

Oil and Autocratic Regime Survival

Online Appendix

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Abstract

This paper uncovers a new mechanism linking oil wealth to autocratic regime survival: increases in oil income lower the risk of ouster by groups that establish new autocratic regimes, not by reducing the likelihood of democratization. We investigate whether oil wealth influences autocratic survival by lowering the chances of democratization, reducing the risk of transition to subsequent dictatorship, or both. Using a new measure of autocratic durability shows that once we model unit effects, oil wealth promotes autocratic survival by lowering their risk of ouster by rival autocratic groups. Evidence also indicates that oil income increases military spending in dictatorships, which suggests that increasing oil wealth may deter coups that can cause regime collapse.

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Data Appendix S: Summary statistics and sample regime collapses

Table S-1: Summary statistics

Variable	N	Mean	Std Dev	Min	Max
Autocratic Transition	4138	0.024	0.155	0	1
Democratic Transition	4138	0.022	0.148	0	1
Regime duration	4138	19.2	17.3	1	105
Calendar time	4138	33.3	15.2	1	61
Civil War	4138	0.151	0.358	0	1
Neighbor Democracy	4138	0.333	0.600	0	2
$\overline{\text{Log}(GDPpc)}$	4138	7.50	0.797	6.16	9.72
$\overline{\text{Log}(GDPpc)}_{Dev}$	4138	-0.0096	0.360	-1.64	1.53
$\overline{\text{Oilpc}}$	4138	1.97	2.54	0	9.67
$\overline{\text{Oilpc}}_{Dev}$	4138	0.0259	1.13	-6.81	5.46
$\overline{\text{Dict}}$	4138	0.0246	0.0336	0	0.194
$\overline{\text{Dem}}$	4138	0.0231	0.0369	0	1

Table S-3: Oil income and all regime failures

Full results from Table 1 (a)

Sample Include \bar{Y}_i	Full No	Restricted	Restricted No	Full No	Restricted Yes	Full Yes
	(1)	(2)	(3)	(4)	(5)	(6)
Oil_{t-1}	-0.121** (0.04)	-0.265** (0.10)				
\overline{Oil}_i			-0.092* (0.04)	-0.111** (0.04)	-0.053+ (0.03)	-0.071* (0.03)
Oil_{Dev}			-0.196 (0.12)	-0.166 (0.13)	-0.300* (0.14)	-0.290* (0.13)
\overline{Fail}_i					13.212** (1.15)	14.901** (1.37)
\overline{GDPpc}_i	0.028 (0.13)		0.170 (0.11)	0.015 (0.12)	0.036 (0.08)	-0.064 (0.09)
$GDPpc_{Dev}$	1.070** (0.29)		0.895** (0.31)	1.122** (0.30)	0.499 (0.40)	0.585 (0.39)
$GDPpc_{t-1}$		0.242 (0.37)				
Civil war $_{t-1}$	0.511** (0.18)	0.778** (0.25)	0.287 (0.18)	0.502** (0.19)	0.410* (0.18)	0.543** (0.19)
Neighbor democracy $_{t-1}$	0.376** (0.10)	0.323** (0.12)	0.364** (0.10)	0.374** (0.10)	0.361** (0.11)	0.367** (0.11)
Duration time	-0.030 (0.02)	0.004 (0.03)	-0.019 (0.02)	-0.029 (0.02)	0.043 (0.03)	0.049+ (0.03)
Duration time ²	-0.000 (0.00)	0.001 (0.00)	-0.000 (0.00)	-0.000 (0.00)	-0.001 (0.00)	-0.001+ (0.00)
Duration time ³	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)	0.000+ (0.00)
Area under ROC	0.671		0.631	0.672	0.748	0.799
Observations	4138	3176	3176	4138	3176	4138
Countries	114	88	88	114	88	114

+ p<0.10; * p<0.05; ** p<0.01. Conditional logit in column 2. Ordinary logit with errors clustered on country in all other columns. Calendar time polynomials (3) included in all models but not reported. Years: 1947-2007.

Table S-4: Oil income and democratic transitions

Full results from Table 1 (b)

Sample Include \bar{Y}_i	Full No	Restricted	Restricted No	Full No	Restricted Yes	Full Yes
	(1)	(2)	(3)	(4)	(5)	(6)
Oil_{t-1}	-0.153** (0.05)	-0.002 (0.17)				
\overline{Oil}_i			-0.113+ (0.07)	-0.224** (0.07)	-0.089+ (0.05)	-0.169** (0.06)
Oil_{Dev}			0.032 (0.20)	0.107 (0.16)	-0.055 (0.21)	-0.038 (0.19)
\overline{Dem}_i					17.634** (2.16)	24.107** (3.55)
\overline{GDPpc}_i	0.318+ (0.17)		0.351** (0.12)	0.396* (0.18)	0.191+ (0.11)	0.159 (0.14)
GDPpc $_{Dev}$	1.578** (0.39)		0.939* (0.44)	1.336** (0.40)	0.583 (0.48)	0.651 (0.49)
GDPpc $_{t-1}$		-0.075 (0.61)				
Civil war $_{t-1}$	0.185 (0.26)	0.199 (0.41)	-0.186 (0.23)	0.236 (0.26)	0.046 (0.23)	0.341 (0.25)
Neighbor democracy $_{t-1}$	0.360* (0.15)	0.367* (0.17)	0.426** (0.15)	0.365* (0.15)	0.456** (0.16)	0.447** (0.16)
Duration time	-0.060* (0.03)	-0.054 (0.05)	-0.036 (0.04)	-0.067* (0.03)	0.014 (0.04)	0.014 (0.04)
Duration time ²	0.001 (0.00)	0.004* (0.00)	0.000 (0.00)	0.001 (0.00)	-0.000 (0.00)	-0.000 (0.00)
Duration time ³	0.000 (0.00)	-0.000* (0.00)	0.000 (0.00)	-0.000 (0.00)	0.000 (0.00)	0.000 (0.00)
Area under ROC	0.721		0.732	0.723	0.804	0.862
Observations	4138	2102	2102	4138	2102	4138
Countries	114	63	63	114	63	114

+ p<0.10; * p<0.05; ** p<0.01. Conditional logit in column 2. Ordinary logit with errors clustered on country in all other columns. Calendar time polynomials (3) included in all models but not reported. Years: 1947-2007.

Table S-5: Oil income and autocratic transitions

Full results from Table 1 (c)

Sample Include \bar{Y}_i	Full No	Restricted	Restricted No	Full No	Restricted Yes	Full Yes
	(1)	(2)	(3)	(4)	(5)	(6)
Oil_{t-1}	-0.055 (0.05)	-0.325* (0.13)				
\overline{Oil}_i			-0.097+ (0.05)	-0.014 (0.05)	-0.075+ (0.04)	-0.023 (0.05)
Oil_{Dev}			-0.263* (0.12)	-0.280* (0.14)	-0.324* (0.13)	-0.347* (0.14)
\overline{Dict}_i					14.344** (1.74)	19.877** (2.71)
\overline{GDPpc}_i	-0.262 (0.19)		0.349* (0.16)	-0.335+ (0.19)	0.172 (0.15)	-0.318+ (0.16)
$GDPpc_{Dev}$	0.480 (0.41)		0.408 (0.55)	0.818+ (0.49)	0.154 (0.62)	0.384 (0.55)
$GDPpc_{t-1}$		0.249 (0.57)				
Civil war $_{t-1}$	0.692** (0.26)	0.943** (0.33)	0.431+ (0.24)	0.643* (0.27)	0.501* (0.24)	0.701** (0.25)
Neighbor democracy $_{t-1}$	0.433** (0.16)	0.333+ (0.17)	0.355* (0.16)	0.425** (0.16)	0.300+ (0.17)	0.313+ (0.17)
Duration time	-0.003 (0.03)	0.061 (0.05)	0.013 (0.04)	0.003 (0.03)	0.065 (0.04)	0.083* (0.04)
Duration time ²	-0.001 (0.00)	0.000 (0.00)	-0.001 (0.00)	-0.001 (0.00)	-0.002 (0.00)	-0.003* (0.00)
Duration time ³	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)	0.000+ (0.00)	0.000 (0.00)	0.000* (0.00)
Area under ROC	0.710		0.662	0.724	0.735	0.828
Observations	4138	2202	2202	4138	2202	4138
Countries	114	57	57	114	57	114

+ p<0.10; * p<0.05; ** p<0.01. Conditional logit in column 2. Ordinary logit with errors clustered on country in all other columns. Calendar time polynomials (3) included in all models but not reported. Years: 1947-2007.

