Oil Discovery, Oil Production, and Coups d'État*

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Abstract

How does the discovery and production of oil affect the risks of coups d'état? We analyze a model of bargaining between government and military in which oil rents (a) increase the value of capturing the state but also (b) allow leaders to coup-proof their governments and/or appease potential plotters. These mechanisms offset each other once oil wealth is realized; incentives to topple the government are countered by the government's capacity to thwart or discourage coups. But when oil is newly discovered and rents have not yet been realized, plotters may launch a coup before power shifts decisively against them. Coup attempts are uniquely likely in such windows of opportunity, but those same coup attempts are exceptionally likely to fail. We uncover these relationships in an analysis of coup attempts and outcomes, oil production, and oil discovery in a global sample of states from 1980-2010.

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Technology for identifying and extracting sub-surface natural resources is changing the global political economy. The club of international oil exporters, long dominated by a handful of states holding vast reserves of easily accessed crude, now includes states with reserves that are either newly discovered or only recently accessible with new extraction methods. Though oil extraction has dramatically increased over the last thirty years and many states' reserves have been diminished or depleted, global proved oil reserves more than doubled between 1980 and 2014. Thirty-nine countries reported untapped reserves of at least one billion barrels in 2014, yet only twenty-five countries documented proved and accessible reserves of at least one billion barrels in 1980 (EIA 2014). Many of these newcomers are developing states that hope oil will generate rapid economic growth, including Ghana, Kenya, Uganda, Myanmar, and Ethiopia. Anticipated oil wealth prompts surges in infrastructure construction, foreign direct investment, and expectations of higher living standards. But the promise of future oil wealth also threatens to undermine economic and political development. Oil production may cause democratic backsliding (Dunning 2008, Ross 2012), civil war under some conditions (Bell and Wolford 2015, Fearon 2005, Ross 2012), ethnic secessionism (Basedau and Pierskalla 2014, Le Billon 2001), and economic crises stemming from commodity price volatility (Bruckner and Ciccone 2010, Ramsay 2011). And in the international arena, regional rivalries, political deadlock, and corruption have already imposed costly delays on corporations working to exploit recently discovered oil reserves. In Uganda, for example, lawsuits and protests demanding greater transparency have delayed the construction of necessary extraction infrastructure for nearly a decade.[1]

We explore another political problem posed by oil production and discovery: the risk of a coup d'état.[2] Coups continue to be a ubiquitous method of political change in developing states; between 2000 and 2015, nearly fifty coups were attempted and thirteen elected leaders were removed from power (Powell and Thyne 2011). Further, both coups and new oil discoveries are geographically concentrated in developing regions like west Africa and southeast Asia. Beginning with a formal model that elucidates how leaders and coup plotters might respond to the presence of expected future oil wealth, we test and find support for three key hypotheses. First, oil-rich states are attractive prizes for militaries who might gain power by launching a coup, but oil wealth also provides incumbent governments with resources that can be used either to placate ambitious rivals or fortify the state's defenses. These effects offset each other so that oil production, i.e. realized wealth, has negligible consequences for the frequency of coup attempts. Second, coup attempts are much more likely when new oil is discovered but before it can be exploited. In the window between the an oil reserve's discovery and the beginning of its production, military elites' interests in state control are piqued, and the government does not yet have the resources to coup-proof or appease potential plotters. Finally, the pressure to act quickly before new oil discoveries begin to deliver wealth drives coup plotters into riskier coups than they might attempt at other times. As a result, the probability with which coup attempts succeed decreases in the

[1] Frynas and Paulo (2007) evaluate the presence of a " new scramble" for Africa's resources. Gyimah-Boadi and Prempeh (2012) weigh the effects of new oil wealth on Ghana while Vokes (2012) assesses how new oil may affect Uganda.

[2] For a recent survey of the ambiguous relationship between oil wealth and coups d'état, as well as an attempt to disaggregate it by in- and off-shore production and use price shocks as a tool for identification, see Nordvik (2019).

extent of proved but unexploited oil reserves.

Recent events suggest the plausibility of our argument. In 2001, the Australian oil and gas developer Woodside discovered vast quantities of oil off of the Mauritanian coast. This was welcome news in one of the poorest countries in Africa, and many Mauritanians hoped that their long-time dictator, Ould Sid'Ahmed Taya, might use the discovery to improve the country's lagging economic development. But while Woodside and other Western companies prepared the field for offshore production, military elites had other plans. Though President Taya had avoided suffering a coup attempt for nearly twenty years, he faced attempts in 2003 (failed) and 2005 (successful). Observers attributed these attempts to fear of increased repression and greater public sympathy for opposition figures arguing for nationalization of these new natural resources. The coups delayed oil production and imposed both political and economic costs. Mauritania suffered yet another coup in 2007 and shortly after that Woodside sold its share in Mauritania's oilfields at a substantial loss. Around the same time, international oil executives were preparing to tap into new offshore fields discovered near São Tomé and Príncipe. These new discoveries promised to dramatically change the economy of this tiny island nation, though one prescient country expert warned the *New York Times* that "oil has created dreams of grandeur for a tiny place that has been on the margins of global affairs for many years. The army and the political and business elites sense something coming and want a part of it" (Romero 2003). The government was removed by a successful coup before oil production could commence. President Manuel Pinto da Costa, who served from 1975 to 1991 and again from 2011 to 2016, attributed the coup to the "smell of oil" stirring in the minds of military elites.[3]

