likelihood of disrupting the property rights of national oil companies. By way of global comparison, Table 2 presents inter-regional data on political violence. It is worthwhile noting that the MENA region, while having a much smaller population and lower population density than other regions, records the highest severity of political attacks, though it varies from month to month.

Thirdly—and perhaps most importantly—we focus on the MENA states because they provide an opportunity to test our hypotheses in the absence of firm-level options to mitigate risks to property rights through expatriation, through exit. Production in the MENA states is monopolized by sovereign firms (Table 3) who control a localized monopoly over production and minimal investment arrangements overseas. Unlike multinational energy corporations that can more readily shift assets away from global "hot spots," the MENA monopolies should exhibit the highest sensitivities to risks of political destabilization due to their fundamental, vested interest in local resources. This fixed nature of our population of monopolies provides confidence our reduced form regression model is free of bias due to observed offshoring of production in the face of destabilizing local conditions.[6]

[6] It should be noted that not all national oil companies are the same. Rather, they exhibit significant diversity of founding histories (Marcel, 2006), organizational features (Radon and Logan, 2016), and inter-linkages with the broader national political structures (Stevens, 2008; Cheon, 2019) and international power dynamics (Sim and Fulton, 2019) in which they operate.

Table 2
Snapshot of Terrorism by Region.

Region	Total Events	Successful Attacks	Victim Deaths
Middle East & North Africa	20,712	18,931	54,246
South Asia	19,885	18,740	55,175
South America	17,867	16,638	28,020
Western Europe	14,930	12,977	6218
Central America & Caribbean	10,566	10,138	28,703
Sub-Saharan Africa	7047	6677	33,804
Southeast Asia	6455	6041	11,636
North America	2877	2426	4484
Russia & Newly Independent States	2176	1836	4408
Eastern Europe	1004	927	701
East Asia	700	588	592
Central Asia	236	221	381
Australasia & Oceania	234	206	158

Notes: Total terrorist events, successful attacks, and victim deaths listed for each region in the world from 1996 to 2014. Data retrieved from Global Terrorism Database, available at https://www.start.umed.edu/gtd.

Table 3
MENA National Oil Monopolies and Neighboring States.

Country	Oil Company	Neighboring Oil-Producing States
Algeria	Sonatrach Algeria	Libya, Tunisia, Mali*, Mauritania*, Morocco, Niger*
Egypt	Egyptian General Petroleum Corporation	Libya, Saudi Arabia, Turkey, Jordan
Iran	National Iranian Oil Company	Algeria, Bahrain, Iraq, Kuwait, Qatar, Oman, Saudi Arabia, Turkey, UAE, Afghanistan, Armenia*, Azerbaijan*, Pakistan*, Turkmenistan
Iraq	Iraq National Oil Company	Iran, Kuwait, Saudi Arabia, Syria, Turkey, Jordan
Kuwait	Kuwait Petroleum Corporation	Iran, Iraq, Saudi Arabia
Libya	Libya National Oil Company	Algeria, Egypt, Tunisia, Chad*, Greece*, Niger*
Qatar	Qatar General Petroleum Corporation	Bahrain, Iran, Saudi Arabia, UAE
Saudi Arabia	Saudi Arabian Oil Company	Bahrain, Egypt, Iran, Iraq, Kuwait, Qatar, Oman, Jordan, UAE, Eritrea*, Yemen
UAE	Dubai Petroleum Company & Abu Dhabi National Oil	Iran, Qatar, Oman, Saudi Arabia

Notes: For each country in our analysis, the oil monopoly and the neighboring oil-producing states are listed. Countries marked with an asterisk are not included in the count of neighboring terrorist attacks and kills employed in the primary analysis. An alternative specification including those nations is available on request. Findings for the two specifications are not dissimilar and do not alter the reported results. Bahrain, Oman, Syria, Tunisia, and Turkey not included in our sample due to missing production data from OPEC.

To summarize, we focus our analysis on a critical population of fossil fuel owners who operate on monopoly terms in a hotbed of both political violence and oil production. While we hesitate to argue we may thus establish robust inferential insights into the behavior of all fossil fuel owners in all settings, we are confident that key results should prove transferrable to other contexts marked by significant assets at risk, severe political violence and spatially-fixed, monopoly ownership.[7] Fig. 1 presents a map of the study region and highlights the firms at the center of our analysis.

[7] While we have seen some measured convergence in organizational patterns among international oil monopolies and national oil monopolies in recent years (Cheon, 2019), we find sustained recognition of distinctive characteristics of national oil companies relative to international oil companies in the academic and practitioner literature. Notably, Nakhle (2017) provides a valuable comparative account, with rich background references on the distinctive governance, contracting, and licensing behavior of the MENA national oil companies in particular, while Claes and Garavini (2020) provide valuable commentary on the evolution of the OPEC community relative to their international, private market counterparts.

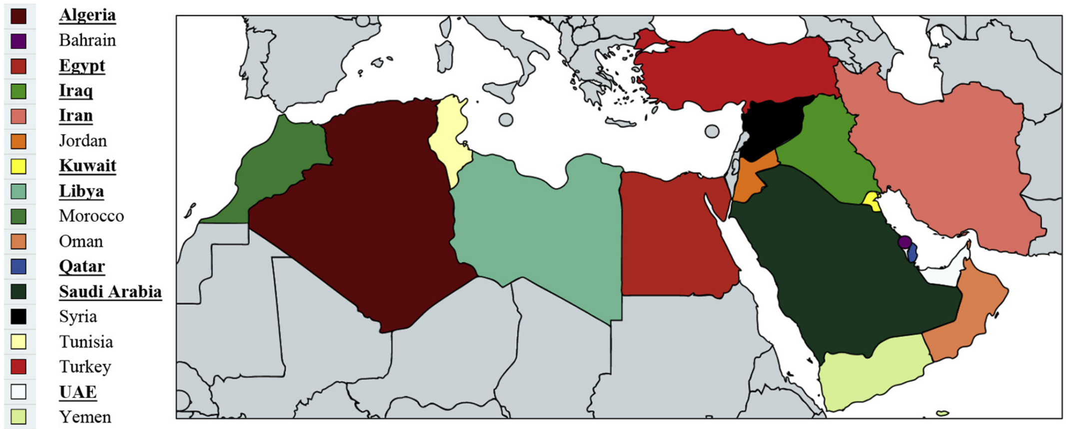


Fig. 1. Area of Focus: National Oil Monopolies of Middle East and North Africa.

3.2. Empirical model

Our hypothesis of violent Hotelling pressures suggests that we should see oil monopoly countries increasing production after events of political violence, proportional to the size of the threat. We test this hypothesis by estimating the impact of in-country political attacks and kills on monopolies' oil production in the following period. We estimate a log-linear model to capture the effect of rising frequency and lethality of political violence in country c at time $t-l$ on the quantity of oil produced at time t:

$$\ln q_{c,t} = \alpha + \beta_1 attacks_{c,t-l} + \beta_2 kills_{c,t-l} + \gamma_1 \ln p_{t-l} + \gamma_2 r_{t-l} + \gamma_4 i_{t-l} + \gamma_5 t + \gamma_6 t^2 + \chi_c + \varepsilon_{c,t}. \tag{7}$$

We include control variables for the natural log of the world price of oil $\ln p_{t-l}$, the S&P 500 index return r_{t-l}, the 3-month Treasury bill rate i_{t-l}, a linear time trend t, a quadratic time trend t^2, and country fixed effects χ_c.[8] Table 4 gives summary statistics for the key variables and controls. After describing our factors in greater detail below, we progress to examine several alternative specifications to test for robustness, excluding a variety of these variables and controlling for potentially confounding influences such as civil wars, major insurgencies, contagion effects, and military spending.

3.3. Outcome variable: Oil production

We employ production data from OPEC to construct our primary dependent variable. We transform reported production volumes to employ the natural log of annual oil production for our population of MENA national oil monopolies from 1996 to 2014. Our main specifications thus utilize a monthly dataset of oil production for these nine monopolies, giving 2376 firm-month observations.

3.4. Accounting for time to production

We estimate our model with a variety of lag structures. This is done to ensure the robustness of our results and account for the delays inherent in the translation of managerial decisions to increase oil production at the firm level and actual changes in realized production. According to the latest econometric literature, it takes at least six months for oil production to register the full effects of a supply shock (Kilian, 2009; Kilian and Murphy, 2012; Baumeister and Hamilton, 2019). Where exogenous shocks also impact inventory demand, production levels may take 12 to 15 months to stabilize.[9] To engage the ambiguity inherent in modeling firm-level responses to exogenous shocks when setting production levels, our primary specifications alternate between the use of 6- and 12-month lags. We also investigate 9- and 15-month lags and find comparable effects as those reported below.

