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What Goes Up Must Come Down: Military Expenditure and Civil Wars

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ABSTRACT

This paper examines the impact of civil war on military expenditure. We employ two measures of military expenditure: the share of military expenditure in general government expenditure and the logarithm of military expenditures. We would reasonably expect a priori that military expenditure as a share of general government expenditure increases during a civil war and that such increases would taper off over the duration of a civil war. We also explore whether the termination of a civil war induces a decline in the share of military expenditure as a share of the general government expenditure in the short-run. We find evidence the of share of military expenditure increases during a civil war and falls in the year succeeding the end of a civil war, and, in particular, if a war ends in a peace treaty. The level of military expenditures, however, rises during civil wars and does not appear to decline in the short-term after the end of a civil war.

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Introduction

Civil war lowers economic growth, generates declines in public health and social well-being, and fractures the social contract that underpins civil society (Gates et al. 2012). The most significant negative impact of civil war may come from portfolio substitution, that is, the combined impact of government shifting resources away from productivity enhancing activities and the government's worsening fiscal balance crowding out private investment (Imai and Weinstein 2000). As military expenditure consumed over 1.69 trillion dollars in public resources in 2016 (SIPRI 2017), there is sufficient reason to try to understand the drivers, and inhibitors, of greater spending on the military.

This paper examines the impact of civil war on military expenditure. We employ two measures of military expenditure: the share of military expenditure in general government expenditure and the natural logarithm of military expenditures. We would reasonably expect a priori that the share of military expenditure to general government expenditure increases during a civil war. We also explore whether the termination of a civil war induces a decline in share of military expenditure in the short-run. It is entirely possible that the share of military expenditure is 'sticky' and once the share of the general government budget increases as the result of a civil war, it persistently remains higher for an extended period. We explore the importance of the definition of civil war, its intensity, and duration. We examine the robustness of our results using the logarithm of military expenditures. Finally, we examine robustness across different estimators, instruments, and control variables.

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The remainder of this paper is structured as follows. The next section reviews the literature on military expenditure and civil wars and develops the testable hypotheses. Section 'Empirical Methodology and Data' describes the data and develops the estimation methodology. Section 'Results' of the paper presents and considers the results. The last section concludes and discusses opportunities for future research.

Review of the Literature

Engaging in armed conflict can drive military expenditure higher and otherwise divert resources away from development objectives. Collier and Hoeffler (2006) estimate that the loss of economic growth induced by civil war amounts to 2.2% for each year of conflict and that most countries do not recover growth quickly, needing an average of 14 years to catch up to what would have been their GDP without a war. The negative consequences of civil war are not limited to economic growth. Civil war persistently lowers democratization (Armey and McNab 2015) and degrades public health outcomes (Ghobarah, Huth, and Russett 2004). Moreover, recent research has found that military expenditure negatively and robustly affects economic growth (see for example Dunne and Tian 2013, 2015; Hou and Chen 2013, 2014; Töngür, Hsu, and Elveren 2015). Thus, high postwar military expenditures may exacerbate the slower growth that makes recurrent war more likely.

The literature on the determinants of military expenditure has followed two strains: one primarily focused on external threats and arms races (Collier and Hoeffler 2007; Deger and Sen 1983; Nordhaus, Oneal, and Russett 2009) and the other on the economic political and strategic determinants of spending, leading to the inclusion of GDP, trade, democracy, and population in empirical models of military expenditure (Bove and Brauner 2016; Nordhaus, Oneal, and Russett 2009). Our study contributes to the determinants literature. Increases in oil rents, for example, may increase military expenditure, at least in Middle Eastern and North African countries. Corruption, however, may mitigate the threat oil rents pose in terms of increasing the likelihood of civil wars (Fjelde 2009). More populous countries have higher military expenditure, along with those whose neighbors are facing internal conflicts (Phillips 2015). While democracies generally spend less on their militaries, this is somewhat dependent on the type of democracy (Albalate, Bel, and Elias 2012).

Several studies do examine the impact of civil war on public expenditure. In a panel of countries from 1980 to 1997, civil war negatively impacts the percentage change in education expenditures, though we caution that this result explicitly assumes that democracy and GDP are exogenous (Lai and Thyne 2007). Higher levels of public spending on political goods (rather than military expenditure) may lower the threat of internal conflict (Fjelde and De Soysa 2009). Military expenditure does not appear to affect the probability of civil unrest in a panel of countries (Taydas and Peksen 2012). Governments tend to bias spending towards social programs and away from military expenditure, especially during election periods (Bove, Efthyvoulou, and Navas 2016).

With regard to civil war and military expenditure, various models show rising military expenditures because of civil wars (Albalate, Bel, and Elias 2012; Collier and Hoeffler 2007; Dunne, Perlo-Freeman, and Smith 2008). Military expenditure appears to decline as a share of government expenditure after the end of a civil war, but we caution the result is derived from 26 observations across 5 countries using a fixed effects estimator and should be viewed with a significant degree of caution (Chen, Loayza, and Reynal-Querol 2008). We attempt here to incorporate being in a civil war, the impact of an ongoing war, and the impact of civil war termination on demand for military expenditure in a more rigorous dynamic panel framework.

From this discussion, we develop several testable hypotheses of interest. First, we postulate that the onset of civil war significantly increases the share of military expenditure in general government expenditure. Second, we hypothesize that as the duration of a conflict increases, these increases will diminish. Thirdly, we hypothesize that the termination of civil significantly decreases the share of military expenditure in general government expenditure. Finally, we hypothesize that there will be similar effects on the level of expenditures, and similar effects with an alternate definition of civil war. In the next section, we discuss our empirical approach and data for testing these hypotheses.

Empirical Methodology and Data

The choice of how to measure civil war, military expenditure, and the empirical approach may significantly influence the estimates of the influence of civil war on the share of military expenditure. Our measurement choices are standard. For measuring civil war and its termination, as in much of the previous literature, we employ the Correlates of War project's (CoW) database on intrastate wars. For robustness, we also consider the alternate definition of intra-state wars from the Uppsala Conflict Data Program at the Peace Research Institute Oslo (UCDP/PRIO). We employ military expenditure data from the Stockholm International Peace Research Institute (SIPRI).

Much of the research on the impact of civil war on various political and economic outcomes has employed the Ordinary Least Squares (OLS) estimator or the error components estimator. We consider either approach risky given the possibility of unobservable country and time-specific effects (OLS) and the potential persistence of the military expenditure variable (error components). Concerns about persistence of many political and economic variables that may be none the less influenced by civil war have led to the use of the difference Generalized Method of Moments (GMM) and system GMM estimators (see for ex. Acemoglu et al. 2008; Aslaksen 2010). We argue that GMM estimators are appropriate to the task of estimating the influence of civil war and its termination on the share of military expenditure in general government expenditure.

Data

To investigate the hypotheses regarding the influence of civil war and civil war termination on the share of military expenditure, we obtain data on military expenditure from SIPRI's Military Expenditures Database.[1] We define the dependent variable, *Military Share*, as the share of military expenditure in general government expenditure. There are 3,598 observations for military expenditure as a share of general government expenditure in the SIPRI database. For military expenditure as a share of general government expenditure, the data are available from 1988 to 2016, though this varies significantly country-by-country. For robustness, we also examine the impact of civil wars on the log of defense expenditures as suggested in Smith (2017). Similarly, data on the level of military expenditure are available from 1949 to 2016, again with significant variation country by country. We constrain our sample to the same countries and time periods that we use for military expenditures as a share of general government expenditures to obtain comparable results.

We obtain data on civil wars and the termination of civil wars from the CoW project (Sarkees and Wayman 2010). We also obtain information on interstate wars from the same source. The CoW project defines a civil war as a conflict between a government and one or more armed internal non-state groups. An internal armed conflict must have at least 1,000 battle-related deaths per year to qualify for inclusion as a civil war in the CoW database. The project uses these criteria to assign a date for the termination of a civil war. Following Sarkees and Wayman (2010), we define the variable *CoW at War* as a dummy variable that is equal to 1 if a war starts or is ongoing in a period, 0 otherwise. We define a variable, *CoW War End*, as a dummy variable that is equal to 1 if a war ends, 0 otherwise. We also create a duration variable, *CoW War Duration* that captures the duration of each civil war event. The CoW data are available from 1816 to 2007. Lastly, to control for the possibility that interstate wars influence the share of military expenditure, we use the CoW data to measure interstate war starts, duration, and conclusions in the same way we do for civil wars.

For robustness, we also define civil wars according to the UCDP/PRIO criterion (Gleditsch et al. 2002). This lowers the threshold for an armed conflict to 25 battle deaths per year. We define at war, duration, and war end in the same way that we do for the CoW data. UCDP/PRIO also include data on the conditions under which a war terminates. We include dummy variables for wars ending in a peace agreement, military victory for the government, victory for the rebels, and whether a conflict ends in a stalemate or low-level violence.

