Journal of Peace Research

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The Effect of Civil War on Education, 1980–97[*]

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This study examines the negative effects of civil wars and the post-civil war environment on educational expenditures and enrollment. Two causal mechanisms are considered. First, civil wars are likely to destroy a state's system of education through the loss of infrastructure and personnel. Second, a less deleterious cause may be the drawing away of funds for increased military expenditures to fight the civil war. Using UNESCO education data, the authors examine the percent change in educational expenditures and primary, secondary, and tertiary enrollment for all states from 1980 through 1997. The authors use a measure of when a state is in a civil war, a dynamic post-civil war measure, an interaction with military spending, and relevant control variables. The results indicate strong support for the notion that civil war is devastating for a system of education, as both expenditures and enrollment decline during periods of civil war. No support was found for the reallocation of education funds towards military spending during a civil war. These results highlight the importance of addressing the social costs of a civil war. Civil wars do not simply impose social costs because of increased funding to the military; rather, they severely disrupt a state's ability to provide even basic social services.

Introduction

Over the last fifty years, civil wars have caused over 16.2 million deaths and have lasted over six years on average. These statistics stand in stark contrast to the negative effects of interstate wars (3.33 million deaths with an average duration of three months in the same time period), which have traditionally received far more attention in the conflict literature (Fearon & Laitin, 2003). Only recently have researchers examined the impact of civil wars on the health of the population (Ghobarah, Huth & Russett, 2003), mortality rates (Guha-Sapir & Van Panhuis, 2002; Reynal-Querol, 2002), bilateral trade (Bayer & Rupert, 2004), and economic growth (Kang & Meernik, 2005). This article extends these works by examining the effects of civil war on another important indicator of social wellness: education.

Despite the growing number of papers examining intrastate conflict, not enough attention has been paid to the local patterns of distress which accompany civil wars (Pedersen, 2002). An obvious reason for this lack of research is the assumption that civil wars *must* be devastating for a country, obviating the need for a systematic analysis. While this assumption is plausible on face value, recent

studies show problems with many previously held assumptions concerning civil wars. Fearon & Laitin (2003) and Collier & Hoeffler (2004), for example, find fault with the longstanding assumption that political repression and ethnic fractionalization lead to civil unrest. More recent work seems to resolve this issue with a more thorough examination of ethnic fractionalization (Montalvo & Reynal-Querol, 2005), highlighting the need to re-examine established assumptions about civil conflicts. It is also important to analyze how civil wars impact education specifically. A large body of research, ranging from arguments made by Aristotle and Locke (Sargent, 1996) to more recent work, shows that education is important for economic growth (Adeola, 1996), equality (Gradstein, 2003), and social stability (Ritzen, Easterly & Woolcock, 2000). Therefore, examining if and how civil wars impact education has important implications for a wide range of indicators of social wellness. A detailed analysis of how civil wars impact education may also have important implications for the policymakers, allowing them to understand the needs of states recovering from civil conflict. Civil wars may simply have a short-term effect, as state resources are funneled from social spending into military spending (a variant on the 'guns for butter' theory). Alternatively, civil wars may have a more long-term impact by destroying a state's ability to provide education through the loss of infrastructure and people.

The Negative Impact of Civil Wars on Education

The Impact on Educational Expenditures

Civil wars may reduce government funding to education through two mechanisms. First, civil wars may destroy a state's capacity to provide educational services. Governments face both direct and indirect economic costs as a result of a civil war, both of which are likely to be detrimental to a state's education system. *Direct costs* are the military costs (discussed in the next section) and the destruction of a state's infrastructure. The destruction of school facilities and the infrastructure needed to support those facilities is likely to reduce expenditures by removing important fixed assets necessary for a functioning education system. For example, the destruction of school facilities during a civil war is likely to reduce expenditures for maintenance of those facilities. *Indirect costs* include the loss of revenue due to the presence of a civil war (e.g. a reduction in foreign investment and tourism) and the loss of human productivity due to death or injury. The reduction of revenue likely forces the government to either reduce spending across all programs or sacrifice non-military expenditures. This is a similar process as the 'guns for butter' argument, although empirically the government is not increasing military expenditures; rather, it is simply reallocating from educational expenditures to maintain its current military spending (or prevent a steeper decrease in military expenditures). Injuries and deaths to educators and educational administrators are also likely to significantly impair a state's educational system and reduce expenditures. We should observe a reduction in expenditures as salaries are no longer allocated to individuals who have either fled or been killed. Thus, both direct and indirect costs are likely to destroy a state's education system, which should reduce educational expenditures.

H1: During periods of civil conflict, there is likely to be a decrease in education spending by a state.

In addition to declines during a civil war, a state's investment in education after a civil war should also drop, owing to the loss of critical infrastructure and individuals. Funds will instead be allocated to the rebuilding of these lost assets. Until these are rebuilt, educational expenditures should continue to decline. The decline in a state's economy after a civil war (Kang & Meernik, 2005) will

also limit the funds available for education. Faced with a declining economy, governments are likely to focus their resources on economic development projects to the detriment of other policies, such as education.

H2: After a civil war, there is likely to be a decrease in education spending by a state.

