Supplemental Appendix For

On Malaria and the Duration of Civil War

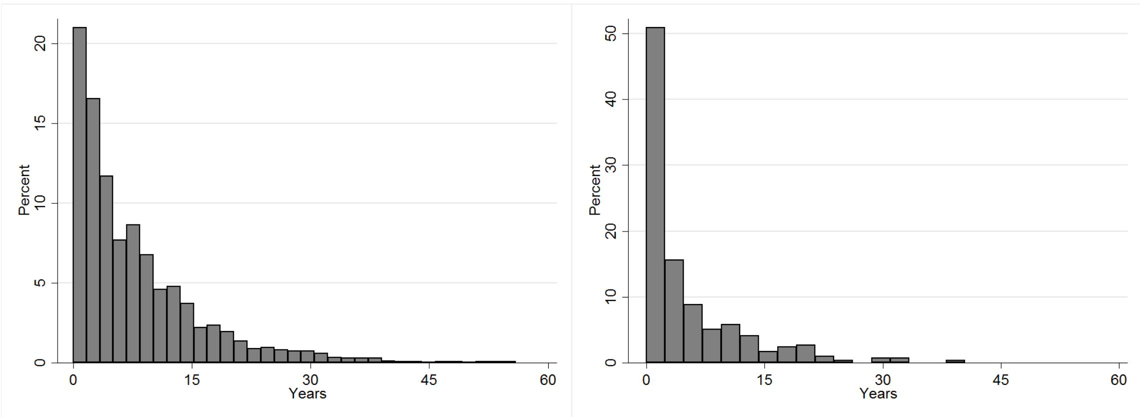
This supplemental appendix proceeds in two parts. First, in the section immediately below, I discuss the measurement decisions and summary statistics for my primary variables; *civil war duration*, *malaria prevalence* and *rebel strength*. Following this discussion, I report and interpret a series of coefficient tables corresponding to the robustness models mentioned in the main paper's empirical section.

Dependent & Independent Variables

In this section, I first present a series of summary statistics for my dependent variable: *civil war duration*. Recall that this (dyadic) dependent variable is measured in months since the onset of a given government-to-rebel civil conflict, and recorded in days until the final day of a given calender-month. As mentioned in the main paper, conflicts experiencing a lull of two calender years or more in fighting between a specific government and rebel group are treated as separate conflict dyads, and civil wars beginning in 1945 and 1946 were omitted due to the unavailability of data on *malaria prevalence* prior to 1946. The distribution of *civil war duration* is presented in Figure A.2 for both my 'repeated year' sample as a whole (Figure A.1a) and for my 'termination year-months' separately (Figure A.1b). Figure A.1a corresponds to all conflict onset year-months, conflict termination year-months, and conflict persistence year-months that were included in my sample and demonstrates that my dependent variable has a range of one month to approximately 56 years, a mean of roughly eight years, and a median of approximately five years. For the 342 civil conflict dyads in my sample, 295 had terminated as of 2004, and this termination subsample (Figure A.1b) indicates that those civil wars that do end prior to 2004 typically conclude within five years (mean) or three years (median) of their onset.

Figure A.1: Histograms of Civil War Duration

(a) All Observations (b) Civil War Terminations



I next provide a more detailed discussion of my *rebel strength* variable, including its component parts. After this discussion, I present and interpret a variety of summary statistics and figures for my *malaria prevalence* and *rebel strength* variables. As mentioned in the Analysis Section of the main paper, the four component parts to *rebel strength* are dichotomous indicators of: (i) whether a rebel organization has a clear central command (ii) the mobilization capacity (in terms of number of available fighters) of a rebel group, (iii) a rebel group's ability to procure arms, and (iv) rebel fighting capacity, as constructed by Cunningham, Gleditsch and Salehyan (2009). I discuss each of these dichotomous indicators in turn, while providing additional theoretical justification for each component part vis-à-vis Hypothesis 2, which posited that high *malaria prevalence* will prolong civil wars *only among civil wars involving weak rebel groups*.

The first component part mentioned above is a dichotomous indicator of whether a rebel group "has a clear leadership structure and if the leadership exercises a high degree of control over the organization," under the premise that, relative to less centralized or more fragmented groups, centralized rebel groups will exhibit more control over forces, and hence will be better able to effectively target government actors (Cunningham, Gleditsch and Salehyan, 2009, 580). This feature fits nicely into my group-density based arguments with regards to malaria prevalence in that more centralized and less fragmented groups should exhibit more concentrated, rather than diffuse, fighting and deployment styles. Similarly, the second component part to *rebel strength* taps directly into the mobilization capacity of a given insurgency, in particular capturing whether a given rebel group exhibits high mobilization capacity (in terms of number of fighters) relative to government actors. Hence, the second component to *rebel strength* provides an indicator of the current (and latent) *number* of available rebel fighters, which corresponds directly to the relationship between absolute group size, malaria transmission, and civil war, as outlined in the theoretical section of the main paper.

The third component part to *rebel strength* measures whether (or not) rebels have a high arms procurement capacity. Like centralized control, this serves as a proxy for the degree to which a given insurgent group practices diffuse, guerilla style fighting tactics, as opposed to military tactics that more closely match those utilized by government forces. Therefore, this component will allow me to further capture whether a given rebel group truly has advantages in terms of both group density, and phase 1 (as opposed to phase 2) level impacts on the natural environment surrounding rebel group bases and habitats. In addition, it is likely that this indicator (and those above) also captures, to a degree, the likelihood that a rebel group possesses the resources to rotate troops into and out of conflict zones, as opposed to remaining in conflict zones full time.