We obtain data on the extent (or lack thereof) of democracy from the Polity IV data-set. The Polity IV data-set measure quantifies democratic and autocratic characteristics of governing institutions and

subtracts the autocracy score from the democracy score to obtain its composite index. As two components of the Polity score contain conflict as a criterion (Vreeland 2008), we subtract the *Regulation of Participation* and *Competitiveness of Participation* components of the democracy score as these measures include aspects of conflict. We normalize the conflict-free democracy score to the 0 (complete lack of democracy) to 1 (complete democracy) range. The Polity IV data are available from 1800 to 2015.

We employ data which the literature suggests are significant determinants of military expenditure including GDP, GDP per capita, openness to international trade, population, and population density, among others. We obtain these variables from the World Bank's 2017 *World Development Indicators*. Combining the data-sets yields an unbalanced panel data-set from 1988 to 2008, although we must recognize that the number of observations varies significantly by country. We further reduce the sample to include only those countries for which there are 3 or more observations. We also reduce the sample to include only those countries for which the dependent variable, *Military Share*, and the independent variables of interest are available. The resulting unbalanced panel data-set has 152 distinct developed and developing countries with 2,284 observations, with an average number of 15.02 observations per country. Table 1 defines the variables used in the empirical model and their sources. Table 2 presents descriptive statistics of these variables. Table 3 presents the sample countries and time periods, respectively.

Model Specification

To test the proposition that civil war influences the share of military expenditure, we specify the general estimation form in terms of a dynamic model:

$$\begin{aligned}\text{Military Share} = {} & \alpha + \beta_1 \text{Military Share}_{i,t-1} + \tau_1 \text{ At War}_{i,t-1} + \tau_2 \text{ War Duration}_{i,t-1} + \tau_3 \text{ War End}_{i,t-1} \\ & + \mathbf{X}'_{\mathbf{i,t-1}}\boldsymbol{\Theta} + \mu_i + \lambda_t + u_{i,t}\end{aligned} \tag{1}$$

where μ_i and λ_t denote the unobservable individual country and time effects, respectively. The subscripts *i* and *t* denote country and time, respectively. We expect a priori that the share of military expenditure is persistent, that is, the current share of military expenditure is a function of the past period's share of military expenditure. The binary indicator, *At War,* indicates whether a country was engaged in a civil war in during that year. The variable *War Duration* captures the number of years at war. The binary indicator, *War End,* indicates whether a civil war has ended in that year. The coefficients τ capture the treatment effects of interest. We assume that the error term, u_{it}, are white noise.

In part we adopt this specification, because the variables of interest may be non-stationary. We examine whether any of the variables of interest exhibit a unit process as the presence of a unit root, unless *N* and *T* grow large, is likely to induce inconsistent and biased estimates (Baltagi 2008). We employ a Fisher test to examine the null hypothesis that all the panels are non-stationary versus the alternative that at least one panel is stationary (Maddala and Wu 1999). We reject the null hypothesis of non-stationarity for the share of military expenditure and the independent variables at the 1% level of significance.[2]

To provide a baseline, we present the results of the pooled OLS estimator and the two-way error components estimator. The pooled OLS estimator explicitly assumes the time and country-specific effects are equal to zero and, if these unobservable effects are present and correlated with the regressors, is biased and inconsistent. If unobservable country- or time-specific effects are significant, then an error components estimator is more appropriate than the OLS estimator.[3] We conclude that the random effects GLS estimator is inconsistent and employ the less efficient, but consistent fixed effects (or within) estimator. In addition, using the within estimator, we reject the null hypothesis of homoscedasticity at the 1% level of significance.[4] We reject the null hypothesis of no serial correlation at the 1% level (Drukker 2003; Wooldridge 2001).[5] Finally, we reject the null hypothesis that the individual and time-specific effects are jointly equal to zero at the 1% level of significance and employ the two-way within estimator throughout the remainder of the paper.

However, there are additional concerns with the within estimator that point to using system or difference GMM. While there is significant variation in the shares of military expenditure across countries,

Table 1. Variables.

Variable	Definition	Units	Source
CoW at war	Dummy variable equal to 1 if a civil war is ongoing in that year, 0 otherwise	(0,1)	Correlates of war
CoW war Count	Duration of civil war	Years	Authors' calculation
CoW war End	Dummy variable equal to 1 if a civil war ends in that year, 0 otherwise	(0,1)	Correlates of war
GDP per capita	Gross domestic product divided by total population	Local currency units	WDI
Government victory	Dummy variable that is 1 if the government prevails in a conflict	(0,1)	UCDP/PRIO armed conflict data-set
Interstate at war	Dummy variable that is 1 for the parties of an interstate war, 0 otherwise	(0,1)	Correlates of war
Interstate war end	Dummy variable that is 1 for the end of an interstate war between two or more parties, 0 otherwise	(0,1)	Correlates of war
Military expenditure	Natural log of military expenditure in local currency in the country year		SIPRI (2017)
Military expenditure share of government	Military expenditures as a share of general government expenditures	Percent [0,1]	SIPRI (2017)
Military share of GDP	Military expenditures as a share of GDP	Percent [0,1]	SIPRI (2017)
OECD dummy	Dummy variable that is 1 for OECD members, 0 otherwise	(0,1)	OECD
Openness to trade	The ratio of the sum of imports and exports to GDP	Percent [0,1]	Authors' calculation and WDI
Peace agreement	Dummy variable that is 1 if a conflict ends with a peace agreement, 0 otherwise	(0,1)	UCDP/PRIO
Population	Natural log of population in the country year		WDI
Polity2	The POLITY score is computed by subtracting the Autocracy score from the Democratic Score. We use Vreeland's (2008) adjustment to eliminate systematic conflict endogeneity and normalize to a 0 (strongly autocratic) to 1 (strongly democratic) scale	Fraction [0,1]	Center for Systemic Peace (2016)
PRIO at war	Dummy variable equal to 1 if a civil war is ongoing per the UCDP/PRIO threshold, 0 otherwise	(0,1)	UCDP/PRIO
PRIO war Count	Duration of civil war meeting the UCDP/PRIO threshold	Years	Authors' calculation
PRIO war end	Dummy variable equal to 1 if a civil war ends in a specific year per the UCDP/PRIO threshold, 0 otherwise	(0,1)	UCDP/PRIO
Rebel victory	Dummy variable that is 1 if a conflict ends with rebel victory, 0 otherwise	(0,1)	UCDP/PRIO
Urban population	Percentage of the population living in urban areas	Percent [0,1]	WDI

Table 2. Descriptive statistics.

	Count	Mean	Standard deviation	Minimum	Maximum
COW at war	2284	0.067	0.249	0.000	1.000
COW war count	2284	0.017	0.128	0.000	1.000
COW war end	2284	0.427	2.159	0.000	21.000
Defense to GDP	2250	2.653	3.706	0.149	117.350
Defense share	2284	8.459	6.969	0.000	57.478
Interstate at war	2284	0.014	0.118	0.000	1.000
Interstate war end	2284	0.013	0.112	0.000	1.000
Interstate war count	2284	0.016	0.146	0.000	3.000
Log of GDP per capita	2254	10.546	2.357	1.771	17.760
Log of military expenditures	2223	22.648	3.040	13.040	32.390
Log of population	2260	16.059	1.640	11.138	21.004
Openness to international trade	2225	85.344	49.686	0.255	445.911
Polity2	2116	0.710	0.331	0.000	1.000
Population density	2243	0.165	0.546	0.001	6.913
UCDP government victory	2284	0.006	0.075	0.000	1.000
UCDP peace agreement	2284	0.008	0.091	0.000	1.000
UCDP rebel victory	2284	0.002	0.042	0.000	1.000
UCDP at war	2284	0.155	0.362	0.000	1.000
UCDP war end	2284	0.043	0.203	0.000	1.000
UCDP war count	2284	2.058	6.977	0.000	48.000

the shares appear to be relatively stable within countries, suggesting that military share is persistent within countries across time. Across the sample, the average year-to-year change in the share of military expenditure in general government expenditure is only 0.3%. This suggests that it is appropriate to include the lagged dependent variable, however, the use of a within estimator with a lagged dependent variable violates strict exogeneity as the lagged dependent variable is mechanically correlated with the error term (Perotti 1996). Additionally, we are concerned that some of the traditional determinants of the share of military expenditure, including GDP per capita, may be endogenous. We are also concerned that some regressors may be, as our dependent variables, persistent. Previous explorations of the determinants of military expenditure that do not take these potential econometric issues into account are likely to be suspect, due to the inconsistent nature of their estimators.