An alternative explanation for decreases in educational expenditures during civil wars is a slight variation in the 'guns for butter' theory. During the 1960s and 1970s, modernization theorists claimed that military strength is a modernizing force because of the military's ability to mobilize resources for sustained economic growth, maintain stability necessary for effective policy implementation, and exercise control over actors who would otherwise be slow to change (Halpern, 1963; Levy, 1966). Over time, theoretical and empirical weaknesses in the modernization theory caused researchers to examine alternative arguments. One alternative argument that has found much support has come to be known as the 'guns for butter' theory, which argues that money spent on the military takes away resources from social programs (Adeola, 1996). Over the past two decades, numerous researchers have examined the relationship between military and social expenditures, generally finding a negative relationship between the two (e.g. Russett, 1969; Dixon & Moon, 1986; Huang & Mintz, 1990; Looney, 1990).

Two expansions of the 'guns for butter' theory are relevant for our argument. First, past research suggests that the negative effects of military expenditures on social spending will be exacerbated in poor countries. For example, Sen (1990) finds that Third World governments fail to meet the most basic needs of their citizens, owing to their foreign debts and high military spending. Given that the vast majority of civil wars occur in poor countries, we might expect civil conflict to be especially devastating for educational expenditures in these situations. Second, it is likely

that the negative relationship between military expenditures and education expenditures is exacerbated during periods of civil conflict. This is because the government will devote as many resources as possible to military expenditures in order to prevent its own collapse (Russett, 1969; Collier, 1999). For example, the Sudanese government spent around 10% of government expenditures on the military during periods of peace compared to 20% during periods of civil war (Mohammed, 1999). In a more systematic analysis, Collier et al. (2003) report that developing countries spend an average of 2.8% of their GDP on the military, which jumps to nearly 5% during periods of civil war. Therefore, it is likely that trade-offs between military and educational expenditures will be higher during periods of civil war than in peacetime.

H3: During periods of civil conflict, increases in military expenditures are likely to lead to decreases in education expenditures.

The Impact on Enrollment

While the previous section explained the expected negative effect of civil war on educational expenditures, this section extends our analysis by examining educational enrollment. Civil wars are likely to cause school enrollments to decrease, owing to the physical destruction of schools, school closure in the interest of safety, displacement of refugees, deaths of students and educators, and subversive tactics used by rebel groups. For example, Greenberg (1994) explains that schools have been closed for months at a time throughout the decades-long Israeli–Palestinian conflict. Israeli authorities often closed Palestinian schools, arguing that they were centers for anti-Israeli protests. Palestinians also caused closures by staging violent protests, making it unsafe to open schools. Sengupta (2003) adds the Congo example, arguing that the closure of schools has made the innocence of youth the biggest victim of the Congo civil war.

Further, Pedersen (2002) explains that subversive groups have pursued many tactics, including destruction of schools, to undermine the government. He cites evidence from diverse countries, such as Mozambique, Sudan, Angola, Guatemala, Colombia, Afghanistan, and the Philippines, as evidence of these tactics. Refugee flows may also contribute to decreased enrollment as civilians flee to neighboring countries for safety or better economic opportunity during civil war (Collier, Hoeffler & Patillo, 1999; Collier et al., 2003). We should expect any of these reasons to result in decreased school enrollment.

H4: During periods of civil conflict and after, there is likely to be declining enrollment in primary, secondary, and tertiary education.

In addition to reduced enrollment across all levels of education, another effect of civil war on education should be seen in decreased secondary school enrollment specifically for males, who are expected to fight for either the state or the rebels during periods of civil conflict (Collier, 2000; Collier & Hoeffler, 2004; Thyne, 2006). For example, Human Rights Watch (1998) reported that university classes in Sudan were suspended in 1996 except for an all-female school. Some 65,000 unmarried males were conscripted into the army later that year. Younger males were forced to flee the violence or risk being forced to fight. A group of these refugees have come to be known as the 'Lost Boys of Sudan', providing an example of the heightened detrimental consequences of civil war on young males (American Red Cross, 2004). While a growing literature notes the role of females as combatants in civil conflicts (Arthur, 1998; Kriger, 1992), we might expect groups to target males more than females, owing to fighting capabilities and societal norms suggesting that females have no role in the military. Gender ideologies in Sierra Leone, for example, emphasize the reproductive roles of females as their dominant function in society, which causes both rebels and the government to rely exclusively on forced recruitment of males for combat (Conciliation Resources, 1997). Amnesty International (2000) explains similar treatment of males during the Sudanese civil war (1983–2005), citing evidence that men and boys were often rounded up during raids by police and soldiers and sent to military bases, while females were left behind. The notion that education for males will be principally harmed during periods of civil conflict leads to our final hypothesis.

H5: During periods of civil conflict, the decline in secondary enrollment for males is likely to be greater than the decline in secondary enrollment for females.

Research Design

To test these hypotheses, we examine changes in a state's education expenditures and enrollment on an annual basis. The unit of analysis is state-year for all countries from 1980 through 1997.[1] The dependent variable used to test the effect of civil war on education expenditures (H1 and H2) is the percent change in a state's educational expenditure from the previous year.[2] Data for this variable

[1] We use this time period because of data availability. Starting in 1998, UNESCO changed how they reported expenditure data, providing a more disaggregated level of analysis for spending. While we expect that aggregating their data would allow for a comparable series, we elect to report through 1997.