The final component part to *rebel strength* is a dichotomous measure of whether (or not) a rebel group has a "high" fighting capacity, in relation to government forces (Cunningham, Gleditsch and Salehyan, 2009, 580). As argued by Cunningham, Gleditsch and Salehyan (2009, 580-581) "groups with low fighting capacity should be less likely to try to challenge the government in direct armed confrontation and instead opt for hit and run attacks typical of guerrilla warfare." This measure therefore captures elements of rebel group density and size, the degree of (malarial) conflict zone habitation (under the assumption that groups with lower fighting capacity will have even lower incentives and abilities to travel outside of conflict zones), and the degree to which the socio-geographic features of a given conflict zone are conducive to rebels defensive capabilities (which is likely to be highly correlated with the practice of guerilla fighting tactics). Therefore, taken together, each of these four component parts captures an important dimension of rebel group weakness, and of rebel groups' incentives (and willingness) to pursue guerilla military tactics in civil war. As many of these very features, including group size and group density, were explicitly linked to the malaria burdens described in the main paper, I believe that *rebel strength* serves as a reasonable proxy for the dynamics underlying Hypothesis 2.

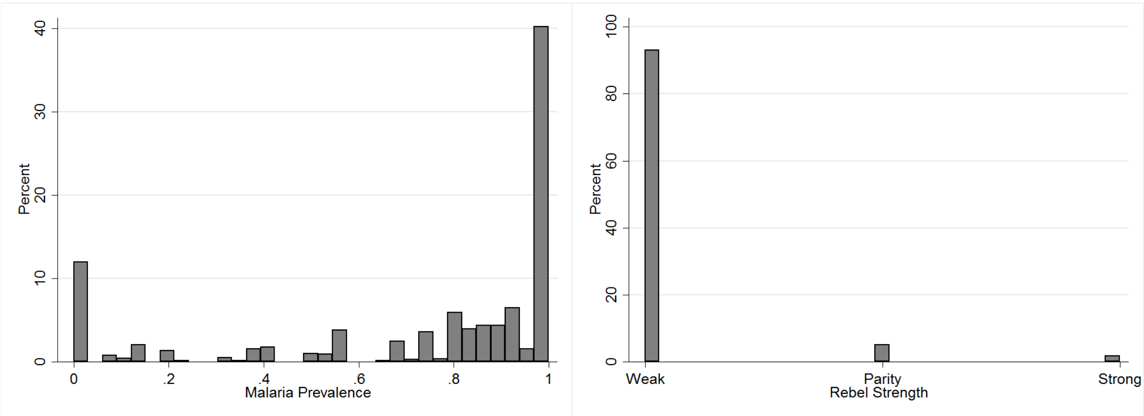
I next examine the aggregate summary statistics for my *malaria prevalence* and *rebel strength* variables. Table A.1 first presents the primary summary statistics for these two variables across my entire sample. As one can see, *malaria prevalence* is typically moderate to high for the countries and regions in my sample, although there is a high level of variation therein, whereas rebel groups typically exhibit low levels of *rebel strength* for my sample as a whole. The histograms for these two variables are presented in Figure A.2 and provide a more nuanced picture of the above conclusions. Specifically, one can see here that the two most common rates of malaria for my sample are 0% (roughly 12% of all observations) and 100% (roughly 40% of all observations), with a moderate number of cases throughout this variable's entire range. By comparison, slightly over 90% of all observations for *rebel strength* lie within "weak" rebel cases, with the remaining observations falling roughly equally across the higher two categories of *rebel strength* (i.e., "parity" and "strong").

Table A.1: Summary Statistics for Independent Variables

	Median	**Mean**	**Std. Dev.**	**Min**	**Max**
Malaria prevalence (%)	0.88	0.73	0.35	0	1
Rebel strength	0	0.09	0.34	0	2

Figure A.2: Histograms of Independent Variables

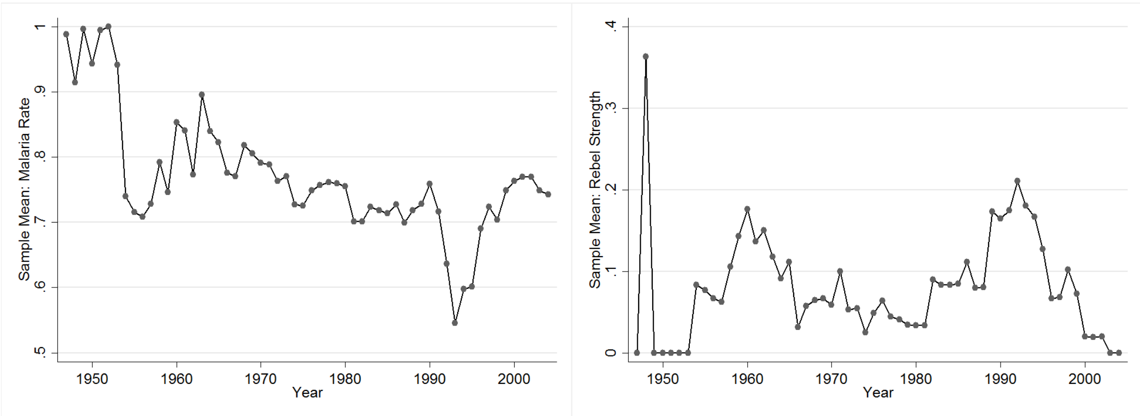
(a) Malaria Prevalence (b) Rebel Strength



The next set of graphs evaluates whether one observes variation in *malaria prevalence* and *rebel strength* over time for my 1947-2004 sample of interest. To do so, I calculate the yearly average for each independent variable at each year in which a civil war was observed as beginning, ongoing, or concluding. I then plot these yearly averages via time series plots in Figure A.3. Turning to Figure A.3, one can first note here that the average yearly malaria prevalence for the countries and regions in my sample is moderately declining over the 1947-2004 time period. It begins at a levels of 90% for my sample (though is highly volatile therein) during the 1950's and early 1960's—roughly 20% above the sample mean—and then slowly declines from these rates to stabilize around 70%-75% by the late 1970's (with one sharp drop in the mid 1990's towards 50%). Turning next to the time series plot of *rebel strength* (Figure A.3b), one does not find a clear trend in this case. Rather, there appears to be a high degree of variation over my entire time period of interest, with generally higher (and more volatile) levels of *rebel strength* during the first half of the series (i.e., 1947-1970), and civil conflicts heavily dominated by weak rebel groups thereafter (with the exception of an upswing in *rebel strength* during the mid 1990's). In sum, there appears to be a significant degree of variation in my variables not just across the countries in my sample, but also over my temporal range of analysis.