3.5. Treatment variables: Events of political violence

We employ data from the Global Terrorism Database (GTD) developed and maintained by the University of Maryland College Park. This dataset meticulously reports individual events of political violence globally from 1970 to 2016 (LaFree and Dugan, 2007). The GTD employs three criteria in identifying political violence for inclusion of events in the database:

1. The action lies outside the context of legitimate warfare (LaFree et al., 2006);
2. The goal of the action is economic, political, religious, or social; and
3. The act was intended to “coerce, intimidate, or convey some other message to a larger audience (or audiences) than the immediate victims.”

In using the GTD, we employ the term “political violence” in lieu of “terrorism,” recognizing the former generally includes the latter. When we apply more precise definitions of terrorism, such as that of Keohane (2002), to the GTD, many of the events in which we are most interested fail to pass the bar of inclusion.[10] This definition includes both domestic actors targeting their own country's institutions, such as the Shura Council of Benghazi Revolutionaries operating in Libya, as well as international groups operating across borders, such as al-Qaeda. It excludes violence inflicted by state actors, as the perpetrators would belong to the same government that oversees the national oil monopoly, introducing endogeneity between cause and effect. A wider inclusion of violent attacks against state targets—labeled as non-terrorist insurgencies and so excluded from the GTD—would in all likelihood increase the strength of any estimated responses to political destabilization theorized to constitute violent Hotelling pressures. Our approach is therefore intentionally conservative.

As Fig. 2 shows, observed severities of political violence have been increasing over time, but fluctuate significantly from year to year. Whereas there were fewer than 1000 attacks and 5000 kills annually

[8] We choose the log-linear model because it is a natural form to estimate the impact of a discrete variable on a continuous variable. The conclusions do not change if we use log-log or linear-linear, but log-linear is the most intuitive way to estimate and report the results for these types of variables. We further discuss alternative modeling approaches in Appendix B.

[9] We extend the lag structure to 15 months in Appendix A, and the results hold.

[10] Keohane (2002) defines terrorism as “deliberately targeted surprise attacks on arbitrarily chosen civilians” in ways designed to instill fear.

Table 4
Descriptive Statistics for Monthly Data, 1996–2014.

Variable	Mean (St. Dev.)	Min / Max	Mean (St. Dev.)	Min / Max
	MENA Group		Kuwait	
Production (Mbl)	2684.145 (2430.282)	53 / 10,700	2343.106 (305.739)	1785 / 2970
Total Attacks	11.246 (43.793)	0 / 503	0.053 (0.225)	0 / 1
Attacks v Gov't	0.998 (4.118)	0 / 58	0.004 (0.062)	0 / 1
Attacks v Police	1.942 (8.338)	0 / 122	0.004 (0.062)	0 / 1
Total Kills	35.68 (155.632)	0 / 3559	0.144 (1.747)	0 / 28
Kills v Gov't	1.722 (8.512)	0 / 165	0.000 (0.000)	0 / 0
Kills v Police	5.143 (28.589)	0 / 922	0.004 (0.062)	0 / 1
	Algeria		Libya	
Production (Mbl)	1438.027 (183.133)	1145 / 1735	1275.117 (462.723)	100 / 1790
Total Attacks	3.053 (93.314)	0 / 943	0.250 (1.319)	0 / 12
Attacks v Gov't	8.527 (8.009)	0 / 63	0.061 (0.354)	0 / 3
Attacks v Police	0.428 (0.805)	0 / 5	0.030 (0.229)	0 / 2
Total Kills	1.417 (1.836)	0 / 12	0.170 (1.052)	0 / 12
Kills v Gov't	1.061 (4.864)	0 / 67	0.030 (0.245)	0 / 3
Kills v Police	2.977 (6.205)	0 / 46	0.045 (0.528)	0 / 8
	Egypt		Qatar	
Production (Mbl)	661.044 (140.366)	491 / 930	955.530 (368.940)	416 / 1660
Total Attacks	7.080 (15.894)	0 / 107	0.019 (0.137)	0 / 1
Attacks v Gov't	0.303 (0.978)	0 / 8	0.004 (0.062)	0 / 1
Attacks v Police	2.318 (4.960)	0 / 37	0.000 (0.000)	0 / 0
Total Kills	9.871 (24.452)	0 / 244	0.011 (0.137)	0 / 2
Kills v Gov't	0.144 (0.642)	0 / 6	0.000 (0.000)	0 / 0
Kills v Police	2.742 (5.908)	0 / 39	0.000 (0.000)	0 / 0
	Iran		Saudi Arabia	
Production (Mbl)	3736.420 (316.282)	3018 / 4280	8916.011 (813.648)	7210 / 10,700
Total Attacks	0.640 (0.961)	0 / 4	1.144 (3.475)	0 / 28
Attacks v Gov't	0.098 (0.335)	0 / 2	0.038 (0.191)	0 / 1
Attacks v Police	0.125 (0.384)	0 / 3	0.049 (0.532)	0 / 8
Total Kills	1.807 (5.262)	0 / 40	2.163 (7.033)	0 / 47
Kills v Gov't	0.170 (1.424)	0 / 22	0.322 (0.990)	0 / 7
Kills v Police	0.485 (2.180)	0 / 20	0.636 (3.280)	0 / 36
	Iraq		UAE	
Production (Mbl)	2314.337 (980.008)	53 / 4685	2517.712 (282.733)	250 / 3226
Total Attacks	83.477 (104.930)	0 / 503	0.027 (0.183)	0 / 2
Attacks v Gov't	8.045 (9.746)	0 / 58	0.000 (0.000)	0 / 0
Attacks v Police	13.258 (21.183)	0 / 122	0.004 (0.062)	0 / 1
Total Kills	267.909 (383.611)	0 / 3559	0.000 (0.000)	0 / 0
Kills v Gov't	14.045 (21.340)	0 / 165	0.004 (0.062)	0 / 1
Kills v Police	39.398 (77.174)	0 / 922	0.000 (0.000)	0 / 0

Notes: For each country in our analysis as well as the entire group, this table lists the mean, standard deviation, minimum, and maximum of monthly oil production (in million barrels), total terrorist attacks and kills, attacks and kills on government institutions, and attacks and kills on police. There are 264 observations for each individual state monopoly, for a total of 2376 month-firm observations overall.

in the MENA region in the 1990s, totals averaged closer to 2000 and 5000, respectively, by the late 2000s. The graph also shows attacks on government and police—the ultimate protectors of property rights—have remained a fraction of overall violence while following similar patterns over time.

3.6. Economic controls

To isolate the effect of political violence on oil production, we control for exogenous economic factors that might impact production. We include four types of controls: the world price of oil, equity and bond market returns, and time trends. Appendix B expands the controls with additional variables available at an annual frequency, including time-varying, country-level gross domestic product (GDP) growth. The results remain robust to the inclusion of these controls.

The treatment effect might also depend on the size of the economy, as measured by GDP, but this variable cannot serve as a control because it is not a plausibly exogenous economic factor. In these countries, oil production (the dependent variable) is almost certainly a large driver of annual GDP for each firm-year observation. In essence, our model is estimating the effect of political violence on a significant component *of* GDP, and therefore it is unwise to control for GDP, which includes this component. Instead, we estimate the correlation of GDP with attacks (0.046) and kills (0.043), both of which are very close to zero. This finding reassures us that political violence is not being driven by the size of the economy – and therefore, this relationship is not contaminating our estimated results.

3.6.1. World Price of oil

Although each company in our sample is large, none can control the price by themselves. As a result, the world price of oil is a plausibly exogenous factor that indicates the current equilibrium between the world's demand for oil and other companies' supply in the marketplace in which each firm is competing. This average, over the years and across nations, is readily available for download via Bloomberg. We employ the geographically appropriate Dubai price in the current estimations.

3.6.2. U.s. equity and bond markets

Oil extracted from the ground and sold generates cash flows that may be profitably reinvested within financial markets. To highlight the magnitude of MENA sovereign wealth funds funded by petroleum revenues, the IMF estimates that in 2008, the Abu Dhabi Investment Authority and the Saudi Arabia Monetary Authority respectively held between $250 billion and $875 billion in foreign assets, a sum comparable to the total holdings of all hedge funds ($1.5 trillion) and private equity funds ($700 billion) in the world (Drezner, 2008). To control for the opportunity cost of holding fossil fuels in the ground, we first control for the annual average returns to the U.S. Standard and Poor (S&P) 500 index. This measure seeks to capture perceived changes to the opportunity cost of foregoing investments in the blue-chip U.S. equities. Second, we control for more low-risk, high-liquidity bond markets with the coupon rate of U.S. 3-month treasury bills. Together these two measures serve as strong proxies for the changing market view of sovereign oil firms' overseas investment opportunities.