[2] This variable is the difference in spending between time t and time t–1 divided by the spending at time t–1. We do not multiply this variable by 100, so a value of 1 for this variable represents a 100% increase. We use this measure, as opposed to a change in educational expenditures/total government expenditure, because we are interested in direct changes and not relative changes. The educational expenditures/total government expenditure would pick up changes when total government expenditures increased faster than educational expenditures. We believe this is a different phenomenon than when educational expenditures are actually cut.

are from the United Nations Education, Scientific, and Cultural Organization (UNESCO).[3] The dependent variable for the final set of hypotheses is the percent change in a state's enrollment at the primary, secondary, and tertiary levels. We also examine percent changes at the secondary-level enrollment by sex. These data also come from UNESCO.[4]

Independent Variables

The effects of civil wars on changes in education expenditures and enrollment are tested using a dichotomous variable indicating the presence (1) or the absence (0) of civil war in each country-year. The list of civil wars was taken from the Correlates of War (COW) intrastate war dataset (Sarkees, 2000).[5] We also examine the data using the Uppsala/PRIO data on civil conflicts (Gleditsch et al., 2002). From these data, we test three measures of civil conflict: all civil conflicts, medium civil conflicts, and civil wars only.[6] To test the second hypothesis, we include a dichotomous variable coded 1 for all years after a civil war and 0 otherwise.[7]

To test for a potential 'guns for butter' effect (H3), we include the percent change in a state's military expenditures. Data for this variable come from the Correlates of War (COW) National Material Capabilities data (Singer, Bremer & Stuckey, 1972).[8] In addition to this variable, we also include an interaction between the civil war variable and the percent change in military expenditures variable to test the argument that the negative effect of military expenditures will be exacerbated during periods of civil conflict (H3).

We also include some additional variables that are likely to influence the percent change in a state's educational expenditures and

[3] Data are available at http://www.uis.unesco.org/pagesen/ ed.htm. Data for educational expenditures are in a state's local currency. To create this dependent variable, for each state, we adjusted their spending to account for inflation by setting the spending to a baseline year. For every state, data on changes in their local currency value from year to year were acquired from the World Bank's World Development Indicators. Each state's base year is set at 1990 (so 1990 = 1, and the relative value of their currency is relative to 1990). Using these data, the educational expenditures series was adjusted to reflect the yearly change (Edex/conversionfactor).

[4] See note 3 for the data source. UNESCO collects the data from relevant national authorities by having them complete surveys. One potential problem with these data is the variation in how well national authorities are able to provide correct assessments. Fortunately, UNESCO provides some quality control of the data. These are clearly the best estimates of a state's educational system. The alternative is to assume that we cannot empirically analyze cross-national education data. Another possible issue is whether categories like primary, secondary, and tertiary are consistently defined across states. UNESCO attempts to standardize this in the survey and documentation provided to each state's relevant education authority. The figures for both expenditures and enrollment have been used in previous studies (Brown & Hunter, 2004; Stavasage, 2005; Thyne, 2006). One final problem is that the UNESCO data have a great deal of missing data. Fortunately, these data are not disproportionately missing from periods of civil war. Roughly 89% of the cases are not at civil war, while 11% are. This distribution is exactly reflected by the missing data. Of the data that are missing, 88% are from non-civil war state years, while 12% are from civil war state years. Recent studies by Stasavage (2005) and Thyne (2006) demonstrate that the results from a sample including missing data and one with imputed data are very similar. Thus, while in an ideal world we would not have any missing data, we do not believe that this will substantially bias our results.

[5] Data are available at http://cow2.la.psu.edu/.

[6] Data are available at http://www.prio.no/cscw/datasets. We use Type 3 conflicts (internal).

[7] We do not difference the civil war variable because we expect the presence of a civil war to directly influence the percent change in our dependent variables. We consider any period where a state is not in a civil war and had a civil war previously in our data to be a post-civil war case. We relax this coding rule and discuss its implications in the analysis section.

[8] Data are available at http://cow2.la.psu.edu/. We convert this variable to 1996 US dollars. The percent change variable is a state's military expenditures at time t minus expenditures at time $t-1$, divided by expenditures at time $t-1$. Ideally, this variable would be in local currency to match the dependent variable. Using US dollars creates a potential problem where the value of military expenditures is influenced by changes in the exchange rate and not necessarily changes in actual military spending, especially if civil wars dramatically change a state's exchange rate. Alternative sources of data (e.g. the World Bank) have extensive missing data as compared to the COW data. Converting back to a state's local currency is also problematic, as there are missing data for exchange rates between several states and the USA (at least for the World Bank and IMF data). We attempted both solutions, and the results for the civil war variables are unchanged.

enrollment.[9] First, we include a measure of a state's level of economic development. Wealthier states may be better able to increase educational expenditures and boost enrollment (Brown & Hunter, 2004; Stasavage, 2005). This is measured as a state's GDP/capita taken from Gleditsch's expanded GDP/capita database (Gleditsch, 2002).[10] Second, we include a measure of a state's regime type. Democratic governments may increase education spending to a greater degree than their non-democratic counterparts in order to boost their electoral fortunes (Stasavage, 2005). Data for this variable are from the Polity IV project, which provides a measure of a state's regime type in the form of its autocracy score subtracted from its democracy score to produce a variable that ranges from –10 (very autocratic) to 10 (very democratic) (Marshall & Jaggers, 2000). Third, we include a measure of the percent change in a government's non-military expenditures to control for the changes in government expenditures.[11] Finally, for the enrollment models, we include a measure of the percent change in a state's population because growing populations should be more likely to have increases in enrollments. These data are from the World Bank's World Development Indicators.