In the remainder of this paper, we show that these anecdotes typify a generalizable relationship between oil discovery and increased coup risk. First, we analyze a game-theoretic model that elucidates the effects of realized and anticipated oil wealth on the probability of coup attempts *and* the rate at which observed coup attempts succeed. Proved but unexploited reserves promise to shift power in the government's favor, which incentivizes the military to attempt a coup before the government can either coup-proof or appease potential plotters in a straightforward application of the link between commitment problems and costly fighting (see Bell and Wolford 2015, Powell 2004). We predict that (a) the probability of a coup attempt decreases in existing wealth only when proved reserves are positive, (b) the probability of a coup attempt increases in proved but unexploited oil reserves, and (c) the probability with which observed coup attempts succeed decreases in proved but unexploited oil reserves. Finally, we uncover each of these patterns in a global sample of states from 1980-2010 that leverages data on publicly announced oil discoveries.

Theoretical Model

Suppose that a government G and military M attempt to share the rents of governance, represented by a continuously divisible pie ($\pi_t > 0$), in two periods $t = \{1,2\}$. In each period, the government offers the military some share of political influence or budgetary largesse, which the military either accepts, dividing the pie as planned, or rejects by attempting a coup d'état. The coup's chances of success depend on the resources that G can devote to

[3] This quotation has been previously cited by Shaxson (2007) and Weszkalnys (2008)

coup-proofing and placating dissatisfied soldiers, the former reducing a coup's chances of success and the latter drying up potential support for toppling the leader. The government's chances of defeating a coup attempt depend on oil revenue, the level of which changes from one period to the next. By the second period, the national pie has grown due to increased oil revenue, but as the pie grows the chances of a successful coup d'état fall. It is in this context—the knowledge that oil revenue will one day increase—that dividing the pie is most difficult and, as we show below, that the risk of a coup d'état is greatest.

In period $t = 1$, the national pie is $\pi_1 = R$, where $R > 0$ indicates oil wealth generated by current extraction efforts. G's proposal $x_t \in [0,1]$ allocates $x_1\pi_1$ to itself and $(1-x_1)\pi_1$ to the military, and if the latter accepts, the division is implemented for the first period only. If M rejects, its chances of a successful coup, $c_1(p,R)$, depend on its own structural advantages (say, soldiers' loyalty and officers' ability to coordinate) and the size of the national pie, such that it successfully topples the government with probability

$$c_1(p,\pi_1) = \frac{p}{1+R},$$

which increases in M's natural advantages ($p \in (0,1)$) but decreases in state oil wealth (R). The winner of the coup attempt eliminates the other and controls the rents of governance for the remainder of the game, but a coup is costly; it risks compromising future oil wealth through the destruction of infrastructure, the disruption of production, or the provocation of international sanctions (Marinov and Goemans 2014). Whether successful or unsuccessful, a coup attempt destroys a fraction $d \in (0,1)$ of the national pie, such that after a coup attempt the winner controls only $\pi_t(1-d)$ for any period during and after victory.

As long as no coup is attempted in the first period, play continues at $t = 2$ with G making a new proposal (x_2) to divide a national pie that has grown larger due to the exploitation of new oil reserves ($r \geq 0$), such that $\pi_2 = R + r$. The pie has grown, making deals easier to strike in principle, but new oil wealth also harms the military's coup prospects, which in the second period are

$$c_2(p,\pi_2,w) = \frac{p}{1+R+rw},$$

where $w > 0$ is the marginal rate at which new oil wealth is converted into relative power. Should the military accept the government's second period proposal, it receives a share of a larger pie, i.e. $(R+r)(1-x_2)$, and should M reject, its chances of successfully toppling G are weakly lower than they were in the first period, such that

$$c_2(p,\pi_2,w) \leq c_1(p,\pi_1).$$

Without loss of generality, we assume that players value first- and second-period payoffs equally, i.e. that there is no discounting. Thus, we can define their payoff functions as

$$u_G = \begin{cases} \pi_1 x_1 + \pi_2 x_2 & \text{if peace} \\ \pi_1 x_1 + \pi_2 \left(1 - \frac{p}{1+R+rw}\right)(1-d) & \text{if coup at } t=2 \\ \pi_1 \left(1 - \frac{p}{1+R}\right)(1-d) + \pi_2 (1 - \frac{p}{1+R})(1-d) & \text{in coup at } t=1 \end{cases}$$

for the government and

$$u_M = \begin{cases} \pi_1(1-x_1)+\pi_2(1-x_2) & \text{if peace} \\ \pi_2(1-x_1)+\pi_2\left(\frac{p}{1+R+rw}\right)(1-d) & \text{if coup at } t=2 \\ \pi_1\left(\frac{p}{1+R}\right)(1-d)+\pi_2\left(\frac{p}{1+R}\right)(1-d) & \text{in coup at } t=1 \end{cases}$$

for the military. Future oil revenues generate expectations that today's deal may not be stable, because the leader cannot promise not to take advantage of her improved prospects of resisting a coup d'état in the future. As a result, the military must choose whether to make a costly, risky coup attempt in the present, before the chances of successfully toppling the government decline.