Appendix A: Robustness tests

The top panel of Table A-1 shows the variance of the mean levels and deviations of oil wealth, by geographic region. Oil income has the most variation in the Middle East and North Africa – both across and within countries. This is also the region where dictatorships tend to be the most stable during the sample period, suggesting that statistical approaches (such as a conditional logit) that drop countries that do not experience transitions exclude many cases from the region with the most variation in oil income.

The bottom panels report results from the specification in column 6 from Table 1 when we add a binary variable for the ‘excluded’ region and interactions between this excluded region and \overline{Oil} and between region and Oil_{Dev} . The coefficient estimates for \overline{Oil} and Oil_{Dev} estimate the marginal effect of these variables for all regions except for the ‘excluded’ region. We report the Wald test for the interaction terms, which estimates whether these interaction terms are jointly significant. A statistically significant Wald test provided some evidence that the oil estimates are substantively different in the excluded region.

Table A-1: Robustness to excluding geographic regions

(a) Sample variance, by region

	Region				
	MENA	LA	Asia	SSA	EU
Variance \overline{Oil}_{Dev}	3.72	0.71	0.81	0.82	0.93
Variance \overline{Oil}_i	8.13	3.91	2.97	3.48	3.25

(b) Democratic transitions

	All regions included	Excluded region				
		MENA	LA	Asia	SSA	EU
\overline{Oil}	-0.169** (0.06)	-0.141* (0.07)	-0.204* (0.09)	-0.187** (0.06)	-0.154* (0.06)	-0.161* (0.07)
Oil_{Dev}	-0.038 (0.19)	0.127 (0.19)	-0.044 (0.26)	-0.151 (0.19)	-0.076 (0.20)	-0.074 (0.20)
Wald test (χ^2)		0.3	2.9	0.7	1.7	0.9

(c) Autocratic transitions

	All regions included	Excluded region				
		MENA	LA	Asia	SSA	EU
\overline{Oil}	0.039 (0.07)	-0.091 (0.08)	0.001 (0.05)	-0.030 (0.06)	-0.016 (0.05)	-0.036 (0.05)
Oil_{Dev}	-0.347* (0.15)	-0.294+ (0.17)	-0.303+ (0.16)	-0.402* (0.16)	-0.344* (0.15)	-0.343* (0.14)
Wald test (χ^2)		0.6	2.1	0.9	1.2	9.1*

+ p<0.10; * p<0.05; ** p<0.01. Logit with errors clustered on country. Control variables, time dependence polynomials (3), and calendar time polynomials (3) included in all models but not reported. Years: 1947-2007. Wald tests are for the interaction between the region dummy and oil variables in the full sample.

Table A-2: Oil income and autocratic survival

(Ross 2008 Oil & Gas rents)

(a) Democratic transitions

Sample Include \bar{Y}_i	Full No	Restricted	Restricted No	Full No	Restricted Yes	Full Yes
	(1)	(2)	(3)	(4)	(5)	(6)
Oil_{t-1}	-0.183** (0.06)	-0.012 (0.21)				
\overline{Oil}_i			-0.130* (0.06)	-0.114+ (0.06)	-0.227** (0.07)	-0.206** (0.07)
Oil_{Dev}			-0.044 (0.15)	0.015 (0.17)	0.040 (0.14)	0.056 (0.16)
\overline{Dem}_i				18.889** (2.15)		28.766** (2.97)
Log likelihood	-351.1	-169.1	-279.6	-263.8	-349.9	-298.8
Observations	3593	1654	1654	1654	3593	3593

(b) Autocratic transitions

Sample Include \bar{Y}_i	Full No	Restricted	Restricted No	Full No	Restricted Yes	Full Yes
	(1)	(2)	(3)	(4)	(5)	(6)
Oil_{t-1}	-0.088 (0.06)	-0.447** (0.15)				
\overline{Oil}_i			-0.111+ (0.06)	-0.084 (0.05)	-0.039 (0.06)	-0.046 (0.06)
Oil_{Dev}			-0.330** (0.12)	-0.414** (0.13)	-0.371** (0.13)	-0.451** (0.14)
\overline{Dict}_i				15.676** (1.93)		21.787** (2.79)
Log likelihood	-377.6	-234.2	-322.1	-306.8	-374.6	-337.3
Observations	3593	1756	1756	1756	3593	3593

+ $p < 0.10$; * $p < 0.05$; ** $p < 0.01$. Conditional logit in column 2. Ordinary logit with errors clustered on country in all other columns. Time dependence polynomials (3); calendar time polynomials (3); and control variables (GDP per capita, Civil War, Neighbor Democracy) included in all models but not reported. Years: 1961-2007.

Table A-3: Fuel income and autocratic survival
(Haber & Menaldo 2011 Fuel Income)

(a) Democratic transitions

Sample Include \bar{Y}_i	Full No	Restricted	Restricted No	Full No	Restricted Yes	Full Yes
	(1)	(2)	(3)	(4)	(5)	(6)
$Fuel_{t-1}$	-0.144** (0.06)	-0.105 (0.18)				
\overline{Fuel}_i			-0.116+ (0.06)	-0.089+ (0.05)	-0.202** (0.07)	-0.163** (0.06)
$Fuel_{Dev}$			0.009 (0.18)	-0.071 (0.20)	0.075 (0.14)	-0.048 (0.17)
\overline{Dem}_i				17.684** (2.06)		24.211** (3.34)
Log likelihood	-414.8	-235.0	-344.7	-322.0	-413.0	-357.2
Observations	4138	2102	2102	2102	4138	4138

(b) Autocratic transitions

Sample Include \bar{Y}_i	Full No	Restricted	Restricted No	Full No	Restricted Yes	Full Yes
	(1)	(2)	(3)	(4)	(5)	(6)
$Fuel_{t-1}$	-0.161* (0.07)	-0.282* (0.13)				
\overline{Fuel}_i			-0.097+ (0.05)	-0.069+ (0.04)	-0.128* (0.06)	-0.097 (0.06)
$Fuel_{Dev}$			-0.246+ (0.13)	-0.300* (0.14)	-0.314* (0.15)	-0.348* (0.16)
\overline{Dict}_i				14.220** (1.77)		19.592** (2.61)
Log likelihood	-449.4	-300.7	-397.9	-381.2	-448.2	-408.2
Observations	4138	2202	2202	2202	4138	4138

+ $p < 0.10$; * $p < 0.05$; ** $p < 0.01$. Conditional logit in column 2. Ordinary logit with errors clustered on country in all other columns. Time dependence polynomials (3); calendar time polynomials (3); and control variables (GDP per capita, Civil War, Neighbor Democracy) included in all models but not reported. Years: 1947-2007.

Table A-4: Regression of country means

Oil variable	H&M	H&M	Ross	Ross
Transition	Dem	Autocratic	Dem	Autocratic
\overline{Oil}_i	-0.331+ (0.18)	0.077 (0.15)	-0.310+ (0.18)	-0.003 (0.15)
R^2	0.246	0.257	0.233	0.256
Observations	113	114	110	110

+ p<0.10; * p<0.05; ** p<0.01. Dependent variable is $\overline{FailType}_i$. OLS; standard errors in parentheses. One observation per country. All models control for mean level of $\log(GDPpc_{t-1})$, $CivilWar_{t-1}$, $NeighborDemocracy$, $TimeDuration$ and $TimeDuration^2$. Model in first column excludes Costa Rica as an outlier; including it more than doubles the size of the coefficient. Coefficient estimate in first column indicates that a 2 standard deviation increase in mean oil level is associated with a 1.7% decrease in mean democracy. Coefficient in third column indicates a similar 1.5% decrease in mean democracy.

