THE AFTERMATH OF CIVIL WAR[*]

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Abstract

Using an "event-study" methodology, this paper analyzes the aftermath of civil war in a cross-section of countries. It focuses on those experiences where the end of conflict marks the beginning of a relatively lasting peace. The paper considers 41 countries involved in internal wars in the period 1960-2003. In order to provide a comprehensive evaluation of the aftermath of war, the paper considers a host of social areas represented by basic indicators of economic performance, health and education, political development, demographic trends, and conflict and security issues. For each of these indicators, the paper first compares the post- and pre-war situations and then examines their dynamic trends during the post-conflict period. It conducts this analysis both in absolute and relative terms, the latter in relation to control groups of otherwise similar countries. The paper concludes that, even though war has devastating effects and its aftermath can be immensely difficult, when the end of war marks the beginning of lasting peace, recovery and improvement are indeed achieved.
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The Aftermath of Civil War

I. Introduction

War has devastating consequences for a country, including death, displacement of people, and destruction of public infrastructure as well as physical and social capital. World Bank (2003), one of the most recent and comprehensive reports, concludes that the economic and social costs of civil wars are not only deep but also persistent, even for years after the end of the conflict. However, when the end of war represents the beginning of lasting peace, there are good reasons to believe that recovery, albeit gradual, is possible. This is what neoclassical models of economic growth and convergence would predict and what the evidence of recovery in Europe (after World War II), Korea, and Vietnam, among others, would seem to indicate. The objective of this paper is to contribute some stylized facts on the evidence regarding the economic, social, and political aftermath of civil wars.

The scarce literature that studies the consequences of civil wars has usually focused on the costs *during* conflict. Few studies analyze the costs of civil war after peace agreements are signed, and we would like to contribute to this literature. Working with a cross-section of countries with well defined pre- and post-war periods, this paper uses an event-study methodology to provide a general evaluation of the aftermath of internal wars along basic economic, social, and political dimensions. Although this paper is mainly descriptive, it gives motivation and evidence on various hypotheses surrounding the consequences of internal wars. It will hopefully induce more specific and analytical research in future work.

Brief review of the literature. There is little controversy on the dire effects of civil and international wars. They kill people, destroy infrastructure, weaken institutions, and erode social trust. Moreover, the destruction of infrastructure and institutions leaves the population under conditions that increase the risk of disease, crime, political instability, and further conflict. Collier et al. (2003) provide a review of the literature on the costs of civil war. Collier (1999) finds that during civil war countries tend to grow at

2.2 percentage points less than during peace. Using World Health Organization data on 23 major diseases in populations distinguished by gender and age groups, Ghobarah, Huth, and Russett (2003) find that civil war increases substantially the incidence of death and disability produced by contagious diseases. Soares (2005) provides an estimation of the welfare cost of violence in a sample of countries applying a willingness-to-pay approach to account for the health consequences of war. For instance, Soares estimates that the civil conflict in Colombia, by reducing life expectancy at birth by 2.2 years, produces a loss of 9.7% of GDP. Other studies focus on the neighbouring effects of civil war. Murdoch and Sandler (2002 and 2004) show that civil wars reduce growth over an entire region of neighbouring countries. Montalvo and Reynal-Querol (2007) explore the influence of refugees from civil wars on the incidence of malaria in the refugee-receiving countries. They show that for each 1000 refugees there occur between 2000 and 2700 cases of malaria in the refugee-receiving country.

The empirical literature on the *aftermath* of civil and international war is scarcer. It seems to indicate that countries do recover in the post-conflict period to at least their pre-war situations. In a cross-country empirical analysis, Przeworski et al. (2000) finds that post-war economic recovery is rapid. Their results indicate that the average rate of growth during the five years following a war is 5.98 percent. They also find that wars cause more damage under dictatorships than under democracies, but, in contrast, recoveries are faster under dictatorships than under democracies. Barro and Sala-i-Martin (1995) explain post-war recoveries --considering the examples of Japan and Germany following World War II-- arguing that whenever a war destroys a given production factor relatively more than other factors, the rate of return of the latter increases, thus creating the forces of convergence that spur rapid growth. Collier and Hoeffler (2004) provide a systematic empirical analysis of aid and policy reform in the post-conflict growth process. It is based on a comprehensive data set of large civil wars, covering 17 societies during their first decade of post-conflict economic recovery. They find that during the first 3 post-conflict years absorptive capacity is no greater than normal, but that in the rest of the first decade it is approximately double its normal level. They also find that growth is more sensitive to policy in post-conflict societies.

Organski and Kugler (1977, 1980) analyze the economic effects of the two World Wars on a sample of mainly European countries. They find that in the "long run" --15 to 20 years-- the effects of war are dissipated in both losers and winners, occurring typically a return to pre-war growth trends. Miguel and Roland (2005) analyze the impact that U.S. bombing on Vietnam had on the country's subsequent economic development. They compare the heavily bombed districts with the rest and find that U.S bombing did not have a lasting negative impact on poverty rates, consumption levels, infrastructure, literacy, and population density, as measured around 2002. Inferring to other cases, they conclude that local recovery from the damage of war can be achieved if "certain conditions" are met.

As mentioned above, we use an event-study methodology. Regarding its application to the study of conflict, there are some important papers that precede our work. Chen and Siems (2004) use it to examine the effects of terrorism on global capital markets. They examine the U.S capital market's response to 14 terrorist attacks from 1915, and the response of global capital markets to both the Iraq's invasion of Kuwait in 1990 and the 9/11 terrorist attacks in New York and Washington. They find that terrorist attacks and military invasions have great potential to affect capital markets around the world in a short period of time. They also find that U.S capital markets recover sooner than other global capital markets. Abadie and Gardeazabal (2003) use an event-study methodology to analyze the impact of terrorism on firms in the Basque Country. They find that firms having a significant presence in the Basque Country improved their performance more than other firms when truce became credible and, correspondingly, a worse relative performance at the end of the ceasefire. Davis and Weinstein (2002) consider the Allied bombing of Japanese cities in WWII as a shock to the relative size of the cities. They find that, in the wake of the destruction there was an extremely powerful recovery. Most cities returned to their relative sizes within about 15 years.

The paper's methodology. In this paper, we use an "event-study" methodology to analyze the aftermath of war in a cross-section of countries. We focus on those experiences where the end of conflict marks the beginning of a relatively lasting peace. The event-study methodology consists of transforming calendar time into "event time" in order to be able to aggregate and extract meaningful statistics from a collection of

experiences that have a given event in common. In our case, the "event" is the occurrence of civil war, and the pre- and post-war periods are defined as periods free of war. These considerations guide the selection and preparation of the sample.

Since our objective is to provide a comprehensive evaluation of the aftermath of war, we examine a host of social areas. These are represented by basic indicators of economic performance, health and education, political development, demographic trends, and conflict and security issues. For each of these indicators, the paper first compares the post- and pre-war situations and then analyzes their dynamic trends during the post-conflict period. The purpose is to examine the nature of the recovery from war, suggesting evidence on the costs of war and the extent of a peace dividend. The comparative analysis is done controlling for country fixed effects and considering the experience of conflict countries both on their own and in comparison with two control groups of otherwise similar countries.

Basic conclusions. As result of war, post-conflict countries find themselves behind otherwise similar developing countries in terms of income per capita, some aspects of health and educational achievement, and key areas of political development. Moreover, longer wars produce larger damage in economic activity and make economic recovery significantly slower. However, when peace is achieved and sustained, recovery is indeed possible. Virtually all aspects of economic, social, and political development experience gradual improvement in the aftermath of civil war. Progress in social areas is accompanied by a continuous reallocation of public resources away from military expenditures and, above all, a steady rise in average income per capita. An important caveat on this paper is that it serves only as a broad overview: Its conclusions refer to the typical or average country afflicted by war and reflect mostly a descriptive and statistical examination. Future research should analyze in greater detail the heterogeneity of post-conflict situations, their causal mechanisms, and the policies that make them successful.