Our model shares a basic strategic tension with Powell's (2004) treatment of commitment problems due to shifting power, where the prospect of changing minmax values can induce costly preventive steps in the present in order to arrest an expected decline.[4] Its closest analogue is Bell and Wolford's (2015) model of civil war onset in the shadow of rising oil wealth, though we introduce a key substantive change by linking the initial distribution of power to the extant level of oil wealth and modeling the military's initial structural advantages, i.e. $c_t(p,\pi_t)$. This allows us to derive comparative statics over the effects of both realized and anticipated oil wealth and over the link between anticipated oil wealth and the rate with observed which coup attempts succeed in toppling governments.

Equilibrium Analysis

Our solution concept is Subgame Perfect Equilibrium (SPE or simply "equilibrium"), which requires that players can promise only to take actions that will be in their interest to carry out. This captures the model's key strategic tension: once oil reserves are converted into new wealth, the government cannot promise not to use that wealth to enhance its position relative to potential coup plotters. The government is happy to offer the military a large share of the pie in the first period to avert a coup attempt, but once new oil wealth is realized, the government can renege on generous bargains and force the military to take a less favorable deal. We show in this section that the government's inability to commit not to enhance its power relative to the military can provoke costly, risky coup attempts in the first period. After establishing sufficient conditions for a coup attempt, we conduct comparative statics analysis to show realized and expected oil wealth shape both the probability of attempted coups d'état and their rate of success.

The military attempts a coup in equilibrium due to the government's inability to credibly commit not to use future oil revenues to insulate itself from the threat of a coup. Whatever G offers in the first period, it will be tempted to yield less in the second, and since it has a newfound power to resist coup attempts, it cannot promise not to reduce the share of the rents that goes to the military. Given complete information, the government is sure to be able to secure a favorable second-period bargain at no risk of a coup. Future oil wealth, even as it promises to increase the total pie, creates a commitment problem; the government

[4] McMahon and Slantchev (2015) study coups when the military must also face a foreign adversary, but we abstract away from international threats.

cannot commit ex ante to a second-period bargain that compensates the military for its loss of bargaining power. Anticipating this, M attempts a coup rather than accept even the most generous first-period bargain ($x_1 = 0$) when

$$\pi_1 c_1(p,\pi_1)(1-d) + \pi_2 c_1(p,\pi_1)(1-d) > \pi_1 + \pi_2 c_2(p,\pi_2,w)(1-d).$$

Rearranging terms, we can express this inequality as

$$c_1(p,\pi_1) - c_2(p,\pi_2,w) > \frac{\pi_1 - \pi_1 c_1(p,\pi_1)(1-d)}{\pi_2(1-d)},$$

which states that M cannot be induced not to launch a coup at $t = 1$ when the shift in its coup prospects from the first to the second period (the left side of the inequality) is sufficiently large (cf. Powell 2004). When M's anticipated losses due to diminished coup prospects outweigh the costs of launching a coup in the present, it attempts to topple G and capture the national pie before its prospects erode.

Proposition 1. *When $r > \hat{r}$ and $p > \hat{p}$, where*

$$\hat{r} = \frac{1}{2}\left(\frac{R(1+R)}{1-d} - 2R + \sqrt{\frac{R(4(1-d)(1+R)(R+d) + Rw(1-2d-R)^2)}{w(1-d)^2}}\right) \tag{1}$$

and

$$\hat{p} = \frac{R(1+R)(1+R+rw)}{(1-d)(R(1+R)+rw(r+2R))}, \tag{2}$$

M rejects all possible proposals $x \in [0,1]$, ensuring that a coup occurs at $t = 1$ in any SPE. If either constraint fails, then G makes proposals x_1^* and x_2^* that M accepts along the equilibrium path.

Proposition 1 states that two conditions must be satisfied in order for M to solve the government's commitment problem by launching a coup. First, oil discoveries must be sufficiently large ($r > \hat{r}$), promising to worsen M's coup prospects substantially over time. But since oil discovery r enters into the value $\hat{p}$ we conduct further analyses below to confirm that its indirect effects on coup risk are the same as the direct effect implied by $r > \hat{r}$. Second, the military's structural advantages in launching a coup must be sufficiently strong ($p > \hat{p}$), ensuring that declines in coup prospects are meaningful; if M begins the game too weak, then even large declines in its coup prospects are insufficient to prompt it to launch a coup. In fact, Proposition 1 shows that M's structural advantage (p) has a straightforwardly positive effect on the probability of a coup attempt, since $\hat{r}$ is not a function of p. Military professionalism and tight civilian control make coup attempts structurally difficult, whether in terms of coordinating beyond the gaze of the government or securing soldiers' loyalty. Unsurprisingly, less-advantaged militaries have more to lose by the state's accumulation of oil wealth, so they are uniquely likely to launch coup attempts ($p > \hat{p}$). However, absent rising oil wealth—i.e., absent any complicating factor to stand in the way of an efficient government-military bargain—M's structural advantages are unrelated to coups.

The coup constraints defined by Lines (1) and (2) can also help us derive precise expectations about the effects of both future oil wealth (r) and existing oil wealth (R) on the probability of a coup attempt. First, Proposition 2 confirms that, in addition to its direct effect on M's decision to launch a coup through shifting power, rising oil wealth has a complementary indirect effect.