Table A-5: Linear probability model

(with country and year FE)

Oil variable	H&M	H&M	Ross	Ross
Transition	Dem	Autocratic	Dem	Autocratic
Oil_{t-1}	-0.132 (0.26)	-0.723** (0.27)	0.027 (0.28)	-0.859** (0.29)
R^2	0.039	0.035	0.041	0.033
Observations	4138	4138	3593	3593

+ p<0.10; * p<0.05; ** p<0.01. Dependent variable is Regime Transition (Democratic, Autocratic). OLS with country and year fixed effects; standard errors in parentheses. All models control for: $Log(GDPpc_{t-1})$, $CivilWar_{t-1}$, $NeighborDemocracy$, $TimeDuration$. Coefficient estimate in second column indicates that a 2 standard deviation increase in oil is associated with a 4.0% decrease in the linear probability of autocratic transition. Coefficient in fourth column indicates a similar 4.8% decrease in linear probability of autocratic transition.

Table A-6: Oil income and democratic transition
(with ACLP/CGV data)

Calendar time	Trend	Trend	Year FE	Year FE
\overline{Oil}_i	-0.188** (0.06)	-0.112 (0.07)	-0.196** (0.07)	-0.124+ (0.07)
Oil_{Dev}	0.095 (0.14)	-0.022 (0.19)	0.144 (0.14)	0.043 (0.19)
\overline{Dem}_i		32.485** (4.77)		33.914** (5.02)
Log likelihood	-401.1	-332.5	-362.0	-294.3
Observations	4368	4368	3273	3273

+ p<0.10; * p<0.05; ** p<0.01. Dependent variable is Democratic Transition. Ordinary logit with standard errors clustered on country. All models control for: $Log(GDPpc_{t-1})$, $CivilWar_{t-1}$, $NeighborDemocracy$, $TimeDuration$, and $TimeDuration^2$. Estimates for \overline{Oil}_i are much larger and statistically significant at the 0.05 level when we include mean and deviation of $log(Population)$ (not reported).

Table A-7: Modeling time and oil price

	Y	Y	N	N
Year FE	Y	Y	N	N
Year polynomials	N	N	Y	Y
Oil price control	N	N	Y	Y
Transition	Democratic	Autocratic	Democratic	Autocratic
\overline{Oil}_i	-0.189** (0.07)	-0.023 (0.05)	-0.181** (0.06)	-0.023 (0.05)
Oil_{Dev}	0.066 (0.23)	-0.368* (0.15)	0.006 (0.19)	-0.347* (0.15)
\overline{Dem}_i	28.780** (3.78)		24.159** (3.41)	
\overline{Dict}_i		20.977** (2.96)		19.872** (2.69)
Log likelihood	-308.4	-372.0	-355.3	-408.9
Observations	3175	3316	4138	4138

+ p<0.10; * p<0.05; ** p<0.01. Dependent variable is Regime Transition (Democratic, Autocratic). Ordinary logit with clustered standard errors in parentheses. All models control for: $Log(GDPpc_{t-1})$, $CivilWar_{t-1}$, $NeighborDemocracy$, $TimeDuration$.

Table A-8: Time period results
(pre-1980 & post-1979)

Transition	<u>Democratic</u>		<u>Autocratic</u>	
	N	Y	N	Y
Oil interactions with pre-1980 dummy				
\overline{Oil}_i	-0.189** (0.07)	-0.241** (0.09)	-0.023 (0.05)	-0.073 (0.09)
Oil_{Dev}	0.066 (0.23)	0.164 (0.23)	-0.368* (0.15)	-0.465* (0.23)
$\overline{Oil}_i \times pre80$		0.125 (0.13)		0.084 (0.13)
$Oil_{Dev} \times pre80$		-0.263 (0.35)		0.150 (0.23)
<u>Coefficients for the pre-1980 period</u>				
$\beta_{\overline{Oil}} + \beta_{\overline{Oil} \times pre80}$		-0.116 (0.11)		0.012 (0.07)
$\beta_{Oil_{Dev}} + \beta_{Oil_{Dev} \times pre80}$		-0.099 (0.32)		-0.315* (0.17)
Log likelihood	-308.4	-307.8	-372.0	-371.6
Observations	3175	3175	3316	3316

+ p<0.10; * p<0.05; ** p<0.01. Dependent variable is Regime Transition (Democratic, Autocratic). Ordinary logit with clustered standard errors in parentheses. All models control for: $Log(GDPpct_{t-1})$, $CivilWar_{t-1}$, $NeighborDemocracy$, $RegimeDuration$, and year fixed effects.

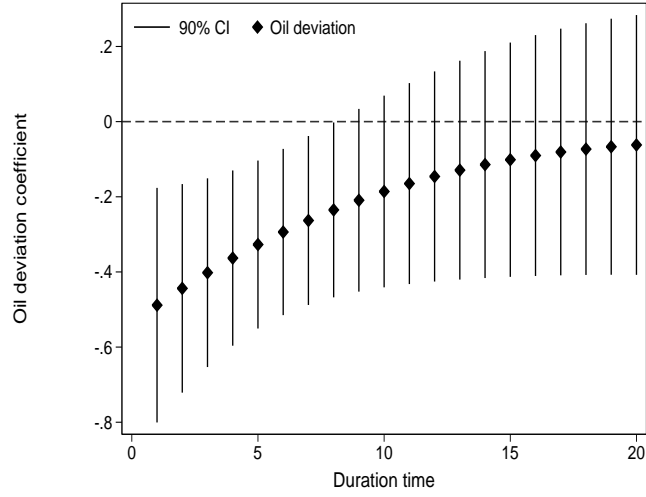


Figure A-1: *Non-proportional hazard for Oil Deviations, Autocratic transitions model.* This graph shows how the coefficient for Oil_{Dev} varies by duration time in the model reported in Table 1, Panel C, column 6 (with year fixed effects). The Wald-test for the (3) interactions between duration time polynomials (3) and Oil_{Dev} , however, yields a test statistic with $p = 0.28$, suggesting that these coefficients are not jointly statistically different from zero. A test of non-proportional hazards in a Cox model (stratified by country) also indicates that the proportional hazard assumption is not violated. Nonetheless, there appears to be a substantive pattern suggesting that the within-country effect is concentrated in the first decade the autocratic regime holds power. Similar Wald-tests and tests for non-proportional hazards in Cox models for models reported in column (6) of Panels A and B in Table 1 yield test statistics with $p > 0.65$, suggesting that the proportional hazards assumption is not violated.

Andersen and Ross (2014) argue that the effect of oil occurs over periods greater than a year because many oil-rich countries have sovereign wealth funds or other mechanisms for smoothing short-term fluctuations in oil income. To investigate this, we use longer lagged moving averages of oil income to calculate the deviation variable. The main result for within-country changes in oil wealth remains, though it becomes slightly weaker as the moving average increases over more lagged years. Figure A-2 shows the coefficient estimates for oil deviations, using the lagged moving average for oil income instead of the one-year lagged deviation.