The rest of the paper proceeds as follows. Section II describes the data, their sources, and methodology of analysis. Section III presents and discusses the results, first, on the comparison between the pre- and post-war periods and, second, on the trends of change after the war. Section IV offers some concluding remarks.

II. Data and Methodology

In exploring the patterns of behavior of various economic, social, and political variables in post-war countries, this study focuses on internal (or civil) conflicts. The information on conflicts comes from the Armed Conflict Dataset of International Peace Research Institute, Oslo (PRIO). We group *internal* and *internationalized internal* armed conflict as internal wars.[1] In order to focus on major conflicts, we limit our analysis to those with the highest intensity level in the PRIO dataset, i.e., more than 1000 battle-related deaths per year during the war.

In an attempt to provide a comprehensive set of stylized facts on post-war transitions, this paper examines the following dimensions: *economic performance*, including the level and growth rate of GDP per capita, the share of domestic investment in GDP, the share of government expenditure in GDP, the share of military expenditure in government expenditure, and the inflation rate; *health and education*, represented by the rates of infant mortality, adult female mortality, adult male mortality, primary school enrollment, and secondary school enrollment; *political development*, including indices of democracy and autocracy, civil liberties and political rights, and law and order; *demographic development*, such as the old dependency ratio, young dependency ratio, and female-male ratio; and other forms of *conflict*, specifically the incidence of terrorist attacks. Detailed description of these variables, including definitions and sources, is provided in Appendix 2.

Given its wide-ranging coverage of themes and variables, the paper uses an "event-study" methodology that can produce clear and succinct results. This methodology consists of reorganizing the data by converting calendar time into event time.[2] In this particular application, the occurrence of a war is the event that serves to anchor the data. For instance, we define the last year before the start of a war as event year -1, the next-to-the-last year as event year -2, and so on. Similarly, the first year after the end of a war is defined as event year 1, the second year as event year 2, etc.

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[1] According to PRIO's definitions, *internal armed conflict* occurs between the government of a state and internal opposition groups without intervention from other states; *internationalized internal armed conflict* occurs when such conflict involves intervention from other states.
[2] For other presentations of this methodology, see Bruno and Easterly (1998) and Wacziarg and Welch (2003).

The definition of the war event is crucial in our empirical evaluation. We define it such that its pre and post periods can be characterized as relatively free of war. In particular, in order to ensure that we analyze the aftermath following the true resolution of an armed conflict, we require at least 10 years of peace after the war. This means that in cases of elongated conflicts with temporary ceasefire periods, our "war event" includes initial war, (short) interwar peace, and resumption of war. In case a country undergoes two wars with more than ten years of peace in between, the two wars are treated as independent events.[3]

In order to reach a favorable compromise between sample size and period extension, we measure the pre-conflict period as the 7 years before the war, and similarly the post-conflict period as the 7 years after the war. These are the "event" years under consideration. One difficulty in applying the event-study methodology has to do with sample changes across event years. Ideally, we should have a constant sample comprised of the same countries for all event years. Unfortunately, a preliminary assessment of the data reveals that for each individual variable, quite a few countries have data only for a subset of years under consideration. For instance, a country may have GDP per capita growth rate data in the first three years after the war, but no more thereafter. In addition, since our sample period is from 1960 through 2003 and we look at seven years both before and after the war, a country could have started the conflict "too early" (e.g., 1962) or ended the conflict "too late" (e.g., 2000), in the sense that it would not have a well-defined pre-war period in the former case or a well-defined post-war period in the latter case. On the other hand, however, if we do restrict to a perfectly constant sample, we might end up with too few countries included. In order to achieve a balance between the two extremes, we set our criterion in the following way. For the comparison of pre- and post-war periods, a country will be included in the sample for a *particular variable*, if for this variable it has at least 5 years of observations in the 7-year window before the war and likewise after the war. (Naturally, to be considered in the sample, the country would still have to meet the criterion of being war-free 10 years before and 10 years after the war). For the analysis of the aftermath of conflicts, the data availability restriction is

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[3] A concern arises when some countries experience external war during the pre- or post-internal conflict periods. In such cases, the periods around the war event cannot be characterized as peaceful. To eliminate this contamination, we exclude these countries from our samples for all variables.

imposed only on event years after the war (i.e., a country does not need to have sufficient pre-war data). Our samples are variable specific --it is quite likely, then, that a country meets the requirement for one variable but fails for another.

Our empirical analysis studies the typical patterns of countries that experienced civil war, examining, first, the *average* difference between the post- and pre-war periods and, then, the *average* rates of change in the years after the war. The analysis is made considering the experience of conflict countries both on their own and with respect to two control groups of countries. The control groups are the full sample of non-conflict developing countries and the subset located in the geographic region of the corresponding conflict country (see below for details). Since some of the variables under consideration may follow world trends (e.g., the wave of democratization in the case of political development variables or the discovery of new vaccines in the case of health indicators), the comparison with the full sample of developing countries is necessary to separate these world trends from the real costs of war and the merits of pacification. The comparison with respect to regional countries is relevant because it can also capture some of these world trends while matching more closely the level of development of corresponding conflict countries. The main disadvantage of the regional control group is that its geographic proximity to conflict countries may make them susceptible to the effects of war.

The potential disadvantages of both control groups are reduced by the way we implement the comparisons with respect to them. Considering a given indicator variable, for each conflict country and event year, we measure the *control* value as the median for the control group in the calendar year corresponding to the event year. Then, we take the difference between the conflict-country value and the control value in a given event year for each variable under consideration. Two series of differences are generated, corresponding, respectively, to the two control groups. Clearly, the control values (and the sample of countries from which they are computed) are specific to each indicator variable under study.

Appendix 1 provides summary information on the various country samples. A country is marked with double asterisk if it is included in the samples for both pre- and post-war comparison and post-war analysis. A single asterisk indicates that this country is

used only for post-war evaluation. For example, 17 countries are considered in the internal war comparison of GDP per capita growth rate before and after the war; these countries together with other 7 that lack pre-war information are used for evaluation of post-war only. Three variables, i.e., military expenditures, law and order, and terrorist attacks are examined only in the event years after the war due to their lack of available data in the pre-war period.[4]

Altogether, we work with 41 countries involved in internal wars (15 from Africa, 17 from Asia, 3 from Europe, and 6 from Latin America) during the period 1960-2003. Among these countries, six (Burma, Cambodia, Iraq, Liberia, Sri Lanka and Sudan) were entangled in *two* internal conflicts.

III. Results

As mentioned above, we carry out two complementary exercises. In the first, we evaluate and compare the central tendency of each variable before and after the war, both by itself and with respect to two control groups (Table 1). In addition, for the level and growth rate of GDP per capita only, we examine to what extent the duration of the war affects the difference between the pre- and post-war periods (Table 2). In the second exercise, we estimate the average slope (or rate of change) of each variable during the post-conflict period, also by itself and with respect to the two control groups (Table 3). Likewise, we assess whether the duration of the war has an impact on the rate of change of per capita GDP, both in levels and growth rates, in the post-war period (Table 4). To be precise, the following regression equations represent the exercises just described. For the pre-post war comparison,

$$y_{i,t} = \alpha_1 + \alpha_2 * Post_{i,t} + \mu_i + \varepsilon_{i,t} \tag{1}$$

$$y_{i,t} = \alpha_1 + \alpha_2 * Post_{i,t} + \alpha_3 * Dur_i * Post_{i,t} + \mu_i + \varepsilon_{i,t} \tag{2}$$

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[4] For example, WDI started to collect military expenditures data (% as central government expenditures) in 1990; and ICRG provides ratings on law and order after 1984.

where the subscripts i and t represent country and event year, respectively; y is the variable under consideration; *Post* is a dummy variable that takes the value of 1 for the years of the post-war period, and 0 otherwise; μ is a country-specific effect (modeled as a country dummy); α_2 is the main parameter of interest and represents the average difference in the variable y between the post- and pre-war periods; α_3 represents the effect of each additional war year on the post-pre difference; *Dur* is the duration of the war in number of years; and ε is the regression residual.