Proposition 2. *The coup constraint $p > \hat{p}$ becomes easier to satisfy as r increases.*

Thus, rising future oil wealth also lowers the minimum threshold of strength ($\hat{p}$) above which M launches a coup, driving down the value of remaining at peace so far that, when power will shift sufficiently, even relatively less-advantaged militaries are willing to gamble on fairly low odds of success. Propositions 1 and 2 together imply that coup attempts should be likeliest when proved but unexploited oil reserves are greatest.

The relationship between coup attempts and existing oil wealth is more complicated. Existing oil wealth, which has already shaped relative power between government and military, is unrelated to coup attempts when no future wealth will come on line ($r = 0$), but when new oil wealth *is* anticipated ($r > 0$), the coup constraints are more difficult to satisfy when extant oil wealth is larger.

Proposition 3. *Existing oil wealth R has no relationship with coup attempts when $r = 0$, but when $r > 0$ the the coup constraints $r > \hat{r}$ and $p > \hat{p}$ become harder to satisfy as R increases.*

When no new oil has been discovered ($r = 0$), then coups do not happen in equilibrium, because the distribution of power is commonly known and stable. Thus, there is no relationship between oil wealth R and coups when there are no new oil resources yet to be exploited. However, when oil has been discovered but not yet exploited ($r > 0$), then existing oil wealth makes the coup constraints more difficult to satisfy. The more wealth the government already derives from oil, the larger its initial advantages in defeating coup attempts, so further increases in wealth only make M's already-insurmountable problem worse. The military needs ever larger initial structural advantages p and a lower cost of fighting d to attempt a coup when the government already enjoys substantial oil wealth. Therefore, oil wealth should be unrelated to coup attempts when $r = 0$. Once oil has been discovered, the chances of a coup decrease in existing wealth and increase in future oil wealth.

We can derive a final empirical implication by studying $\hat{p}$, or the minimum probability of success in the first period that can tempt the military to launch a coup attempt. Recall that, as stated in Proposition 2, the minimum chances of success required to tempt M into launching a coup attempt fall as expected oil revenues grow; in other words, the larger the potential shift in power, the longer odds of success M is willing to accept in order to launch a coup and stave off a future adverse shift in power. Translating this into the language of our empirical model, we want to know the expected probability of victory for militaries that launch coup attempts, and if we let p be uniformly distributed such that $p \sim \mathrm{U}(\hat{p}, 1)$, the expected probability of a successful coup is

$$\mathrm{E}(c_1(p, \pi_1)) = \int_{\hat{p}}^{1} \left(\frac{p}{1+R} \times \frac{1}{1-\hat{p}} \right) d\mathrm{U}\, dp.$$

As stated in Proposition 4, the expected chances of success decrease in (r).

Proposition 4. *The expected probability of success for attempted coups decreases in r.*

Therefore, the more power will shift against coup plotters, the more their future coup prospects and shares of the national pie promise to shrink as oil wealth grows, the longer odds on success they will countenance in a coup attempt. Therefore, as r increases, the equilibrium (i.e., observed) rate at which coup attempts succeed accordingly falls.

Our model allows us to derive three hypotheses over two distinct outcome variables: the probability with which coups are attempted and the probability with which observed coups succeed.

Hypothesis 1. The probability of a coup attempt decreases in oil wealth only when proved oil reserves are positive; with no discovery, there is no relationship.

Hypothesis 2. The probability of a coup attempt increases in proved oil reserves.

Hypothesis 3. The probability with which observed coup attempts succeed decreases in proved oil reserves.

We include relevant control variables in the empirical models below, but our ability to draw four hypotheses from the theoretical model, spread across two different outcome variables, can itself increase our confidence in the utility of the theoretical model for explaining patterns in the data. If, for example, oil discovery might be related to coup attempts through a mechanism unrelated to shifting power, then we should not expect to uncover the relationship predicted by Hypothesis 3, even if Hypothesis 2 finds confirmation in the data. We turn now to an empirical evaluation of these predicted relationships.

Data

We test our hypotheses with a cross-national time-series data oil production, oil discovery, coup attempts, and coup outcomes in countries with populations of at least 500,000.[5] Our temporal range spans 31 years from 1980 to 2010, constrained by the availability of accurate cross-national oil discovery data. We have complete data on both coup activity and oil discoveries for a total of 3,957 country-year observations occurring across 172 countries.

Our first outcome variable, *Coup Attempt*, is dichotomous and equals 1 in any country-year in which a coup was attempted. We adopt Powell and Thyne's (2011) definition of coups as "illegal and overt attempts by the military or other elites within the state apparatus to unseat the sitting executive" (p. 252), which clearly delineates coup attempts from other threats to state power, such as civil war, non-violent protest movements, and assassinations. Our second outcome variable, *Coup Success*, is also dichotomous and equals 1 only when a qualifying coup attempt results in a transfer of power that lasts for at least seven days.[6] Our data include more than 150 coup attempts and almost exactly half of these coups were successful. Coup attempts occurred in 63 states while 45 states—approximately one in four

[5] Many datasets from which we draw do not include information for countries below this threshold.

[6] This condition exists because many coups are "successful" only for a matter of hours, or sometimes days, before loyal troops restore the incumbent to power (see Bell and Sudduth 2017, Powell 2012, Powell and Thyne 2011).

in our sample—suffered at least one successful coup d'état. We created both variables with Powell and Thyne's (2011) data.