3.6.3. Time trends

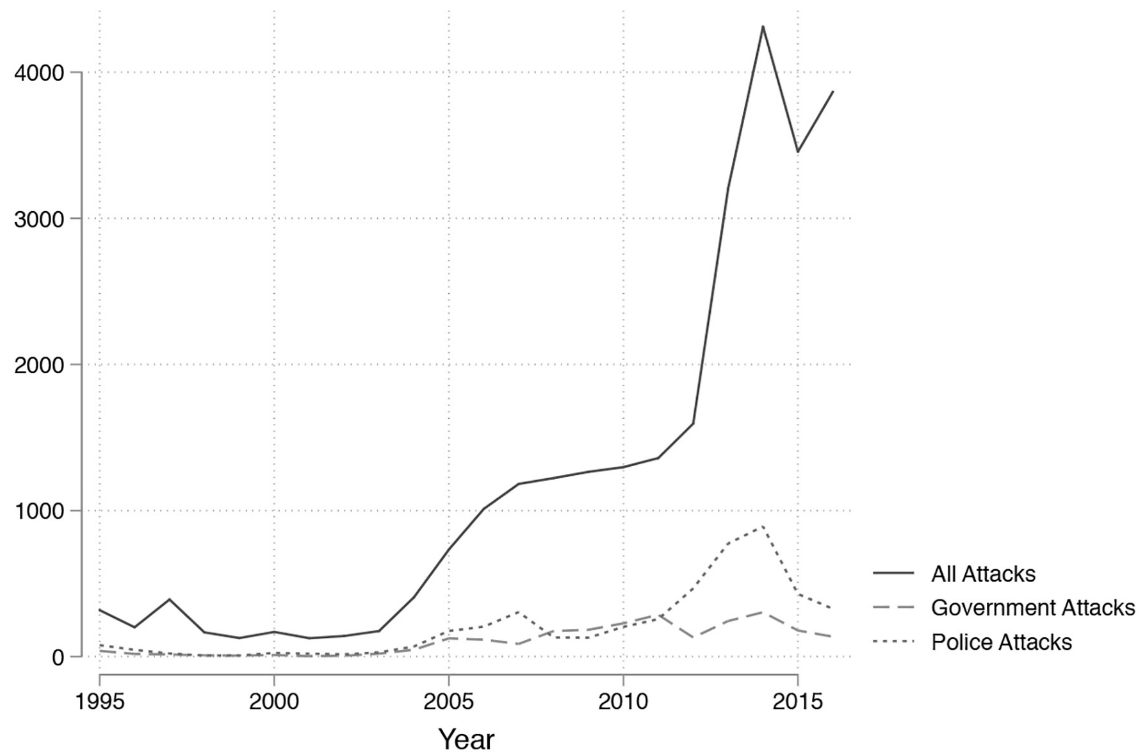
We include both a linear and quadratic time trend in our models to account for well-known nonlinearities in time series of oil prices and production. For example, Kilian (2009), Maslyuk and Smyth (2009), and Hamilton (2011) show prices and production respond disproportionately to non-market and geopolitical shocks in non-linear ways. As a result, simply controlling for prices, output, and interest rates is insufficient. Inclusion of these amplification factors allow predicted oil production to respond disproportionately to unobserved economic factors.[11]

4. Empirical findings

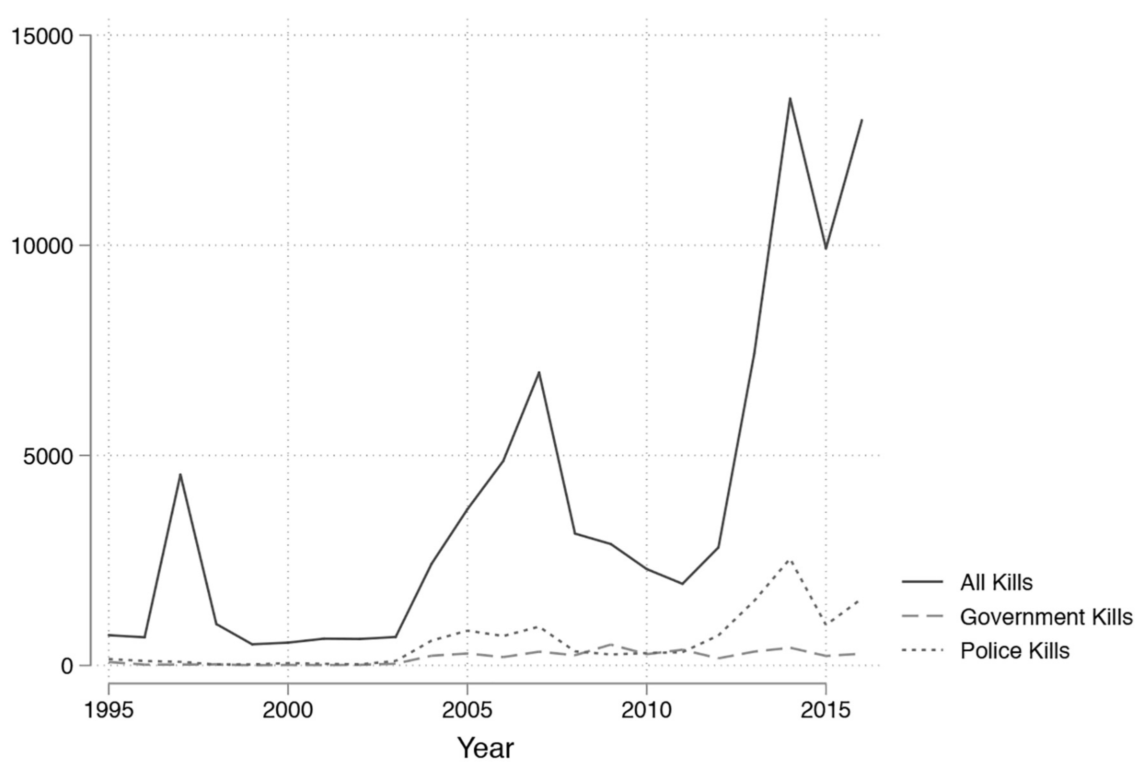
4.1. Main results

Table 5 presents our four main specifications examining all instances of political violence as drivers of oil production. Predictors are lagged 6 months in the first two columns and 12 months in the latter two. Results show strong support for H1-A. Rising frequencies of successful attacks (*attacks*) shows a positive, statistically significant impact on oil

[11] We also run tests where we square the other variables, such as attacks, kills, and oil price, and the results are robust to the inclusion of all these squared variables. Estimates available from authors upon request.



(a) Frequency



(b) Lethality

Fig. 2. Frequency and Lethality of Political Violence in MENA Region.

Table 5
Main Effects: Frequency and Lethality of Terrorist Violence.

	(1)	(2)	(3)	(4)
	6-mo lag	6-mo lag	12-mo lag	12-mo lag
Attacks	0.0025**	0.0027**	0.0024**	0.0025**
	(0.0007)	(0.0009)	(0.0007)	(0.0008)
Kills	0.0001	0.0002	0.0001	0.0002
	(0.0001)	(0.0002)	(0.0001)	(0.0002)
ln(Oil Price)	−0.0130	−0.0141	−0.0042	−0.0046
	(0.0592)	(0.0614)	(0.0583)	(0.0593)
S&P 500	−0.1672	−0.1715	0.1907**	0.1876**
	(0.1549)	(0.1639)	(0.0815)	(0.0754)
T-bill	12.3471	11.8005	5.5124	5.0350
	(11.6016)	(10.3837)	(11.7369)	(10.5071)
Attacks×Kills		−0.0000		−0.0000
		(0.0000)		(0.0000)
Observations	2322	2322	2268	2268
R^2	0.1235	0.1242	0.1069	0.1073

Notes: Dependent variable is the natural log of monthly oil production. Regression includes country fixed effects and linear and quadratic times trends. Standard errors are clustered by firm and reported in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

production in all specifications. Moreover, the magnitude is consistent across specifications, with an additional attack leading to a 0.24–0.27% increase in production. These specifications, however, show no support for H1–B. Rising lethality of political violence (*kills*) is insignificant as a driver of production, both as a standalone variable in columns (1) and (3), as well as in the specifications (2) and (4) that account for the influence of the interactions of frequency and lethality in shaping marginal effects.

Table 6 presents a second set of regressions structured to test H2 and H3, examining the impact of political violence that targets the institutions of the state. Here, terrorist violence and market controls are lagged 6 months. Columns (1) and (2) show strong support for H2-A and H2–B. Estimated coefficients of increases in both the frequency and lethality of terrorist violence targeting police are significant and positive. When controlling for the interaction (*Attacks* × *Kills*) in Column (2), main effects remain significant and positive and increase in magnitude.