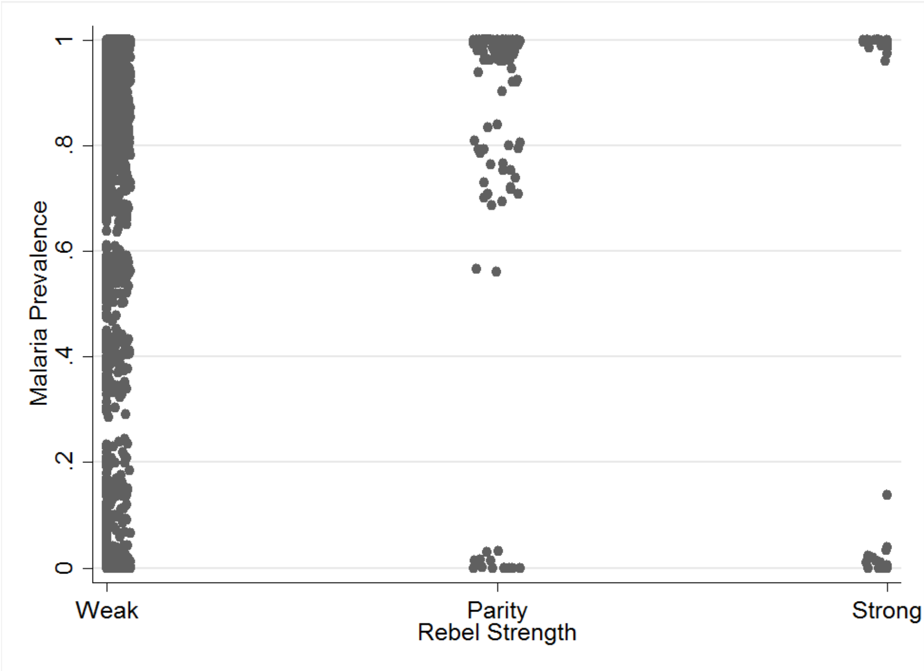
Figure A.3: Variation in Independent Variables by Year

(a) Malaria Prevalence (b) Rebel Strength



As discussed in the main paper, my tests of Hypothesis 2 focus upon not only my *malaria prevalence* and *rebel strength* variables, but also upon their interaction (i.e., *malariaXrebel-strength*). Also recall that when evaluating the substantive effects of this interaction, I typically examine a 0-to-1 change in *malaria prevalence* at each respective level of *rebel strength*. To ensure that I have a sufficient number of observations at each of these intersections, I next generate a scatter plot of my *malaria prevalence* and *rebel strength* variables, jittering these plotted points for ease of interpretation. This scatter plot appears in Figure A.4 and indicates that while my observations for *malaria prevalence* are indeed sparser within the "parity" and "strong" *rebel strength* categories than for the "weak" categories, I do indeed have coverage and support across the entire range of these two variables, particularly for *malaria prevalence's* values of 0 and 1, which represent the two most common values on *malaria prevalence* for my sample, and also the values that I use to evaluate my Hypothesis 2 marginal effects. Hence, the observed variation derived from my interaction of *malaria prevalence* and *rebel strength* encompasses the entire range of values under examination, suggesting that the marginal effects and Hypothesis 2 tests presented in the main paper are indeed appropriate.

Figure A.4: Scatter Plot of Independent Variables (Jittered)



Robustness Models

As mentioned earlier, I also reassess my empirical models under a wide number of alternative model specifications. For each of these robustness tests, and when applicable, I estimate the three main model specifications presented in Table 1 of the main paper (i.e. Models 1-3) and then assess the stability and statistical significance of each *malaria prevalence* coefficient estimate therein. The following section presents and summarizes these additional robustness models.

To begin, I re-evaluate my primary models when using a sample that includes all *coup d'états* as civil war cases, along with a control variable for these cases, demonstrating that my decisions with respect to coups have no effects on the significance levels for *malaria prevalence* (Table A.2). The second robustness test evaluates my findings when an alternate control for a country/region's tropical location is used in place of *percent tropic*. I specifically employ the (natural log of the) latitude of a country's geographic centroid—a measure of tropical location that is relatively less sensitive to a country or region's total geographic size—and then re-estimate each model specification with this alternate control. As indicated in Table A.3, I find in this case that doing so has no effect on the statistical significance of my findings vis-à-vis *malaria prevalence*. Following extant civil war research (e.g., Mukherjee, 2006; Buhaug, Gates and Lujala, 2009), I next re-estimate my main results while addressing the potential for unit (i.e., conflict dyad) level heterogeneity in my data with a multiplicative unit specific frailty term (estimated via random effects), rather than with clustered standard errors. I find in this case (Table A.4) that my *malaria prevalence* results remain robust to the inclusion of a unit-specific frailty term.

As alluded to in the main paper, my next robustness test further assesses whether my findings for *malaria prevalence* and civil war duration are arising due to omitted variable bias with particular regard to state capacity. Low state capacity could cause both high malaria prevalence and lengthy civil wars, and while several of my primary controls (such as *democracy* and *ln GDP per capita*) have been used as measures of state capacity in past civil conflict research (e.g., Fearon and Laitin, 2003), other scholars have called these operationalizations into question (Hendrix, 2010). Hence Table A.5 takes these concerns into account by additionally controlling for three of the most direct and verifiable measures of state capacity, as argued by Hendrix (2010, 2011): *bureaucratic quality*,[1] *ln military expenditure*,[2] and *taxes/GDP*.[3] Given limitations in temporal coverage for these measures, my resultant sample in Table A.5 corresponds to only civil wars beginning during the post-1983 period, which also forces me to omit *war on core territory* from these survival model specifications as it has no variation during this period. These challenges notwithstanding, my findings for *malaria prevalence* remain negative and highly significant across all three specifications in Table A.5, suggesting that malaria has a prolonging effect on civil war duration that is independent to state capacity.