For the post-war exercise, we use the following regression equations,

$$y_{i,t} = \beta_1 + \beta_2 * Year_t + \mu_i + \varepsilon_{i,t} \tag{3}$$

$$y_{i,t} = \beta_1 + \beta_2 * Year_t + \beta_3 * Dur_i * Year_t + \mu_i + \varepsilon_{i,t} \tag{4}$$

where, *Year* indicates the event year after the war (1 through 7), β_2 is the main coefficient of interest and represents the average change in the variable of interest from year to year in the post-war period, and β_3 represents the effect of each additional year of war on the post-war average change.

The dependent variable, y, is measured by itself and in deviation from the median of each control group. It can then take three values, according to,

$$y_{i,t} = \begin{pmatrix} y_{i,t} \\ y_{i,t} - \bar{y}_{i,t} \\ y_{i,t} - \tilde{y}_{i,t} \end{pmatrix}$$

where $\bar{y}_{i,t}$ represents the median of the non-conflict *developing-country* control group associated with country i in year t; and, similarly, $\tilde{y}_{i,t}$ denotes the median of the non-conflict *regional-country* control group for the same country and year. Given the large number of variables under consideration, Tables 1 and 3 report, respectively, only the estimated α_2 and β_3 coefficients, and associated standard errors, for the three versions of each dependent variable.

We provide two sets of figures as complements to the tables. Figure 1 plots the median in each event year (seven years before the war and seven years after) for the conflict countries and the control groups. Figure 2 plots the medians in each event year after the war (this is not repetitive of Figure 1 because the sample for post-conflict analysis is larger than that for the post-pre war comparisons).

Pre-post war comparisons

Visual examination of typical trends before and after the war can be illustrative and motivate more precise statistical analyses. From Figure 1, we can recognize three types of behavior. Some variables (GDP per capita level and growth, investment share, inflation rate, polity2, civil and political rights, female-male ratio, and incidence of terrorism) exhibit a different pattern, including a different level, for after and before the war. Other variables (mortality rates, educational enrollment rates, and dependency ratios) show a change in level that seems to correspond to the continuation of a (declining or increasing) trend established before the war. The final group (investment rate and government expenditures) presents no discernible level change from before to after the war.

Statistical analysis can reveal if average or typical patterns are representative of the sample or if cross-country heterogeneity prevents any summary conclusion. For this purpose, we conduct fixed-effects regressions that estimate and allow the comparison of the means per period, as indicated in the previous section. Country fixed-effect estimation allows controlling for inherent country characteristics that are unrelated to the transition from war to peace.

Let's start with the economic indicators. The average level of GDP per capita is significantly lower after than before the war, particularly in relation to the control groups. This is undoubtedly a direct reflection of the cost of war. On the other hand, the average growth rate of GDP per capita in conflict countries appears to be significantly larger after than before the war (by about 2.4 percentage points). The increase is even more pronounced when compared with the change experienced by the control groups. These two results are in line with those in Przeworski et al. (2000) and Barro and Sala-i-Martin (1995): After the destruction of the war, recovery is achieved through faster than usual

growth. The increase in economic growth occurs with the support of an increase in the investment rate. The contribution from capital accumulation, however, seems to be somewhat weak and significant only when compared to the control groups. This suggests than the increase in growth is also due to a recovery in capacity utilization and, possibly, improved factor productivity.

Government expenditures (as ratio to GDP) increased by about 1 percentage point from the pre- to the post-war period and may have also contributed to higher growth. This change is, however, not significantly different from that experienced in the control groups; it can be argued that for them, not being in a dire post-conflict situation, the expansion in government expenditures had less potential to bring about larger growth. Finally, regarding the inflation rate, it is significantly larger after than before the war, whether compared or not with the control groups. For the few experiences where reliable inflation data during the war is available, the pattern is that the inflation rate increases sharply during the war as government revenue sources dwindle and then decreases at the onset of peace. For the next section we leave the question as to whether the inflation rate keeps decreasing in the aftermath of war.

The health and education indicators share some patterns. When conflict countries are considered by themselves (that is, without reference to the control groups) there is a marked improvement in health and education in the post-war period as compared to the pre-war period. (Naturally, improvement means a decrease in mortality rates and an increase in school enrollment rates). When compared with the control groups, however, the improvements are less clear cut. For the case of primary school enrollment, conflict countries improved not only with respect to their pre-war level but also with respect to the gains obtained by the control group. However, for the other indicators, the improvement is the same as or even lower than in at least one of the control groups. In the case of infant and adult female mortality, the improvement experienced by conflict countries is not significantly different from that of either control group. For adult male mortality and secondary school enrollment --two variables related to direct combatants--, the improvement in conflict countries fell significantly below that of the control groups. The fact that these health and education indicators improved in absolute terms signals the important influence of world trends (for instance reflecting educational and health

international campaigns) even for conflict-ridden countries; however, the fact that the improvements fell below international standards reflects the unquestionable cost of war.

Regarding the political variables, there is also evidence of absolute improvement in the post-war period as compared with the pre-war period. Polity 2 –measuring prevalence of democracy and absence of autocracy—presents a higher average level after than before the war. Gastil's measure of civil liberties and political rights (for which a smaller number represents an improvement) also indicates a better situation after than before the war. Nevertheless, for both variables the improvement falls short of what was achieved by the control groups. Again, the cost of the war is reflected in the failure of conflict countries to achieve international standards.

Comparing the pre- and post-war periods, the old dependency ratio becomes larger, changing in a manner similar to a demographic transition. The increase is more pronounced than that of the developing-country control group but not significantly different than that of countries in the same region. The young dependency ratio declines in absolute terms, which may also be consistent with a demographic transition. However, when we compare the experience of conflict countries with that of others in the same region, we see that the young dependency ratio increases in relative terms. This confirms a larger death toll suffered by working-age adults in the course of the war. Lastly, the female-male ratio also experiences a statistically significant level change: The ratio of women to men is larger after than before the war; this increase is even more pronounced and statistically significant when compared with the experience of either control group. The imbalance created in conflict countries in this regard is likely generated by the fact that the majority of war fatalities are men.

Finally, regarding the other conflict variable, the incidence of terrorist attacks suffers a level increase from the pre- to the post-war period, but this change is not statistically significant either in absolute or relative terms (mostly due to the large variation across countries in this regard).[5]

In Table 2 we examine the effect of the duration of the war on the change in GDP per capita, in levels and growth rates, between the pre- and post-war periods. Regarding

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[5] For Terrorist attacks, the corresponding panel in Figure 1 shows not the median but the 75th percentile. The median for this variable is always 0.

the level of GDP per capita, the coefficients of interest become statistically significant when the variable is expressed as deviation from the regional-country control group. The results indicate that the loss of GDP per capita as result of a major war is significant even if it is brief and that this loss increases gradually with the war's duration. Regarding the growth rate of GDP per capita, the duration of the war does not seem to have an impact on its change between the pre- and post-war periods.