For political violence targeting the government, the base specification in Column (3) shows support for H3-A but not for H3–B. The analysis estimates a positive, significant impact on oil production for increased frequencies of attacks that is approximately three times the

Table 6
Varieties of Violence: Police and Government.

	(1)	(2)	(3)	(4)
	Police	Police	Government	Government
Attacks	0.0068**	0.0098**	0.0186***	0.0250***
	(0.0025)	(0.0037)	(0.0047)	(0.0067)
Kills	0.0008**	0.0031***	0.0006	0.0047**
	(0.0003)	(0.0008)	(0.0006)	(0.0016)
ln(Oil Price)	−0.0255	−0.0230	−0.0328	−0.0341
	(0.0721)	(0.0701)	(0.0770)	(0.0780)
S&P 500	−0.1712	−0.1728	−0.1668	−0.1750
	(0.1660)	(0.1753)	(0.1534)	(0.1579)
T-bill	14.1314	12.0992	17.9948	17.4006
	(13.1500)	(11.2736)	(16.1898)	(15.9175)
Attacks×Kills		−0.0000**		−0.0003**
		(0.0000)		(0.0001)
Observations	2322	2322	2322	2322
R^2	0.0842	0.0942	0.0850	0.0908

Notes: Dependent variable is the natural log of monthly oil production. In Columns 1 and 2, only Attacks and Kills on government entities are included. In Columns 3 and 4, only Attacks and Kills on the police are included. Regression includes country fixed effects and linear and quadratic times trends. Standard errors are clustered by firm and reported in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

magnitude as that estimated for increased frequencies of attacks on police (0.0186 vs. 0.0068). Increasing lethality of political violence is insignificant. When controlling for the interaction (*Attacks* × *Kills*) in Column (4), the panel regression shows both main effects to be significant and positive.

These results are robust to changes in the setting of lags. Appendix A shows that the coefficients reported in Table 5 are nearly identical with 9- and 15-month lags, whereby events of political violence exhibit a positive, statistically significant impact on production. An additional attack is associated with a 0.24–0.27% increase in production. As seen in Table 5, when looking at all forms of violence, the lethality of violence (*Kills*) is insignificant, and the inclusion of an interaction variable does not alter the results.

Results examining violence against the government and police are similarly robust. Appendix A shows that *Attacks* versus the government and police are significant drivers of production at a 12-month lag, and again, accounting for the interaction of *Attacks* × *Kills* renders the coefficient on *Kills* significant and positive.

Across models, our controls appear reasonable and suggestive of rational economic behavior. At a lag of 12 months, the S&P 500 is significant and positive, suggesting that oil companies set out to increase extraction when equities markets are improving. This is consistent with economic theory in two ways: (1) It suggests that producers are responding to aggregate demand in the form of an expanding global economy, and (2) Hotelling's rule predicts that oil companies will extract and sell more oil to invest the proceeds in a rising stock market. Bond market returns are similarly positive but insignificant, which is unsurprising since stock prices should internalize the risk-free rate into their valuation. Finally, the oil price is statistically insignificant, consistent with the latest economic theory and empirical evidence showing that oil producers do not respond to prices in the short run (Anderson et al., 2016).

4.2. Robustness tests

Our main findings indicate that increasing political violence drives sovereign oil monopolies to increase near-term production. These results lend credence to the theory of risk-induced extraction and confirm our hypothesis of violent Hotelling pressures. A series of robustness checks further serve to increase our confidence in these findings.

4.2.1. Exogeneity of political violence

An important strength of our model lies in the arguably exogenous nature of political violence, which theoretically should lie outside the "black box" of rational firm behavior. Indeed, the architects of political violence generally aim to drive institutional change by attacking people, as opposed to strategic resources; this is one of the factors that differentiate them from traditional wartime combatants (Pape, 2005). To put this idea to the test, we re-run the model with additional controls for traditional wartime activity. An ongoing war would more clearly threaten company assets and so, if unobserved, could inflate the estimated effect of observed political violence on firm action. Table 7 displays five such tests with 6-month lags. The first model runs the main specification with a dummy variable for all country-months in which one of our sample states faced an ethnic or revolutionary war. The remaining four models control for wars in a single country. Data informing the selection of dummy variables for civil wars and insurgencies observed in four OPEC states—Algeria, Egypt, Iraq, and Libya—are drawn from the Political Instability Task Force organized by the Center for Systemic Peace.[12] The primary pattern of results holds in all five specifications.

[12] See http://www.systemicpeace.org/inscrdata.html for the CSP's datasets on armed conflict and intervention.

Table 7
Robustness Test: Ethnic & Revolutionary War Controls.

	(1)	(2)	(3)	(4)	(5)
	All	Algeria	Egypt	Iraq	Libya
Attacks	0.0025***	0.0025**	0.0025**	0.0025**	0.0026**
	(0.0007)	(0.0008)	(0.0007)	(0.0008)	(0.0008)
Kills	0.0001	0.0001	0.0001	0.0001	0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
ln(Oil Price)	−0.0153	−0.0224	−0.0162	−0.0133	−0.0959
	(0.0637)	(0.0420)	(0.0649)	(0.0347)	(0.0757)
S&P 500	−0.1684	−0.1751	−0.1932	−0.1677	−0.2045
	(0.1581)	(0.1531)	(0.1732)	(0.1312)	(0.1668)
T-bill	12.6232	10.8767	13.4410	12.3901	24.1010
	(12.5722)	(13.7326)	(12.3833)	(9.5071)	(15.3048)
Observations	2322	2322	2322	2322	2322
R^2	0.1237	0.1239	0.1244	0.1235	0.1565

Notes: Dependent variable is the natural log of monthly oil production. In Column 2, a dummy variable is used to control for firm-years in which Algeria is experiencing a war. In Column 3, a dummy variable is used to control for firm-years in which Egypt is experiencing a war. In Column 4, a dummy variable is used to control for firm-years in which Iraq is experiencing a war. In Column 5, a dummy variable is used to control for firm-years in which Libya is experiencing a war. In Column 1, a dummy variable is used to control for all war experiences in the other specifications combined. Standard errors are clustered by firm and reported in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4.2.2. Reverse causation

Our model assumes that the quantity of oil production does not have a reverse causal effect on political violence. A growing literature on the "resource curse" has questioned whether terrorists intentionally target oil resources, beginning with Gelb (1988) and Autry (1993) and building on the empirical work of Sachs and Warner (1995). Many studies have found that oil abundance makes it more likely that a country will experience violent conflict, but it is a weak relationship—by some counts, affecting less than half of oil-producing states (Ross, 2003, 2004). Some recent work confirms this relationship. Koos and Pierskalla (2016) show that in Nigeria local government areas with more oil production tend to experience more violence.[13] Of course, this correlation could just result from reverse causality due to violent Hotelling pressures.

Other recent studies cast additional doubt on the claim that oil production leads to political violence. Basedau and Lay (2009) point out that it is equally possible for oil to have the opposite effect. According to "rentier state theory," oil-rich governments might buy off opposition groups, making them less violent than other unstable countries. Consistent with this hypothesis, they find that oil per capita and violent conflict exhibit an inverted U-shaped relationship, with the most oil-rich countries "almost completely spared from violent conflict." These countries form the majority of our sample in this paper. Dreher and Kreibaum (2016) add nuance to this finding by studying the motivations of ethno-political groups and showing that oil makes them more likely to rebel and trigger a civil war in an effort to extract oil rents, but not to become terrorists or engage in wholesale political violence.[14]

When the focus shifts from oil *production* to oil *reserves*, the evidence for the resource curse is stronger. Caselli et al. (2015) and Morelli and Rohner (2015) show that a high concentration of oil reserves increases the likelihood of interstate conflicts and civil wars, respectively, especially when the resource ownership is concentrated among a particular ethnic group. Both analyses are interested in S, the remaining resource stock, while our hypotheses focus on q, the rate of extraction. This is a crucial distinction. There is no evidence in these studies that increased *production* attracts violence—and especially political violence, which is not their preferred outcome variable.

We therefore test this resource curse hypothesis in the context of our theoretical model by estimating the effect of the lagged log of production on terrorist violence. The results of this exercise support our presumption that oil production does not have a significant effect on attacks, confirming our intuition that terrorism is much more likely to impact production than vice versa. This result holds when production is lagged 6, 9, 12, and 15 months, and it continues to hold with or without the inclusion of the controls used in our main model above.[15]

Similarly, we consider the possibility that oil production is associated with higher unemployment, either because it depletes the reserves that form the basis of expectations for future economic growth or because the government tries to increase oil revenues when the economy needs to be stimulated. This higher unemployment, in turn, might motivate people to rebel and join violent political groups. Using the annual data in Appendix B, we test the effect of oil production on both the unemployment rate and the year-to-year change in unemployment, and we find that it is consistently insignificant and has the wrong sign for such a hypothesis. The other variables generally have little explanatory power as well, suggesting that unemployment is not a central factor in this analysis.