Malaria is but one of the many tropical diseases that affect human morbidity and mortality. Moreover, many non-malarial diseases often co-occur with malaria across regions and time,

[1]*Bureaucratic quality* is a seven-point ordinal indicator that uses expert assessments of the degree to which a "country's bureaucracy is characterized by (1) regular, meritocratic recruitment and advancement processes, (2) insulation from political pressure, and (3) the ability to provide services during governmental changes (Knack, 2001)" (Hendrix, 2010, 275). Data are taken from the Political Risk Services Group's (PRSG) International Country Risk Guide (ICRG, 2007) and Hendrix (2010).

[2]*Ln military expenditure* is measured as the per capita total military expenditure for a given country in a given year, and taken from Singer, Bremer and Stuckey (1982) and Hendrix (2010).

[3]*Taxes/GDP* is the ratio of a country's actual to predicted tax revenue, otherwise known as *relative political capacity*. Taken from Kugler and Arbetman (1997) and Hendrix (2010); see Hendrix (2010, 279) for a detailed discussion of this measure, and its advantages over related measures of taxation.

and several—such as yellow and dengue fever—may similarly contribute to social strife (Letendre, Fincher and Thornhill, 2010). As such, the findings presented above do not rule out the possibility that these secondary diseases (i) have a comparable effect to that of malaria on civil war duration and (ii) potentially lead me to falsely conclude a significant effect of *malaria prevalence* when in fact it is these secondary diseases that are truly driving my results. Hence, verifying whether my core findings are attributable to omitted (disease) variable bias is critical. Drawing on the same sources and coding scheme discussed for *malaria prevalence* in the main paper, I accordingly construct two comparable geographic disease prevalence measures for yellow and dengue fever,[4] and include them as control variables in the models reported in Table A.6. This table indicates that my findings for *malaria prevalence* are highly robust to the inclusion of these controls. Moreover, the coefficient estimates for *dengue fever* are negative and marginally statistically significant across several of the models in Table A.6 (though those for *yellow fever* are not), thereby implying that *dengue fever* may have a similar conflict-prolonging effect to that of *malaria prevalence*.

There have been a number of global trends in malaria over the past half century, including what has been described in recent decades as a "rapidly increasing disease burden" that is generally attributed to population shifts and climate shocks (Sachs and Malaney, 2002, 680). To ensure that my findings are not simply an artifact of these temporal dynamics, I next re-ran my three primary models while including year fixed effects in each. As Table A.7 indicates, these fixed effects generally reduced the statistical significance of all of my independent and control variables, and yet, my main findings for *malaria prevalence* remain robust across my three model specifications at least at the $p < .05$ level. To a related point, the civil conflicts that I examine above are relatively heterogenous, and, for example, many of my conflict cases end within a few years of onset whereas a small subset of others then last for over 50 years. Thus, outliers or 'exceptional cases' may have undue influence on my findings. Accordingly, I calculated DFbeta scores for my three specifications, and then re-ran each model with extreme DFbeta scores removed. As one can see in Table A.8, dropping these outliers did not affect my

[4]Note that given data limitations, these two measures were constructed using even fewer temporal data points than those used for *malaria prevalence*; likely ensuring that *yellow fever* and *dengue fever* have higher measurement error than does my primary independent variable.

main results, as the coefficient estimate for *malaria prevalence* remains statistically significant at the $p < .05$ level across all three models. Next, recall that my primary models included a binary *democracy* control. While this dichotomous operationalization of democracy helps to ensure that my specifications and results are as comparable as possible to past research on civil war duration Cunningham, Gleditsch and Salehyan (e.g., 2009), it may diminish the potential strength of this variable's predictive power in my models. To ensure that the decision to use a dichotomized Polity IV indicator as my primary measure of democracy was not adversely affecting my findings, I re-run my primary models while including the full ordinal *Polity IV* indicator in place of the *democracy* indicator described above. These alternate specifications appear in Table A.9 below and confirm that *malaria prevalence* remains a significant predictor of civil war duration even after including this alternate operationalization of democracy.

While the operationalization of *malaria prevalence* described in the main paper emphasizes the temporal precedence of *malaria prevalence* vis-à-vis civil war (and its duration), an assessment of the more instantaneous effects of *malaria prevalence* on *civil war duration*—while potentially more endogenous—has significant policy relevance. Indeed, assessing the effects of malaria in year t on a civil war's probability of ending in that same year can give policymakers (i) a real time prediction of a civil war's likelihood of immediate termination, given current malaria levels, and (ii) a sense of whether a reduction in current malaria prevalence levels can be expected to yield an increased likelihood of peace. I therefore create a second measure of *malaria prevalence* where I interpolate the CID's 1946, 1966, 1982, and 1994 malaria values to the yearly level such that any given year now corresponds to the most proximate year of CID malaria prevalence observance (forward or backwards, and thus including all civil wars occurring in 1945 and 1946). Re-running my models with these interpolated results yields two key insights. First, and in support of Hypotheses 1 and 2, this interpolated *malaria prevalence* measure is negative and significant ($p < .05$) across all three models (Table A.10). Second, the instantaneous effects of *malaria prevalence* on *civil war duration* are even stronger than the lagged effects identified above.