The aftermath of war

The previous exercise was directed at assessing the changes that may have occurred after the war *in comparison* to before the war. In this section, we focus on the post-war period to examine the pattern of change when peace begins. Figure 2 gives a preview of the trend of the social and economic indicators in the aftermath of internal wars. For each indicator, it presents the medians of, respectively, the conflict countries and the two control groups for each of the seven years after the war. The most apparent observation from the figure is the pattern of recovery in all dimensions after the war. In most cases, the indicators show a dynamic pattern that is consistent with gradual social improvement. In the other cases, the improvement appears to occur early in the aftermath of internal wars. There are no clear or significant signs of worsening conditions after the onset of peace. Although this recovery does not always mean progress *vis-à-vis* the control groups, it is nonetheless remarkable.

Table 3 shows the estimation of the average time trend (or slope) of each indicator for the sample of conflict countries. As before, we use a fixed-effects estimator to allow for different intercepts per country. To save space, the table presents only the slope coefficients for each variable of interest, specified in absolute terms and in deviation from the control groups.

Regarding the economic indicators, GDP per capita in conflict countries has a significantly positive time trend that is also larger than that of any of the control groups. This gradual improvement is, of course, the result of higher levels of GDP growth in conflict countries after the war. In turn, GDP per capita growth shows no significant linear time trend; its pattern appears to follow an inverted U with best results towards the 4th or 5th year after the onset of peace. The investment rate shows a positive slope, but it

is statistically significant only when compared with the regional-country control group. The average investment rate in conflict countries starts lower than that in the regional-country control group, but before elapsing one decade after the war, it converges with this control group's investment rates. It appears, then, that conflict countries are able to approach their respective region in terms of GDP per capita in part through their higher investment rates in the years after the war.

Public finances also experience interesting changes in the aftermath of civil wars. Government expenditure (as ratio to GDP) has a declining time trend that is statistically significant in absolute terms but not relative to the control groups. Military expenditure (as ratio to government expenditures) has a clear and significant declining trend in the aftermath of war, both in absolute terms and in deviation from the developing-country control group. Interestingly, when military expenditure in conflict countries is considered with respect to that of countries in the same region, the declining trend disappears: the threat of civil war becoming an external one may induce countries in the region to increase their military expenditure during the war and decrease it afterwards. In brief, after peace is achieved, conflict countries gradually reduce their government expenditures and sharply deemphasize the importance of military expenditure in the use of fiscal resources.[6]

In absolute terms, the indicators of health and education share a significant improving time trend (that is, negative for mortality rates and positive for school enrollment rates). Regarding relative improvement, the average recovery rate for primary school enrollment is larger in conflict countries than in any of the control groups. The opposite is the case, however, for secondary school enrollment, where conflict countries actually under-perform relative to both control groups. The case of health indicators is in the middle: the average rate of improvement in infant and adult female and male mortality rates is not different from that of at least one of the control groups.

Regarding the political variables, there are some signs of absolute improvement as measured by the democracy index of Polity 2 (positive slope) and Gastil's civil liberties

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[6] In this regard, note the contrast between sustainable peace (which we analyze in this paper) and insecure post-conflict. Collier and Hoeffler (2006) investigate the effects of post-conflict military spending on the risk of resumed hostilities. They find that high military spending significantly increases the risk of renewed conflict.

index (negative slope). However, only in the latter case the slope is statistically significant. In relative terms, especially when compared with countries in the same region, the progress in conflict countries is the same as in the control group. On the other hand, ICRG's index on law and order does show a marked and significant rate of progress in conflict countries, both in absolute terms and in comparison with both control groups. It seems, then, that in the aftermath of civil war, while political rights are slow to advance, police and judicial systems improve at an accelerated rate.[7]

Regarding demographic variables, in the aftermath of war there is a continuation of the demographic transition in conflict countries: In absolute terms, the old dependency ratio presents an increasing trend, while the young dependency ratio shows a declining one. Relative to both control groups, there is no discernible trend in either dependency ratio, indicating that the pattern of demographic transition in post-conflict countries is shared with otherwise similar countries. On the other hand, the female-male ratio, after increasing during the war, exhibits a statistically significant declining trend in the aftermath. This is true both in absolute terms and relative to the regional-country control group; it reveals a gradual recovery of the male population from its losses during the war.

Finally, regarding the conflict indicator, the incidence of terrorist attacks decreases significantly in the aftermath of internal wars, as implied by its estimated negative trend.[8] This is the case both in absolute terms and in relation to both control groups. When more complex, nonlinear behavior is allowed (not shown in the table) terrorist attacks seem to follow a quadratic trend with some increase early in the aftermath of war and a subsequent marked decline. The end of the civil war appears to eventually lead to pacification of other types of internal strife.

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[7] Notice again that since we deal with peaceful recoveries, our analysis is different from that in papers which investigate the risk of renewed conflict. Binningsbo et al. (2007) investigates the long term effects of post-conflict justice on the duration of peace. Collier and Hoeffler (2007) study the political, economic, and military aspects of post-conflict situations to address the risk of renewed conflict. The results on political design suggest an ambiguous effect of government elections: they reduce conflict risk in the year when they are held but increase it in the following year. More generally, these authors find that democratic institutions do not appear to reduce the risk of renewed hostilities.

[8] The terrorism data comes from the ITERATE project (see Mickolus, Sandler, Murdock, and Flemming, 2004). It mostly covers incidents of terrorism that have a transnational component. Therefore, it may reflect imperfectly the domestic nature of terrorist attacks that characterizes post-conflict situations.

Table 4 examines whether the duration of the war has an impact on the speed of post-conflict recovery. As previously, this is studied only for the case of GDP per capita. Regarding its level, the results indicate that GDP per capita has a positive trend in the aftermath of conflict whose slope is diminished with the duration of the war. This is significantly so for the comparisons in absolute and relative terms. Regarding economic growth, the result is qualitatively similar: the growth rate of GDP per capita has a positive trend which declines as the duration of the war is larger. This is true in absolute terms and in relation to the developing-country control group (the pattern of signs is the same in the comparison to the regional-country control group but the statistical significance is weaker). In brief, the cost of war is here manifested in the negative effect which its duration has on the level and growth of GDP per capita.

IV. Conclusions

War has devastating effects, and its aftermath can be immensely difficult. Nevertheless, when the end of war marks the beginning of lasting peace, recovery and improvement are feasible realities.

This paper has not attempted to measure the cost of war in all its human and material dimensions. However, it finds evidence on the negative consequences of war in all components of the analysis. One of them is the comparison between the pre- and post-war periods. There, the cost of war is reflected in the substantial drop in per capita income suffered by conflict countries during the war and in their failure to make similar progress as other comparable countries in key areas of political development (such as civil liberties and democratic rule) and some aspects of health and educational achievement closely related to combatants (such as adult male mortality and secondary school enrollment). In other, more basic, areas of social development (such as infant mortality and primary school enrollment), conflict countries have been able to partake of the wave of international progress even despite the war. This is arguably a testament to the beneficial impact of medical innovations, educational programs, and the international campaigns to promote them.

Naturally, the problems associated with war do not start when fighting begins. They were present before and may have precipitated, and even generated, the civil conflict. Therefore, it stands to reason that the resolution of war, when it promotes enduring peace, may signal the start of the solution of these problems. The behavior of economic growth gives evidence to this notion: Prior to the war, economic growth is quite low and even negative. After the war, economic growth becomes strongly positive, with an average rate 2.4 percentage points higher than before the war.