4.2.3. Exogeneity of the price of oil

A third concern might involve the assumed exogeneity of the market controls, particularly the oil price. Eight of the eleven countries in our sample are members of OPEC, which is frequently described as a cartel with price-setting power. Most evidence, however, does not support this characterization in the modern period. For example, Alhajji and Huettner (2000) review 13 statistical studies that seek to detect whether OPEC acts like a cartel, wherein 11 reject the cartel hypothesis. Hochman and Zilberman (2015) explain these findings by showing that OPEC is not only motivated by extracting profit from its foreign customers; its members also have to please their domestic consumers, frustrating their ability to act as one cartel. Hamilton (2009) further supports this conclusion, showing that OPEC members' production levels persistently deviate from the so-called "quotas" OPEC purports to enforce. This is unsurprising, as OPEC deploys no "clear monitoring or enforcement mechanism." Hamilton concludes, "Although there was once a time in which a few oil companies played a big role in world oil markets, that era is long past."

Despite a lack of evidence, we take the price-setting concern seriously and test the robustness of our model in each of the main four specifications with the world oil price excluded from the regression. The tests, reported in Table 8, show that terrorist attacks continue to be positive and statistically significant, confirming that our findings are not solely dependent on an exogenous oil price control variable.

4.2.4. Cross-border contamination

We anticipate that the impacts of violent Hotelling pressures may cross national borders. Our concern follows from long-recognized historical trends of "contagion" of warfare, revolutions, crime, and other forms of instability from one county to another (Keohane, 2002; Black, 2013; National Academy of Sciences, 2013). Given the prevalence of cross-border political violence in the region over the last two decades, as seen markedly in Syria, Turkey, and Iran, we wish to assess whether unobserved "contagion" effects may be driving the results. To investigate cross-border influences, we produce a matrix of adjacent countries for each of the MENA states (Table 3). This allows us to construct a measure for each country-month in our panel for the total number of attacks and the total number of victim deaths for all oil-producing neighboring states.

[13] Koos and Pierskalla argue anecdotally that Nigerian elites expropriated oil rents, angered the local population, and then suppressed peaceful protests, leading to violent conflict.

[14] Consistent with research by Pape (2005), this distinction may lie in variable levels of "greed" and "grievance."

[15] These regression results are all available from the authors upon request.

Table 8
Robustness Test: Sensitivity to Oil Price.

	(1)	(2)	(3)	(4)
	6-mo lag	6-mo lag	12-mo lag	12-mo lag
Attacks	0.0025**	0.0027**	0.0024**	0.0025**
	(0.0007)	(0.0009)	(0.0007)	(0.0008)
Kills	0.0001	0.0002	0.0001	0.0002
	(0.0001)	(0.0002)	(0.0001)	(0.0002)
S&P 500	−0.1705	−0.1750	0.1902**	0.1871**
	(0.1647)	(0.1742)	(0.0766)	(0.0707)
T-bill	11.4327	10.8281	5.1697	4.6606
	(9.0621)	(8.0525)	(9.1333)	(8.1154)
Attacks×Kills		−0.0000		−0.0000
		(0.0000)		(0.0000)
Observations	2322	2322	2268	2268
R^2	0.1234	0.1240	0.1068	0.1073

Notes: Regression replicates main effects (Table 5) with the exclusion of the oil price. Dependent variable is the natural log of monthly oil production. Regression includes country fixed effects and linear and quadratic times trends. Standard errors are clustered by firm and reported in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 9
Robustness test: contagion effects.

	(1)	(2)	(3)
	All	Police	Government
Attacks	0.0028**	0.0102**	0.0259***
	(0.0010)	(0.0040)	(0.0076)
Kills	0.0001	0.0031***	0.0048**
	(0.0003)	(0.0008)	(0.0018)
Attacks×Kills	−0.0000	−0.0000**	−0.0003**
	(0.0000)	(0.0000)	(0.0001)
Adjacent Attacks	0.0007	0.0023	0.0066
	(0.0009)	(0.0028)	(0.0073)
Adjacent Kills	0.0003	0.0010	0.0027
	(0.0001)	(0.0009)	(0.0015)
Adjacent Attacks×Kills	−0.0000	−0.0000	−0.0001
	(0.0000)	(0.0000)	(0.0001)
ln(Oil Price)	−0.0066	−0.0257	−0.0501
	(0.0613)	(0.0691)	(0.0766)
S&P 500	−0.1923	−0.1904	−0.1902
	(0.1593)	(0.1724)	(0.1641)
T-bill	3.7637	8.2980	18.2094
	(11.9438)	(12.4318)	(15.8033)
Observations	2322	2322	2322
R^2	0.1474	0.1034	0.1021

Notes: Dependent variable is the natural log of monthly oil production. Independent variables are lagged 6 months. Regression includes country fixed effects and linear and quadratic times trends. Standard errors are clustered by firm and reported in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

We test whether cross-border impacts confound our original results by running specifications that include terrorism attacks and kills from neighboring oil-producing states. Table 9 reports the resulting coefficients, which show no contagion effects, and our original treatment effects remain robust to their inclusion.

4.2.5. Alternative causal mechanism

Our validation of the theory of risk-induced extraction hinges on the *mechanism* by which political violence spurs production. In the face of rising political violence, states may have an incentive to sell oil and use the proceeds to increase military spending. This alternative causal mechanism, if valid, would contradict our theoretical priors. We can test this alternate mechanism using the military expenditure database from the Stockholm International Peace Research Institute.[16] Table 10 shows four models that attempt to predict military spending with political violence. In the first two models (with and without an interaction term), the dependent variable is the natural log of annual military spending. In the latter models, the dependent variable is military spending as a percentage of the country's gross domestic product (GDP). In all four cases, both attacks and kills are insignificant at the 5% level. Political violence does not appear to predict spending.

Table 10
Robustness test: military spending predictions.

	(1)	(2)	(3)	(4)
	ln(Spending)	ln(Spending)	Spend/GDP	Spend/GDP
Attacks	0.0008	−0.0014	0.0001*	0.0000
	(0.0006)	(0.0018)	(0.0000)	(0.0001)
Kills	−0.0002	−0.0012	−0.0000	−0.0000
	(0.0003)	(0.0007)	(0.0000)	(0.0000)
ln(Oil Price)	0.1715	0.1620	−0.0096*	−0.0097*
	(0.1109)	(0.1135)	(0.0048)	(0.0048)
S&P 500	0.1891**	0.2161**	0.0066	0.0070
	(0.0698)	(0.0784)	(0.0048)	(0.0049)
T-bill	−8.3875	−1.5234	1.2373	1.3228
	(16.2530)	(14.9587)	(1.0484)	(1.0241)
Attacks×Kills		0.0000		0.0000
		(0.0000)		(0.0000)
Observations	1806	1806	1824	1824
R^2	0.1556	0.1720	0.3355	0.3386

Notes: In Columns 1 and 2, the dependent variable is the natural log of annual military spending. In Columns 3 and 4, the dependent variable is annual military spending as a percentage of the country's gross domestic product (GDP). Independent variables are lagged 6 months. Regression includes country fixed effects and linear and quadratic times trends. Standard errors are clustered by firm and reported in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

As a further robustness test, Table 11 replicates our main specification with the inclusion of military spending as a control. All attacks and government attacks remain significant and positive, consistent with our main findings. The coefficient on police attacks remains positive but not significant, but police kills are positive and significant at the 1% level. Moreover, military spending remains an insignificant predictor of production. These tests confirm that military spending is not a confounding factor—and therefore, not the mechanism by which political violence spurs production.

4.2.6. Multicollinearity of treatment variables

The two measures of political violence—frequency and lethality—are clearly related. In fact, *attacks* (frequency) are a prerequisite for *kills* (lethality), and so it is not surprising that they have a high correlation (0.829). It is therefore reasonable to wonder whether our results are partly driven by multicollinearity in our preferred model, which includes them both simultaneously. While we believe it is important (and more conservative) to show that each is significant even after controlling for the other, we run robustness tests separating them into their own models in Table 12. Not only are our results robust to this separation, but they actually become stronger, both in magnitude and in statistical significance.

4.2.7. Alternative measure of political risk

Political violence is only one type of risk, and observed violence may not be a perfect measure of anticipated risk. For these reasons, we consider an alternative measure of political risk. It is not our preferred measure because (a) its construction is less transparent and (b) its meaning is more difficult to interpret; however, it serves as a useful check on the validity using violence as a measure of this type of risk.

In this robustness test, we use the political risk index from the International Country Risk Guide (ICRG) compiled monthly by the PRS Group.[17] Each country is scored on 12 variables that add up to a

[16] See sipri.org/databases/milex.