Oil Discovery, created by Bell and Wolford (2015), uses country-year information on oil reserves compiled by the United States Energy Information Administration (EIA). The EIA estimates proved oil reserves for every country each year by compiling data drawn from government and industry sources. Proved reserves increase when new oil fields are discovered, estimates of oil located in known reserves increase, or when new technology like hydraulic fracking increases the amount of known oil that can be feasibly drawn to the surface for production and refinement. Reserve figures are provided in billions of barrels and typically reflect annual changes to estimated reserves of as little as one million barrels. These estimated reserves are public information, and the larger discoveries are often widely broadcast in the media. It is therefore reasonable to expect that military elites would have some knowledge of significant changes in a state's estimated oil reserves.[7] If discoveries are kept secret—presuming that systematic obfuscation is possible—then they can't influence perceptions of shifting power in a complete information setting like our model, so publicly known oil discovery is the appropriate concept to measure.

To calculate *Oil Discovery* in year t, Bell and Wolford (2015) subtract reserves at year $t-1$ from reserves in year t. Then, to account for changes caused by oil production in $t-1$, we add the EIA's estimate for production in $t-1$ to this difference.[8] If the difference is zero or negative (no oil discovered), *Oil Discovery* equals zero. Finally, because the relative importance of an oil discovery is dependent upon the size of a state's existing oil reserves, this difference in billions of barrels is transformed into the ratio of the new discovery over proved reserves at $t-1$ and then logged. Logging the variable accounts for diminishing returns on very large discoveries; the difference made by a 50% increase vis-á-vis a 20% increase is substantively larger than that between 250% and 220% increases.[9] Therefore,

$$\text{Oil Discovery} = \max\left\{0, \ln\left(\frac{Reserves_t - (Reserves_{t-1} - Production_{t-1})}{Reserves_{t-1}} + 1\right)\right\}$$

To test Hypotheses 1 and 2 and to better parse the effects of oil discovery and production we also include a measure of logged oil production in barrels per day per person (ln(*pcProduction*)).

The empirical models include several well-established correlates of coup activity. To capture the economic drivers of coup attempts (Londregan and Poole 1990), we add logged per capita gross domestic product (ln(*pcGDP*)) and Δ*pcGDP*, which is the percentage change in per capita gross domestic product from the previous year.[10] Bivariate comparisons of these variables against *Coup Attempt* show both economic indicators are strongly correlated with

[7]Geologists have criticized EIA estimates for proved reserves for inaccuracy, but this does not undermine our argument unless there is reason to believe that military elites are able to independently evaluate these estimates. We think it is reasonable to expect that military elites will accept the estimates reported by industry and government sources, as they lack the capacity to form their own estimates. For this reason, *reported* estimates are more relevant than the *true* (and unknowable) size of a country's oil reserves.

[8]EIA estimates for production are in thousands of barrels per day, so this estimate is first transformed into billions of barrels per year so that it corresponds to the unit used for reserves estimates.

[9]We add 1 before logging because $\ln(1) = 0$, which means a state with no oil discovery will maintain the value 0 (rather than $\ln(0) = -\infty$) when the measure is log-transformed.

[10]Both measures are created using economic data from the Penn World Tables (Heston, Summers and Aten 2009). Estimates are in 2005 USD.

coup activity. In country-years suffering a coup attempt, ln(*pcGDP*) averaged 7.329 ($1,525) while Δ*pcGDP* averaged -1.70%. In non-coup years, these averages are 8.355 ($4,250) and +1.25%, respectively.

We account for military welfare with four variables. First, we expect military regimes to be exceptionally susceptible to coups d'état, perhaps because military elites have increased access to the incumbent or because military rule in the status quo legitimizes military rule in the future. Using Geddes's (1999) authoritarian regime typology, we mark military-led governments with the dichotomous variable *MilGovt*. These governments comprise roughly 13% of the country-years in the sample yet account for 48% of attempted coups. Second, coup plotters face greater challenges in states with very large militaries, because military size exacerbates coordination problems and increases the threat of post-attempt conflict with loyal military forces. Therefore, we adapt data on military size from the Correlates of War Composite Index of National Capabilities (Singer, Bremer and Stuckey 1972), which counts military personnel in thousands. There are diminishing effects as military size increases, so we log this variable to create ln(*Personnel*).[11] Militaries are substantially smaller when coups are attempted; in observations with coup attempts, military size averaged approximately 19,000 personnel, which is less than half the sample's average military size of 39,000. The third military variable, *SoldierQuality*, is a measure of military disposition created by Powell (2012). *SoldierQuality* is the ratio of military expenditures to military personnel. Where spending per soldier is greater, militaries may be more favorably disposed to the status quo and less likely to risk a coup attempt. Similarly, our fourth measure, Δ*MilSpending* is the annual percentage change in military expenditures. Bivariate tests show coup attempts are more likely when both Δ*MilSpending* and *SoldierQuality* are low. Data for both measures are from the Correlates of War Composite Index of National Capabilities (Singer, Bremer and Stuckey 1972).