For the next three robustness model specifications, I verify that my primary results hold under three alternative (parametric) survival model estimators that have been employed in past civil war studies (e.g., Hegre et al., 2001; de Rouen and Sobek, 2004; Buhaug, Gates and Lujala, 2009). Specifically, I re-estimate my models of *civil war duration* while assuming parametric distributional survival forms of a (i) Weibull distribution (ii) exponential distribution, or (iii) Gompertz distribution. I report the full models (i.e., Model 3) for each of these three parametric estimators together in Table A.11. As one can see, these alternate, more stringent, distributional assumptions continue to yield statistically significant results for *malaria prevalence* at the $p < .05$ level. Hence, the robustness models presented here suggest that my conclusions are not dependent on the use of Cox Proportional hazards models, on my handling of unit or time specific heterogeneity, or upon the presence (or absence) of outlier cases.

Finally, I examine whether my primary findings are robust to the inclusion of a more extensive set of geography-based civil war correlates. To do so, I rely on the geo-referenced civil war-zone covariates developed by Buhaug, Gates and Lujala (2009), which include variables such as a conflict's location on a *border*, a conflict zone's distance from a country's capital city (and the interaction of this measure with *border*), the presence of gemstones, drugs, or petroleum in the conflict zone, and the percentage of a conflict zone corresponding to mountainous and forest terrain. One notable challenge in incorporating these covariates into a test of my hypotheses is that these data are at the conflict-dyad level, rather than the more disaggregated rebel group conflict-dyad level. This ensures that Buhaug, Gates and Lujala's geo-referenced conflict measures are at a higher level of aggregation than the units analyzed above (and in, e.g., Cunningham, Gleditsch and Salehyan (2009)). Attempts to reconcile these differences yielded a substantial number of non-matching cases (though an analysis using those cases that did perfectly match supported the above conclusions). Thus, for the present robustness test, I focus instead on separately replicating the five primary duration models reported in Buhaug, Gates and Lujala (2009)—which individually assess the effects of Buhaug, Gates and Lujala's geo-coded variables on civil war duration—and then add my malaria measure(s) to each of the authors' reported model specifications. Accordingly, this exercise not only allows me to evaluate the robustness of my primary malaria finding in light of a wide variety of geo-located control variables, but also enables me to examine the sensitivity of my results under a different level of unit-aggregation, and a smaller sample size. I report my findings for *malaria prevalence*—when added to Buhaug, Gates and Lujala (2009)'s five reported Weibull specifications—in table A.12 and then present a comparable set of models that use my aforementioned interpolated *malaria prevalence* measure in table A.13 (all conclusions remain when using a Cox model instead). I find that *malaria prevalence* continues to exert a highly significant prolonging effect on civil war across 9 of these 10 robustness models, wherein for the one case where *malaria prevalence* did not achieve traditional significance it nevertheless remained significant at the $p < .12$ level. Hence my findings for *malaria prevalence* appear to be robust to the inclusion of this broader set of geo-located civil war correlates.

Table A.2: Cox Proportional Hazard Estimates of Civil War Duration: Coup d'état Control

	Model 1	**Model 2**	**Model 3**
Malaria prevalence (%)	-0.499**	-0.511**	-0.607**
	(0.168)	(0.181)	(0.192)
Rebel strength	.	0.412**	0.239
		(0.113)	(0.199)
MalariaXRebel-strength	.	.	0.273
			(0.212)
War on core territory	-0.619**	-0.828**	-0.871**
	(0.271)	(0.319)	(0.312)
Coup d'état	2.214**	2.075**	2.115**
	(0.320)	(0.327)	(0.322)
ELF index	0.377	0.545*	0.566*
	(0.311)	(0.324)	(0.318)
Ethnic conflict	-0.066	0.094	0.097
	(0.146)	(0.158)	(0.157)
Democracy	-0.798**	-0.763**	-0.793**
	(0.171)	(0.223)	(0.226)
Ln GDP per capita	-0.020	-0.021	-0.025
	(0.083)	(0.089)	(0.088)
Two or more dyads	-0.527**	-0.536**	-0.521**
	(0.134)	(0.114)	(0.134)
Territorial control	.	-0.372**	-0.344**
		(0.130)	(0.147)
Ln population	.	-0.058	-0.054
		(0.060)	(0.059)
Percent tropics	.	0.148	0.150
		(0.213)	(0.212)
Africa	.	-0.134	-0.173
		(0.188)	(0.191)
Number of conflicts	386	386	386
Number of failures	339	339	339
Observations	2,392	2,392	2,393

Note: ** indicates $p < .05$; * indicates $p < .10$; values in parentheses are robust standard errors clustered by conflict id.

Table A.3: Cox Proportional Hazard Estimates of Civil War Duration: Ln Latitude Control

	Model 1	**Model 2**	**Model 3**
Malaria prevalence (%)	-0.666**	-0.963**	-1.004**
	(0.182)	(0.222)	(0.227)
Rebel strength	.	0.485**	0.400
		(0.164)	(0.291)
MalariaXRebel-strength	.	.	0.145
			(0.326)
War on core territory	-0.687**	-0.791**	-0.827**
	(0.273)	(0.323)	(0.318)
ELF index	0.393	0.250	0.287
	(0.328)	(0.344)	(0.342)
Ethnic conflict	-0.057	0.054	0.058
	(0.149)	(0.165)	(0.166)
Democracy	-0.796**	-0.813**	-0.829**
	(0.184)	(0.234)	(0.235)
Ln GDP per capita	-0.064	-0.075	-0.077
	(0.087)	(0.090)	(0.089)
Two or more dyads	-0.551**	-0.595**	-0.586**
	(0.140)	(0.141)	(0.141)
Territorial control	.	-0.281*	-0.275**
		(0.151)	(0.151)
Ln population	.	-0.004	-0.005
		(0.065)	(0.065)
Ln latitude	.	0.256**	0.257**
		(0.083)	(0.084)
Africa	.	-0.160	-0.187
		(0.191)	(0.194)
Number of conflicts	341	341	341
Number of failures	294	294	294
Observations	2,341	2,341	2,341

Note: ** indicates $p < .05$; * indicates $p < .10$; values in parentheses are robust standard errors clustered by conflict id.