Several instrumental variable approaches are available to address systematic endogeneity, including using lags of the dependent variable as an explanatory variable. While the Anderson-Hsiao (Anderson and Hsiao 1982) Instrumental Variables (IV) and difference GMM estimator are consistent, both may be relatively inefficient to the system GMM estimator.[6] Therefore, we employ a system-GMM estimator that uses lagged differences and lagged levels as instruments for the lagged dependent variable and other endogenous variables (Arellano and Bover 1995; Blundell and Bond 1998). The short *T* and persistent series appear to support the extra moment conditions of the system GMM vice the difference GMM (Baltagi 2008) and should produce dramatic efficiency gains over the difference GMM (Blundell and Bond 1998). GMM estimators also offer standard errors that are robust to heteroskedasticity and serial correlation.

Researchers have several options available to them when using GMM estimators that incur important trade-offs. We explore the robustness of our specification choices and the sensitivity of our results to changes in the set of instruments. We collapse the instrument matrix and limit the number of lags to control for instrument proliferation. We also use the two-step process that is generally more efficient and naturally resilient to heteroscedasticity. The two-step process, however, tends to downward bias standard errors enough to make inference impossible when instrument counts are large. To counter this issue, we employ the two-step process with Windmeijer corrected standard errors which ameliorates such problems. We also employ forward orthogonal deviations using information on future differences to instrument for past differences. We explicitly assume that population, population density, and the time effects are exogenous variables and GDP, GDP per capita, openness to international trade, and democracy are endogenous.

We present the two-step estimates with collapsed instruments, a lag-limit of three, forward orthogonal deviations, and Windmeijer corrected standard errors.[7] We test the hypothesis that the error term

Table 3. Sample countries.

Country	Years	Country	Years
Afghanistan	2004–2008	Lesotho	1998–2008
Albania	1990–2008	Liberia	2004–2008
Algeria	1990–2008	Libya	1997–2008
Angola	1996–2008	Lithuania	1993–2008
Argentina	1995–2008	Luxembourg	1995–2008
Armenia	2005–2008	Macedonia	1997–2008
Australia	1988–2008	Madagascar	1988–2008
Austria	1988–2008	Malawi	2002–2008
Azerbaijan	1994–2008	Malaysia	1990–2008
Bahrain	1990–2008	Mali	2000–2008
Bangladesh	1988–2008	Malta	2000–2008
Belarus	2001–2008	Mauritania	2004–2008
Belgium	1988–2008	Mauritius	1990–2008
Belize	1996–1997; 2000–2008	Mexico	1990–2008
Benin	1989–1990; 2000–2008	Moldova	1995–2008
Bolivia	1988–2008	Mongolia	1988–2008
Bosnia and Herzegovina	2002–2008	Montenegro	2006–2008
Botswana	1988–2008	Morocco	1990–2008
Brazil	1996–2008	Mozambique	1998–2008
Brunei	1988–2008	Myanmar	1997–2005
Bulgaria	1998–2008	Namibia	1991–2008
Burkina Faso	1988–2008	Nepal	2000–2008
Burundi	1990–2008	Netherlands	1995–2008
Cambodia	1996–2008	New Zealand	1988–2008
Cameroon	1996–2008	Nicaragua	2000–2008
Cape Verde	1994–2008	Niger	1995–2008
Canada	1988–2008	Nigeria	2000–2008
Central African Rep.	1991–1996; 2002–2008	Norway	1988–2008
Chad	1995–2008	Oman	1990–2008
Chile	1990–2008	Pakistan	1993–2008
China	1989–2008	Panama	1988–2008
Colombia	1988–2008	Papua New Guinea	1988–2008
Congo	1992–1993; 2001–2008	Paraguay	1988–2008
Costa Rica	2000–2008	Peru	2000–2008
Cote d'Ivoire	1997; 2003–2008	Philippines	1989–2008
Croatia	1992–2008	Poland	1995–2008
Cyprus	1995–2008	Portugal	1991–1991
Czech Republic	1995–2008	Qatar	1990–2008; 2002–2008
Dem. Rep. of the Congo	1996–2008	Russian Federation	1998–2008
Denmark	1988–2008	Rwanda	1992–2008
Djibouti	1990–2008	Saudi Arabia	1990–2008
Dominican Rep.	1997–2008	Senegal	1994–2008
Ecuador	1995–2008	Serbia	2000–2008
Egypt	2002–2008	Seychelles	1988–2008
El Salvador	1990–2008	Sierra Leone	2000–2008
Eritrea	1993–2003	Singapore	1990–2008
Estonia	1995–2008	Slovak Republic	1995–2008
Fiji	1992–2008	Slovenia	1995–2008
Finland	1988–2008	South Africa	2000–2008
France	1988–2008	Spain	1988–2008
Gabon	2000–2006	Sri Lanka	1990–2008
Gambia	2000–2008	Sudan	1990–2008
Georgia	1995–2008	Swaziland	1988–2008
Germany	1991–2008	Sweden	1988–2008
Ghana	1988–2008	Switzerland	1988–2008
Greece	1988–2008	Syria	1990–2008
Guatemala	1995–2008	Taiwan	1988–2008
Guinea	1991–2004	Tajikistan	1998–2004; 2008
Guinea-Bissau	1994–2005	Tanzania	1991–2008
Guyana	2000–2008	Thailand	1995–2008
Honduras	1990–1993; 2000–2008	Timor	2004–2008
Hungary	1995–2008	Togo	1989–1995; 2003–2005
India	1998–2008	Trinidad and Tobago	1992–1994; 2000–2008
Indonesia	1993–2008	Tunisia	1991–2008

(*Continued*)

Table 3. (*Continued*).

Country	Years	Country	Years
Iran	1990–2008	Turkey	2002–2008
Ireland	1988–2008	Uganda	1997–2008
Israel	2000–2008	Ukraine	1995–2008
Italy	1988–2008	United Arab Emirates	1997–2008
Jamaica	1990–2008	United Kingdom	1988–2004
Japan	1988–2008	United States	2001–2008
Jordan	1988–2008	Uruguay	1999–2008
Kazakhstan	2002–2008	Uzbekistan	1994–2003
Kenya	1988–2008	Venezuela	1989–2008
Kuwait	1990–2008	Vietnam	2003–2008
Kyrgiz Republic	1995–2008	Yemen	1990–2008
Laos	2000–2008	Yugoslavia	2000–2008
Latvia	1998–2008	Zambia	2004–2008
Lebanon	1990–2008		

is serially correlated in the first order and not serially correlated in the second order. We test the validity of the moment conditions using the Hansen test and robustness of additional moment conditions with the Hansen difference test.[8] These test statistics are in order, suggesting that the system GMM estimator is appropriately specified.

Results

We find empirical evidence that participation in a civil war increases the share of military expenditure in general government expenditure. This evidence appears to be robust and statistically significant across estimators, specifications, instrument sets, and definitions of civil war. We find that, as one might reasonably expect a priori, that governments facing a civil war divert resources towards the military. Moreover, we find empirical evidence that the level of military expenditure also increases in response to participation in a civil war.

We find evidence that the end of a civil war leads to a decline in military expenditure as a share of general government expenditure in the succeeding period, that is, the share of military expenditure is not 'sticky.' We also find empirical evidence that the termination of a civil war, as defined by the CoW measure, decreases the share of military expenditure in general government expenditure. This evidence is robust to variations in the estimators, specifications, and instrument sets. While this result is sensitive to the choice of definition of civil war, it appears that, using the UCDP/PRIO measure, civil wars that end in peace agreements, as opposed to other kinds of terminations, lead to a reduction in expenditures.

Military Share, Civil War, and Termination of Civil Wars

A priori, we hypothesize, based upon the literature, that governments allocate a greater share of expenditure to the military during a civil war and reduce the share of military expenditure after the termination of a civil war. We would expect a positive and statistically significant relationship between the advent of a civil war and the share of military expenditure in general government expenditure in the succeeding period. Likewise, we would expect a negative and statistically significant relationship between the conclusion of a civil war and the share of military expenditure in the succeeding period. We continue to present the OLS and within estimates to establish the bounds for the system GMM estimator.

We find robust empirical evidence that countries at war in the preceding period positively impacts the share of military expenditure in general government expenditure. The estimated coefficients for *CoW at War* are positive and statistically significant across the pooled OLS, within, and system GMM estimators, as well as across definitions of civil war. Table 4 presents our basic results using the CoW measure of civil war. The pooled OLS estimate suggests that being at war increases the military expenditure share by approximately 1.5 points while the within estimate is somewhat higher, suggesting a 1.95

Table 4. Military expenditure as a share of general government expenditure correlates of war measure of civil war start, duration, and termination.