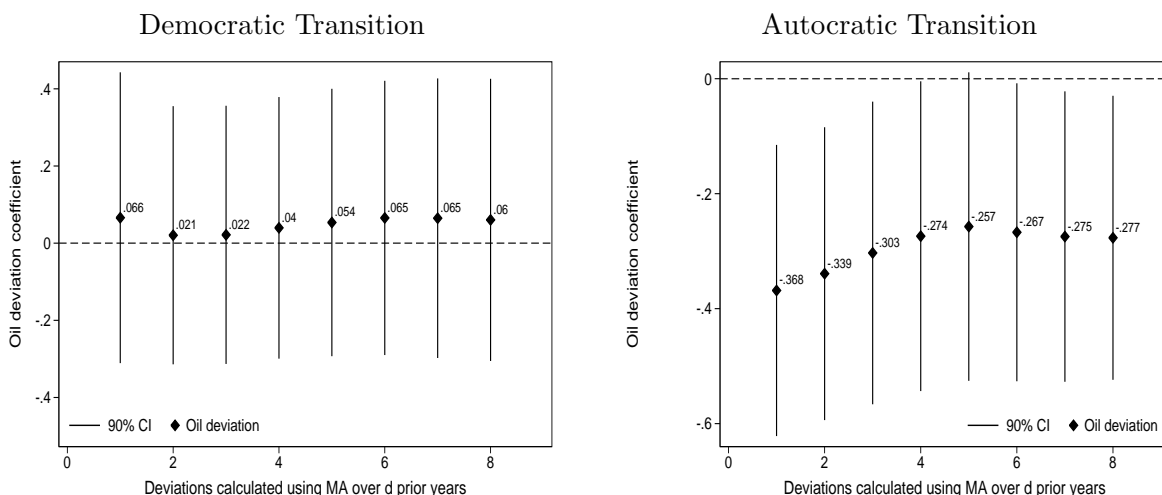
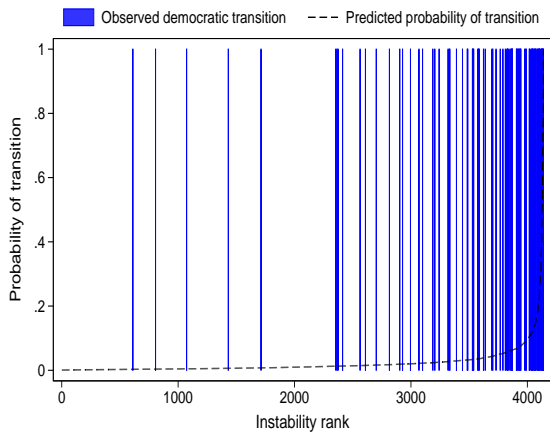


Figure A-2: *Coefficients for oil deviations, calculated using lagged moving averages for oil income.* This graph reports the results for the Oil_{Dev} coefficient for the main model specification (column 6 in Table 1) when the model includes year fixed effects. The value of 1 on the horizontal axis of these figures corresponds with the coefficient estimate for $Oil_{Dev} \equiv Oil_{t-d,i} - \overline{Oil}_i$ where $d = 1$. We then calculate the deviations using the lagged moving average of oil income over the previous d periods instead of just the one-year lag. The coefficients and confidence intervals for Oil_{Dev} are shown as d increases from 1 to 8.

Democratic Transition



Autocratic Transition

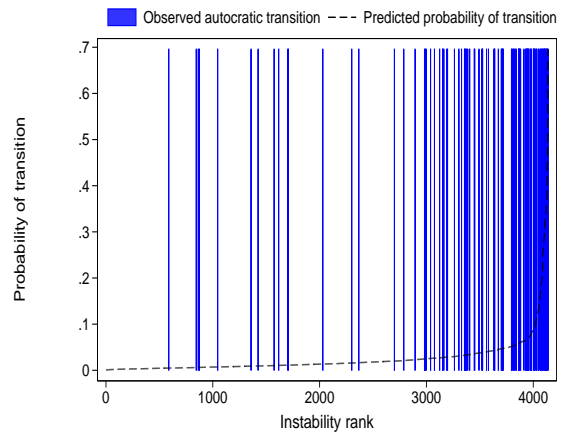


Figure A-3: *Separation plots*. The vertical axes and the dashed lines show the predicted risk of transition (models reported in column 6 of Table 1, panels B and C). The horizontal axes order the observations from the lowest to the highest predicted risk for 4138 observations. The vertical blue shading marks observations where the dependent variable is equal to one, or observed transitions. These plots show that the democratic transition model appears to perform better than the autocratic transition model.

Appendix B: Extension of conditional logit in Haber and Menaldo (2011)

Table B-1 explores why the null result for time-varying oil income and democracy in the conditional logit model (column 2, Panel B, Table 1 in the main text) differs from the positive result reported in the Appendix to Haber and Menaldo (2011). Our baseline specification is different from the HM model in a couple of ways: we examine a shorter time period (post-1946); we control for regime duration; we substitute calendar year polynomials for year fixed effects; we log the oil income variable; and we examine a sample of autocracies (only) to assess the likelihood of democratic transition. This latter difference means that we are using only one-half of a typical Markov switching model, which in this literature simultaneously estimates the risk of transition to and from democracy.

The first column replicates the conditional logit result from the Appendix to Haber and Menaldo (2011). This specification is a simple logit that includes year fixed effects for every year from 1970 onwards as well as country fixed effects (thus technically an unconditional logit).¹ The second column includes interactions between the year fixed effects and the lagged dependent variable, allowing the time effects to vary by whether the incumbent regime is a dictatorship or a democracy. The positive result for oil remains. The third column interacts the country fixed effects with lagged regime, allowing the country effects to vary by type of transition. The oil coefficient is now much smaller and no longer significant at the 0.10 level. The fourth column includes interactions between lagged regime and both year and country effects. The fifth column replicates this result by using only one-half of a full Markov switching model in that it only examines autocratic observations that are at risk of democratizing. The main result for oil income is again smaller and not statistically different from zero. This suggests that one reason our result is different is that our estimate for oil income is conditioned on a country effect that aggregates information only over autocratic observations and not over both autocratic and democratic observations.

The sixth column substitutes calendar year polynomials for year fixed effects; the result for oil income is similar to that in column 1. The seventh column uses the natural log of oil income instead of the raw per capita value. The oil income coefficient is no longer significant (because oil income has been transformed, the size of the coefficient in column 5 is not comparable to that in other columns). In the eighth column, we control for regime duration time with three polynomials (and interact them with lagged regime). The coefficient for oil income is positive, suggesting that modeling regime duration does not substantively alter the estimate of the oil coefficient. In the ninth column, we restrict the sample to the post-WWII period, and this yields similar results to column 1.

Finally, in the last column we implement all of these changes to the specification at once: we log oil income, use only the autocratic half of the Markov switching model, substitute calendar year polynomials for year fixed effects, restrict the sample to post-1946, and control for regime duration. This specification is most similar to the empirical approach we use throughout the paper. The oil income coefficient is now negative but not statistically different from zero.

The results in this table suggest two changes we make to the model specification that are most likely to account for why the null finding in our model of the relationship between oil income and democratic transition (column 2, Panel B, Table 1 in the main text) differs from the positive finding in Haber and Menaldo's. First, we use the natural log of oil income which, as column 7 suggests, diminishes the positive influence of oil income on the risk of democratic transition.

¹At $T > 20$, the coefficient estimates for the conditional logit and the unconditional logit with unit FE's converge (see Katz 2001). The coefficient for the conditional logit is: 1.333 (0.65).

Second, we employ one-half of a full Markov transition model and thus analyze only autocratic observations. This means we estimate cross-country unit effects only for autocratic time periods, which is equivalent to interacting the country fixed effects with the lagged dependent variable (measuring prior state) in a full Markov transition model.

Sample restriction in conditional logit: Oil and regime transition example

The conditional logit model makes two changes to an ordinary logit: it restricts the sample to countries that transition to or from democracy during the sample period, excluding countries that never change states; and it accounts for unit specific effects. Table B-2 explores the relative influence of these changes by first showing how a simple logit performs using the full (column 1) and restricted samples (column 2). The third column introduces unit effects by employing a conditional logit. This is the same model reported in the Appendix to Haber and Menaldo (2011) and shown in column 1 of Table B-2. The difference between the odds ratios in the first two columns is the result of excluding the cases that never change. The difference between the estimates in the second and third columns results from accounting for unit effects.

First, note that the number of countries drops from 165 to 80 when the sample is restricted to include only those that change states. This change to the model moves the odds ratio from a negative and significant estimate to a positive (though statistically insignificant) estimate. Adding unit effects in the third column makes the odds ratio more positive and statistically significant.

We are reluctant to interpret these results substantively without estimating both the cross-country and within-country variation, but provide them as a caution to users of conditional logit models. For models of oil and democratic transitions, the potential bias from restricting the sample (reflected in the difference in odds ratios in columns 1 and 2 of Table B-2) shows up in the results reported in Table 1 of the main text as bias in the estimates of the cross-country correlations (\overline{Oil}_i). Comparing the $\beta_{\overline{Oil}_i}$'s in models in columns 5 and 6 in Panel B in Table 1 (main text) shows that restricting the sample biases the estimate in a positive direction (towards zero in this case). This should not be surprising because many of the countries that do not democratize during the sample period have high oil incomes.