The aftermath of war is a period of recovery. Virtually all aspects of economic, social, and political development experience gradual improvement in absolute terms. It is interesting to note that recovery happens rather swiftly in macroeconomic areas: output per capita increases, capital investment rises, and inflation decreases at rates sufficiently high to indicate gradual convergence to similar non-conflict countries. This pattern of relative improvement (and, thus, convergence) is shared by other social and political indicators, but not all. As an indication of the dire consequences of war, in aspects directly related to victims, combatants, and political processes (such as mortality, secondary enrollment, and democratic rights) the rate of recovery in post-conflict countries is at best comparable to that of otherwise similar countries. However, in other social areas (such as primary school enrollment, the correction of demographic imbalances, the rule of law, and the incidence of terrorist attacks), recovery happens at rates higher than those in other developing countries. Interestingly, this progress in social areas is accompanied by a continuous reallocation of public resources away from military expenditures.

We can learn from the different behavior of social and political variables in post-conflict situations. Take, for instance, the contrasting behavior of democratic rights and the perception of law and order. The former is slow to advance and may require the foundation of long-run institutions to be consolidated, while the latter can be achieved by a variety of strong government regimes. Even then, pacification after civil war does not occur overnight: Terrorist attacks can be quite pervasive in the couple of years following the cessation of hostilities, but even this tends to subside overtime, giving way to a true resolution of the civil war.

This paper is intended as a broad overview of the economic, social, and political conditions in the aftermath of civil war. Its conclusions refer to the typical or average country afflicted by war and reflect mostly a descriptive and statistical examination. We have attempted to account for some of the heterogeneity across conflict countries --both in the change between pre- and post-war situations and in the rate of recovery in the aftermath of war-- by assessing the effects of the *duration* of armed civil conflict. There, we also find evidence of the cost of war: The drop in per capita GDP during the war is larger the longer the war persists; more interestingly, the rate of increase and even acceleration of per capita GDP in the aftermath of war declines significantly with the length of conflict.

The paper's shortcomings implicitly suggest a rich agenda for future research. This should include a deeper analysis of the heterogeneity in the recovery patterns of conflict countries, a careful examination of the causal mechanisms underlying these patterns, and an evaluation of policies proposed for successful post-conflict recovery, including demobilization of ex-combatants, external intervention and aid, domestic redistributive programs, and institutional reform.

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Table 1: Pre- and post-war comparison

A. Economic

Dependent Variable	Post – Pre (conflict countries)	Post – Pre (developing-countries control)	Post – Pre (regional-countries control)	Obs./ countries
a. GDP per capita	-0.150** [0.046]	-0.252** [0.044]	-0.283** [0.043]	249/18
b. GDP per capita growth rate	2.381* [1.299]	3.395** [1.277]	4.609** [1.537]	235/17
c. Investment share	0.166 [0.477]	1.387** [0.432]	1.014* [0.589]	192/14
d. Government expenditure	0.957** [0.341]	0.137 [0.357]	-0.782 [0.512]	165/12
e. Inflation	13.048** [5.404]	10.643** [5.319]	11.673** [5.350]	176/13

B. Health and Education

Dependent variable	Post – Pre (conflict countries)	Post – Pre (developing-countries control)	Post – Pre (regional-countries control)	Obs./ countries
a. Infant mortality	-24.311** [1.259]	-3.314** [0.924]	2.095 [1.565]	280/20
b. Adult female mortality	-32.202** [5.332]	-5.129 [4.956]	6.219 [4.663]	292/21
c. Adult male mortality	-32.966** [4.932]	22.962** [4.670]	10.356** [4.665]	292/21
d. Primary school enrollment	13.207** [1.679]	5.814** [1.515]	3.613** [1.799]	292/21
e. Secondary school enrollment	16.680** [1.235]	-5.853** [1.343]	-1.907 [1.368]	276/20

C. Political

Dependent variable	Post – Pre (conflict countries)	Post – Pre (developing-countries control)	Post – Pre (regional-countries control)	Obs./ countries
a. Polity2	4.437** [0.531]	-3.128** [0.469]	-1.067** [0.474]	227/17
b. Civil liberties and political rights	-0.853** [0.130]	0.342** [0.127]	0.073 [0.153]	165/12

D. Demographic

Dependent variable	Post – Pre (conflict countries)	Post – Pre (developing-countries control)	Post – Pre (regional-countries control)	Obs./ countries
a. Old dependency ratio	0.510** [0.067]	0.372** [0.067]	0.111 [0.071]	333/24
b. Young dependency ratio	-5.321** [0.745]	0.540 [0.725]	2.940** [0.712]	333/24
c. Female – male ratio	0.741** [0.216]	1.025** [0.221]	1.606** [0.280]	333/24

E. Conflict

Dependent variable	Post – Pre (conflict countries)	Post – Pre (developing-countries control)	Post – Pre (regional-countries control)	Obs./ countries
a. Terrorist attacks	0.634 [1.421]	0.634 [1.421]	0.677 [1.410]	265/19

Table 2: Pre- and post-war comparison (length of war effect)

a. GDP per capita

Dependent variable	Conflict countries	Developing-countries control	Regional-countries control	Obs./ countries
Constant	7.071** [0.032]	-0.394** [0.030]	-0.705** [0.029]	249/18
Post-war dummy	-0.144 [0.091]	-0.189** [0.087]	-0.136* [0.082]	249/18
Interaction term	-0.001 [0.007]	-0.008 [0.007]	-0.017** [0.006]	249/18

b. GDP per capita growth rate

Dependent variable	Conflict countries	Developing-countries control	Regional-countries control	Obs./ countries
Constant	2.868** [1.123]	2.010* [1.099]	2.153* [1.159]	235/17
Post-war dummy	2.499 [2.676]	2.502 [2.634]	4.858 [2.981]	235/17
Interaction term	-0.015 [0.202]	0.118 [0.200]	-0.033 [0.217]	235/17

Note: Interaction term = Post-war dummy * Years of war

Table 3: The aftermath of wars

A. Economic

Dependent variable	Post – Pre (conflict countries)	Post – Pre (developing-countries control)	Post – Pre (regional-countries control)	Obs./ countries
a. GDP per capita	0.036** [0.006]	0.026** [0.006]	0.027** [0.006]	167/24
b. GDP per capita growth rate	0.458 [0.492]	0.349 [0.487]	0.372 [0.493]	166/24
c. Investment share	0.141 [0.111]	0.017 [0.100]	0.275* [0.163]	129/19
d. Government expenditure	-0.259** [0.092]	-0.136 [0.094]	-0.185 [0.121]	139//20
e. Military expenditure	-1.355** [0.415]	-0.923** [0.417]	-0.627 [0.503]	26/5
f. Inflation	-6.931** [2.753]	-6.391** [2.732]	-4.905* [2.770]	156/23

B. Health and Education

Dependent variable	Post – Pre (conflict countries)	Post – Pre (developing-countries control)	Post – Pre (regional-countries control)	Obs./ countries
a. Infant mortality	-1.155** [0.197]	-0.317 [0.201]	0.151 [0.197]	195/28
b. Adult female mortality	-2.459** [0.538]	-0.335 [0.571]	-0.666 [0.592]	181/26
c. Adult male mortality	-2.038** [0.555]	-0.616 [0.525]	-0.227 [0.558]	181/26
d. Primary school enrollment	2.064** [0.478]	1.592** [0.478]	1.684** [0.509]	189/27
e. Secondary school enrollment	0.820** [0.213]	-1.695** [0.242]	-1.206** [0.256]	187/27