Because the data are cross-sectional and time series, there exists the potential for bias due to heteroskedasticity and autocorrelation. To address the former, we use Panel Corrected Standard Errors (Beck & Katz, 1995).[12] We are less concerned with potential problems for autocorrelation because we are already examining a differenced dependent variable – the percent change in educational expenditures and enrollment – and not the level of either. We also tested for correlated errors using a Lagrange multiplier test. The results indicated that we could not reject the null of independent errors.[13]

Results

Table I displays the results for the first three hypotheses (effect of civil war on educational expenditures, effect in the post-civil war years, and the influence of increased military spending during a civil war). Models 1–3 present results using the COW data, while Models 4–6 present the results from the Uppsala/PRIO civil war data. We do not include the models with the all-civil conflicts and the medium civil war conflicts variables. Only the Uppsala/PRIO civil war measure was significant. The lack of significance for lower-level civil conflicts is unsurprising as only higher-level conflicts are likely to inflict the amount of damage that would retard a state's educational system.

Looking at Table I, the civil war variable is significant and negative in all the models, indicating that when a state is in a civil war, it reduces its educational expenditures by from 3.1% to 3.6% each year, depending on the model. To provide some context for this result, we compare it to the percent change in non-military government expenditures. Based on Model 1, a state would need to suffer a 15.5% decrease in non-military

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[9] We use the same control variables (with the exception of percent change in population) for the expenditures and enrollment models because we believe these variables influence both processes. Democratic and wealthier states should have both higher enrollments and expenditures (Sirowy & Benavot, 1986). Similarly, increases in social spending should help boost a state's enrollment by providing resources to societal institutions that encourage enrollment. For example, investment in health care and welfare should help to reduce infant and child mortality, which should lead to greater enrollment levels.

[10] The bulk of data from Gleditsch (2002) are from the Penn World Tables and World Bank data.

[11] Data for total government expenditures come from the World Bank. We convert to 1996 US dollars and subtract military expenditures to generate non-military expenditures.

[12] For the secondary models, we were able to estimate only panel level heteroscedastic disturbances. Panel corrected standard errors (PCSE) allow us to control for heteroscedasticity within and across panels (states in this case) by estimating OLS and then correcting the errors calculated by the variance-covariance matrix (Beck & Katz, 1995).

[13] We also ran our model using a lagged dependent variable and the results did not change.

Table I. PCSE Results for the Effect of Civil Wars on the Percent Change in Educational Expenditures

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
				Uppsala/ PRIO	*Uppsala/ PRIO*	*Uppsala/ PRIO*
	COW	*COW*	*COW*			
Percent military	0.241***	0.238***	0.235***	0.240***	0.242***	0.243***
expenditures	(0.065)	(0.066)	(0.065)	(0.065)	(0.065)	(0.065)
Civil war	–0.034*	–0.036*	–0.038*	–0.033*	–0.031*	–0.031*
	(0.017)	(0.017)	(0.016)	(0.018)	(0.018)	(0.018)
Civil war*	–	0.025	0.026	–	–0.038	–0.038
per milex		(0.038)	(0.039)		(0.053)	(0.053)
Post-civil war	–0.004	–0.004	–	–0.003	–0.003	–
	(0.032)	(0.032)		(0.015)	(0.015)	
Dynamic	–	–	–0.113*	–	–	–0.013
post-civil war			(0.068)			(0.039)
Polity	0.0008	0.001	0.0009	0.0007	0.0007	0.0007
	(0.0006)	(0.001)	(0.0006)	(0.0006)	(0.0006)	(0.0006)
LNGDPC	–0.008*	–0.008*	–0.009*	–0.007	–0.006	–0.007
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Percent non-	0.200**	0.199**	0.196**	0.200**	0.200**	0.200**
military gov't exp.	(0.068)	(0.068)	(0.068)	(0.068)	(0.068)	(0.068)
Constant	0.110**	0.111**	0.123***	0.097**	0.096**	0.096**
	(0.041)	(0.040)	(0.038)	(0.040)	(0.040)	(0.039)
	N = 1,362	N = 1,362	N = 1,362	N = 1,362	N = 1,362	N = 1,362
	χ^2 = 19.85***	χ^2 = 26.28***	χ^2 = 29.31***	χ^2 = 26.65***	χ^2 = 26.73***	χ^2 = 26.70***
	$R^2 = 0.077$	$R^2 = 0.078$	$R^2 = 0.081$	$R^2 = 0.077$	$R^2 = 0.08$	$R^2 = 0.08$

* $p < .05$, ** $p < .01$,*** $p < .001$ (one-tailed). Panel corrected standard errors are in parentheses. Estimations performed using Stata 8.0.

government expenditures to experience a 3.1% decrease in educational expenditures. This statistically and substantively significant result provides empirical support for the argument that civil wars decrease educational expenditures (H1). The dramatic drop in educational funding during the civil war in the Democratic Republic of Congo demonstrates this finding, as government spending on education dropped to less than 1% of government expenditure during the civil war (EIU, 2000).

While Hypothesis 1 is supported, Hypothesis 2 (the effect of the post-civil war period) is not supported. The post-civil war variable is not statistically significant. One explanation is that this variable examines an average

effect across all the years after a state has been in a civil war.[14] The impact on educational spending may be only temporary and may decline over time. Model 3 examines this explanation by using a variable that declines over time. Specifically, we model it as 1/(time since the end of the civil war^3).[15] In the first year, the value is 1 (1/1). In the second year, the variable takes a value of .125 (1/(2^3)). Model 3 displays the results for this dynamic

[14] We also tested this variable for only five- and ten-year increments. Neither of these variables was statistically significant.
[15] Because we have no prior expectation about the nature of the decline, we modeled several forms starting with the first power and modeling up to the tenth power. While higher powers yielded slightly better model fits, the coefficient and level of statistical significance are not different than using the third power.

post-civil war variable. The new post-civil war variable is negative and significant, indicating that civil wars negatively impact the rate of educational expenditures, even after the war is over. This variable also indicates that, over time, the effect dissipates. So in the first year, the effect is an 11.3% reduction, but in the second year the effect is only a 1.4% reduction (11.3%*.125). However, this finding is not as robust as the civil war variable. Using the Uppsala/PRIO civil war data, none of the post-civil war variables are statistically significant. Thus, the reduction in expenditures following a civil war is sensitive to our measure of civil war.