The models also control for five sociopolitical conditions related to coup risk. Ethnic politics can affect coup decisions, and some coups are fueled by ethnic divisions within the ranks (Harkness 2012). Lacking precise demographic data for military armed forces, we use a broad index of ethnic fractionalization. *EthnicFrac*, from Fearon and Laitin (2003), is a standard measure of this kind of social division. *EthnicFrac* ranges from 0 (perfect homogeneity) to 1 (perfect heterogeneity) and is indeed significantly higher (average of .525 versus .408) in country-year observations that suffer a coup attempt. Some also argue that coups are less likely in democracies because these regimes offer safe, regular mechanisms for leader replacement. We control for this with *PolityX*, Vreeland's (2008) time-series modification of the popular Polity index that places all states on a spectrum ranging from -10 (absolutely autocratic) to 10 (absolutely democratic) (Marshall and Jaggers 2009). Finally, the best predictor of instability is past instability, so we control for three measures of recent and contemporaneous turmoil: (1) *CivilWar*, which is dichotomous and equal to 1 when a state is engaged in a violent conflict that satisfies the UCDP/PRIO definition of civil conflict (Themnér and Wallensteen 2012), (2) *SinceCoup*, which counts the number of years since a country's last coup according to Powell (2012), and (3) *SinceReform*, which counts the years since the last major political reform per the Polity Project (Marshall and Jaggers

[11] We add 1 before logging to avoid values approaching $-\infty$ for states with fewer than 1,000 enlisted military personnel.

2009). Briefly, the average country-year observation with a coup event suffered coup twice as recently (9.6 years v. 21.8 years), had major political reforms twice as recently (6.4 years v. 12 years), and was fighting an active civil war twice as often (32.9% v. 16.8%) relative to the averages among non-coup country-year observations in the sample.

Empirical Models

The outcome variable for Hypotheses 1 and 2 is *Coup Attempt*, so we use logistic regressions with robust standard errors clustered by country. The tests for Hypothesis 1, which examines the effect of oil production, are a series of models that use an increasing number of variables to predict *Coup Attempt* (see Table 1). There are no statistically significant relationships between oil production and coup attempts, and the coefficients vary widely across models. Instead, adverse changes in per capita gross domestic product, the presence of a military government, small military size, and political instability are related to coup attempts in every model in which they appear. These findings are consistent with both the literature and Hypothesis 1: oil wealth is unrelated to the probability of a coup attempt.

Table 1: Logit Models of Oil Production and Coup Attempts

	Model 1.1	**Model 1.2**	**Model 1.3**	**Model 1.4**	**Model 1.5**
$ln(pcProduction)$	-9.30	3.90	-5.86	-4.95	4.34
$ln(pcGDP)$		-0.68^{***}	-0.30	-0.04	0.05
$\Delta pcGDP$		-4.24^{***}	-3.82^{**}	-3.80^{**}	-3.44^{**}
$\Delta MilSpending$		-0.002	-0.00	-0.00	-0.07
EthnicFrac			0.70	0.70	0.59
PolityX			0.03	0.01	0.02
MilGovt			1.98^{***}	1.60^{***}	1.69^{***}
SinceReform				-0.19^{*}	-0.22^{**}
SinceCoup				-0.03^{**}	-0.03^{**}
CivilWar				0.46^{*}	0.78^{***}
SoldierQuality					-0.06
$ln(Personnel)$					-0.24^{**}
Constant	-3.39^{***}	2.06^{**}	-1.74	-2.87^{*}	-2.28
N	4,026	2,714	2,345	2,345	2,330
Estimated Effects					
Prob. of −20% Effect	30.1%	0.6%	19.6%	15.8%	1.6%
Prob. of +20% Effect	0.1%	9.7%	0.6%	0.9%	16.2%
Prob. of Lesser Effect	**69.9%**	**89.7%**	**79.8%**	**83.3%**	**82.2%**

These are logistic regression results with robust standard errors clustered by country. Asterisks mark statistical significance at 90%, 95%, and 99%. Effects are calculated using the confidence interval method (Rainey 2014) and represent the probability that an increase in oil production from zero to the mean among oil producing states will result in at least a 20% increase or decrease in the estimated probability of a coup attempt.

We also use Rainey's (2014) confidence interval method to calculate the likelihood that a substantial increase in oil production will increase the risk of a coup attempt. This method uses the confidence interval around estimated marginal effects to calculate these likelihoods. In this case, we estimate the chances that an increase in logged production per capita from zero to the average among oil producing states (approximately 0.018) will raise or lower the risk of a coup attempt by at least 20%, relative to the risk when oil production is zero. The advantage of this approach is that it distinguishes insignificant coefficients that occur when a confidence interval hardly encompasses zero from those insignificant coefficients that occur when a large range of negative of positive effects falls within the 95% confidence interval. These estimates are included at the bottom of Table 1, and they indicate that oil production has a negligible effect on the risk of a coup attempt.[12]

When we run the same models after adding *Oil Discovery*, we find support for Hypothesis 2 (see Table 2), which links coups not to production but to discovery. In all but one of the models, *Discovery* is positively correlated with coup activity. The results for the control variables are almost identical to those produced by Models 1.1 - 1.5. Still, the results raise an important question. Why might *Oil Discovery* have no effect on *Coup Attempt* in the simplest model (Model 2.1)? We find that *Oil Discovery* is more likely in states that are already somewhat wealthy, because more oil tends to be discovered in states that already have some oil.[13] In effect, Model 2.1 conflates the positive effect of *Oil Discovery* on the probability of a coup attempt with the negative effect of extant wealth (ln(*pcGDP*)) on coup attempts, yielding a small insignificant coefficient that isn't discernible from zero.