Table A.4: Cox Proportional Hazard Estimates of Civil War Duration: Conditional Frailty

	Model 1	**Model 2**	**Model 3**
Malaria prevalence (%)	-0.847**	-1.014**	-0.951**
	(0.293)	(0.358)	(0.370)
Rebel strength	.	0.609**	0.813**
		(0.191)	(0.345)
MalariaXRebel-strength	.	.	-0.307
			(0.423)
War on core territory	-0.483	-0.762	-0.728
	(0.455)	(0.507)	(0.510)
ELF index	0.035	0.362	0.349
	(0.473)	(0.611)	(0.513)
Ethnic conflict	0.046	0.195	0.200
	(0.216)	(0.226)	(0.227)
Democracy	0.789**	-0.847**	-0.835**
	(0.236)	(0.255)	(0.256)
Ln GDP per capita	-0.017	0.028	0.033
	(0.131)	(0.134)	(0.135)
Two or more dyads	-0.460**	-0.471**	-0.472**
	(0.175)	(0.172)	(0.172)
Territorial control	.	-0.464**	-0.469**
		(0.176)	(0.177)
Ln population	.	-0.042	-0.044
		(0.079)	(0.080)
Percent tropics	.	0.359	0.369
		(0.324)	(0.324)
Africa	.	-0.274	-0.257
		(0.267)	(0.269)
θ	0.669	0.610	0.620
	(0.216)	(0.204)	(0.201)
Number of conflicts	341	341	341
Number of failures	294	294	294
Observations	2,341	2,341	2,341

Note: ** indicates $p < .05$; * indicates $p < .10$; values in parentheses are robust standard errors clustered by conflict id.

Table A.5: Cox Proportional Hazard Estimates of Civil War Duration: Additional State Capacity Controls

	Model 1	**Model 2**	**Model 3**
Malaria prevalence (%)	-2.458**	-1.722**	-1.732**
	(0.942)	(0.850)	(0.847)
Rebel strength	.	0.797	-5.192
		(0.530)	(15.324)
MalariaXRebel-strength	.	.	6.021
			(15.252)
War on core territory	.	.	.
ELF index	0.662	-0.234	-0.079
	(0.723)	(1.012)	(1.238)
Ethnic conflict	0.836**	1.564**	1.588**
	(0.294)	(0.238)	(0.400)
Democracy	-1.080*	-1.153**	-1.143**
	(0.321)	(0.509)	(0.503)
Ln GDP per capita	-0.179	-0.002	0.002
	(0.280)	(0.365)	(0.363)
Two or more dyads	-0.502**	-0.443*	-0.436*
	(0.247)	(0.256)	(0.252)
Territorial control	.	-1.093**	-1.083**
		(0.513)	(0.511)
Ln population	.	-0.409**	-0.430**
		(0.174)	(0.191)
Percent tropics	.	0.088	0.050
		(0.767)	(0.793)
Africa	.	0.290	-0.195
		(0.553)	(0.727)
Bureaucratic quality	-0.064	0.202	0.188
	(0.192)	(0.246)	(0.262)
Ln military expenditure	-0.054	0.040	0.017
	(0.145)	(0.259)	(0.286)
Taxes/GDP	-7.026**	-9.799**	-9.455**
	(2.477)	(2.968)	(3.617)
Number of conflicts	82	82	82
Number of failures	62	62	62
Observations	433	433	433

Note: ** indicates $p < .05$; * indicates $p < .10$; values in parentheses are robust standard errors clustered by conflict id.

Table A.6: Cox Proportional Hazard Estimates of Civil War Duration: Additional Disease Controls

	Model 1	**Model 2**	**Model 3**
Malaria prevalence (%)	-0.636**	-0.713**	-0.749**
	(0.203)	(0.209)	(0.214)
Rebel strength	.	0.488**	0.412
		(0.152)	(0.286)
MalariaXRebel-strength	.	.	0.127
			(0.321)
War on core territory	-0.492*	-0.689**	-0.723**
	(0.288)	(0.327)	(0.323)
ELF index	0.225	0.382	0.412
	(0.330)	(0.354)	(0.354)
Ethnic conflict	-0.070	-0.002	0.002
	(0.152)	(0.173)	(0.173)
Democracy	-0.707**	-0.803**	-0.816**
	(0.199)	(0.232)	(0.235)
Ln GDP per capita	-0.052	-0.031	-0.033
	(0.090)	(0.092)	(0.092)
Two or more dyads	-0.600**	-0.618**	-0.609**
	(0.143)	(0.140)	(0.141)
Territorial control	.	-0.308**	-0.302*
		(0.155)	(0.156)
Ln population	.	0.035	0.034
		(0.067)	(0.067)
Percent tropics	.	0.266	0.263
		(0.281)	(0.282)
Africa	.	-0.290	-0.314
		(0.231)	(0.234)
Yellow fever	0.227	0.328	0.333
	(0.203)	(0.285)	(0.286)
Dengue fever	-0.257	-0.347*	-0.344*
	(0.161)	(0.187)	(0.188)
Number of conflicts	341	341	341
Number of failures	294	294	294
Observations	2,341	2,341	2,341

Note: ** indicates $p < .05$; * indicates $p < .10$; values in parentheses are robust standard errors clustered by conflict id.