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	Fixed effects	System GMM	OLS	Fixed effects	System GMM
Military share$_{t-1}$	0.915** (0.018)	0.638** (0.069)	0.908** (0.048)	0.915** (0.018)	0.637** (0.070)	0.886** (0.053)
COW at war$_{t-1}$	1.494* (0.756)	1.950** (0.610)	1.488** (0.470)	1.488* (0.756)	1.948** (0.612)	1.655** (0.572)
COW war duration$_{t-1}$	−0.073 (0.055)	−0.057 (0.051)	−0.079+ (0.046)	−0.073 (0.055)	−0.057 (0.051)	−0.084+ (0.051)
COW war end$_{t-1}$	−1.412* (0.668)	−1.276* (0.519)	−1.221* (0.501)	−1.412* (0.669)	−1.275* (0.522)	−1.297** (0.495)
Interstate at war$_{t-1}$	–	–	–	3.851 (4.907)	4.570* (1.897)	1.414 (4.976)
Interstate duration$_{t-1}$	–	–	–	−1.788 (2.319)	−1.585 (1.345)	−1.262 (2.064)
Interstate war end$_{t-1}$	–	–	–	−2.109 (3.700)	−3.176** (0.900)	0.234 (3.760)
Observations	1884	1884	1884	1884	1884	1884
Adjusted R^2	0.917	0.487	–	0.917	0.485	–
*M*1	0.225	0.000**	0.008**	0.209	0.000**	0.009**
*M*2	0.665	–	0.236	0.646	–	0.231
Number of instruments	–	–	63	–	–	69
Lag limits	–	–	3	–	–	3
Collapsed	–	–	Yes	–	–	Yes
One step or two	–	–	Yes	–	–	Yes
Orthogonal	–	–	Yes	–	–	Yes
Hansen J-test	–	–	0.330	–	–	0.321
Diff. in Hansen test	–	–	0.838	–	–	0.642

Notes: Year dummies included in all models. *m*1 and *m*2 are tests for first-order and second-order serial correlation, asymptotically *N*(0,1). *m*1 test for within estimator is the Wooldridge *F*-test. GMM results are with heteroscedastically consistent standard errors and test statistics. *P*-values for *m*1 and *m*2 are shown. The two-step estimates contain the Windmeijer correction. *Orthogonal* is the forward orthogonal deviations transform instead of first differencing. The Hansen *J*-test is a test of overidentifying restrictions for the GMM estimators. The difference-in-Hansen test is a test of the exogeneity of the instruments for the lagged military share variable with the null hypothesis that the instruments are exogenous. *P*-values are shown for the Hansen *J*-test and Difference in Hansen test. All models include controls for GDP per capita, Democracy, Population, Population Density, and Openness to International Trade. Full estimates available upon request. **, *, + denote significance at the 1, 5, and 10% levels, respectively.

point increase. For the system GMM estimates, the affect ranges from 1.48 percentage points to 1.655 percentage points when interstate war is added as a control variable. The estimated coefficient for *CoW at War* is statistically significant at the 1% level for all the system GMM specifications using the COW measure.[9] As the average war in our sample lasted 3.7 years, the GMM estimates point to a between this would amount to an average increase in spending of between 5.5 and 6 percentage points over the course of an average civil war. On average, most countries spend a little less than 2.5% of government expenditures on the military, so these increases amount to between a 60% increase for a one year civil war, to a 150% increase over the course of an average war.

We expect that these increases in spending would potentially taper off as a war dragged on, and include a variable for the duration of time at war. The coefficients on duration are consistently negative for both measures of civil war. However, the coefficients for duration are smaller in magnitude than the coefficients for a country being at war, suggesting this tapering off increases in defense spending. This finding is statistically significant at the 10% level in the models using the CoW measure of civil war. Thus, this variable suggests the increase may be closer to 4.8 to 5.5 percentage points in an average 3.5 year war.

Likewise, we find empirical evidence across the different estimators that the conclusion of a civil war leads to a decline in the share of military expenditure in the succeeding period. The termination of a civil war leads to an approximately 1.2 percentage point decline in the share of military expenditures. The estimated coefficient for *War End* is statistically significant at the 5% and 1% level in the system GMM specifications.

Alternate Measure of Civil War

Tables 5 and 6 use the alternate measure from UCDP/PRIO to measure a civil war's start, duration, and conclusion. UCDP/PRIO also includes data on how a civil war ends – whether in a military victory for

Table 5. Military expenditure as a share of general government expenditure UCDP/PRIO measure of civil war start, duration, and termination.

	(7)	(8)	(9)	(10)	(11)	(12)
	OLS	Fixed effects	System GMM	OLS	Fixed effects	System GMM
Military share$_{t-1}$	0.913** (0.018)	0.643** (0.067)	0.887** (0.056)	0.914** (0.018)	0.642** (0.068)	0.852** (0.052)
UCDP at war$_{t-1}$	0.766** (0.292)	0.915 (0.601)	0.708+ (0.417)	0.765** (0.292)	0.907 (0.600)	0.929* (0.380)
UCDP war duration$_{t-1}$	−0.011 (0.013)	0.005 (0.036)	−0.003 (0.017)	−0.011 (0.013)	0.006 (0.037)	0.003 (0.018)
UCDP war end$_{t-1}$	0.093 (0.488)	0.130 (0.583)	−0.248 (0.412)	0.122 (0.492)	0.146 (0.587)	−0.593 (0.449)
Interstate at war$_{t-1}$	–	–	–	3.769 (4.524)	4.385* (1.683)	2.862 (4.189)
Interstate duration$_{t-1}$	–	–	–	−1.983 (2.123)	−1.824 (1.275)	−1.148 (1.946)
Interstate war end$_{t-1}$	–	–	–	−1.847 (3.444)	−2.760** (0.798)	−1.167 (3.110)
Observations	1884	1884	1884	1884	1884	1884
Adjusted R^2	0.917	0.483	–	0.917	0.483	–
*M*1	0.193	0.000**	0.007**	0.193	0.000**	0.009**
*M*2	0.593	–	0.202	0.593	–	0.194
Number of instruments	–	–	63	–	–	69
Lag limits	–	–	3	–	–	3
Collapsed	–	–	Yes	–	–	Yes
One step or two	–	–	Yes	–	–	Yes
Orthogonal	–	–	Yes	–	–	Yes
Hansen J-test	–	–	0.120	–	–	0.356
Diff. in Hansen test	–	–	0.652	–	–	0.108

Notes: See Table 4. **, *, + denote significance at the 1, 5, and 10% levels, respectively.

Table 6. Military expenditure as a share of general government expenditure UCDP/PRIO measure of civil war start, duration, and termination including type of conflict termination.

	(13)	(14)	(15)	(16)	(17)	(18)
	OLS	Fixed effects	System GMM	OLS	Fixed effects	System GMM
Military share$_{t-1}$	0.916** (0.018)	0.645** (0.067)	0.865** (0.048)	–	–	–
Military expenditure$_{t-1}$	–	–	–	0.935** (0.009)	0.732** (0.047)	0.860** (0.070)
UCDP at war$_{t-1}$	0.790** (0.291)	0.872 (0.601)	0.913* (0.371)	0.080** (0.028)	0.034 (0.050)	0.105 (0.064)
UCDP war duration$_{t-1}$	−0.013 (0.013)	0.016 (0.037)	0.000 (0.017)	0.001 (0.001)	0.004 (0.004)	−0.001 (0.005)
UCDP war end$_{t-1}$	0.779 (0.676)	0.697 (0.807)	−0.158 (0.591)	0.110 (0.082)	0.086 (0.084)	0.029 (0.081)
Government victory$_{t-1}$	−1.327 (0.855)	−1.416 (0.990)	−0.253 (0.854)	−0.147 (0.123)	−0.224+ (0.116)	−0.144 (0.184)
Rebel victory$_{t-1}$	−0.094 (1.036)	0.482 (0.956)	0.308 (1.272)	0.107 (0.168)	0.167 (0.177)	0.079 (0.134)
Peace agreement$_{t-1}$	−2.529** (0.901)	−1.889* (0.911)	−1.864* (0.929)	−0.244* (0.110)	−0.157+ (0.081)	−0.103 (0.088)
Interstate at war$_{t-1}$	3.617 (4.227)	4.280** (1.549)	3.689 (3.456)	−0.317 (0.513)	−0.141 (0.370)	0.090 (0.547)
Interstate duration$_{t-1}$	−2.155 (1.977)	−1.945 (1.214)	−1.498 (1.711)	0.237 (0.329)	0.169 (0.299)	0.193 (0.261)
Interstate war end$_{t-1t-1}$	−1.587 (3.245)	−2.581** (0.744)	−1.785 (2.848)	0.076 (0.234)	0.007 (0.095)	−0.304 (0.346)
Observations	1884	1884	1884	1850	1850	1850
Adjusted R^2	0.918	0.488	–	0.996	0.929	–
*M*1	0.189	0.000	0.008	0.001	0.000	0.001
*M*2	0.689	–	0.199	0.000	–	0.317
Number of instruments	–	–	75	–	–	69
Lag limits	–	–	3	–	–	3
Collapsed	–	–	Yes	–	–	Yes
One step or Two	–	–	Yes	–	–	Yes
Orthogonal	–	–	Yes	–	–	Yes
Hansen J-test	–	–	0.448	–	–	0.433
Diff. in Hansen test	–	–	0.128	–	–	0.494

Notes: See Table 4. **, *, + denote significance at the 1, 5, and 10% levels, respectively.

either side, a stalemate or low-level violence, or a peace treaty. Table 5 replicates our models from Table 4 using the UCDP/PRIO measures, and Table 6 adds in these war-end conditions.