Once we control for wealth, the effect of *Oil Discovery* on *Coup Attempt* is statistically significant, as predicted by Hypothesis 2, though the magnitude is not great. In the most inclusive model (Model 2.5), a one standard deviation increase in *Oil Discovery* (0.2) increases the predicted probability of a *Coup Attempt* by about 14%. We expect only a modest increase in coup risk, however, because this coefficient represents the relationship between discovery and coup attempts *averaged across the entire sample*.

Finally, the promise of future oil wealth also affects whether the coups we observe actually succeed. Our final model evaluates Hypothesis 3, which predicts that coups attempted following larger oil discoveries will be less likely to be successful than those associated with smaller discoveries. While coup outcomes depend on many random factors related to the ability to coordinate and surprise the leadership (Fearon 2004), *Oil Discovery* is an important exception. The promise of future coup-proofing compels plotters to act quickly and to accept greater risks in the present. We therefore use logistic regression with clustered standard errors on the sample of attempted coups to predict coup success. Table 3 shows that coup success is negatively associated with the size of oil discoveries in a given year. The descriptive statistics also bear out this important relationship between oil discovery and coup success rates. Among coups that occurred in years when no new oil was discovered, 63% were successful. However, in coups occurring in the same year as discoveries, the success rate falls to just 33%. As expected, large discoveries motivate especially risky coups. Eleven

[12] Nordvik (2019) disaggregates oil wealth by in- and offshore production and finds that only the former is associated with an increased incidence of coups, using oil price shocks as a “plausibly exogenous” source of variation; yet even if shocks are endogenous sources of variation, they also introduce a potentially different mechanism—a temporary shock to government capabilities—unrelated to any mechanism associated with aggregate oil wealth itself.

[13] In fact, only once in this 31 year span did a country that produced absolutely no oil at $t-1$ announce oil discoveries in year t.

Table 2: Logit Models of Oil Production, Oil Discovery, and Coup Attempts

	Model 2.1	Model 2.2	Model 2.3	Model 2.4	Model 2.5
OilDiscovery	0.21	0.52*	0.69**	0.50*	0.54**
ln(*pcProduction*)	-9.00	2.79	-7.74	-6.99	1.88
ln(*pcGDP*)		-0.64***	-0.25	-0.05	0.02
Δ*pcGDP*		-5.13***	-4.81**	-4.70**	-4.22**
Δ*MilSpending*		-0.04	0.00	-0.03	-0.11
EthnicFrac			0.95	0.96	0.86
PolityX			0.04	0.02	0.03
MilGovt			2.11***	1.83***	1.91***
SinceReform				-0.16	-0.20*
SinceCoup				-0.03*	-0.03*
CivilWar				0.32	0.61*
SoldierQuality					0.01
ln(*Personnel*)					-0.22**
Constant	-3.44***	1.76*	-2.34	-3.17*	-2.80*
N	3,745	2,489	2,145	2,145	2,130
Pseudo L-L	-494.7	-362.5	-281.5	-277.0	-273.1

These are logistic regression results with robust standard errors clustered by country.
Asterisks mark statistical significance at 90%, 95%, and 99% thresholds.

Table 3: Logit Model of Oil Discovery and Coup Success

OilDiscovery	-2.10*
ln(*pcProduction*)	-8.06
Δ*pcGDP*	-4.68
CivilWar	0.004
SoldierQuality	-0.37
Constant	3.27
N	95
Pseudo L-L	-61.16

$^{*}\,p < 0.1$

coups were attempted when states made a discovery that was above the 80th percentile of all reported discoveries, and only 2 (18%) were successful. The 39 coups following smaller discoveries (below the 80th percentile) had a success rate of 38%.

Intuition suggests that a single factor both encouraging coup attempts but making them less likely to succeed is puzzling; why should militaries be more likely to launch coups when their chances are lower? Our theoretical model explains why; just like states waging preventive wars, the greater the anticipated losses associated with an opponent's growth, the lower the present prospects of success a declining side needs to engage in costly conflict (Wolford 2019, Ch. 4). This relationship also raises the standard for alternative explanations: a superior explanation must account for oil discovery raising the risk of coup attempts (Hypothesis 2) yet lowering the rate of success (Hypothesis 3), as well as the null effect of extant oil wealth (Hypothesis 1).

Conclusion

The pernicious effect of oil discovery on the risk of coups d'état is not unique to Mauritania, São Tomé, and other states that experienced oil discoveries and coups in close proximity. Realized oil wealth has competing, and on average countervailing, effects on the probability of attempted coups. Oil revenue increases the value of capturing the state, but it also makes it easier for the government to guard against coup attempts. Our theoretical model, however, predicts that not current but *expected* oil wealth is associated with coup attempts, because plotters hope to strike before the government can consolidate a shift in relative power. We also predict that larger announced oil reserves should also be associated with a lower rate of success in those coups that are attempted, because larger shifts in power will tempt plotters to launch coups on even longer odds of successfully toppling the leadership. We uncover all three predicted patterns in a sample of countries from 1980-2010, leveraging data on announced but not yet exploited oil reserves.

In addition to resolving the puzzle of why oil rich states are neither more nor less prone to coups despite their unique advantages in coup-proofing, we also show that violent conflict between and within states is often driven by similar mechanisms. Expected shifts in the distribution of power, which create a commitment problem when agreements must be self-enforcing, have been linked empirically to interstate wars (Bell and Johnson 2015), civil conflicts (Bell and Wolford 2015), preventive domestic repression (Carey et al. n.d.), and now attempted coups d'état. Coup attempts may often be "all-or-nothing" affairs, requiring surprise and extensive coordination to be carried off, but we have uncovered one factor, dramatic future increases in national oil wealth, that systematically pushes plotters towards launching coups d'état even when the odds are not strongly in their favor.