Table A.7: Cox Proportional Hazard Estimates of Civil War Duration: Year Fixed-Effects

	Model 1	**Model 2**	**Model 3**
Malaria prevalence (%)	-0.574**	-0.864**	-0.809**
	(0.197)	(0.234)	(0.256)
Rebel strength	.	0.374**	0.491*
		(0.139)	(0.256)
MalariaXRebel-strength	.	.	-0.189
			(0.329)
War on core territory	-0.494	-0.738**	-0.688*
	(0.309)	(0.357)	(0.359)
ELF index	0.424	0.682**	0.650*
	(0.320)	(0.344)	(0.342)
Ethnic conflict	-0.101	0.040	0.031
	(0.137)	(0.155)	(0.157)
Democracy	-1.095**	-1.168**	-1.151**
	(0.217)	(0.252)	(0.253)
Ln GDP per capita	0.008	0.028	0.032
	(0.089)	(0.092)	(0.091)
Two or more dyads	-0.503**	-0.498**	-0.505**
	(0.140)	(0.141)	(0.143)
Territorial control	.	-0.294**	-0.297**
		(0.145)	(0.149)
Ln population	.	-0.031	-0.031
		(0.059)	(0.059)
Percent tropics	.	0.436*	0.434*
		(0.231)	(0.231)
Africa	.	-0.263	-0.232
		(0.190)	(0.199)
Number of conflicts	341	341	341
Number of failures	294	294	294
Observations	2,341	2,341	2,341

Note: ** indicates $p < .05$; * indicates $p < .10$; year fixed effects included in all models; values in parentheses are robust standard errors clustered by conflict id.

Table A.8: Cox Proportional Hazard Estimates of Civil War Duration: Outliers Removed

	Model 1	**Model 2**	**Model 3**
Malaria prevalence (%)	-0.659**	-0.730**	-0.765**
	(0.182)	(0.212)	(0.217)
Rebel strength	.	0.482**	0.399
		(0.164)	(0.328)
MalariaXRebel-strength	.	.	0.136
			(0.357)
War on core territory	-0.640**	-0.813**	-0.843**
	(0.274)	(0.323)	(0.318)
ELF index	0.384	0.467	0.495
	(0.327)	(0.355)	(0.355)
Ethnic conflict	-0.058	0.046	0.051
	(0.149)	(0.166)	(0.165)
Democracy	-0.787**	-0.815**	-0.828**
	(0.184)	(0.235)	(0.236)
Ln GDP per capita	-0.064	-0.045	-0.047
	(0.089)	(0.093)	(0.093)
Two or more dyads	-0.546**	-0.561**	-0.551**
	(0.140)	(0.142)	(0.142)
Territorial control	.	-0.307**	-0.300*
		(0.155)	(0.157)
Ln population	.	0.001	-0.001
		(0.066)	(0.066)
Percent tropics	.	0.219	0.217
		(0.230)	(0.231)
Africa	.	-0.099	-0.120
		(0.202)	(0.205)
Number of conflicts	341	341	341
Number of failures	293	293	293
Observations	2,340	2,340	2,340

Note: ** indicates $p < .05$; * indicates $p < .10$; values in parentheses are robust standard errors clustered by conflict id.

Table A.9: Cox Proportional Hazard Estimates of Civil War Duration with Ordinal Polity IV Control

	Model 1	**Model 2**	**Model 3**
Malaria prevalence (%)	-0.709**	-0.824**	-0.858**
	(0.181)	(0.210)	(0.210)
Rebel strength	.	0.406**	0.334
		(0.157)	(0.298)
MalariaXRebel-strength	.	.	0.120
			(0.326)
War on core territory	-0.651**	-0.678**	-0.705**
	(0.279)	(0.324)	(0.319)
ELF index	0.476	0.473	0.500
	(0.306)	(0.349)	(0.349)
Ethnic conflict	-0.078	0.023	0.027
	(0.153)	(0.169)	(0.169)
Polity IV	-0.046**	-0.044**	-0.045**
	(0.010)	(0.013)	(0.013)
Ln GDP per capita	-0.034	-0.012	-0.013
	(0.086)	(0.089)	(0.090)
Two or more dyads	-0.578**	-0.601**	-0.594**
	(0.137)	(0.139)	(0.139)
Territorial control	.	-0.330**	-0.326**
		(0.153)	(0.154)
Ln population	.	-0.002	-0.002
		(0.068)	(0.068)
Percent tropics	.	0.277	0.276
		(0.223)	(0.222)
Africa	.	-0.007	-0.026
		(0.182)	(0.184)
Number of conflicts	341	341	341
Number of failures	294	294	294
Observations	2,341	2,341	2,341

Note: ** indicates $p < .05$; values in parentheses are robust standard errors clustered by conflict id.

Table A.10: Cox Proportional Hazard Estimates of Civil War Duration: Interpolated Malaria Measure

	Model 1	**Model 2**	**Model 3**
Malaria prevalence (%)	-0.562**	-0.671**	-0.708**
	(0.213)	(0.273)	(0.281)
Rebel strength	.	0.451**	0.389
		(0.116)	(0.301)
MalariaXRebel-strength	.	.	0.107
			(0.328)
War on core territory	-0.756**	-0.959**	-0.992**
	(0.282)	(0.323)	(0.321)
ELF index	0.464	0.585*	0.619*
	(0.316)	(0.331)	(0.337)
Ethnic conflict	-0.050	0.080	0.086
	(0.153)	(0.161)	(0.162)
Democracy	-0.805**	-0.836**	-0.847**
	(0.185)	(0.235)	(0.235)
Ln GDP per capita	-0.059	-0.072	-0.075
	(0.098)	(0.100)	(0.100)
Two or more dyads	-0.507**	-0.514**	-0.506**
	(0.135)	(0.138)	(0.137)
Territorial control	.	-0.333**	-0.332**
		(0.149)	(0.149)
Ln population	.	-0.023	-0.025
		(0.061)	(0.061)
Percent tropics	.	0.167	0.171
		(0.234)	(0.235)
Africa	.	-0.159	-0.180
		(0.194)	(0.198)
Number of conflicts	355	355	355
Number of failures	308	308	308
Observations	2,407	2,407	2,407

Note: ** indicates $p < .05$; * indicates $p < .10$; values in parentheses are robust standard errors clustered by conflict id.