Table B-3 reports the results for a similar exercise using the *democratic* and *autocratic* transition dependent variables employed in Tables 1 and 2 of the main text. For both types of transition, restricting the sample in the ordinary logit moves the estimate for Oil_{t-1} closer to the estimate from the conditional logit. Again, we caution against interpreting these estimates substantively because the ordinary logit models with a lagged covariate do not separately estimate the cross-country and within-country variation.

Table B-1: Oil income and democratic transitions
(Replication and extension of Haber and Menaldo's conditional logits)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log Oil	N	N	N	N	N	N	Y	N	N	Y
Markov	Full	Full	Full	Full	Half	Full	Full	Full	Full	Half
Years	all	all	all	all	all	all	all	all	post-1946	post-1946
Regime duration polynomials (3)	N	N	N	N	N	N	N	Y	N	Y
Calendar time polynomials (3)	N	N	N	N	N	Y	N	N	N	Y
Year effects	Y	Y	Y	Y	Y	N	Y	Y	Y	N
Year effects×Regime _{t-1}	N	Y	N	Y	N	N	N	N	N	N
Country effects×Regime _{t-1}	N	N	Y	Y	N	N	N	N	N	N
Oil income per capita	1.316* (0.66)	1.417* (0.72)	0.242 (0.66)	0.421 (0.88)	0.421 (0.88)	0.997** (0.35)	0.059 (0.12)	1.003 (0.62)	1.345* (0.60)	-0.021 (0.25)
Observations	5932	5278	4980	4530	3060	5932	5932	5932	3211	1858
Countries in sample	80	80	79	79	73	80	80	80	69	64

+ p<0.10; * p<0.05; ** p<0.01. Dependent variable is ACLP (Boix and Rosato prior to 1946) transition to democracy, as combined in Haber and Menaldo (2011). Fixed effects logit with robust standard errors clustered on country. All years ≡ 1817-2002. Country fixed effects included in all models. Number of observations drops in columns 2-4 because some years/countries (interacted with lagged DV) do not change states. When oil is not logged the per capita total is divided by 1000, as in Haber and Menaldo (2011).

Table B-2: Potential bias from sample restriction

Logit Sample	Simple Full	Simple Restricted	Conditional Restricted
Oil income _{t-1}	-1.02 (0.026)	0.25 (0.635)	1.33 (0.039)
Countries	165	80	80
Observations	9305	5932	5932

Replication and extension of conditional logit models in the Appendix to Haber and Menaldo (2011). Reported odds ratio for transition from Autocracy to Democracy. P-values in parentheses. Model specification is the same as in column 1 of Table B-1.

Table B-3: Potential bias in the conditional logit

(a) Democratic transitions

Logit Sample	Simple Full	Simple Restricted	Conditional Restricted
Oil income _{t-1}	-0.169 (0.00)	-0.095 (0.12)	-0.002 (0.99)
Countries	114	63	63
Observations	4138	2120	2120

(b) Autocratic transitions

Logit Sample	Simple Full	Simple Restricted	Conditional Restricted
Oil income _{t-1}	-0.056 (0.33)	-0.131 (0.01)	-0.325 (0.01)
Countries	114	57	57
Observations	4138	2202	2202

Extension of analysis reported in Table 1. Odds ratios reported; p-values in parentheses. Model only examines countries coded as autocracy on January 1 of the observation year. Control variables include: $\text{Log}(GDPpc)_{t-1}$, CivilWar_{t-1} , Neighbor Democracy, Calendar year trend (3), and duration polynomials (3).

Appendix C: Oil Wealth and Polity Durable variable

Haber and Menaldo (2011) examine how oil wealth influences democracy using two measures of the latter concept: the combined Polity scale (treated as a quasi-continuous variable); and a binary indicator of transition from non-democracy to democracy from Cheibub, Gandhi and Vreeland (2010). They show that the negative statistical correlation between oil and these measures largely disappears once they account for unit fixed effects. They find no evidence that time-varying oil wealth is negatively correlated with the level of democracy, changes in the level of democracy, or the risk of democratic transition. In this Appendix, we examine another widely used measure of ‘regime instability’, the Polity Durable variable, which is a binary indicator of whether the combined Polity score has changed three or more points (in either direction) over the past three years.

We begin by taking all the Polity Durable failures where we have non-missing data on oil wealth and the combined Polity scale on December 31 of the prior calendar year is less than six, indicating that Polity codes the observation year as not-Democracy. To test the relationship between oil wealth and the risk of a Polity Durable failure, we use a logit model with a similar specification to that used throughout.² The first column of Table C-1 reports this result and shows that lagged oil wealth is negatively correlated with the risk of Durable failure – the now standard finding reflected in the bulk of the research on the oil curse. The next column separates the cross-sectional and time-varying oil wealth information using two separate variables (see main text). This result indicates that the mean value of oil wealth is negatively correlated with Durable failure but that time-varying oil wealth, while negative, does not have a strong statistical association with this measure of political change.

Next we separate the ‘democratic’ Polity Durable failures from the ‘non-democratic’ failures. The former category includes only those Durable failures where the combined Polity score is 6 or more on December 31 of the observation year, indicating that the Durable failure is also a ‘democratic transition’ – as defined by Polity. The models in columns 3 and 4 report the results for tests of the democratic Polity Durable failures. There is a strong negative correlation between oil wealth and the risk of these failures, but it appears to only be a cross-sectional correlation, consistent with our findings in the text and the main findings in Haber and Menaldo (2011).

In the final two columns of the top panel of C-1, we examine non-democratic Durable failures – all those not marked as ‘democratic’. These include events such as the legalization of opposition parties in the former Zaire (1992) and the Iranian Revolution (1979) as well as shifts in the Iranian Presidency between the moderate and conservative factions of the theocratic regime in 1997 and 2005. As these examples illustrate, these failures include events where: (1) the incumbent regime loses power and (2) events when the incumbent regime remains in power. The results indicate a negative correlation between oil wealth and the risk of non-democratic Durable failures. However, the result in column 6 suggests that this correlation is again mostly cross-sectional.

The bottom panel of C-1 reports the results from identical tests using the GWF measure of autocratic regime collapse (all failures, autocracy-to-democracy transitions, and autocracy-to-autocracy transitions). The results for All Failures and Democratic Transitions in columns 7-10 are nearly identical to the results from similar tests using the Polity Durable variable. We do not find this surprising because – particularly in the case of democratic transitions – both data sources are coding similar events. However, the results using the GWF data differ from those using the

²Control variables include: a calendar time trend; duration polynomials; Log GDP per capita; Civil war; and Neighbor democratization, and a constant.

Polity Durable data for non-democratic transitions. Tests using the GWF data indicate a strong negative correlation between *time-varying* oil wealth and autocracy-to-autocracy transitions while the Polity Durable tests show that the correlation between oil wealth and non-democratic Durable failures is largely cross-sectional. In short, we get similar answers using the two data sets when asking questions about democratic transitions but very different answers when asking about other types of political change in autocracies.

To help readers better understand why the results differ for non-democratic Polity Durable failures and GWF autocracy-to-autocracy transitions, Table C-2 lists 57 autocracy-to-autocracy regime collapses that are not captured by the Durable failure variable. This is a conservative list of regime collapses because we only include cases where no Durable failure is observed in years $t-1$, t , or $t+1$. Thus it is impossible to capture these autocratic regime collapse events with the Polity data.

Finally, Table C-3 lists the 79 observations of Durable failure when there is no autocratic regime collapse, as measured by GWF. In all of these cases, Polity Durable codes a ‘regime failure’ even though the incumbent autocratic regime – as we define it – remains in power. In 59 of these 79 cases, the incumbent leader remains in power. Again this is a conservative list because we only include those Durable failures where no regime collapse occurred in years $t-1$, t , or $t+1$.