The announcement of oil reserves can lead to tragic outcomes despite the promise of boosting national wealth in developing countries that may sorely need it. Our model incorporates the possibility of a growing national pie explicitly into its logic, but the promise of "more to go around" is insufficient to stave off a costly, risky coup d'état when oil revenues *also* promise a shift in domestic power that favors the government over potential coup plotters. Governments often have incentives to misrepresent the size of the pie that they otherwise share with military factions (Dal Bó and Powell 2009), but we show that costly coup attempts may be launched even under complete information. Uncertainty is not necessary to generate costly conflict in our model, though it could avert coup attempts if only governments were able to hide the extent of newly proved oil reserves. Their ability to do so, however, given that many states rely on foreign expertise managing massive exploratory operations, is clearly in question.

Appendix

Proof of Proposition 1. Begin at $t = 2$, where M accepts some x_2 iff

$$\pi_2(1-x_2) \geq \pi_2\left(\frac{p}{1+R+rw}\right)(1-d) \Leftrightarrow x_2 \leq 1 - \frac{p(1-d)}{1+R+rw} = \overline{x}_2.$$

If G wishes to secure acceptance, it meets M's acceptance constraint at equality, since to win acceptance of some $x_2 < \overline{x}_2$ would be unprofitable. Therefore, it proposes $x_2^* = \overline{x}_2$ rather than some $x_2 > \overline{x}_2$ when

$$\pi_2\overline{x}_2 \geq \pi_2\left(1 - \frac{p}{1+R+rw}\right)(1-d),$$

which is sure to be true given the costs of conflict.

Moving back to $t = 1$, M accepts some x_1 iff

$$\pi_1(1-x_1) + \pi_2(1-\overline{x}_2) \geq \pi_1\left(\frac{p}{1+R}\right)(1-d) + \pi_2\left(\frac{p}{1+R}\right)(1-d),$$

where

$$x_1 \leq 1 - \frac{p(1-d)(R(1+R)+rw(r+2R))}{R(1+R)(1+R+rw)} = \overline{x}_1.$$

Provided that $\overline{x}_1 \geq 0$, G meets M's acceptance constraint at equality, proposing $x_1^* = \overline{x}$, if it wishes to induce acceptance (as before, it has no incentive to propose some $x_1 > \overline{x}_1$). It proposes $x_1^* = \overline{x}_1$ rather than some $x_1 > \overline{x}_1$ that induces rejection when

$$\pi_1\overline{x}_1 + \pi_2\overline{x}_2 \geq \pi_1\left(1 - \frac{p}{1+R}\right)(1-d) + \pi_2\left(1 - \frac{p}{1+R}\right)(1-d),$$

which is sure to be true given the costs of conflict. But when r and p are sufficiently large, M rejects any $x_1 \in [0,1]$, which we can show by setting $x_1 = 0$ and solving

$$\pi_1\left(\frac{p}{1+R}\right)(1-d) + \pi_2\left(\frac{p}{1+R}\right)(1-d) > \pi_1 + \pi_2(1-\overline{x}_2),$$

which is satisfied when $r > \hat{r}$ and $p > \hat{p}$ as defined, respectively, in Equations (1) and (2).

Therefore, when $r > \hat{r}$ and $p > \hat{p}$, all SPE are sure to entail a coup attempt at $t = 1$; otherwise, G makes proposals that M accepts in the unique (and peaceful) SPE. □

Proof of Proposition 2. We prove the claim by showing that

$$\frac{\partial \hat{p}}{\partial r} = -\frac{Rw(1+R)\left((1+R)(2r+R)+r^2w\right)}{(1-d)(R(1+R)+rw(r+2R))^2} < 0$$

is negative. □

Proof of Proposition 3. First, that no relationship between coup attempts and R exists when $r = 0$ follows from Proposition 1, because coup attempts do not occur on the equilibrium path when $r \leq \hat{r}$. Second, to establish that the coup constraints become harder to satisfy as R increases, we show that

$$\frac{\partial \hat{r}}{\partial R} = -1 + \frac{1+2R}{2(1-d)} + \frac{2(1-d)(d+2dR+R(2+3R)) + Rw(1-2d-R)(1-2d-2R)}{2w(1-d)^2\sqrt{\frac{R(4(1-d)(1+R)(d+R)+Rw(1-2d-R)^2)}{w(1-d)^2}}} > 0$$

and

$$\frac{\partial \hat{p}}{\partial R} = \frac{R^2(1+R)^2 + rw(1+R)\left(r+3rR+4R^2\right) + r^2w^2\left(r+2rR+2R^2\right)}{(1-d)(R(1+R)+rw(r+2R))^2} > 0$$

are strictly positive. □

Proof of Proposition 4. To prove the claim, we show that

$$\frac{\partial \mathrm{E}(c_1(p,\pi_1))}{\partial r} = -\frac{Rw\left((1+R)(2r+R)+r^2w\right)}{2(1-d)(R(1+R)+rw(r+2R))^2} < 0$$

is negative. □

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