While some empirical support was found for the first two hypotheses, no support was found for the third hypothesis (the wartime 'guns for butter' argument). While the percent change in military expenditures variable is significant in Table I, the interactive variable is not statistically significant for either civil war model (Models 2 and 5). Because the standard error of the interactive variable is conditional on its constituent terms, we recalculated the standard error using standard procedures (Brambor, Clark & Golder, 2005), and the variable is still not statistically significant. Changes in military expenditures during a civil war do not lead to reductions in educational expenditures. However, the percent change in military expenditures variable is significant but positive. An increase in military spending leads to an increase in education spending during peacetime. These results do not necessarily provide evidence against the more general 'guns for butter' argument, as we are examining a specific subset of social spending. Trade-offs may occur, although our findings indicate that education is not a place where funds are taken during peacetime or wartime. This fits with other research that has found a positive relationship between military spending and educational expenditures, but trade-offs with other social sectors like health care or economic growth (Kick et al., 1998; Yildirim &

Sezgin, 2002). The non-finding for the interaction variable means that civil wars reduce educational expenditures not because states are taking money from education to fund their military spending, but because civil war is disrupting a state's more general ability to provide social services like education to its citizenry.[16] The Sudanese case provides perhaps the most poignant example of this disruption. Begun in 1983, this civil war caused over 2 million deaths, displaced over 4 million people, and devastated the social infrastructure, including the system of education (CIA, 2005). Among the few schools that remain in operation, class sizes average 94 pupils per teacher, and the local literacy rate lingers between 10% and 20%. Few of the remaining buildings have desks, blackboards, textbooks, materials, or qualified teachers (Shalita, 1994; Brander, 1996).

Table II examines the effect of civil wars on educational enrollment, providing a test of Hypothesis 4, that civil wars reduce enrollment across all categories of education. Models 7 (COW) and 10 (Uppsala/PRIO) report the results for percent changes in primary education, Models 8 (COW) and 11 (Uppsala/PRIO) are for percent changes in secondary, and Models 9 (COW) and 12 (Uppsala/PRIO) are for tertiary education. Across all the models, states in a civil war experience a 1.6% to 3.2% decrease in enrollment, depending on the level of enrollment. While changes of 1.6% for primary enrollment seem small, the changes in the actual number of students are still important. For example, the mean number of enrolled primary students is 4 million. A 1.6% decline is a loss of about 64,000 students. Compared to the effect of a decrease in population change, this would require about a 3% reduction in population to achieve a 1.7% decline in primary enrollment. Thus, this result provides strong evidence that civil wars

[16] These results hold even when we jointly model military and educational expenditures as dependent variables using a seemingly unrelated regression.

Table II. PCSE Results for the Effect of Civil Wars on the Percent Change in Educational Enrollment (Primary, Secondary, and Tertiary)

	Model 7	*Model 8*	*Model 9*	*Model 10*	*Model 11*	*Model 12*
	COW, DV = percent Δ primary	*COW, DV = percent Δ secondary*	*COW, DV = percent Δ tertiary*	*Uppsala/ PRIO, DV = percent Δ primary*	*Uppsala/ PRIO, DV = percent Δ secondary*	*Uppsala/ PRIO, DV = percent Δ tertiary*
Percent military	0.004	0.040	–0.014	0.003	0.039	–0.017
expenditures	(0.009)	(0.054)	(0.030)	(0.010)	(0.053)	(0.029)
Civil war	–0.018***	–0.019*	–0.036*	–0.016*	–0.019*	–0.032**
	(0.006)	(0.009)	(0.016)	(0.007)	(0.010)	(0.013)
Dynamic	–0.017	0.005	–0.031	0.008	–0.014	–0.005
post-civil war	(0.019)	(0.029)	(0.044)	(0.015)	(0.018)	(0.034)
Polity	–0.0002	–0.002*	–0.002*	–0.0002	–0.002*	–0.003*
	(0.0002)	(0.001)	(0.001)	(0.0002)	(0.001)	(0.001)
LNGDPC	–0.014***	–0.007*	0.007	–0.013***	–0.007**	0.009
	(0.002)	(0.003)	(0.010)	(0.002)	(0.003)	(0.010)
Percent non-	0.006	0.035	–0.033	0.005	0.034	–0.034
military gov't exp.	(0.009)	(0.056)	(0.031)	(0.009)	(0.055)	(0.030)
Percent	0.537***	0.485	0.943*	0.544***	0.488	0.938**
population	(0.148)	(1.13)	(0.381)	(0.147)	(1.14)	(0.383)
Constant	0.134***	0.106*	0.004	0.125***	0.102*	–0.013
	(0.017)	(0.051)	(0.091)	(0.017)	(0.049)	(0.087)
	N = 1,681	N = 1,137	N = 1,207	N = 1,681	N = 1,137	N = 1,207
	$\chi^2 =$ 292.84***	$\chi^2 =$ 582.59***	$\chi^2 =$ 22.76***	$\chi^2 =$ 312.37***	$\chi^2 =$ 274.09 ***	$\chi^2 =$ 21.70***
	$R^2 = .116$	$R^2 = .023$	$R^2 = .025$	$R^2 = .113$	$R^2 = .022$	$R^2 = .024$