Using this measure, we essentially lower the threshold of what makes a civil war. Unsurprisingly, we find that civil war increases defense expenditures to a lesser degree as part of overall government expenditures. In the system GMM models presented in Table 5 being at war increases a country's expenditures between 0.7 and 0.9 percentage points, these findings are significant at the 10% and 5% levels, respectively.[10]

Table 7. Military expenditure civil war start, duration, and termination.

	(19)	(20)	(21)	(22)	(23)	(24)
	OLS	Fixed effects	System GMM	OLS	Fixed effects	System GMM
Military expenditure$_{t-1}$	0.938** (0.008)	0.729** (0.047)	0.938** (0.083)	0.934** (0.009)	0.730** (0.047)	0.855** (0.032)
COW at war$_{t-1}$	0.258** (0.079)	0.190* (0.077)	0.204* (0.089)	–	–	–
COW war duration$_{t-1}$	−0.011* (0.006)	−0.004 (0.005)	−0.009 (0.009)	–	–	–
COW war end$_{t-1}$	−0.120+ (0.066)	−0.059 (0.039)	−0.070 (0.077)	–	–	–
UCDP at war$_{t-1}$	–	–	–	0.076** (0.028)	0.037 (0.050)	0.104+ (0.061)
UCDP war duration$_{t-1}$	–	–	–	0.002 (0.002)	0.003 (0.004)	−0.001 (0.006)
UCDP war end$_{t-1}$	–	–	–	0.050 (0.059)	0.034 (0.061)	−0.001 (0.070)
Interstate at war$_{t-1}$	−0.292 (0.563)	−0.122 (0.398)	−0.008 (1.039)	−0.303 (0.526)	−0.134 (0.383)	0.155 (0.727)
Interstate duration$_{t-1}$	0.282 (0.374)	0.198 (0.320)	0.116 (0.405)	0.252 (0.343)	0.182 (0.310)	0.104 (0.328)
Interstate war end$_{t-1}$	0.017 (0.222)	−0.033 (0.099)	−0.155 (0.728)	0.054 (0.226)	−0.009 (0.096)	−0.262 (0.434)
Observations	1850	1850	1850	1850	1850	1850
Adjusted R^2	0.996	0.930	–	0.995	0.928	–
*M*1	0.178	0.000**	0.009**	0.002**	0.000**	0.001**
*M*2	0.573		0.194	0.000	–	0.400
Number of instruments	–	–	69	–	–	69
Lag limits	–	–	3	–	–	3
Collapsed	–	–	Yes	–	–	Yes
One step or two	–	–	Yes	–	–	Yes
Orthogonal	–	–	Yes	–	–	Yes
Hansen J-test	–	–	0.356	–	–	0.305
Diff. in Hansen test	–	–	0.108	–	–	0.244

Notes:See Table 4. **, *, + denote significance at the 1, 5, and 10% levels, respectively.

The share of military expenditures, following civil wars, is not sticky when wars end with peace agreements. Although negative throughout, the coefficients on war-end are not significant in the case of the UCDP/PRIO measures. In Table 6 we present the results with different war-endings included. While military expenditures appear to be sticky in the case of wars that end with military victories for either side or with stalemates and low-level violence, wars that end with peace agreements significantly reduced the defense share of government expenditures in our models.

Military Expenditure Level, Civil War, and Controls

Lastly, we examine the robustness of our results by changing the dependent variable from the share of military expenditure in general government expenditure to the natural log of military expenditures.[11] We find much more limited evidence of any impact of war on the overall level of expenditures, and in particular find that while spending in terms of expenditure share may not be 'sticky,' the level of expenditures appears to be sticky.

Turning to the estimates in Table 7, we find that *CoW at War* is positive and statistically significant the system GMM specifications. The CoW of war measure suggests a 20% increase in expenditures and the UCDP/PRIO a 10% increase. These coefficients are significant at the 5 and 10% levels, respectively. Neither duration nor war end are statistically significant. Revisiting the war-end conditions in Table 6, there does not appear to be a significant impact on the stickiness of expenditures because of how a war ends.

Thus, it seems that although at the end of a war military expenditures make up less of a government's portfolio, particularly in the case of a peace agreement, this change is driven not so much by a decrease in defense expenditures but by an increase in overall and other kinds of expenditures.

Conclusion

Given the well-documented relationship between military expenditure and economic growth, persistently high levels of military expenditure may constitute a significant challenge to post-conflict development. Persistent increases in the share of military expenditure in general government expenditure as

the result of civil war would not only impede growth but likely increase the likelihood of future conflict. We do not, however, find robust empirical evidence to support the hypothesis that the share of military expenditure is 'sticky', finding instead, that the share declines in the year succeeding the end of a civil war, particularly when wars end in peace agreements.

Our research is potentially good news regarding the composition of public expenditures post-conflict. The decline in the share of military expenditure suggests that public resources may be available for productivity enhancing expenditures, to include education, health, and infrastructure investments. We caution that these public resources may also be siphoned by corrupt activities as institutional quality tends to suffer as the result of civil war. We also note that the level of overall expenditures may decline if post-conflict growth fails to materialize.

Given our findings and critiques of the extant literature, we believe an investigation of the composition of public expenditures and civil war would be of benefit to policymakers and practitioners alike. What happens to the shares of education and health expenditure following the termination of a civil war? What happens to the capacity of the state to make productive investments in infrastructure? Answering these questions may help provide concrete advice and assistance following the end of conflict.

Notes

1. The SIPRI data are publicly available at: https://www.sipri.org/databases/milex.
2. We run three tests for each of the variables to interest: without a trend, with a trend, and with a one-period lag. We reject the null hypothesis of non-stationarity at the 1% level of significance for each of the variables. Detailed test statistics are available upon request.
3. To determine whether a within or random effects error components estimator is appropriate, we use a Hausman test and reject the null hypothesis of the exogeneity of the components and the regressors at the 1% level of significance. Comparing a two-way random effects GLS estimator and a two-way within estimator, we reject the null hypothesis that the differences in the two sets of estimated coefficients are not systematic with a Chi-squared test with 7 degrees of freedom and a resultant test statistic of 181.07.
4. We employ a Breusch–Pagan test and reject the null hypothesis of homoscedasticity with a Chi-squared test with 1 degree of freedom and resultant test statistic of 2717.01.
5. We employ the Wooldridge test for autocorrelation in the panel data and reject the null hypothesis of no first-order autocorrelation with a $F(1,138)$ test statistic of 18.97 for the within estimator with a lagged dependent variable.
6. The difference GMM estimator is consistent, relatively more efficient than the Anderson-Hsaio IV estimator, and employs all available lagged levels of the dependent variable, beginning with the second lag, as instruments for the lagged difference of the dependent variable (Arellano and Bond 1991). The difference GMM estimator, however, may also be inefficient because levels may not be good instruments for differences. Differences may be a superior instrument for the levels (Roodman 2006). The system GMM estimator may thus be consistent and relatively efficient when some regressors are persistent.
7. The unrestricted, one-step system GMM estimates, the one-step estimates with collapsed instruments, the one-step estimates with collapsed instruments and a lag limit of three, the two-step estimates with collapsed instruments and a lag-limit of three are available upon request in an unpublished Appendix 1.
8. We find evidence that the system GMM estimated coefficients for an AR(1) model falls within the bounds of the OLS and fixed effects estimators, and proceed, with empirical evidence that the model is well specified. The system GMM estimator, for all but the most constrained specification, lies within the established bounds (and the most constrained estimate is only slightly outside the bound), regardless of restrictions on lag-length or the composition of the instrument matrix. These estimates are available upon request.
9. Estimates are similar, and significant at the 1% level, across different System GMM models, see Appendix Tables A3 and A4.
10. Additional specifications and estimates are available upon request in an unpublished manuscript.
11. We first examine whether the military expenditure series exhibits a unit root and fail to reject the null hypothesis of a unit root using a Fisher-type test. We take the natural logarithm of the series and are able to reject the null of a unit root. Turning to the system GMM estimator, the estimated coefficients for ρ are positive, lie within the established bounds, and are statistically significant at the 1% level of significance. These additional estimates are available upon request. We do not reject the null hypothesis of the Hansen test in any of the GMM specifications. We also fail to reject the null of exogeneity using the difference-in-Hansen tests for each of the GMM specifications. We have evidence that the *AR(1)* model is well specified for the military to GDP series and the ranking of the OLS, within groups, and IV estimators is consistent with our a priori expectations. These estimates are available upon request.