Table A.11: Alternate Survival Model Estimates of Civil War Duration

	Exponential	**Weibull**	**Gompertz**
Malaria prevalence (%)	-0.888**	-0.749**	-0.779**
	(0.281)	(0.217)	(0.252)
Rebel strength	0.489	0.398	0.408
	(0.360)	(0.300)	(0.341)
MalariaXRebel-strength	0.155	0.114	0.131
	(0.393)	(0.328)	(0.374)
War on core territory	-1.018**	-0.769**	-0.829**
	(0.385)	(0.320)	(0.354)
ELF index	0.720	0.483	0.591
	(0.440)	(0.357)	(0.395)
Ethnic conflict	0.061	0.025	0.044
	(0.207)	(0.158)	(0.180)
Democracy	-0.824**	-0.827**	-0.838**
	(0.284)	(0.229)	(0.248)
Ln GDP per capita	-0.082	-0.034	-0.050
	(0.114)	(0.091)	(0.100)
Two or more dyads	-0.653**	-0.566**	-0.641**
	(0.168)	(0.138)	(0.155)
Territorial control	-0.432**	-0.270**	-0.308*
	(0.190)	(0.148)	(0.168)
Ln population	-0.052	0.005	-0.024
	(0.081)	(0.065)	(0.072)
Percent tropics	0.185	0.209	0.192
	(0.294)	(0.224)	(0.253)
Africa	-0.130	-0.119	-0.167
	(0.249)	(0.199)	(0.219)
Constant	-5.076**	-3.715**	-5.494**
	(1.372)	(1.079)	(1.225)
p		0.684	
		(0.038)	
γ			-0.0001
			(0.00)
Number of conflicts	341	341	341
Number of failures	294	294	294
Observations	2,341	2,341	2,341

Note: ** indicates $p < .05$; * indicates $p < .10$; values in parentheses are robust standard errors clustered by conflict id.

Table A.12: Weibull Model Replications of Buhaug, Gates and Lujala (2009)

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Malaria prevalence (%)	-0.517**	-0.550**	-0.505**	-0.559**	-0.510
	(0.202)	(0.190)	(0.209)	(0.181)	(0.321)
Distance to Capital (ln)	-0.241**	-0.276**	-0.249**	-0.297**	-0.265**
	(0.085)	(0.082)	(0.083)	(0.083)	(0.088)
Conflict at border	-0.380*	-0.430**	-0.451**	-0.465**	-0.458**
	(0.197)	(0.199)	(0.189)	(0.196)	(0.197)
Border x distance	0.277**	0.326**	0.339**	0.338**	0.354**
	(0.106)	(0.095)	(0.095)	(0.102)	(0.114)
Rebel fighting capacity	.	0.419**	0.360**	0.427**	0.343*
		(0.178)	(0.188)	(0.187)	(0.189)
Gemstones in conflict zone	.	.	-0.196	.	.
			(0.174)		
Petroleum in conflict zone	.	.	-0.365**	.	.
			(0.152)		
Drugs in conflict zone	.	.	0.025	.	.
			(0.225)		
Mountains in conflict zone	.	.	.	0.002	.
				(0.003)	
Forest in conflict zone	.	.	.	0.003	.
				(0.002)	
Democracy score onset	.	.	.	.	-0.520**
					(0.219)
GDP per capita onsent (ln)	.	.	.	.	0.017
					(0.112)
Post Cold-War Years	0.555**	0.493**	0.542**	0.470**	0.588**
	(0.201)	(0.213)	(0.218)	(0.220)	(0.198)
Constant	-3.118**	-3.193***	-3.243**	-3.276**	-3.203**
	(0.512)	(0.515)	(0.531)	(0.527)	(1.025)
p	0.644	0.670	0.684	0.677	0.665
	(0.039)	(0.041)	(0.041)	(0.041)	(0.044)
Number of conflicts	226	213	213	213	189
Number of failures	201	189	189	189	166
Observations	1,507	1,467	1,467	1,467	1,368

Note: ** indicates $p < .05$; * indicates $p < .10$; values in parentheses are robust standard errors clustered by conflict id.

Table A.13: Weibull Model Replications of Buhaug, Gates and Lujala (2009); Interpolated Malaria Measure

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Malaria prevalence (%)	-0.628**	-0.646**	-0.621**	-0.661**	-0.742**
	(0.205)	(0.184)	(0.196)	(0.183)	(0.310)
Distance to Capital (ln)	-0.262**	-0.293**	-0.271**	-0.320**	-0.285**
	(0.085)	(0.083)	(0.084)	(0.083)	(0.093)
Conflict at border	-0.335*	-0.390*	-0.406**	-0.423**	-0.407**
	(0.195)	(0.200)	(0.191)	(0.196)	(0.194)
Border x distance	0.321**	0.378**	0.393**	0.393**	0.390**
	(0.10-)	(0.091)	(0.093)	(0.097)	(0.104)
Rebel fighting capacity	.	0.442**	0.385**	0.450**	0.346*
		(0.174)	(0.182)	(0.179)	(0.182)
Gemstones in conflict zone	.	.	-0.224	.	.
			(0.174)		
Petroleum in conflict zone	.	.	-0.379**	.	.
			(0.152)		
Drugs in conflict zone	.	.	0.023	.	.
			(0.210)		
Mountains in conflict zone	.	.	.	0.002	.
				(0.003)	
Forest in conflict zone	.	.	.	0.003	.
				(0.002)	
Democracy score onset	.	.	.	.	-0.540**
					(0.214)
GDP per capita onsent (ln)	.	.	.	.	-0.045
					(0.116)
Post Cold-War Years	0.558**	0.495**	0.549**	0.472**	0.649**
	(0.196)	(0.206)	(0.210)	(0.214)	(0.188)
Constant	-3.016**	-3.117***	-3.168**	-3.373**	-2.665**
	(0.499)	(0.501)	(0.514)	(0.509)	(1.043)
p	0.653	0.681	0.697	0.688	0.679
	(0.037)	(0.038)	(0.040)	(0.039)	(0.042)
Number of conflicts	229	216	216	216	190
Number of failures	204	192	192	192	167
Observations	1,517	1,477	1,477	1,477	1,375

Note: ** indicates $p < .05$; * indicates $p < .10$; values in parentheses are robust standard errors clustered by conflict id.

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