* $p < .05$, ** $p < .01$,*** $p < .001$ (one-tailed). Panel corrected standard errors are in parentheses. Estimations performed using Stata 8.0.

are detrimental to a system of education. Civil wars are likely to lead to school closings and significant displacement of individuals, preventing students from enrolling in schools across all levels of education. According to the Liberian Ministry of Education, for example, the civil war in Liberia (1989–96) has caused the displacement of over 800,000 school-children who were forced to flee with their parents or were obliged to become child soldiers. Further, over 80% of Liberian schools were closed during the civil war, and less than 50% of primary and secondary students are enrolled in school (Dukuly, 2004). These findings, coupled with those in Table I, demonstrate the deleterious effects of civil

wars on a state's education system. However, unlike the expenditure models, decreases in enrollment do not continue once a civil war is over. None of the post-civil war variables are significant in any of the models.[17] One explanation for this finding is that, by the end of a civil war, enrollment is likely to have reached its nadir. A civil war is likely to have a tremendous effect in driving out students, making it unlikely that there will be additional students available to leave once the civil war ends. Also, those who attended school during the civil war face no new costs that would prevent them from continuing their

[17] We also tested other post-civil war measures similar to Table I. None were significant.

education. Unlike expenditures, the negative effect of civil wars on enrollment is likely to be during the civil war and not afterwards.

Table III presents the results for the empirical tests of Hypothesis 5, that males in secondary enrollment should be disproportionately affected by civil wars. In Models 13 (COW) and 16 (Uppsala/PRIO), the dependent variable is the percent change in male secondary enrollment, while Models 14 (COW) and 17 (Uppsala/PRIO) report the percent change in female secondary enrollment. Models 15 (COW) and 18 (Uppsala/PRIO) are the ratio of male secondary enrollment to total secondary enrollment. The civil war coefficient is negative and significant for only the male enrollment models, providing some evidence for Hypothesis 5. As a further test, in Models 15 and 18 the dependent variable is male enrollment/total enrollment. Hypothesis 5 predicts that civil wars should lead to a reduction in this measure. Looking at these models, the coefficient for the civil war variable is in the predicted direction and is statistically significant, providing further evidence for Hypothesis 5. Based on this final model, civil wars reduce the balance of males to females by about 1.9% for the COW model and 3.2% for the Uppsala/PRIO model. Wessells (1997) provides chilling first-hand accounts of male recruitment: 'In Ethiopia, armed militias would surround a public area such as a marketplace, order every male to sit down, and then force into a truck anyone deemed "eligible."'

Finally, we also examine the impact of the severity of a civil war on our measures of education. We measure severity for the COW data by dividing the total number killed in a civil war by the number of years the civil war lasted, and then we log that value, producing an average number of deaths per year. We use this value for each year of a civil war. For example, if a civil war lasted four years and 10,000 were killed, our measure would be the ln(2,500) for all four years. For the Uppsala/PRIO data, we use their yearly casualty measures for each civil conflict, not just civil wars (Lacina & Gleditsch, 2005).[18] These results are reported in Table IV. Models 19 (COW) and 23 (Uppsala/PRIO) report the results for educational expenditures, while Models 20–22 COW) and 24–26 (Uppsala/PRIO) present the results for primary, secondary, and tertiary enrollments. Severity influences both enrollments and expenditures. An increase of about 1,000 killed per year in a civil war leads to reductions in expenditures of about 2–2.7% and enrollment by about 1.4% (primary), 1.4–2% (secondary), and 2.7–3.4% (tertiary). More severe civil wars lead to greater reductions in expenditures as more human and physical capital is lost. The influence on enrollment is likely due to the increasing loss of life that accompanies more severe civil wars. The severity of a civil war may reduce enrollment through the displacement of students and their families, the transfer of children into conflict, the destruction of facilities, and, in rare cases, the death of students. For example, during Mozambique's 16-year civil war (1977–92), 40% of schools were forced to close, while at least 490,000 children (around 5% of the total population) died from war-related causes (UN Children's Fund, 1996; United States Mission to the UN, 1996).

The findings for the control variables are mixed across all the models. Looking at the expenditure models in Table I, we find support for the change in the non-military government expenditures variable. This result is similar to the findings of Brown & Hunter (2004), who find increases in educational expenditures per capita with increases in health and social spending. However, the effect of the development level of a state is the opposite of what we expected for the COW civil war models. States with a higher logged GPD/capita are likely to have lower percent increases in educational expenditures. This is likely to be for two

[18] See http://www.prio.no/cscw/cross/battledeaths for more detail on these data.