[17] These data are not publicly available. They require subscriber access, but their website explains the ICRG at https://www.prsgroup.com/explore-our-products/international-country-risk-guide/.

Table 11
Robustness test: military spending controls.

	(1)	(2)	(3)	(4)	(5)	(6)
	All	All	Police	Police	Government	Government
Attacks	0.0020***	0.0020***	0.0029	0.0028*	0.0095***	0.0091***
	(0.0005)	(0.0004)	(0.0017)	(0.0013)	(0.0026)	(0.0017)
Kills	0.0001	0.0001	0.0003***	0.0003***	0.0003***	0.0003***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
ln(Oil Price)	−0.0792	−0.0835*	−0.0882	−0.0895*	−0.0900	−0.0918**
	(0.0468)	(0.0366)	(0.0542)	(0.0391)	(0.0537)	(0.0396)
S&P 500	−0.1614	−0.1342	−0.1711	−0.1475	−0.1704	−0.1462
	(0.1816)	(0.1539)	(0.1861)	(0.1592)	(0.1848)	(0.1577)
T-bill	11.6128	9.5202	10.1487	7.2907	12.2506	9.3701
	(11.9385)	(11.4369)	(12.1878)	(12.0482)	(12.1679)	(11.5520)
ln(Spending)	−0.0409		−0.0378		−0.0366	
	(0.0453)		(0.0444)		(0.0456)	
Spend/GDP		−1.4496		−1.1331		−1.1531
		(1.7061)		(1.8314)		(1.8229)
Observations	1806	1824	1806	1824	1806	1824
R^2	0.1031	0.1246	0.0830	0.1001	0.0866	0.1043

Notes: Dependent variable is the natural log of monthly oil production. Regression includes country fixed effects and linear and quadratic times trends. Standard errors are clustered by firm and reported in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 12
Robustness test: separating frequency and lethality.

	(1)	(2)	(3)	(4)
	6-mo lag	6-mo lag	12-mo lag	12-mo lag
Attacks	0.0027***		0.0026***	
	(0.0007)		(0.0007)	
Kills		0.0006***		0.0005***
		(0.0001)		(0.0001)
ln(Oil Price)	−0.0140	−0.0063	−0.0051	0.0004
	(0.0603)	(0.0520)	(0.0593)	(0.0532)
S&P 500	−0.1646	−0.1776	0.1940**	0.1803**
	(0.1536)	(0.1628)	(0.0837)	(0.0770)
T-bill	12.9872	9.5975	6.2224	3.2880
	(11.9634)	(8.5192)	(12.3344)	(8.7384)
Observations	2322	2322	2268	2268
R^2	0.1231	0.0937	0.1063	0.0781

Notes: Dependent variable is the natural log of monthly oil production. Regression includes country fixed effects and linear and quadratic times trends. Standard errors are clustered by firm and reported in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 13
Robustness test: ICRG political risk ratings.

	(1)	(2)	(3)	(4)
	6-mo lag	9-mo lag	12-mo lag	15-mo lag
Political Risk	0.0303***	0.0263***	0.0242***	0.0236***
	(0.0075)	(0.0056)	(0.0049)	(0.0048)
ln(Oil Price)	−0.0137	−0.0135	−0.0144	−0.0211
	(0.0823)	(0.0751)	(0.0732)	(0.0591)
S&P 500	−0.2113	0.0449	0.2317*	0.1522*
	(0.2045)	(0.1715)	(0.1190)	(0.0782)
T-bill	13.3111	10.7969	9.8311	8.8037
	(25.2280)	(23.0745)	(23.9454)	(23.2428)
Observations	1806	1785	1764	1743
R^2	0.1517	0.1182	0.1026	0.0959

Notes: Regression includes country fixed effects and linear and quadratic times trends. Standard errors are clustered by firm and reported in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

maximum of 100 points reflecting expert assessments of government stability, socioeconomic conditions, investment profile, internal conflict, external conflict, corruption, military in politics, religious tensions, law and order, ethnic tensions, bureaucratic accountability, and bureaucracy quality.

Following the same methodology as we did in our main model, Table 13 shows that the political risk variables yield the same results as our violence variables: Increased risk leads to more oil production at 6-, 9-, 12-, and 15-month lags—and the results are statistically significant at the 1% level.

4.2.8. Structural breaks

Finally, we consider the possibility that the nature of oil production changed along with the business cycle. Perhaps fiscal regimes change with respect to oil investment during recessions, or perhaps the financial crisis of 2008 launched a new era of austerity and restricted access to credit. We control for these potential structural breaks in the model by adding dummy variables that indicate (a) when recessions occur, (b) when the global housing bubble has ended, and (c) when the Great Recession has ended.[18] Table 14 shows the 6-month and 12-month models with these variables included as controls, and the results

[18] For recession months, we rely on the official National Bureau of Economic Research business cycle dates at https://www.nber.org/cycles.html; while these dates are assigned based on United States data, they are still a useful indicator of when the global economy was weak, especially considering how strongly U.S. recessions are related to oil prices econometrically Hamilton (2011). For the post-bubble indicator, we choose September 2008, when Lehman Brothers filed for bankruptcy, as the beginning of the crisis and the end of the bubble.

Table 14
Robustness test: structural breaks.

	(1)	(2)	(3)	(4)	(5)	(6)
	6-mo lag	6-mo lag	6-mo lag	12-mo lag	12-mo lag	12-mo lag
Attacks	0.0025***	0.0025**	0.0025**	0.0024**	0.0024**	0.0024**
	(0.0007)	(0.0008)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Kills	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
ln(Oil Price)	−0.0132	−0.0196	−0.0163	−0.0058	−0.0038	−0.0043
	(0.0602)	(0.0816)	(0.0684)	(0.0585)	(0.0639)	(0.0671)
S&P 500	−0.1649	−0.1788	−0.1825	0.1937**	0.1931**	0.1908*
	(0.1343)	(0.1776)	(0.1893)	(0.0806)	(0.0615)	(0.0866)
T-bill	12.2195	14.4860	14.7830	3.7054	5.2458	5.5910
	(11.1068)	(16.9006)	(17.1129)	(11.4082)	(13.5096)	(17.4158)
Recession	0.0015			0.0121		
	(0.0180)			(0.0134)		
Post-Bubble		0.0251			−0.0038	
		(0.0935)			(0.0565)	
Post-Recession			0.0246			0.0007
			(0.0796)			(0.0754)
Observations	2322	2322	2322	2268	2268	2268
R^2	0.1235	0.1238	0.1238	0.1070	0.1069	0.1069

Notes: Regression includes country fixed effects and linear and quadratic times trends. Standard errors are clustered by firm and reported in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

are all robust to their inclusion. Moreover, the new coefficients are statistically insignificant, indicating that these potential breaks in the time series are not structurally important. These results accord with our earlier findings that oil production is not significantly related to unemployment, which tends to fluctuate with the business cycle.

Because oil is largely produced for exporting, we can test more explicitly for changes in the fiscal regime by controlling for trade. In Table B.5, exports have a strongly significant effect on oil production, but imports do not. In all of these specifications, however, the model continues to deliver the positive, significant results for the effects of political violence on oil production, supporting the robustness of our main estimates to different fiscal regimes.

5. Conclusion

Conventional wisdom seems to hold that uncertainty reduces investment. Indeed, some markets give evidence to this effect (Bloom, 2009; Christiano et al., 2014). In dealing with exhaustible natural resources, however, Sinn (2008) argues that the relationship might flow in the opposite direction. When faced with the threat of losing their property, resource owners may have an incentive to extract even faster to “beat the clock” that ticks with staccato bursts of violence. Until now, the literature has only tested the theory of risk-induced extraction in the context of policy-induced expropriation, particularly in the industrialized world where carbon policy is more common. This extraction also depends on the security of the oil well itself, however, particularly in the oil-rich states of the MENA region. It is here, at the wellhead, that we focus our investigation and find that expropriation threats manifest not from public policy, but rather from the threat of violence and state destabilization. We refer to these threats as “violent Hotelling pressures.”

In this paper, we test a variant of the theory of risk-induced extraction in the context of state oil monopolies and estimate the impact of political violence on production. We find strong support for our hypothesis that oil producers increase extraction in response to increasingly severe political violence and violence that particularly threatens those institutions tasked with securing property rights. Our findings validate the theory of risk-induced extraction and provide a more nuanced understanding of where and when it plays out.

These findings are important, both for understanding market behavior and for global environmental governance. Increased extraction due to violent Hotelling pressures exacerbates the problem of climate change and therefore deserves greater attention by researchers to understand its magnitude, mechanisms, and potential policy responses. In recent years, security studies have increasingly incorporated climate science to improve near- and medium-term planning. Our findings should motivate climate policy to incorporate security studies, as policymakers might otherwise underestimate the threat of state destabilization to undermine efforts to control greenhouse gas emissions. Conversely, this work highlights the benefits of a more secure system of property rights for global climate stability.