Disclosure Statement

No potential conflict of interest was reported by the authors.

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Appendix 1

Table A1. AR(1) specifications for military composition.

	(A1)	(A2)	(A3)	(A4)	(A5)	(A6)	(A7)
	OLS	Fixed effects	System GMM	System GMM	System GMM	System GMM	System GMM
Military share$_{t-1}$	0.934** (0.016)	0.690** (0.049)	0.875** (0.038)	0.827** (0.061)	0.832** (0.061)	0.860** (0.046)	0.959** (0.021)
Constant	0.198 (0.310)	2.010** (0.370)	0.768** (0.278)	1.120* (0.452)	1.080* (0.451)	0.959** (0.337)	0.132 (0.162)
Observations	2112	2112	2112	2112	2112	2112	2112
Adjusted R^2	0.909	0.535	–	–	–	–	–
*M*1	0.169	0.000**	0.002**	0.001**	0.001**	0.002**	0.003**
*M*2	0.668		0.310	0.299	0.300	0.306	0.320
Number of instruments	–	–	248	59	43	43	43
Lag limits	–	–	All	All	3	3	3
Collapsed	–	–	No	Yes	Yes	Yes	Yes
One step or two	–	–	No	No	No	Yes	Yes
Orthogonal	–	–	No	No	No	No	Yes
Hansen J-test	–	–	1.000	0.104	0.380	0.380	0.136
Diff. in Hansen test	–	–	1.000	0.244	0.722	0.722	0.908

Notes: Year dummies included in all models. *m*1 and *m*2 are tests for first-order and second-order serial correlation, asymptotically *N*(0,1). *m*1 test for within estimator is the Wooldridge *F*-test. GMM results are with heteroscedastically-consistent standard errors and test statistics. *P*-values for *m*1 and *m*2 are shown. The two-step estimates contain the Windmeijer correction. *Orthogonal* is the forward orthogonal deviations transform instead of first differencing. The Hansen *J*-test is a test of over-identifying restrictions for the GMM estimators. The difference-in-Hansen test is a test of the exogeneity of the instruments for the lagged military share variable with the null hypothesis that the instruments are exogenous. *P*-values are shown for the Hansen *J*-test and Difference in Hansen test. **,*, + denote significance at the 1, 5, and 10% levels, respectively.

Table A2. Military expenditure as a share of general government expenditure at war, and war termination.

	(A8)	(A9)	(A10)	(A11)	(A12)	(A13)	(A14)
	OLS	Fixed effects	System GMM	System GMM	System GMM	System GMM	System GMM
Military share$_{t-1}$	0.930** (0.016)	0.683** (0.051)	0.875** (0.038)	0.830** (0.067)	0.837** (0.068)	0.841** (0.064)	0.953** (0.024)
COW at war$_{t-1}$	0.872* (0.425)	1.227** (0.412)	1.141** (0.327)	1.363** (0.466)	1.329** (0.462)	1.286** (0.437)	0.669+ (0.386)
COW war end$_{t-1}$	−1.331* (0.583)	−1.509** (0.481)	−1.277** (0.393)	−1.232** (0.397)	−1.239** (0.395)	−1.169** (0.301)	−1.281** (0.396)
Constant	0.203 (0.307)	2.042** (0.386)	0.717** (0.272)	1.037* (0.478)	0.989* (0.476)	1.066* (0.449)	0.160 (0.164)
Observations	2112	2112	2112	2112	2112	2112	2112
Adjusted R^2	0.910	0.540	–	–	–	–	–
*M*1	0.187	0.000**	0.002**	0.001**	0.001**	0.003**	0.003**
*M*2	0.821		0.352	0.341	0.342	0.351	0.369
Number of instruments	–	–	252	63	47	47	47
Lag limits	–	–	All	All	3	3	3
Collapsed	–	–	No	Yes	Yes	Yes	Yes
One step or two	–	–	No	No	No	Yes	Yes
Orthogonal	–	–	No	No	No	No	Yes
Hansen J-test	–	–	1.000	0.145	0.307	0.307	0.124
Diff. in Hansen test	–	–	1.000	0.992	0.761	0.761	0.800

Notes: See Table A1. **, *, + denote significance at the 1, 5, and 10% levels, respectively.

Table A3. military expenditure as a share of general government expenditure.

	(A15)	(A16)	(A17)	(A18)	(A19)	(A20)	(A21)
	OLS	Fixed effects	System GMM	System GMM	System GMM	System GMM	System GMM
Military share$_{t-1}$	0.915** (0.018)	0.638** (0.069)	0.853** (0.030)	0.817** (0.076)	0.808** (0.077)	0.888** (0.040)	0.908** (0.048)
COW at war$_{t-1}$	1.494* (0.756)	1.950** (0.610)	1.693** (0.491)	1.801** (0.668)	1.802** (0.678)	1.572** (0.482)	1.488** (0.470)
COW war duration$_{t-1}$	−0.073 (0.055)	−0.057 (0.051)	−0.062 (0.039)	−0.066 (0.046)	−0.063 (0.046)	−0.073+ (0.042)	−0.079+ (0.046)
COW war end$_{t-1}$	−1.412* (0.668)	−1.276* (0.519)	−1.425** (0.431)	−1.382** (0.475)	−1.404** (0.475)	−1.374** (0.437)	−1.221* (0.501)
GDP per capita$_{t-1}$	−0.021 (0.025)	0.238 (0.184)	−0.054 (0.053)	0.136 (0.205)	0.125 (0.213)	0.127 (0.127)	0.032 (0.091)
Polity2$_{t-1}$	−0.691** (0.193)	−0.272 (0.475)	−1.260* (0.497)	−1.572 (0.977)	−1.775+ (0.981)	−0.956 (0.763)	−0.658 (0.776)
Population	−0.012 (0.032)	−3.023 (1.861)	−0.013 (0.073)	−0.162 (0.143)	−0.186 (0.146)	−0.063 (0.140)	−0.025 (0.099)
Population density	0.301+ (0.161)	0.049 (0.749)	0.521* (0.257)	0.987* (0.479)	1.102* (0.494)	0.453 (0.420)	0.350 (0.304)
Openness to trade	−0.002 (0.002)	0.000 (0.006)	−0.003 (0.004)	−0.011 (0.008)	−0.013 (0.008)	−0.004 (0.008)	−0.002 (0.006)
Constant	1.444* (0.720)	49.407 (30.265)	2.853 (1.888)	4.332 (3.396)	5.221 (3.542)	1.379 (2.658)	1.284 (2.408)
Observations	1884	1884	1884	1884	1884	1884	1884
Adjusted R^2	0.917	0.487	–	–	–	–	–
*M*1	0.225	0.000**	0.006**	0.002**	0.002**	0.005**	0.008**
*M*2	0.665		0.239	0.233	0.235	0.239	0.236
Number of instruments	–	–	883	127	63	63	63
Lag limits	–	–	All	All	3	3	3
Collapsed	–	–	No	Yes	Yes	Yes	Yes
One step or two	–	–	No	No	No	Yes	Yes
Orthogonal	–	–	No	No	No	No	Yes
Hansen J-test	–	–	1.000	0.389	0.502	0.346	0.330
Diff. in Hansen test	–	–	1.000	0.610	0.501	0.724	0.838

Notes: See Table A1. **, *, + denote significance at the 1, 5, and 10% levels, respectively.

Table A4. Military expenditure as a share of general government expenditures including interstate war controls.