Table III.   PCSE Results for Effect of Civil War on Secondary Male and Female Enrollment

	Model 13	Model 14	Model 15	Model 16	Model 17	Model 18
	COW, DV = % Δ male sec.	COW, DV = % Δ female sec.	COW, DV = sec. male/ total sec.	Uppsala/ PRIO, DV = % Δ male sec.	Uppsala/ PRIO, DV = % Δ female sec.	Uppsala/ PRIO, DV = Sec. male/ total sec.
Percent military	0.073	0.032	0.004	0.072	0.032	0.003
expenditures	(0.072)	(0.047)	(0.011)	(0.072)	(0.047)	(0.011)
Civil war	−0.023*	−0.011	−0.019*	−0.032**	−0.016	−0.032**
	(0.012)	(0.013)	(0.010)	(0.013)	(0.012)	(0.012)
Dynamic	−0.038	−0.049**	−0.019	−0.045*	−0.052**	−0.027*
post-civil war	(0.027)	(0.020)	(0.015)	(0.027)	(0.020)	(0.015)
Polity	−0.003	−0.003**	−0.0005	−0.003	−0.003**	−0.0006
	(0.002)	(0.001)	(0.0004)	(0.002)	(0.001)	(0.0004)
LNGDPC	−0.008*	−0.010**	−0.042***	−0.008*	−0.011**	−0.042***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)
Percent non-military	0.063	0.026	0.007	0.062	0.025	0.005
gov't exp.	(0.079)	(0.049)	(0.012)	(0.079)	(0.049)	(0.012)
Percent population	−0.175	0.807	1.34***	−0.171	0.809	1.34***
	(1.44)	(0.893)	(0.122)	(1.44)	(0.893)	(0.124)
Constant	0.128*	0.133**	0.876***	0.126*	0.131**	0.876***
	(0.056)	(0.045)	(0.032)	(0.055)	(0.043)	(0.030)
	N = 1,035	N = 1,035	N = 1,216	N = 1,035	N = 1,035	N = 1,216
	χ^2 = 59.94***	χ^2 = 457.84***	χ^2 = 519.61***	χ^2 = 59.36***	χ^2 = 364.52***	χ^2 = 460.58***
	R^2 = .012	R^2 = .052	R^2 = .412	R^2 = .012	R^2 = .052	R^2 = .415

* $p < 0.05$, ** $p < 0.01$,*** $p < 0.001$ (one-tailed). Panel corrected standard errors are in parentheses. Estimations performed using Stata 8.0.

reasons. First, developing countries often have faster birth rates, generating the need for increased annual expenditures on education. Second, developed countries are likely to already have high levels of educational spending relative to developing countries, producing slower relative increases in educational spending. Stasavage (2005) provides some support for this argument, finding that wealthy governments spend more on education. While Brown & Hunter (2004) and Stasavage (2005) find that democracies are likely to spend more on education, democracy is not significant in any of our educational expenditures models. This is likely due to the use of different dependent variables. Both Brown & Hunter (2004) and Stasavage (2005) analyze the level of spending,

while we analyze annual percent changes in educational spending. Similar to the discussion for wealthier states, democratic states may have a higher level of spending, but this does not necessarily mean they will have higher increases in educational spending. The non-significant findings are likely due to higher percent increases because of lower starting points for non-democratic states.

For primary and tertiary enrollment (Table II), an increase in the total population increases the amount of enrollment. Similar to the expenditure models, we find that wealthier states (as measured by the natural log of GDP/capita) have a general decline in the percent change in primary and secondary enrollments. This finding is more than likely

Table IV.   PCSE Results for Effect of Severity of Civil War on Percent Change of Educational Expenditure and Enrollments

	Model 19	Model 20	Model 21	Model 22	Model 23	Model 24	Model 25	Model 26
	COW, DV = % Δ expend	COW, DV = % Δ primary	COW, DV = % Δ secondary	COW, DV = % Δ tertiary	Uppsala/ PRIO, DV = % Δ expend	Uppsala/ PRIO, = DV % Δ primary	Uppsala/ PRIO, DV = % Δ secondary	Uppsala/ PRIO, DV = % Δ tertiary
PercentΔ military expenditures	0.241*** (0.064)	0.005 (0.009)	0.041 (0.053)	–0.012 (0.028)	0.241*** (0.065)	0.004 (0.009)	0.040 (0.053)	–0.013 (0.029)
Civil war severity	–0.004* (0.002)	–0.002*** (0.0006)	–0.003* (0.001)	–0.005** (0.002)	–0.003* (0.002)	–0.002*** (0.0006)	–0.002* (0.001)	–0.004* (0.002)
Polity	0.0008 (0.0006)	–0.0002 (0.0002)	–0.002* (0.001)	–0.002* (0.001)	0.0008 (0.0006)	–0.0002 (0.0002)	–0.002* (0.001)	–0.002* (0.001)
LNGDPC	–0.008* (0.005)	–0.014*** (0.002)	–0.007** (0.003)	0.008 (0.010)	–0.007 (0.005)	–0.014*** (0.002)	–0.007** (0.003)	0.008 (0.010)
Percent Δ non-military gov't exp.	0.201** (0.069)	0.006 (0.009)	0.035 (0.055)	–0.031 (0.030)	0.201** (0.068)	0.006 (0.009)	0.035 (0.055)	–0.031 (0.030)
Percent Δ population	—	0.536*** (0.148)	0.488 (1.13)	0.942** (0.381)	—	0.543*** (0.153)	0.509 (1.13)	0.918** (0.388)
Constant	0.109** (0.039)	0.132*** (0.017)	0.107* (0.050)	0.001 (0.089)	0.099** (0.039)	0.129*** (0.018)	0.107* (0.050)	–0.003 (0.089)
	N = 1,362	N = 1,681	N = 1,137	N = 1,207	N = 1,362	N = 1,681	N = 1,137	N = 1,207
	χ^2 = 19.81**	χ^2 = 282.91***	χ^2 = 318.93***	χ^2 = 23.37***	χ^2 = 19.05**	χ^2 = 248.47***	χ^2 = 235.99***	χ^2 = 21.95***
	R^2 = 0.078	R^2 = 0.116	R^2 = 0.023	R^2 = 0.025	R^2 = 0.076	R^2 = 0.114	R^2 = 0.023	R^2 = 0.024

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (one-tailed). Panel corrected standard errors are in parentheses. Estimations performed using Stata 8.0.

due to high levels of primary and secondary enrollments in developed countries. Because of these higher pre-existing enrollment levels, developed countries are likely to have slower rates of increase in enrollment as compared to developing states that have a lower level of enrollment. Democratic states were found to likely have declines in secondary and tertiary enrollments. Similar to the explanation for wealth, democratic states are likely to have high pre-existing levels of enrollment.