Many robustness tests corroborate these results, but as always, the analysis has important limitations. First, it does not identify the potential heterogeneity of treatment effects across different political regimes or security policies. Factors such as internal governance or external alliances, for example, might moderate or exacerbate the effect of political violence on oil production. Second, the findings may not generalize to multinational corporations with diverse investment opportunities. Unlike the sovereign monopolies in the MENA region, other large oil firms may have more flexibility to shift capital to alternative industries; therefore, their response to political violence may be weaker. Finally, past behavior may not always be predictive of future behavior. Many MENA countries are currently in the process of diversifying their economies and investment strategies away from dependence on fossil fuels. If they are successful, the effect of political violence on oil production may evolve along with the new corporate priorities as they reflect the changing opportunity cost.

Despite these considerations, this analysis does make clear that political violence has been increasing oil production by national oil monopolies over the last several decades, and the work demonstrates a previously underappreciated benefit of secure property rights. The path of resource extraction is accelerated when those rights are threatened to the clear detriment of the climate. This core finding has important policy implications. It underscores the importance of incorporating climate concerns in national security policymaking and incorporating political violence in the modeling of the future paths of greenhouse gas emissions. Fundamentally, global policymakers should place increased emphasis on the security of property rights to prevent the suboptimal acceleration of exhaustible resource extraction.

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Notes: The national oil monopolies of Middle East and North Africa are denoted in color. Other countries are denoted in gray. Water is denoted in white. Not all of these monopolies are used in our analysis due to lack of data. See Table 1 for list of national monopolies reporting OPEC reproduction data.

Notes: These graphs show the total attacks and kills resulting from political violence in our dataset for the Middle East and North Africa, with specific subcategories denoted for attacks on government and police targets. Data obtained from the Global Terrorism Database (GTD) developed and maintained by the University of Maryland College Park.

Appendix A. Empirical results for alternative lag structures

Our main specifications use 6- and 12-month lags for our explanatory and economic control variables. As a robustness test, we repeat our primary regression (Table 5) using 9- and 15-month lags in Table A.1. Results are highly consistent, with *Attacks* showing a consistent, significant, and positive impact on production. Next, we replicate our work on violence against the police and government using a 9-month lag in Table A.2. Here again, we find strong evidence of risk-induced extraction, as increasing frequencies and intensities of terrorism drive up production. We also find a similar pattern of decreasing marginal interactive impacts (negative slope in the interaction term) in Column (4) regarding violence targeting the government, though at a reduced (−0.0002) slope, meaning that even higher thresholds of violence would need to be met for marginal increases in terrorism to exhibit a reverse impact and reduce production. Taken together, variations in the lag structures increase our confidence in the main results and their support for hypotheses H1.a, H2.a, H2.b, and H3.a.

Appendix B. Empirical results for annual data

Our theory of risk-induced extraction suggests that we should see oil monopoly countries increasing production after terrorist events, proportional to the size of the threat. Our main specifications test this theory by estimating the effect of monthly terrorist violence in a country on their oil production in the following months. As a robustness test, we replicate the investigation using aggregate, annual measures for terrorist violence as a hypothesized driver of increased future oil production. We again estimate a log-linear model, seeking to estimate the effect of the level of attacks and kills in country c at time $t-1$ on the change in the quantity of oil produced at time t:

$$\ln q_{c,t} = \alpha + \beta_1 attacks_{c,t-1} + \beta_2 kills_{c,t-1} + \gamma_1 p_{t-1} + \gamma_2 g_{c,t-1} + \gamma_3 r_{t-1} + \gamma_4 i_{t-1} + \gamma_5 \Delta w_{c,t-1} + \gamma_5 t + \gamma_6 t^2 + \chi_c + \varepsilon_{c,t}. \tag{B.1}$$

The main variables are defined in the same way as in the main specifications. Additionally, an annual frequency allows us to include two factors unavailable at a monthly frequency: the annual growth rate of gross domestic product $g_{c,\,t-1}$ and the annual percent change in world oil consumption $\Delta w_{c,\,t-1}$. Table B.1 lists the annual variables, sources, and descriptive statistics.[19]

Table A.1
Main effects: frequency and lethality of terrorist violence.

	(1)	(2)	(3)	(4)
	9-mo lag	9-mo lag	15-mo lag	15-mo lag
Attacks	0.0024**	0.0026**	0.0024**	0.0025**
	(0.0008)	(0.0009)	(0.0007)	(0.0008)
Kills	0.0001	0.0002	0.0001	0.0002
	(0.0001)	(0.0002)	(0.0001)	(0.0002)
ln(Oil Price)	−0.0095	−0.0103	−0.0034	−0.0038
	(0.0565)	(0.0582)	(0.0483)	(0.0494)
S&P 500	0.0343	0.0300	0.1269**	0.1247*
	(0.1195)	(0.1167)	(0.0543)	(0.0569)
T-bill	8.4563	7.8789	2.4937	2.1247
	(10.7240)	(9.4692)	(11.4124)	(10.3563)
Attacks×Kills		−0.0000		−0.0000
		(0.0000)		(0.0000)
Observations	2295	2295	2241	2241
R^2	0.1138	0.1145	0.1004	0.1007

Notes: The dependent variable is the natural log of annual oil production. Regression includes country fixed effects and linear and quadratic times trends. Standard errors are clustered by firm and reported in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A.2
Varieties of violence: police and government.

	(1)	(2)	(3)	(4)
	Police	Police	Government	Government
Attacks	0.0072**	0.0096**	0.0188***	0.0223***
	(0.0025)	(0.0034)	(0.0046)	(0.0062)
Kills	0.0007**	0.0029***	−0.0002	0.0021*
	(0.0003)	(0.0007)	(0.0008)	(0.0011)
ln(Oil Price)	−0.0147	−0.0147	−0.0219	−0.0229
	(0.0671)	(0.0673)	(0.0729)	(0.0741)
S&P 500	0.1869**	0.1814**	0.1902**	0.1859**
	(0.0747)	(0.0642)	(0.0817)	(0.0797)
T-bill	6.9887	5.3524	10.9396	10.6435
	(13.1302)	(11.4940)	(16.4832)	(16.3381)
Attacks × Kills		−0.0000**		−0.0002*
		(0.0000)		(0.0001)
Observations	2268	2268	2268	2268
R^2	0.0782	0.0856	0.0746	0.0764

Notes: The dependent variable is the natural log of annual oil production. Independent variables are lagged 9 months. Regression includes country fixed effects and linear and quadratic times trends. Standard errors are clustered by firm and reported in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

[19] Some previous studies have used structural vector autoregressions (SVARs) to model prices and quantities with multiple lags. SVARs are very sensitive to the modeler's assumptions, however, because they require the econometrician to explicitly rule out outcomes that violate theoretical priors. Moreover, they tend to be set-identified, requiring the modeler to specify a method by which the most appropriate impulse response is selected from the set of models that fit the data. For all these reasons, SVARs are costly procedures that introduce significant risk of modeling bias. To avoid this risk, we instead (a) report many different lag structures to ensure the robustness of the results and (b) conduct robustness tests in Section 4.2.2 to ensure that our results are not driven by this type of reverse causality.

We include the annual growth rate of gross domestic product (GDP) to control for exogenous macroeconomic factors that may be affecting oil production in each country. Each state oil monopoly may respond to the macroeconomic shocks impacting the business environment in each year. These shocks often arise from outside the oil industry, but they may impact all industries' ability to produce and sell their products. We draw GDP figures from the International Monetary Fund and calculate year-over-year percent changes to capture changes in perceived trends as opposed to basic levels.

We include the annual percent change in world oil consumption to capture perceptible changes in trends of global demand for oil. From 1996 to 2014, OECD demand fell from approximately 48 million to 46 million barrels per day (bpd), while Chinese consumption quadrupled from approximately 3 to 12 million bpd. U.S. oil consumption peaked at approximately 20.7 million bpd from 2004 through 2007, fell with the recession in 2008 and 2009, and has since leveled out around 19 million barrels per day (Energy Information Administration, 2014). Analysts anticipate global oil demand will peak between 2020 and 2040 due to alternative fuel competition, efficiency gains, and environmental policies, posing significant challenges for countries such as the OPEC states who derive very large portions of their GDP from oil exports (van de Graaf and Verbruggen, 2015).

