Appendices for
"Resource Wealth as Rent Leverage: Rethinking the Oil-Stability Nexus"

Appendix 1. Robustness tests of civil war models with a higher onset threshold.

This set of models presents results for robustness tests in which I substituted a higher threshold indicator for civil war onset—one thousand battle deaths, in line with the measure used in Collier and Hoeffler (2009). The effects of oil income per capita were substantively identical to those with the lower threshold in the main models, but as detailed here the effects of rent leverage diverged in some interesting ways.

Model 1 suggests that countries with higher rent leverage measures by a unit change are about 71% less likely to suffer civil wars. However, a one-unit increase in any individual country's rent leverage renders it nearly 500% more likely to experience civil war onset. This is controlling for economic growth, so it is not because of the denominator in rent leverage (income) dropping quickly. Seeking the reason for this, I looked more carefully at the control variables for both state capacity and for repression. In particular physical integrity has less temporal coverage than most of the other indicators in the main models: it begins only in 1981, so when it is included we lose all observations from 1980 and earlier. But including it changed the results for rent leverage, as we see in Model 2—neither the country mean nor deviations from country mean are any longer significant.

As indicated in models 3 and 4, this turns out to be a function of which time period is covered rather than of controlling for repression via physical integrity. It is only prior to 1980 that rent leverage has opposite effects across versus within countries. Between 1960 and 1980, this is the case and drives the results for the entire time series. However, after 1980 there is no relationship. This suggests that the "Big Oil Change" that Andersen and Ross (2014) have found after the 1970s nationalization waves is evident here as well. When foreign oil companies largely controlled this revenue stream, producing countries were much less conflict-prone than non-producers, while large changes in their oil and gas incomes destabilized them from year to year. After 1980, when the political ramifications of nationalization had sunk in, these two different factors had no significant effect on the onset of conflicts.

Robustness Checks for Oil and Civil War Onset
(DV=Civil war onset w/ >1,000 deaths/year;
Collier & Hoeffler 2009)

	(1) 1960-2009	(2) 1981-2009, includes state capacity and repression§	(3) No state capacity or repression, 1981-2009	(4) No state capacity or repression, 1960-1980
Rent leverage$_{(cm)}$	0.286* (0.161)	0.586 (0.313)	0.383 (0.229)	0.104** (0.0789)
Rent leverage$_{(dev)}$	4.799** (2.304)	2.890 (2.285)	3.116 (2.060)	18.39*** (13.88)
Economic growth	0.892*** (0.0111)	0.923*** (0.0160)	0.911*** (0.0135)	0.840*** (0.0215)
Population$_{(ln)}$	1.442*** (0.106)	1.110 (0.132)	1.414*** (0.119)	1.438*** (0.140)
Physical integrity		0.601*** (0.0638)		
State capacity		1.280 (0.508)		
N	5071	2895	3283	1788

Analysis is by logistic regression with odds-ratios (exponentiated coefficients) presented. Robust standard errors in parentheses. Count variable for years since last onset, and three cubic splines, included but not reported. $_{(cm)}$ indicates country means to capture cross-country effects. $_{(dev)}$ indicates country year deviations from overall country means to capture within-country effects. §Because the physical integrity coverage begins only in 1981, including it truncates the time sample
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix 2. Robustness Tests With Squared Terms.

This set of models explores the possibility of curvilinear—and in particular inverted U-shaped—relationships between the measures of oil wealth and the three main outcomes analyzed here. It includes the quadratic (square) of each measure's natural log. The results presented below are odds ratios: thus, an inverted U-shaped relationship would be implied if the raw measure were greater than one and its square were less than one.

We see this in the rent leverage relationship with regime change and civil war onset, but in neither case is either one of the measures statistically significant. This suggests a generally similar effect of both the measure and its square, with the inclusion of both effectively crowding out a singular relationship.

In one case with oil income per capita—autocratic breakdown—we see a statistically significant U-curve relationship. This suggests that, as a qualifier to both the results presented here and recent studies by Ross and Geddes et al, the effect of oil income in insulating dictatorships is more a function of high levels of income. This would be similar to a finding by Collier and Hoeffler (2009) that as oil dependence rose it gradually began to have a conflict-suppressing rather than inducing effect.