Table C-1: Comparing Polity Durable Failure and GWF Autocratic Regime Collapse

(a) Polity Durable Failure

	<u>All Failures</u>		<u>Dem Failures</u>		<u>Non-Dem Failures</u>	
	(1)	(2)	(3)	(4)	(5)	(6)
Oil_{t-1}	-0.320** (0.11)		-0.539* (0.22)		-0.263* (0.11)	
\overline{Oil}_i		-0.280** (0.10)		-0.528* (0.22)		-0.223* (0.11)
Oil_{Dev}		-0.135 (0.10)		-0.056 (0.22)		-0.132 (0.10)

(b) GWF Autocratic Regime Failure

	<u>All Failures</u>		<u>Dem Failures</u>		<u>Non-Dem Failures</u>	
	(7)	(8)	(9)	(10)	(11)	(12)
Oil_{t-1}	-0.351** (0.11)		-0.474** (0.15)		-0.156 (0.16)	
\overline{Oil}_i		-0.283** (0.10)		-0.571** (0.18)		-0.035 (0.14)
Oil_{Dev}		-0.187 (0.14)		0.121 (0.18)		-0.317* (0.16)

+ p<0.10; * p<0.05; ** p<0.01. Dependent variable in top panel is Polity Durable Failure; Democratic Failures are those where the combined Polity score crosses the +6 threshold for ‘democratic’ transition; Non-Democratic Failures are all other Polity Durable Failures. GWF autocratic regime failures are described in the text and listed earlier in the Appendix. Reported coefficient estimates are multiplied by the in-sample standard deviation of the respective variable. Clustered standard errors reported in parentheses. 4179 observations in 118 countries in the top panel; 4138 observations in 114 countries in the bottom panel.

Table C-2: Autocratic Regime Collapse but No Durable Failure

Country	Year	Country	Year
Afghanistan	1973	Iraq	1958
Argentina	1958	Iraq	1963
Bangladesh	1975	Iraq	1968
Benin	1965	Iraq	1979
Benin	1967	Laos	1960
Bolivia	1964	Laos	1962
Burkina Faso	1966	Lesotho	1986
Burkina Faso	1982	Liberia	1980
Burkina Faso	1987	Libya	1969
Burundi	1966	Madagascar	1975
Burundi	1987	Mali	1968
Cameroon	1983	Mauritania	1978
Cen African Rep	1965	Myanmar	1988
Cen African Rep	1979	Nepal	1951
Cen African Rep	1981	Niger	1974
Chad	1975	Nigeria	1993
Colombia	1953	Pakistan	1977
Congo-Brz	1968	Panama	1982
Congo/Zaire	1997	Rwanda	1973
Ecuador	1972	Sierra Leone	1968
El Salvador	1982	Sierra Leone	1992
Gambia	1994	Syria	1951
Ghana	1966	Syria	1958
Guatemala	1958	Thailand	1947
Guatemala	1963	Uganda	1971
Guatemala	1970	Yemen	1974
Guinea	1984	Yemen	1978
Guinea Bissau	1980	Yugoslavia	1990
Haiti	1988		

Autocratic regime collapse observations when: (1) there is no Durable failure in years $t-1$, t , or $t+1$; (2) the autocratic regime collapse did not end in a transition to democracy; and (3) there is non-missing data on the oil wealth variable. 57 observations of regime collapse that end in either transition to a subsequent dictatorship or an occupied regime (Laos 1962).

Table C-3: Durable Failures but No Autocratic Regime Collapse

Country	Year	Leader Exit	Country	Year	Leader Exit	Country	Year	Leader Exit
Algeria	1989	0	Indonesia	1957	0	Paraguay	1989	1
Algeria	1995	0	Iran	1953	1	Peru	1950	1
Algeria	2004	0	Iran	1997	1	Peru	1978	0
Angola	1991	0	Iran	2004	0	Philippines	1981	0
Bangladesh	1978	0	Ivory Coast	2002	0	Senegal	1962	0
Brazil	1974	1	Jordan	1951	1	Senegal	1978	0
Burkina Faso	1969	0	Jordan	1957	0	Sierra Leone	1971	0
Burkina Faso	1977	0	Jordan	1989	0	Sudan	2002	0
Burkina Faso	2001	0	Kenya	1969	0	Swaziland	1973	0
Cambodia	1997	1	Kenya	1997	0	Taiwan	1987	0
Cameroon	1992	0	Korea South	1963	0	Tajikistan	1997	0
Central African Republic	1991	0	Korea South	1972	0	Tanzania	1995	1
Congo Kinshasa	1992	0	Korea South	1981	0	Thailand	1952	0
Czechoslovakia	1968	1	Kuwait	1990	1	Thailand	1955	0
Egypt	2005	0	Madagascar	1991	0	Thailand	1968	0
El Salvador	1964	0	Mauritania	1962	0	Thailand	1971	0
El Salvador	1977	1	Mexico	1977	0	Togo	1991	0
El Salvador	1979	1	Mexico	1988	1	Tunisia	1987	1
Gabon	1990	0	Mexico	1994	1	Uganda	1993	0
Gambia	1996	0	Mongolia	1990	1	Uganda	2005	0
Ghana	1991	0	Morocco	1961	1	Yugoslavia	1951	0
Ghana	1996	0	Morocco	1965	0	Zambia	1972	0
Guatemala	1974	1	Nepal	1957	0	Zambia	2001	0
Guinea	1995	0	Nepal	1981	0	Zimbabwe	1983	0
Guinea-Bissau	1994	0	Nicaragua	1984	0	Zimbabwe	1987	0
Hungary	1956	1	Pakistan	1985	0	Zimbabwe	1999	0
Hungary	1988	1						

Durable failure observations when: (1) there is no regime collapse in years $t-1$, t , or $t+1$; (2) the Durable failure did not mark an increase in the Polity score such that it passed the Democratization threshold of +6; and (3) there is non-missing data on the oil wealth variable. In all 79 cases, the incumbent autocratic regime remains in power and in 59 cases the incumbent leader remains in power.

Appendix D: Endogenous oil income

In this Appendix we report the results of the two-stage models that use logged Oil reserves per capita (5-year lag) as an excluded instrument for logged Oil income per capita (1-year lag). Figures D-1 to D-5 depict the de-measured level of logged oil income per capita (1-year lag) and the de-means value of logged oil reserves per capita (5-year lag) over time for dictatorships in five countries in different regions of the world: Angola, China, Egypt, Malaysia, and Mexico. These graphs illustrate that while oil reserves are highly correlated with income, many of the year-to-year fluctuations in oil income that may reflect political expectations do not correspond to known reserves.

For example, in Angola reserves were stagnant after 2000 but oil income increased steadily after the death of the long-time rebel leader, Jonas Savimbi, in 2002 (and the increase in international oil prices the following year).³ Expectations about increased political stability after Savimbi's death may have contributed to both the steady increase in oil income and regime longevity. In this case, while the oil reserves are clearly correlated with oil income, the former does not pick up the potentially endogenous changes in oil income associated with the expectations about political stability stemming from this decisive political event. In China, we see a similar pattern post-1999: while oil income increased, reserves were stagnant. Indeed for much of the economic reform period (early 1980s onwards), reserves are relatively stagnant but income bounces up and down. In Egypt, both in the early 1980s (after Sadat's assassination) and then again after 2000 (once the younger cohort of the NDP, led by Gamal Mubarak, took over many leadership positions in the party), lagged reserves and oil income run in the opposite direction. In Malaysia, oil income dips during the 1998 Asian financial crisis but then rebounds quickly and increases throughout the 2000s. Lagged reserves, however, are relatively stagnant during this period of political turmoil for the ruling BN coalition. Finally in Mexico the large decline in oil income during the period of economic stagnation in the 1980s (particularly around the crucial 1988 election, prior to which the PRI split) coincides with an increase in lagged resources. Further the potentially decisive decline in oil income over the 15-year period from the mid-1980s to 2000 coincides with a period of stagnant lagged reserves. In the latter four countries, lagged oil reserves appear to reflect the large increases in oil income associated with the 1970s oil boom. These examples are only illustrative, but we believe they nonetheless demonstrate, across a range of cases, that oil income changes linked to decisive political events are not generally reflected in the lagged measure of oil reserves.

Table D-1 reports results from the first stage equations. In each model the excluded instrument, $Reserves_{Dev}$, is strongly correlated with Oil_{Dev} . F-tests indicate that this excluded instrument is statistically different from zero in the first stage. One standard cut-point for these F-tests is 10; the F-statistics from these models exceed this threshold (> 220 in each case).