	(A22)	(A23)	(A24)	(A24)	(A25)	(A26)	(A27)
	OLS	Fixed effects	System GMM	System GMM	System GMM	System GMM	System GMM
Military share$_{t-1}$	0.915** (0.018)	0.637** (0.070)	0.853** (0.035)	0.876** (0.052)	0.892** (0.055)	0.878** (0.038)	0.886** (0.053)
COW at war$_{t-1}$	1.488* (0.756)	1.948** (0.612)	1.700** (0.504)	1.590* (0.612)	1.485* (0.622)	1.589** (0.474)	1.655** (0.572)
COW war duration$_{t-1}$	−0.073 (0.055)	−0.057 (0.051)	−0.062 (0.040)	−0.067 (0.056)	−0.064 (0.058)	−0.067 (0.043)	−0.084+ (0.051)
COW war end$_{t-1}$	−1.412* (0.669)	−1.275* (0.522)	−1.425** (0.434)	−1.513** (0.520)	−1.566** (0.543)	−1.397** (0.440)	−1.297** (0.495)
GDP per capita$_{t-1}$	−0.023 (0.026)	0.229 (0.186)	−0.067 (0.055)	−0.262 (0.318)	−0.334 (0.368)	0.074 (0.133)	0.032 (0.078)
Polity2$_{t-1}$	−0.691** (0.194)	−0.271 (0.477)	−1.235* (0.509)	−1.122 (0.698)	−1.221+ (0.660)	−1.156 (0.808)	−0.909 (0.770)
Population	−0.013 (0.032)	−2.998 (1.864)	−0.004 (0.068)	−0.156 (0.134)	−0.175 (0.137)	−0.034 (0.133)	−0.040 (0.082)
Population density	0.300+ (0.161)	0.055 (0.756)	0.499+ (0.258)	1.021* (0.433)	1.086* (0.448)	0.431 (0.390)	0.440 (0.287)
Openness to trade	−0.002 (0.002)	0.000 (0.006)	−0.002 (0.004)	−0.015+ (0.008)	−0.017+ (0.009)	−0.003 (0.008)	−0.003 (0.005)
Interstate at war$_{t-1}$	3.851 (4.907)	4.570* (1.897)	5.067** (1.712)	4.690** (1.497)	4.393** (1.413)	3.878 (2.720)	1.414 (4.976)
Interstate duration$_{t-1}$	−1.788 (2.319)	−1.585 (1.345)	−1.295 (1.274)	−1.869 (1.676)	−2.197 (1.795)	−2.056 (1.457)	−1.262 (2.064)
Interstate war end$_{t-1}$	−2.109 (3.700)	−3.176** (0.900)	−3.669** (0.957)	−2.993* (1.510)	−2.464 (1.569)	−1.681 (1.814)	0.234 (3.760)
Constant	1.460* (0.726)	49.142 (30.327)	2.783 (1.781)	8.244* (4.058)	9.530* (4.593)	1.605 (2.771)	1.866 (2.002)
Observations	1884	1884	1884	1884	1884	1884	1884
Adjusted R^2	0.917	0.485	–	–	–	–	–
*M*1	0.209	0.000**	0.007**	0.006**	0.007**	0.005**	0.009**
*M*2	0.646		0.233	0.239	0.243	0.228	0.231
Number of instruments	–	–	889	133	69	69	69
Lag limits	–	–	All	All	3	3	3
Collapsed	–	–	No	Yes	Yes	Yes	Yes
One step or two	–	–	No	No	No	Yes	Yes
Orthogonal	–	–	No	No	No	No	Yes
Hansen J-test	–	–	1.000	0.326	0.463	0.321	0.321
Diff. in Hansen test	–	–	1.000	0.861	0.809	0.642	0.642

Notes: See Table A1. **, *, + denote significance at the 1, 5, and 10% levels, respectively.

Table A5. Military expenditure as a share of general government expenditures ucdp/prio civil war measures.

	(A28)	(A29)	(A30)	(A31)	(A32)	(A33)	(A34)
	OLS	Fixed effects	System GMM	System GMM	System GMM	System GMM	System GMM
Military share$_{t-1}$	0.913** (0.018)	0.643** (0.067)	0.850** (0.030)	0.820** (0.067)	0.818** (0.069)	0.877** (0.040)	0.887** (0.056)
UCDP at war$_{t-1}$	0.766** (0.292)	0.915 (0.601)	0.969* (0.379)	0.987+ (0.592)	0.967 (0.594)	0.786* (0.393)	0.708+ (0.417)
UCDP war duration$_{t-1}$	−0.011 (0.013)	0.005 (0.036)	−0.007 (0.015)	−0.009 (0.017)	−0.009 (0.018)	−0.010 (0.015)	−0.003 (0.017)
UCDP war end$_{t-1}$	0.093 (0.488)	0.130 (0.583)	−0.008 (0.556)	0.046 (0.643)	0.045 (0.636)	0.140 (0.623)	−0.248 (0.412)
GDP per capita$_{t-1}$	−0.024 (0.026)	0.212 (0.202)	−0.059 (0.052)	0.108 (0.191)	0.062 (0.203)	0.131 (0.111)	0.055 (0.086)
Polity2$_{t-1}$	−0.635** (0.200)	−0.326 (0.471)	−1.127* (0.471)	−1.010 (0.933)	−1.117 (0.906)	−0.928 (0.747)	−0.752 (0.887)
Population	−0.025 (0.033)	−2.869 (1.870)	−0.032 (0.074)	−0.239 (0.148)	−0.262+ (0.147)	−0.101 (0.131)	−0.105 (0.117)
Population density	0.288+ (0.160)	0.050 (0.737)	0.504+ (0.255)	1.135* (0.478)	1.247* (0.487)	0.540 (0.412)	0.552 (0.385)
Openness to trade	−0.001 (0.002)	0.000 (0.006)	−0.002 (0.004)	−0.014+ (0.008)	−0.016+ (0.008)	−0.005 (0.008)	−0.006 (0.007)
Constant	1.558* (0.733)	47.082 (30.434)	3.018 (1.895)	5.665 (3.567)	6.834+ (3.641)	2.023 (2.703)	2.765 (2.627)
Observations	1884	1884	1884	1884	1884	1884	1884
Adjusted R^2	0.917	0.483	–	–	–	–	–
*M*1	0.193	0.000**	0.004**	0.002**	0.001**	0.003**	0.007**
*M*2	0.593	–	0.184	0.176	0.177	0.187	0.202
Number of instruments	–	–	883	127	63	63	63
Lag limits	–	–	All	All	3	3	3
Collapsed	–	–	No	Yes	Yes	Yes	Yes
One step or two	–	–	No	No	No	Yes	Yes
Orthogonal	–	–	No	No	No	No	Yes
Hansen J-test	–	–	1.000	0.398	0.528	0.455	0.120
Diff. in Hansen test	–	–	1.000	0.614	0.966	0.291	0.652

Notes: See Table A1. **, *, + denote significance at the 1, 5, and 10% levels, respectively.

Table A6. Military expenditure as a share of general government expenditures UCDP/PRIO civil war measures and interstate war controls.

	(A35)	(A36)	(A37)	(A38)	(A39)	(A40)	(A41)
	OLS	Fixed effects	System GMM	System GMM	System GMM	System GMM	System GMM
Military share$_{t-1}$	0.914** (0.018)	0.642** (0.068)	0.852** (0.035)	0.871** (0.045)	0.893** (0.046)	0.873** (0.035)	0.852** (0.052)
UCDP at war$_{t-1}$	0.765** (0.292)	0.907 (0.600)	0.980* (0.379)	1.027+ (0.559)	0.941 (0.596)	0.816* (0.391)	0.929* (0.380)
UCDP war duration$_{t-1}$	−0.011 (0.013)	0.006 (0.037)	−0.007 (0.015)	−0.015 (0.021)	−0.015 (0.025)	−0.009 (0.014)	0.003 (0.018)
UCDP war end$_{t-1}$	0.122 (0.492)	0.146 (0.587)	−0.020 (0.561)	−0.005 (0.596)	0.034 (0.605)	0.118 (0.606)	−0.593 (0.449)
GDP per capita$_{t-1}$	−0.026 (0.026)	0.201 (0.203)	−0.071 (0.054)	−0.299 (0.321)	−0.415 (0.379)	0.078 (0.112)	0.029 (0.067)
Polity2$_{t-1}$	−0.628** (0.200)	−0.321 (0.472)	−1.075* (0.483)	−0.291 (0.841)	−0.267 (0.947)	−1.013 (0.724)	−1.190 (0.797)
Population	−0.026 (0.033)	−2.838 (1.873)	−0.022 (0.068)	−0.228+ (0.136)	−0.247+ (0.142)	−0.073 (0.122)	−0.080 (0.092)
Population density	0.286+ (0.161)	0.054 (0.745)	0.472+ (0.253)	1.166* (0.450)	1.242** (0.469)	0.494 (0.382)	0.581+ (0.308)
Openness to trade	−0.001 (0.002)	−0.000 (0.006)	−0.001 (0.004)	−0.017+ (0.009)	−0.020* (0.009)	−0.004 (0.008)	−0.004 (0.005)
Interstate at war$_{t-1}$	3.769 (4.524)	4.385* (1.683)	4.973** (1.477)	4.680** (1.205)	4.277** (1.158)	3.828 (2.333)	2.862 (4.189)
Interstate duration$_{t-1}$	−1.983 (2.123)	−1.824 (1.275)	−1.487 (1.184)	−1.918 (1.445)	−2.345 (1.504)	−2.045 (1.353)	−1.148 (1.946)
Interstate war end$_{t-1}$	−1.847 (3.444)	−2.760** (0.798)	−3.402** (0.851)	−3.030* (1.241)	−2.351+ (1.246)	−1.665 (1.523)	−1.167 (3.110)
Constant	1.576* (0.740)	46.714 (30.494)	2.885 (1.771)	9.374* (4.145)	11.057* (4.622)	2.123 (2.738)	2.954 (2.209)
Observations	1884	1884	1884	1884	1884	1884	1884
Adjusted R^2	0.917	0.485	–	–	–	–	–
*M*1	0.178	0.000**	0.005**	0.004**	0.004**	0.004**	0.009**
*M*2	0.573		0.179	0.181	0.182	0.179	0.194
Number of instruments	–	–	889	133	69	69	69
Lag limits	–	–	All	All	3	3	3
Collapsed	–	–	No	Yes	Yes	Yes	Yes
One step or two	–	–	No	No	No	Yes	Yes
Orthogonal	–	–	No	No	No	No	Yes
Hansen J-test	–	–	1.000	0.418	0.473	0.356	0.356
Diff. in Hansen test	–	–	1.000	0.749	0.822	0.108	0.108

Notes: See Table A1. **, *, + denote significance at the 1, 5, and 10% levels, respectively.