Finally, looking at the model statistics, we see that these models do not explain the overall variance in the dependent variables very well.

The highest *R*-square value for all the models is .12, and the lowest is .01. While the overall model fit is low, we are primarily concerned with the effect of civil wars rather than developing a more general theory of explaining changes in educational expenditures and enrollment. Also, the chi-squared tests are all significant at the .01 level, providing us with confidence in our findings.[19] Finally, while the

[19] The chi-squared tests are Wald test statistics that all the coefficients are zero. The reason these statistics change, while the *R*-square does not change, is the inclusion of the variance-covariance matrix which varies, based on the type of civil war and post-civil war measure.

R-square is low, this does not necessarily indict our model; rather, it means that there is likely to be both a great deal of randomness in the dependent variable that is not captured by our model and other factors, such as domestic political and social factors, that drive changes in education expenditure and enrollment.

While our results demonstrate that civil wars are devastating for a system of education, one potential criticism of this finding is that educational systems are destroyed prior to a civil war or that civil wars are symptomatic of poor education systems. While education may play an important role in stabilizing a country and preventing civil conflict (Collier & Hoeffler, 2004; Thyne, 2006), this does not necessarily imply that civil wars have no effect on educational expenditures and enrollment. Our research design helps address some of these problems by looking at the percent changes. If education declines sharply prior to a civil war, then our civil war variable should be insignificant, as civil wars would be characterized by smaller declines (and possibly even increases) in the percent change of educational expenditures and enrollment relative to the pre-civil war period. Second, even if poor investment in education causes civil wars, civil wars themselves can still devastate a weak education system. Civil wars can cause low spending and enrollments to decline even more rapidly than in peacetime. As previously discussed, civil wars destroy the physical and human infrastructure that is critical to a state's education system. Our empirical evidence and examples highlight these negative impacts. Finally, we empirically address this potential problem in two ways. First, we include a lagged dependent variable to serve as a distributed lag of all the independent variables. The effect is to make the coefficient of the independent variables measure the immediate impact of the independent variables on the dependent variable (Gujarati, 1995). Our results do not change when we include the lagged dependent variable. Second, we use a two-staged, least-squares design similar to Kang & Meernik (2005) and find that our results still hold.[20]

Conclusion

The results of our article provide evidence that civil wars are devastating to a state's system of education. Civil wars are likely to reduce educational expenditures as well as educational enrollments across all levels. The effect on educational expenditures continues even after a civil war is over. This is likely due to the destruction of schools, general loss of government revenue, and human costs (death, injury, and displacement). The effects of the civil war in Sudan provide a depressing example. Lack of investment in education combined with conscription of students into the army, civilian casualties, and massive flights of refugees have resulted in what human rights watch groups call the 'lost generation of Sudan' (Human Rights Watch, 1998). In addition, we find empirical support that secondary male enrollment was affected more by civil wars than secondary female enrollment.

These findings have important implications for both the policy and academic literatures on civil wars and post-civil war

[20] Kang & Meernik (2005) examine the relationship between economic growth and civil wars. There are two differences between their 2SLS design and ours. First, they look only at post-civil war growth, not the effects during a civil war. Second, their measure combines the duration and fatalities of a civil war (and is thus relatively continuous), while ours is a dichotomous measure of whether a state was engaged in a civil war. Our 2SLS estimate requires the use of the linear probability model for the model predicting the presence or absence of a civil war. While the LPM is not an ideal estimator for a dichotomous dependent variable (Long, 1997), we are more interested in the results for the model where educational expenditures are the dependent variable. Also, we compared LPM estimates with a regular probit, and the signs of the coefficients and levels of statistical significance for the independent variables are the same. For the model predicting civil wars, we use Fearon & Laitin's (2003) model plus our measure of educational expenditures. This is based on the approached used by Kang & Meernik (2005). For the model predicting educational expenditures, we use the presented model. The results of the 2SLS estimator indicate that civil wars still have a negative effect on the percent change in educational expenditures.

reconstruction. First, our results demonstrate that civil wars are likely to destroy a state's education system. This represents a significant problem, especially after a civil war ends. Had civil wars simply reduced educational expenditures through a trade-off with military expenditures, then the end of a civil war would lead to a return to normal educational expenditures. The physical destruction of schools and loss of educators is not something that can be easily replaced once a civil war is over. Thus, policymakers need to focus reconstruction efforts on rebuilding a state's education system, as well as devising short-term plans to help re-enroll students. These results also highlight the importance of preventing civil wars. Civil wars have adverse social impacts that are likely to last beyond the end of fighting. These social costs could potentially hinder the economic development of a state and peace agreements reached between the government and rebels. Finally, the destruction of a state's education system could have long-term implications for other indicators, including economic decline and societal grievances, both of which could foster future civil conflicts within a state. If a civil war cannot be prevented, post-conflict reconstruction should be based on the understanding that civil wars are likely to have devastated a state's social institutions. As a result, foreign donors need to focus on more than just the implementation of peace agreements and the development of an effective government. They also need to devise plans to effectively restore social institutions.

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