Table D-2 reports the second stage results. For each IV result, we first report a naive result for the same model specification on the same sample. The first four columns report results from probit models; the latter four from linear probability models (LPMs). Comparing results from columns (1) and (2) for the transitions to democracy equation, we see that the IV estimate is much larger than the naive result, both of which are positive. This suggests the naive result under-estimates

³Both rising world oil prices and Savimbi's death contributed to the rapid increase in Angolan oil income after 2002. Using the Angolan time series for oil income (log) and the world oil price in a linear model, we find that a post-2002 dummy variable (a proxy for Savimbi's death) accounts for roughly a 32% increase in oil income from 2003-2006, while the increase in the oil price (\$32) accounts for a 47% increase in Angolan oil income after 2002.

the positive correlation between increases in oil income and the likelihood of democratic transition. Comparing results from columns (3) and (4) for transitions to new autocracy, we find that the coefficient estimates of interest are similar: 0.153 and 0.130, respectively. This suggests that the naive estimates may over-estimate the negative correlation between oil and risk of transition to new autocracy, but only slightly. The results in columns (7) and (8) largely mirror these. Though the IV estimate in column (8) is not statistically significant at the 0.10 level and is slightly smaller (-0.716) than the naive estimate (-0.921), it is roughly the same size as the estimate reported in column (2) of Table A-5 (-0.723). For readers concerned with statistical significance, we note that the p-value for the estimate of oil income in (4) is 0.111 and in (8) it is 0.137.

Figure D-6 shows the partial correlation between oil reserves and oil income in the first stage. Two countries – Libya (620) and Chad (483) – stand out as potential outliers in the first stage equation. Dropping one or both of these countries from the analysis strengthens the main finding reported in column (4) of Table D-2: the estimate of interest is greater than 0.16 and statistically significant at conventional levels (results reported in the replication files).

Results reported in the replication files also indicate that when we estimate the model in column (8) but treat both the mean level of oil income and the deviation of oil income as endogenous – by including a second excluded instrument, $\overline{Resources}_i$ – the estimate of interest is almost identical to that reported in column (8). Finally, when we estimate (8) but split the sample by time period (pre-1980 and post-1979) we find similar results: the estimate of interest is -0.78 in the early period and -0.90 and statistically significant at conventional levels in the latter.

Table D-1: First-stage equations

Model	(1)	(2)
$Reserves_{Dev}$	0.691** (0.05)	0.690** (0.05)
$GDPpc_{Dev}$	0.788** (0.15)	0.783** (0.15)
\overline{GDPpc}_i	-0.010 (0.03)	0.003 (0.03)
Civil war	-0.009 (0.05)	-0.013 (0.05)
Nbr democracy	0.001 (0.02)	-0.002 (0.02)
\overline{Oil}_i	0.027** (0.01)	0.025** (0.01)
\overline{Dem}_i	0.525 (0.54)	
\overline{Dict}_i		1.286+ (0.74)
(Intercept)	0.005 (0.28)	-0.118 (0.29)
F-statistic	231	222

+ $p < 0.10$; * $p < 0.05$; ** $p < 0.01$. Dependent variable is Oil_{Dev} . Excluded instrument is: $Reserves_{Dev}$. Standard errors in parentheses, clustered on regime. All models control for duration time (cubic polynomial) and a calendar time trend (cubic polynomial); these are not reported. 3704 observations from 250 distinct autocratic regimes in 114 countries from 1947-2007.

Table D-2: Second-stage IV results

Transition	Probit (1-4)				Linear probability (5-8)			
	Democracy		Autocracy		Democracy		Autocracy	
	Naive	IV	Naive	IV	Naive	IV	Naive	IV
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Oil_{Dev}	0.037 (0.08)	0.138 (0.10)	-0.153* (0.06)	-0.130 (0.08)	-0.087 (0.30)	0.015 (0.34)	-0.921** (0.34)	-0.716 (0.48)
\overline{Oil}_i	-0.075* (0.03)	-0.081* (0.03)	-0.004 (0.03)	-0.004 (0.03)	-0.093 (0.07)	-0.095 (0.07)	0.031 (0.10)	0.027 (0.10)
$GDPpc_{Dev}$	0.213 (0.21)	0.100 (0.24)	0.230 (0.23)	0.197 (0.23)	0.785 (1.01)	0.645 (1.05)	1.264 (0.92)	0.983 (0.98)
\overline{GDPpc}_i	0.057 (0.08)	0.061 (0.07)	-0.189* (0.09)	-0.190* (0.09)	0.158 (0.28)	0.157 (0.28)	-0.240 (0.39)	-0.247 (0.39)
Civil war	0.168 (0.13)	0.176 (0.13)	0.325** (0.13)	0.325** (0.13)	0.802 (0.73)	0.813 (0.73)	1.560 (0.95)	1.583+ (0.95)
Nbr democracy	0.124+ (0.07)	0.125+ (0.07)	0.166* (0.08)	0.166* (0.08)	0.675 (0.44)	0.674 (0.44)	0.903+ (0.47)	0.903+ (0.47)
\overline{Dem}_i	12.378** (1.38)	12.240** (1.41)			104.707** (9.78)	104.570** (9.72)		
\overline{Dict}_i			10.429** (1.69)	10.365** (1.70)			104.399** (19.03)	103.993** (18.99)
(Intercept)	-2.942** (0.71)	-2.941** (0.71)	-0.912 (0.76)	-0.904 (0.76)	-1.540 (2.57)	-1.518 (2.58)	1.775 (4.20)	1.854 (4.20)

+ p<0.10; * p<0.05; ** p<0.01. Standard errors in parentheses, clustered on regime. Dependent variable is Regime Transition (Democratic, Autocratic). Binary dependent variable multiplied by 100 in LPMS for ease of interpretation. All models control for duration time (cubic polynomial) and a calendar time trend (cubic polynomial); these are not reported. First stage result reported in Table D-1. 3704 observations from 250 distinct autocratic regimes in 114 countries from 1947-2007.

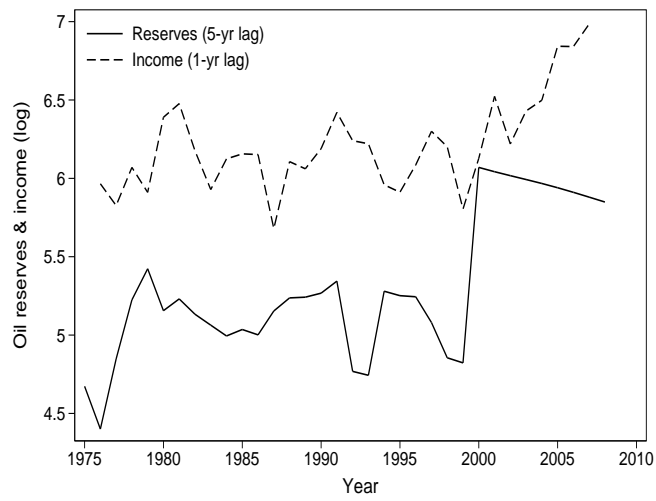


Figure D-1: *Oil reserves (5-year lag) and oil income (1-year lag) in Angola.* Both measures are denominated by population size and then logged, then de-meanned.

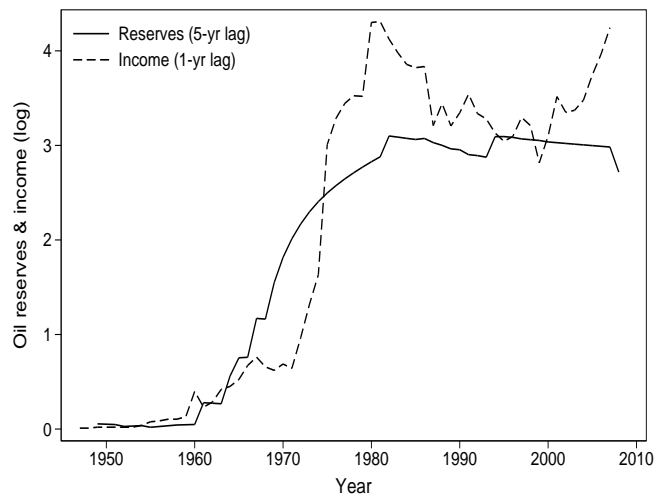


Figure D-2: *Oil reserves (5-year lag) and oil income (1-year lag) in China.* Both measures are denominated by population size and then logged, then de-meanned.