C. Political

Dependent variable	Post – Pre (conflict countries)	Post – Pre (developing-countries control)	Post – Pre (regional-countries control)	Obs./ countries
a. Polity2	0.059 [0.092]	-0.242** [0.114]	0.054 [0.113]	181/26
b. Civil liberties and political rights	-0.058** [0.023]	-0.017 [0.024]	-0.035 [0.025]	202/29
c. Law and order	0.176** [0.042]	0.151** [0.034]	0.111** [0.038]	104/15

D. Demographic

Dependent variable	Post – Pre (conflict countries)	Post – Pre (developing-countries control)	Post – Pre (regional-countries control)	Obs./ countries
a. Old dependency ratio	0.030** [0.015]	0.022 [0.014]	-0.016 [0.014]	202/29
b. Young dependency ratio	-0.559** [0.120]	-0.124 [0.127]	0.073 [0.142]	202/29
c. Female – male ratio	-0.066** [0.029]	-0.041 [0.029]	-0.122** [0.039]	202/29

E. Conflict

Dependent variable	Post – Pre (conflict countries)	Post – Pre (developing-countries control)	Post – Pre (regional-countries control)	Obs./ countries
a. Terrorist attacks	-1.047** [0.398]	-1.047** [0.398]	-0.995** [0.396]	202/29

Table 4: The aftermath of wars (length of war effect)

c. GDP per capita

Dependent variable	Conflict countries	Developing-countries control	Regional-countries control	Obs./ countries
Constant	6.991** [0.025]	-0.439** [0.024]	-0.716** [0.027]	167/24
Post-war trend	0.056** [0.011]	0.042** [0.011]	0.047** [0.012]	167/24
Interaction term	-0.002** [0.001]	-0.002** [0.001]	-0.002** [0.001]	167/24

d. GDP per capita growth rate

Dependent variable	Conflict countries	Developing-countries control	Regional-countries control	Obs./ countries
Constant	1.730 [2.428]	1.186 [2.388]	1.121 [2.461]	166/24
Post-war trend	1.552* [0.912]	1.574* [0.894]	1.292 [0.936]	166/24
Interaction term	-0.125* [0.067]	-0.141** [0.066]	-0.106 [0.068]	166/24

Note: Interaction term = Post-war trend * Years of war

Appendix 1: Data sample

Country	War years	Economic					
		GDP per capita	GDP per capita growth rate	Invest-ment share	Govt expen-diture	Military expen-diture	Inflation
Afghanistan	1978 - 2001						
Algeria	1993 - 2001						
Angola	1975 - 2001						
Argentina	1975						
Azerbaijan	1992 - 1994	*	*	*	*	*	*
Bosnia and Herzegovina	1992 - 1993	*	*				*
Burma	1961 - 1978	*	*				*
Burma2	1992 - 1994	**	**				**
Burundi	1998 - 2002						
Cambodia	1967 - 1978						
Cambodia2	1989				*		
Chad	1965 - 1990	**	*	**	**		*
Colombia	1989 - 2002						
El Salvador	1981 - 1990	**	**	**	**		**
Ethiopia	1974 - 1991						
Guatemala	1969 - 1987	**	**	**	**	*	**
India	1988 - 2003						
Indonesia	1975 - 1978	**	**	**	**		**
Iran	1979 - 1982						
Iraq	1961 - 1975						
Iraq2	1988 - 1991						
Laos	1960 - 1973						
Lebanon	1976 - 1990	*	*	*	*		*
Liberia	1990 - 1992	**	**				**
Liberia2	2003						
Morocco	1975 - 1980	**	**	**	**		**
Mozambique	1981 - 1992	**	**	**	*		*
Nepal	2002 - 2003						
Nicaragua	1978 - 1988	**	**	**		*	**
Nigeria	1967 - 1970	**	**	**	**		**
Pakistan	1971 - 1974	*	*	*	*		*
Peru	1981 - 1993	**	**	**	**		
Philippines	1978 - 1992	**	**	**	**		**
Russia	1995 - 2001						
Rwanda	1991 - 2001						
Sierra Leone	1998 - 1999						
Somalia	1989 - 1992						
South Africa	1980 - 1988	**	**	**	**	*	**
Sri Lanka	1971 - 1971	**	**	**	**		**
Sri Lanka2	1989 - 2001						
Sudan	1963 - 1972	*	*		*		*
Sudan2	1983 - 2003						
Syria	1982 - 1982	**	**	**	**		**
Tajikistan	1992 - 1993	**	**	*	**		**
Uganda	1979 - 1991	**	**	**	*		*
Yemen	1994	**	**	*	*	*	*
Yugoslavia	1991 - 1999						
Number of country-war observations	pre-post	18	17	14	12	0	13
	post only	24	24	19	20	5	

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Appendix 1: Data sample (continued)

Country		Health and Education					Political
		Infant mortality	Adult female mortality	Adult male mortality	Primary school enrollment	Secondary school enrollment	Polity 2
Afghanistan							
Algeria							
Angola							
Argentina							
Azerbaijan		**	**	**	**	**	*
Bosnia and Herzegovina		**	**	**			
Burma		*	*	*	*	*	*
Burma2		**	**	**	**	**	**
Burundi							
Cambodia		*	**	**	**	*	
Cambodia2		**	**	**	**	**	*
Chad		*	**	**	**	**	**
Colombia							
El Salvador		**	**	**	**	**	**
Ethiopia							
Guatemala		**	**	**	**	**	**
India							
Indonesia		**	**	**	**	**	**
Iran							
Iraq							
Iraq2		*	*	*	*	*	*
Laos		*	*	*	*	*	*
Lebanon		**	**	**	**	**	
Liberia			**	**	**	**	**
Liberia2							
Morocco		**	**	**	**	**	**
Mozambique		**	*	*	**	**	**
Nepal							
Nicaragua		**	**	**	**	**	**
Nigeria		**	*	*	**	**	**
Pakistan		*	*	*	*	*	*
Peru		**	**	**	**	**	**
Philippines		**	**	**	**	**	**
Russia							
Rwanda							
Sierra Leone							
Somalia		**	**	**			**
South Africa		*	**	**	**	**	**
Sri Lanka		**	*	*	**	**	**
Sri Lanka2							
Sudan		*	*	*	*	*	*
Sudan2							
Syria		**			**	**	**
Tajikistan		**	**	**	*	*	*
Uganda		**	*	*	**	**	**
Yemen		**	**	**	**	**	*
Yugoslavia							
Number of country-war observations	pre-post	20	21	21	21	20	17
	post only	28	26	26	27	27	26

Appendix 1: Data sample (continued)

Country		Political		Demographic			Conflict
		Civil liberties and political rights	Law and order	Old dependency ratio	Young dependency ratio	Female-male ratio	Terrorist attacks
Afghanistan							
Algeria							
Angola							
Argentina							
Azerbaijan		*		**	**	**	**
Bosnia and Herzegovina		*		**	**	**	**
Burma		*		*	*	*	*
Burma2		**	*	**	**	**	**
Burundi							
Cambodia		*		**	**	**	*
Cambodia2		**		**	**	**	**
Chad		*		**	**	**	*
Colombia							
El Salvador		**	*	**	**	**	**
Ethiopia							
Guatemala		*	*	**	**	**	*
India							
Indonesia		*		**	**	**	**
Iran							
Iraq							
Iraq2		*	*	*	*	*	*
Laos		*		*	*	*	*
Lebanon		*	*	**	**	**	**
Liberia		**	*	**	**	**	**
Liberia2							
Morocco		*		**	**	**	**
Mozambique		**	*	**	**	**	**
Nepal							
Nicaragua		**	*	**	**	**	**
Nigeria		*		**	**	**	*
Pakistan		*		*	*	*	*
Peru		**	*	**	**	**	**
Philippines		**	*	**	**	**	**
Russia							
Rwanda							
Sierra Leone							
Somalia		**	*	**	**	**	**
South Africa		**	*	**	**	**	**
Sri Lanka		*		**	**	**	*
Sri Lanka2							
Sudan		*		*	*	*	*
Sudan2							
Syria		**	*	**	**	**	**
Tajikistan		*		**	**	**	**
Uganda		**	*	**	**	**	**
Yemen		*	*	**	**	**	**
Yugoslavia							
Number of country-war observations	pre-post	12	0	24	24	24	19
	post only	29	15	29	29	29	29

Note: Countries marked with double asterisks are in the sample for Table 1 and 3. Countries marked with a single asterisk are in the sample for Table 3.