	Regime Change		Autocratic Breakdown		Civil War Onset	
	(1)	(2)	(3)	(4)	(5)	(6)
Rent leverage	1.589	--	0.463	--	3.380	--
	(0.743		(0.329)		(3.142)	
Rent leverage^2	0.471	--	0.963	--	0.456	--
	(0.195)		(0.275)		(0.282)	
Economic growth	0.964**	0.965***	0.916***	0.916***	0.964**	0.965**
	(0.0108)	(0.0102)	(0.00906)	(0.00938)	(0.0107)	(0.0105)
Population$_{(ln)}$	1.094	1.127*	1.076	1.020	1.400***	1.405***
	(0.0534)	(0.0605)	(0.0859)	(0.0891)	(0.0860)	(0.0998)
Oil income		0.997		1.362**		1.033
		(0.0726)		(0.162)		(0.0961)
Oil income^2		0.994		0.942***		1.000
		(0.00954)		(0.0149)		(0.0105)
N	5946	6309	2886	3059	5946	6309

Analysis is by logistic regression with odds-ratios (exponentiated coefficients) presented. Robust standard errors in parentheses. Count variables for years since last event, and three cubic splines, included but not reported. Rent leverage and oil income per capita and their quadratics taken as natural logarithms. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix 3. Calculating Natural Gas Income by Country.

The more that natural gas has assumed a central role in the global economy, the more that the lack of a world market price leaves some difficult but increasingly important measurement questions to resolve. Unlike oil, which because of its naturally liquid form is easy to transport and whose different spot prices are closely related, natural gas is largely transported in its natural gaseous form through pipelines whose owners and transit states have a kind of lock on supply that is not the case with oil. As a result, there is wide variation across regions.[1] Second, natural gas production (annualized) is converted from volume to British Thermal Units (BTUs) and multiplied either by a standard price OR by the market price in which that country's natural gas is mostly sold.[2] Haber and Menaldo (2011), by virtue of compiling data going back more than a century and prioritizing historical time-series breadth, used the Well Head Price for Natural Gas in the United States, extending from 1922 to 2008. This price statistic is the most temporally complete available. Another consistent price is the Henry Hub price for the United States. Finally, Hamilton and Clemens (1999, 2002) take the weighted average of all available measures in a single year of their time-series coverage, and their data are available from 1970 from the World Bank.[3]

It is important to note here that even within a single country like the United States prices can vary substantially, sometimes by as much as 30 per cent. It is also true that annual averages can mask large monthly fluctuations, just as they can in the more globally coherent oil market.[4] Absent a truly herculean effort to collect intricate sub-national or monthly price data, and to track each exporter to such micro-market prices, scholars are going to have to recognize that there are tradeoffs involved whether taking a single annual price (versus monthly averages) or multiple regional market prices (versus one price for the entire globe). I simply want to suggest here that it is important to be aware of those tradeoffs and to state explicitly which measurement choice is taken, and why, for the purpose of comparing findings.[5]

There is little reason to be confident that gas rents per capita in Russia, or Iran, or Qatar, have any consistent relationship to the Henry Hub price. So scholars need to be aware of the tradeoffs inherent in striving for global consistency. For datasets focused on particular regions (i.e. Latin America, Asia, etc.) it is more feasible to select a market price by most common destination. For scholars who are focusing on a tighter time period and/or on a particular region of the world, it is feasible to employ regional market prices, which

---

[1] In March 2013, for example, the average US price for natural gas was US$3.40 per million British thermal units, while in Europe it averaged roughly $12 and in Asia nearly $20. "Better Out Than In," *The Economist*, March 2, 2013.

[2] See for example Hamilton and Clemens (1999), Section II pp. 339-40.

[3] Available at http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/ENVIRONMENT/EXTEEI/0,,contentMDK:20502388~menuPK:1187778~pagePK:148956~piPK:216618~theSitePK:408050,00.html

[4] Thanks to Brian Min for his thoughts on this issue.

[5] The innovation of shale fragmentation extraction technology for natural gas ("fracking") and the subsequently dramatic expansion of gas production in the United States and Canada do raise the prospect of an increasingly globalized price market for natural gas before too much longer. One reason is that these events promise to cut into the near monopoly that gas pipeline owners hold on consuming countries. A reasonable benchmark threshold for treating one price as effectively global at the point at which regional market prices for natural gas correlate as closely as current ones for crude oil.

can vary substantially across the major markets (US, EU, Canadian, British and Japanese, for example). Market prices can be found, among other locations, in the “Gas Prices” spreadsheet in BP’s Statistical Review of World Energy.