Figure D-3: *Oil reserves (5-year lag) and oil income (1-year lag) in Egypt.* Both measures are denominated by population size and then logged, then de-meanned.

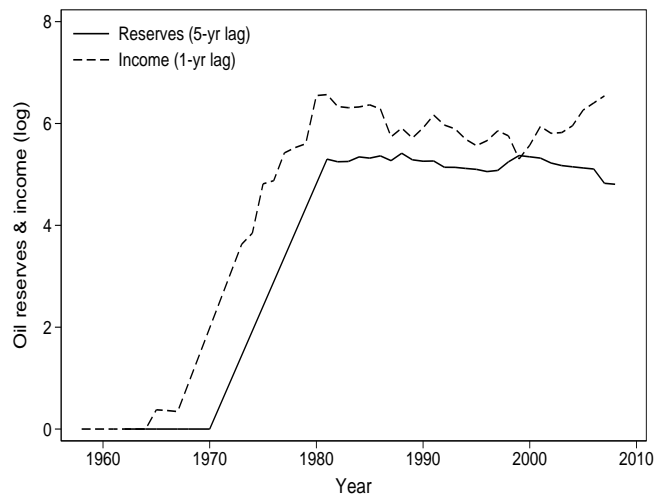


Figure D-4: *Oil reserves (5-year lag) and oil income (1-year lag) in Malaysia.* Both measures are denominated by population size and then logged, then de-meanned.

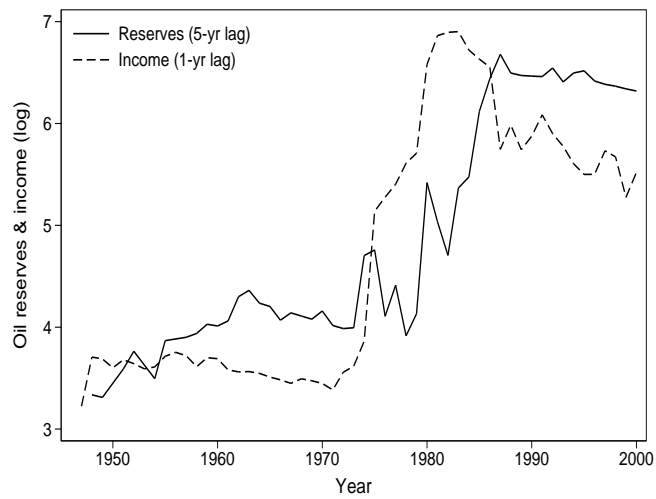


Figure D-5: *Oil reserves (5-year lag) and oil income (1-year lag) in Mexico.* Both measures are denominated by population size and then logged, then de-meanned.

Appendix E: Military spending

Table E-1 reports the summary statistics for Table 2 in the main text. Figure E-1 shows the distribution of military spending in the main sample used in Table 2 of the main text (3288 observations). Military spending data is the logged value of constant dollars. Instead of using population size in the denominator of the dependent variable, we control for population size in all regressions. Unit fixed effects condition estimates on country size.

In results reported in the replication files, we test the robustness of the model in Table 2, column (2). First, we trim the data to exclude all observations with extreme values for differences in oil income (absolute value >2). Second, we exclude all observations with $dfbeta$ values greater than the $2/\sqrt{N}$ cut-point. Third, we run the model with robust regression which down-weights potential outliers. Fourth, we control for military personnel size, with data from the Correlates of War project. These changes all yield similar substantive results, with all estimated coefficients for the differenced variables statistically different from zero at conventional levels. Finally, we compare the coefficients for the LRM using the COW data and military spending data from SIPRI. The SIPRI sample, however, contains less than 1000 observations, which is less than a third of the size of the COW sample. We find substantially stronger estimates for the LRM using the SIPRI data.

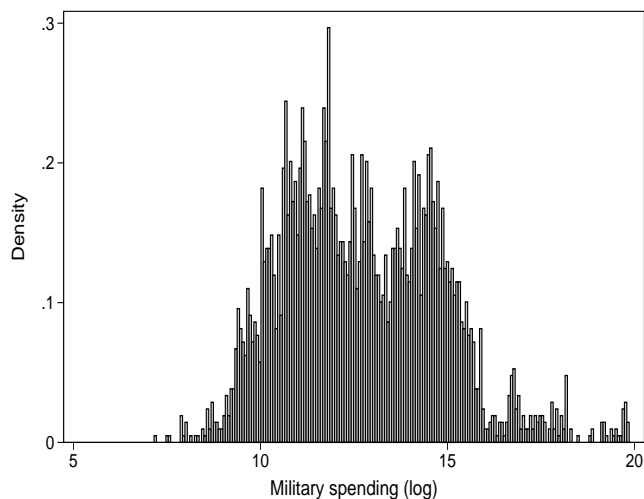


Figure E-1: *Military spending in autocratic regimes*. Logged constant dollar values.

Finally, the graphs in Figure E-2 show the cross-sectional relationship between oil income and military spending in dictatorships. To generate these graphs, we calculated the mean level of oil income (log units) and the mean level of military spending (log units, constant dollars) for each autocratic regime in the sample. Some countries, such as Argentina and Iran, have more than one regime in the sample. Others, such as China and Mexico, have only one autocratic regime during the post-1946 period. The left panel shows the bivariate relationship between the two mean level variables, while the right panel shows the partial regression plot of the bivariate relationship conditional on the (regime-mean) level of GDP per capita (log), population size (log), and international war. In both graphs, there is a strong cross-sectional correlation between oil income and military spending.

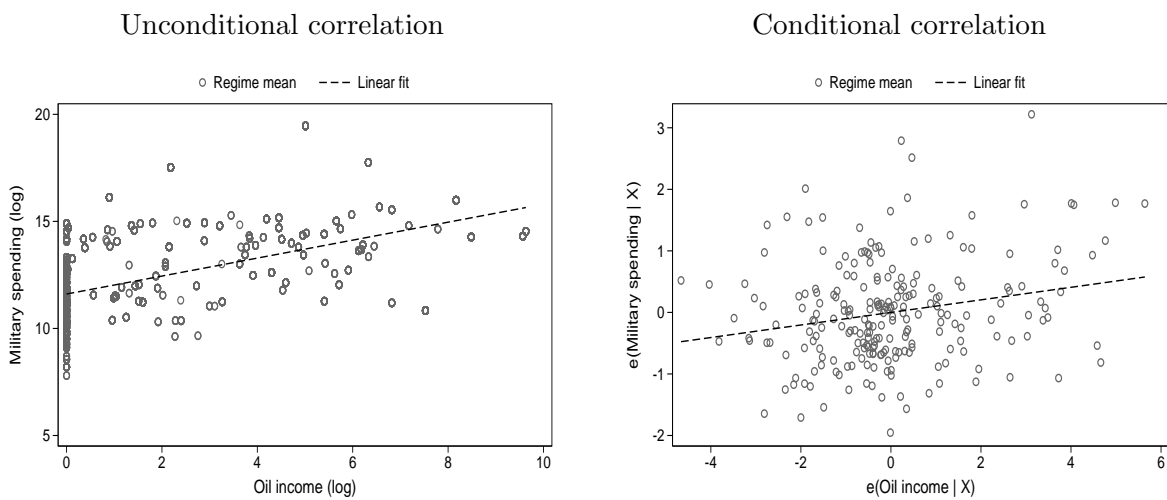


Figure E-2: *Oil income and military spending in autocratic regimes.* Data points reflect the mean levels of oil income (log) and military spending (log) by autocratic regime. Analysis of 230 distinct autocratic regimes from 1947-2007.

Table E-1: Summary statistics

Variable	N	Mean	Std Dev	Min	Max
Military spending	3288	12.72	2.09	7.15	19.85
Oil income	3288	2.19	2.93	0	11.11
Population size	3288	9.18	1.37	5.88	14.09
International war	3288	0.06	0.23	0	1
Civil war	3288	0.17	.38	0	1
Calendar time	3288	37.2	12.9	15	61

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