Appendix 2: Variables' definition and sources

Variables	Definition	Source
Internal/external wars	Conflicts resulting in more than 1000 battle-related deaths per year for every year in the period	International Peace Research Institute, Oslo (PRIO)
GDP per capita	Real GDP per capita	Authors' calculation with data from Penn World Tables 5.6 and World Bank's World Development Indicatiors
GDP per capita growth rate	Real GDP per capita growth rate (%)	Authors' calculation with data from Penn World Tables 5.6 and World Bank's World Development Indicatiors
Investment share	Investment share of real GDP per capita (unit %)	Penn World Tables 6.1
Government expenditure	General government final consumption expenditure (% of GDP)	World Bank's World Development Indicatiors
Inflation	Inflation, GDP deflator (annual %).	World Bank's World Development Indicatiors
Military expenditure	Military expenditure (% of central government expenditure)	World Bank's World Development Indicatiors
Infant mortality	Mortality rate, infant (per 1,000 live births)	World Bank's World Development Indicatiors
Female mortality	Mortality rate, adult, female (per 1,000 female adults)	World Bank's World Development Indicatiors
Male mortality	Mortality rate, adult, male (per 1,000 male adults)	World Bank's World Development Indicatiors
Primary school enrollment	School enrollment, primary (% gross)	World Bank's World Development Indicatiors and Barro & Lee Dataset
Secondary school enrollment	School enrollment, secondary (% gross)	World Bank's World Development Indicatiors and Barro & Lee Dataset
Polity2	A combined polity score (computed by subtracting the autocracy score from the democracy score) An additive twenty-one-point scale (-10 to10), with 10 representing the highest degree of democracy and -10 the lowest	Polity IV
Civil liberties and political rights	Civil liberties and political rights = (political rights + civil liberties)/2 In Freedom House, countries whose combined average ratings for political rights and civil liberties fell between 1.0 and 3.0 (i.e., 1.0≤avg_pr_cl<3.0) were designated "free", between 3.0 and 5.5(i.e., 3.0≤avg_pr_cl<5.5) "partly free", and between 5.5 and 7.0 (i.e., 5.5≤avg_pr_cl≤7.0) "not free".	Freedom House
Law and order	Measured on a 0-6 scale, with 6 representing the best quality of law and order and 0 the lowest	International Country Risk Guide (ICRG) Monthly data for June is selected to represent the whole year.
Old dependency ratio	Old dependency ratio = population over age 65 /population between age15-64 (%)	Authors' calculation from World Bank's World Development Indicatiors
Young dependency ratio	Young dependency ratio = population under age 14 /population between age15-64 (%)	Authors' calculation from World Bank's World Development Indicatiors
Female-male ratio	Female-male ratio = female population / male population (%)	Authors' calculation from World Bank's World Development Indicatiors
Terrorism	Number of terrorism incidents per 10 million people A terrorism incident occurs in that country if the country is the end location of the incident or the start location of hijacking.	ITERATE