Table A7. Military expenditure interstate war controls.

	(A42)	(A43)	(A44)	(A45)	(A46)	(A47)	(A48)
	OLS	Fixed effects	System GMM	System GMM	System GMM	System GMM	System GMM
Military expenditure$_{t-1}$	0.938** (0.008)	0.729** (0.047)	0.855** (0.032)	0.833** (0.081)	0.828** (0.094)	0.879** (0.061)	0.938** (0.083)
COW at war$_{t-1}$	0.258** (0.079)	0.190* (0.077)	0.253* (0.098)	0.237+ (0.123)	0.234+ (0.128)	0.242* (0.112)	0.204* (0.089)
COW war duration$_{t-1}$	−0.011* (0.006)	−0.004 (0.005)	−0.005 (0.006)	−0.001 (0.009)	0.000 (0.009)	−0.004 (0.008)	−0.009 (0.009)
COW war end$_{t-1}$	−0.120+ (0.066)	−0.059 (0.039)	−0.144* (0.057)	−0.180+ (0.097)	−0.185+ (0.101)	−0.162* (0.081)	−0.070 (0.077)
GDP$_{t-1}$	0.052** (0.008)	0.166** (0.041)	0.116** (0.029)	0.068 (0.080)	0.066 (0.092)	0.041 (0.057)	0.025 (0.081)
Polity2$_{t-1}$	−0.114** (0.015)	0.024 (0.051)	−0.258** (0.054)	−0.384** (0.118)	−0.404** (0.127)	−0.291** (0.109)	−0.173+ (0.100)
Population	0.016** (0.005)	0.140 (0.139)	0.051** (0.017)	0.138** (0.044)	0.142** (0.046)	0.112** (0.036)	0.084* (0.040)
Population density	−0.020* (0.009)	−0.054 (0.045)	−0.046+ (0.027)	−0.041 (0.058)	−0.030 (0.064)	−0.038 (0.058)	−0.061 (0.056)
Openness to trade	0.000 (0.000)	0.000 (0.000)	0.001+ (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)
Interstate at war$_{t-1}$	−0.292 (0.563)	−0.122 (0.398)	−0.163 (0.496)	−0.131 (0.340)	−0.121 (0.321)	−0.221 (0.478)	−0.008 (1.039)
Interstate duration$_{t-1}$	0.282 (0.374)	0.198 (0.320)	0.283 (0.352)	0.152 (0.320)	0.140 (0.318)	0.086 (0.293)	0.116 (0.405)
Interstate war end$_{t-1}$	0.017 (0.222)	−0.033 (0.099)	−0.077 (0.175)	−0.011 (0.131)	−0.010 (0.145)	0.134 (0.248)	−0.155 (0.728)
Constant	−0.052 (0.072)	−0.437 (2.206)	−0.398 (0.253)	0.127 (0.644)	0.240 (0.708)	0.074 (0.518)	−0.528 (0.457)
Observations	1850	1850	1850	1850	1850	1850	1850
Adjusted R^2	0.996	0.930	–	–	–	–	–
*M*1	0.178	0.000**	0.005**	0.004**	0.004**	0.004**	0.009**
*M*2	0.573		0.179	0.181	0.182	0.179	0.194
Number of instruments	–	–	889	133	69	69	69
Lag limits	–	–	All	All	3	3	3
Collapsed	–	–	No	Yes	Yes	Yes	Yes
One step or two	–	–	No	No	No	Yes	Yes
Orthogonal	–	–	No	No	No	No	Yes
Hansen J-test	–	–	1.000	0.418	0.473	0.356	0.356
Diff. in Hansen test	–	–	1.000	0.749	0.822	0.108	0.108

Notes: See Table A1. **, *, + denote significance at the 1, 5, and 10% levels, respectively.

Table A8. Military expenditure UCDP/PRIO civil war measure and interstate war controls.

	(A49)	(A50)	(A51)	(A52)	(A53)	(A54)	(A55)
	OLS	Fixed effects	System GMM	System GMM	System GMM	System GMM	System GMM
Military expenditure$_{t-1}$	0.934** (0.009)	0.730** (0.047)	0.855** (0.032)	0.837** (0.072)	0.834** (0.083)	0.858** (0.067)	0.875** (0.082)
UCDP at war$_{t-1}$	0.076** (0.028)	0.037 (0.050)	0.082* (0.037)	0.081 (0.068)	0.076 (0.072)	0.097 (0.063)	0.104+ (0.061)
UCDP war duration$_{t-1}$	0.002 (0.002)	0.003 (0.004)	0.003 (0.003)	0.005 (0.005)	0.005 (0.005)	0.004 (0.004)	−0.001 (0.006)
UCDP war end$_{t-1}$	0.050 (0.059)	0.034 (0.061)	0.035 (0.064)	0.023 (0.082)	0.023 (0.084)	0.023 (0.074)	−0.001 (0.070)
GDP$_{t-1}$	0.056** (0.008)	0.163** (0.043)	0.114** (0.030)	0.061 (0.071)	0.057 (0.080)	0.056 (0.057)	0.086 (0.083)
Polity2$_{t-1}$	−0.115** (0.017)	0.011 (0.051)	−0.258** (0.060)	−0.383** (0.147)	−0.405* (0.156)	−0.278* (0.116)	−0.178+ (0.093)
Population	0.015** (0.005)	0.142 (0.145)	0.051** (0.017)	0.131** (0.041)	0.135** (0.044)	0.116** (0.037)	0.066+ (0.038)
Population density	−0.024* (0.010)	−0.050 (0.046)	−0.049+ (0.029)	−0.026 (0.059)	−0.012 (0.064)	−0.039 (0.062)	−0.017 (0.061)
Openness to trade	0.000+ (0.000)	0.000 (0.000)	0.001+ (0.001)	0.001 (0.001)	0.000 (0.001)	0.001 (0.001)	0.001 (0.001)
Interstate at war$_{t-1}$	−0.303 (0.526)	−0.134 (0.383)	−0.176 (0.462)	−0.144 (0.311)	−0.138 (0.294)	−0.207 (0.412)	0.155 (0.727)
Interstate duration$_{t-1}$	0.252 (0.343)	0.182 (0.310)	0.248 (0.329)	0.114 (0.295)	0.100 (0.292)	0.088 (0.270)	0.104 (0.328)
Interstate war end$_{t-1}$	0.054 (0.226)	−0.009 (0.096)	−0.035 (0.164)	0.033 (0.121)	0.036 (0.128)	0.119 (0.216)	−0.262 (0.434)
Constant	−0.049 (0.075)	−0.394 (2.301)	−0.363 (0.248)	0.320 (0.579)	0.460 (0.630)	0.079 (0.511)	−0.371 (0.489)
Observations	1850	1850	1850	1850	1850	1850	1850
Adjusted R^2	0.995	0.928	–	–	–	–	–
*M*1	0.002**	0.000**	0.000**	0.000**	0.000**	0.000**	0.001**
*M*2	0.000	–	0.408	0.462	0.453	0.471	0.400
Number of instruments	–	–	889	133	69	69	69
Lag limits	–	–	All	All	3	3	3
Collapsed	–	–	No	Yes	Yes	Yes	Yes
One step or two	–	–	No	No	No	Yes	Yes
Orthogonal	–	–	No	No	No	No	Yes
Hansen J-test	–	–	1.000	0.185	0.131	0.305	0.305
Diff. in Hansen test	–	–	1.000	0.013	0.301	0.244	0.244

Notes: See Table A1. **, *, + denote significance at the 1, 5, and 10% levels, respectively.