Table B.2 shows the results for five variations of our annual regression model: (1) excluding kills and the interaction of *Attacks* and *Kills*, (2) excluding GDP growth and the interaction, (3) excluding GDP growth, (4) excluding the interaction, and (5) the full model. In all cases, higher intensities of terrorist violence are positive and significant. In the first two specifications, an additional terrorist attack leads to an increase in annual oil production by 0.01–0.03%. In the latter four specifications, an additional terrorism kill leads to an increase in annual oil production by 0.01–0.02%. The *Attacks* variable is not always statistically significant, which is not surprising given the low number of observations at an annual frequency, but it remains positive and exhibits a consistent magnitude across specifications. Where included, increasing intensities (*Kills*) are always significant and positive in their estimated influence on oil production.

We also use the annual data to determine whether oil production has any effect on unemployment. Table B.3 shows the effect of all the lagged variables (in various combinations) on the unemployment rate, and Table B.4 shows their effect on annual changes in the unemployment rate. The oil production variable is consistently insignificant, as are most of the variables. Higher oil prices and stock market growth are associated with a decrease in the unemployment rate at the 10% level of significance, capturing the expected effects of economic growth.

Finally, we use the annual data to test for any confounding effects of trade, possibly due to changing fiscal regimes that affect how oil is exported. Table B.5 shows that our results are robust to the inclusion of these trade variables.

Table B.1
Annual variable sources and descriptive statistics, 1996–2014.

Variable	Data Source	*N*	Mean	SD	Min	Max
National GDP Growth	World Bank	19	54.21	35.2	12.2	109.1
Oil Price (Dubai)	Bloomberg	19	56.65	35.8	12.7	111.7
World Oil Consumption	EIA.gov	19	82,663	6271	71,812	92,086
S&P 500 (U.S.)	Bloomberg	19	10.26	18.95	−36.55	33.10
U.S. 3-Month Treasury Bill	Bloomberg	19	3.29	2.18	0.56	6.86
Terrorist Attacks	GTD	241	87	370	0	3925
Oil-Neighbors Adjacent Attacks	GTD	241	421	824	2	4697
Terrorist Kills	GTD	241	261	1180	0	13,075
Oil-Neighbors Adjacent Kills	GTD	241	1301	2634	1	16,765

Table B.2
Robustness test: annual frequency.

	(1)	(2)	(3)	(4)	(5)
Attacks	0.0003***	0.0001***	0.0001	0.0001	0.0001
	(0.0000)	(0.0000)	(0.0003)	(0.0001)	(0.0003)
Kills		0.0001***	0.0001**	0.0002***	0.0002***
		(0.0000)	(0.0001)	(0.0000)	(0.0000)
ln(Oil Price)	0.0538	0.0640	0.0668	0.0405	0.0412
	(0.1477)	(0.1161)	(0.1256)	(0.1570)	(0.1675)
GDP Growth	−0.0755			−0.0850	−0.0843
	(0.2775)			(0.2769)	(0.2658)
S&P 500	0.0009	0.0010*	0.0010*	0.0009	0.0009
	(0.0007)	(0.0005)	(0.0005)	(0.0007)	(0.0008)
T-bill	0.0000	−0.0015	−0.0012	0.0043	0.0043
	(0.0133)	(0.0127)	(0.0116)	(0.0158)	(0.0150)
Global Consumption	−0.0076	−0.0005	−0.0003	−0.0048	−0.0047
	(0.0163)	(0.0145)	(0.0139)	(0.0170)	(0.0164)
Attacks × Kills			0.0000		0.0000
			(0.0000)		(0.0000)
Observations	210	253	253	210	210
R^2	0.2888	0.3149	0.3152	0.2979	0.2979

Notes: The dependent variable is the natural log of annual oil production. Regression includes country fixed effects and linear and quadratic times trends. Standard errors are clustered by firm and reported in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B.3
Robustness test: effects on unemployment rate.

	(1)	(2)	(3)	(4)	(5)	(6)
ln(Oil Price)	−1.2401	−1.1360	−1.3008	−1.7426	−1.5745	−1.8739
	(1.6190)	(1.5754)	(1.7272)	(1.9391)	(1.8805)	(2.1237)
GDP Growth	−0.3854	−0.3332	−0.4644	−0.5262	−0.5322	−0.8026
	(0.7732)	(0.7087)	(0.8791)	(0.8192)	(0.8292)	(1.1916)
S&P 500	−0.0144	−0.0134	−0.0136	−0.0160	−0.0153	−0.0162
	(0.0102)	(0.0099)	(0.0101)	(0.0121)	(0.0123)	(0.0129)
T-bill	0.0037	−0.0350	−0.0389	0.0796	0.0271	0.0040
	(0.1778)	(0.1606)	(0.1554)	(0.2074)	(0.1928)	(0.1822)
Global Consumption	−0.0015	−0.0305	−0.0384	0.0350	0.0032	−0.0173
	(0.0648)	(0.0632)	(0.0562)	(0.0638)	(0.0632)	(0.0593)
Attacks		0.0032	0.0061		0.0043	0.0103
		(0.0037)	(0.0068)		(0.0050)	(0.0101)
Kills		−0.0018	−0.0014		−0.0020	−0.0016
		(0.0019)	(0.0013)		(0.0026)	(0.0020)
Attacks × Kills			−0.0000			−0.0000
			(0.0000)			(0.0000)
ln(Oil Production)				−0.3827	−0.8216	−0.9532
				(0.7611)	(0.7890)	(0.7970)
Observations	264	254	254	218	210	210
R^2	0.0516	0.0652	0.0775	0.0825	0.1096	0.1452

Notes: Regression includes country fixed effects and linear and quadratic times trends. Standard errors are clustered by firm and reported in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B.4
Robustness test: effects on change in unemployment rate.

	(1)	(2)	(3)	(4)	(5)	(6)
ln(Oil Price)	−0.6639*	−0.6390*	−0.6614*	−0.6980	−0.6600	−0.7075
	(0.3416)	(0.3460)	(0.3560)	(0.4009)	(0.3952)	(0.4240)
GDP Growth	−0.1198	−0.1556	−0.1734	−0.2076	−0.2351	−0.2780
	(0.2903)	(0.2924)	(0.2961)	(0.3238)	(0.2966)	(0.3206)
S&P 500	−0.0097*	−0.0094*	−0.0095*	−0.0078	−0.0076	−0.0077
	(0.0046)	(0.0047)	(0.0047)	(0.0045)	(0.0046)	(0.0046)
T-bill	0.0682	0.0594	0.0589	0.0484	0.0371	0.0334
	(0.0645)	(0.0674)	(0.0680)	(0.0710)	(0.0724)	(0.0711)
Global Consumption	−0.0337	−0.0414	−0.0425	−0.0307	−0.0374	−0.0407
	(0.0362)	(0.0452)	(0.0448)	(0.0437)	(0.0545)	(0.0547)
Attacks		0.0006	0.0010		0.0008	0.0018
		(0.0006)	(0.0008)		(0.0008)	(0.0013)
Kills		−0.0003	−0.0003		−0.0004	−0.0003
		(0.0004)	(0.0004)		(0.0005)	(0.0004)
Attacks × Kills			−0.0000			−0.0000
			(0.0000)			(0.0000)
ln(Oil Production)				−0.2843	−0.3080	−0.3289
				(0.4510)	(0.5442)	(0.5234)
Observations	264	254	254	218	210	210
R^2	0.0322	0.0363	0.0378	0.0324	0.0378	0.0446

Notes: Regression includes country fixed effects and linear and quadratic times trends. Standard errors are clustered by firm and reported in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B.5
Robustness test: effects of trade regimes.

	(1)	(2)	(3)	(4)
Attacks	0.0005***	0.0004***	0.0002***	0.0001*
	(0.0000)	(0.0001)	(0.0001)	(0.0001)
Kills			0.0002***	0.0002***
		(0.0000)	(0.0001)	
ln(Oil Price)	−0.0124	0.0533	−0.0334	0.0391
	(0.0912)	(0.1438)	(0.0950)	(0.1537)
GDP Growth	−0.0714	−0.1330	−0.0850	−0.1442
	(0.1522)	(0.2256)	(0.1479)	(0.2226)
S&P 500	0.0001	0.0009	−0.0001	0.0008
	(0.0006)	(0.0008)	(0.0006)	(0.0008)
T-bill	0.0002	0.0012	0.0065	0.0057
	(0.0106)	(0.0149)	(0.0125)	(0.0182)
Global Consumption	−0.0238	−0.0067	−0.0200	−0.0037
	(0.0153)	(0.0171)	(0.0154)	(0.0181)
Exports	0.0153***		0.0155***	
	(0.0023)		(0.0024)	
Imports		0.0047		0.0048
		(0.0081)		(0.0083)
Observations	202	202	202	202
R^2	0.6110	0.3137	0.6301	0.3239

Notes: Regression includes country fixed effects and linear and quadratic times trends. Standard errors are clustered by firm and reported in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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