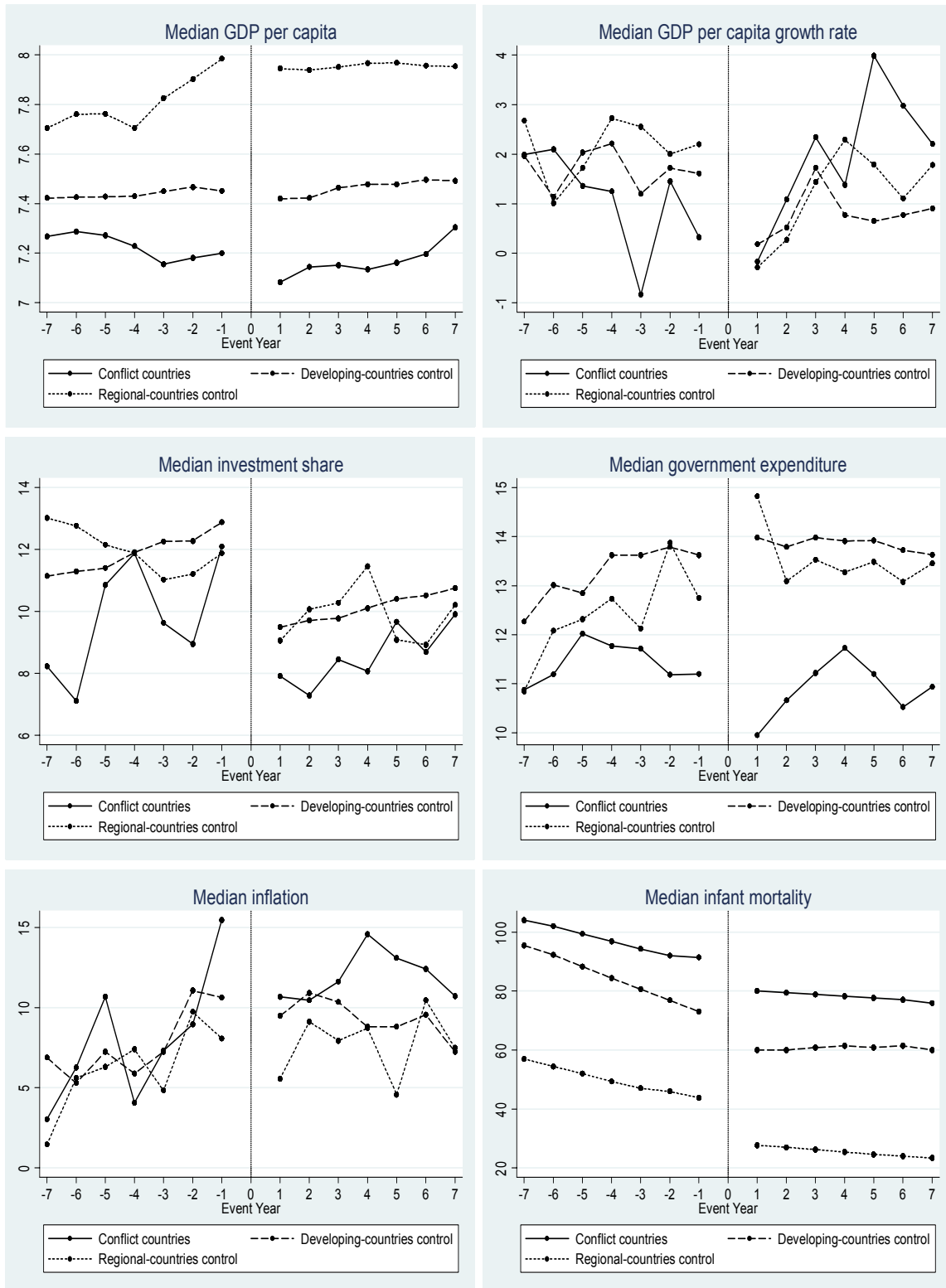## Figure 1: Pre- and post-war comparison
Sample median by event year
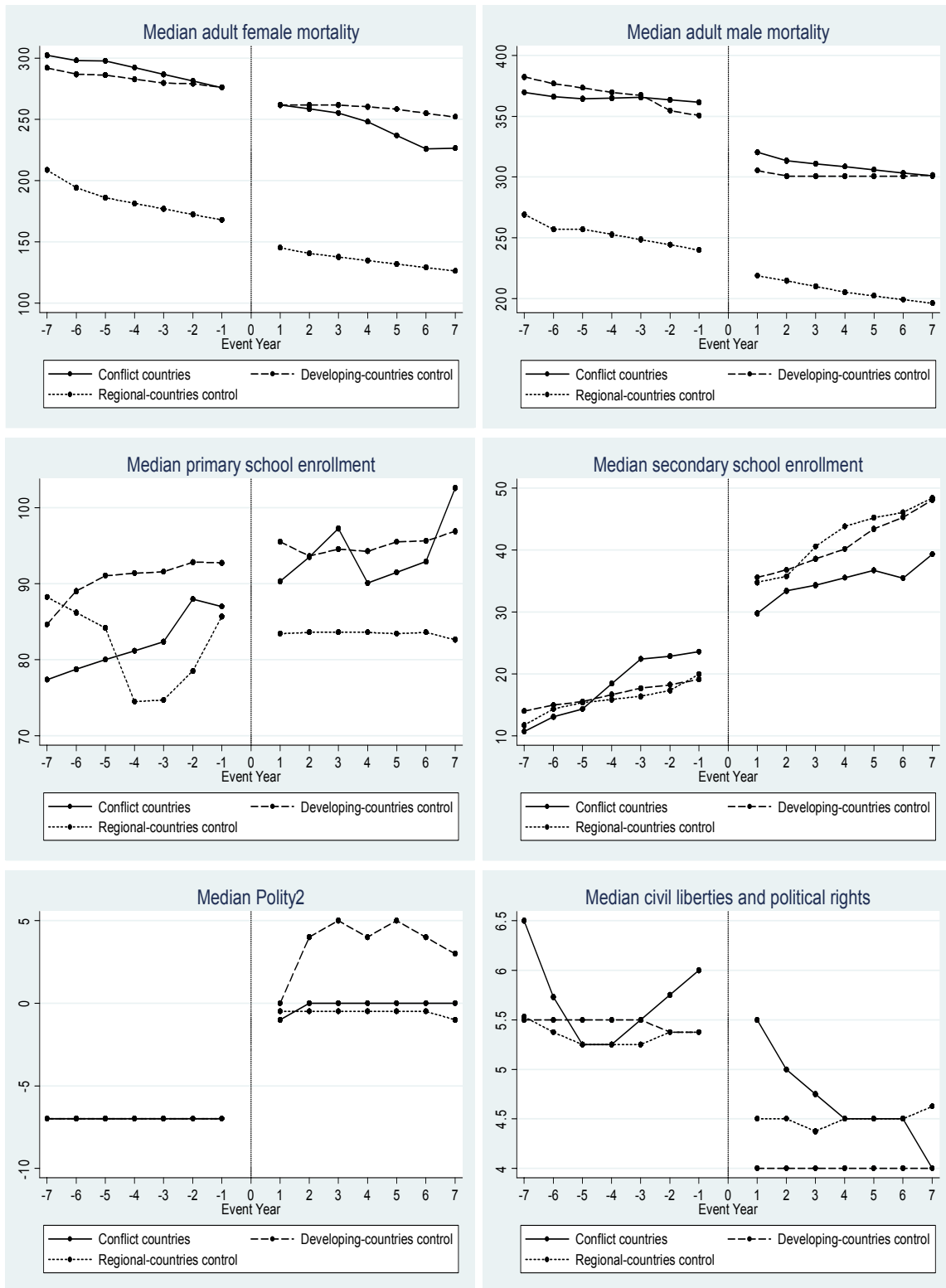
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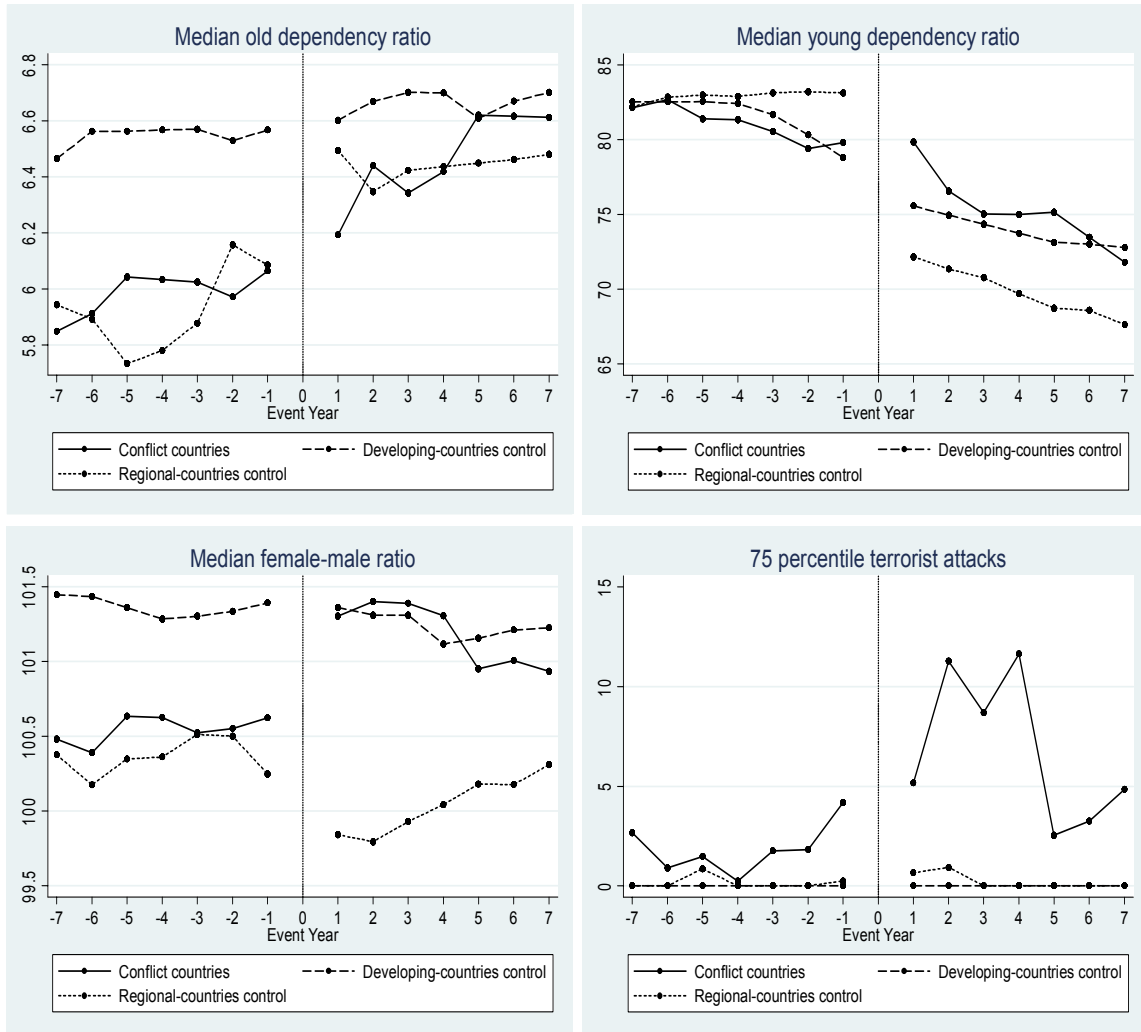
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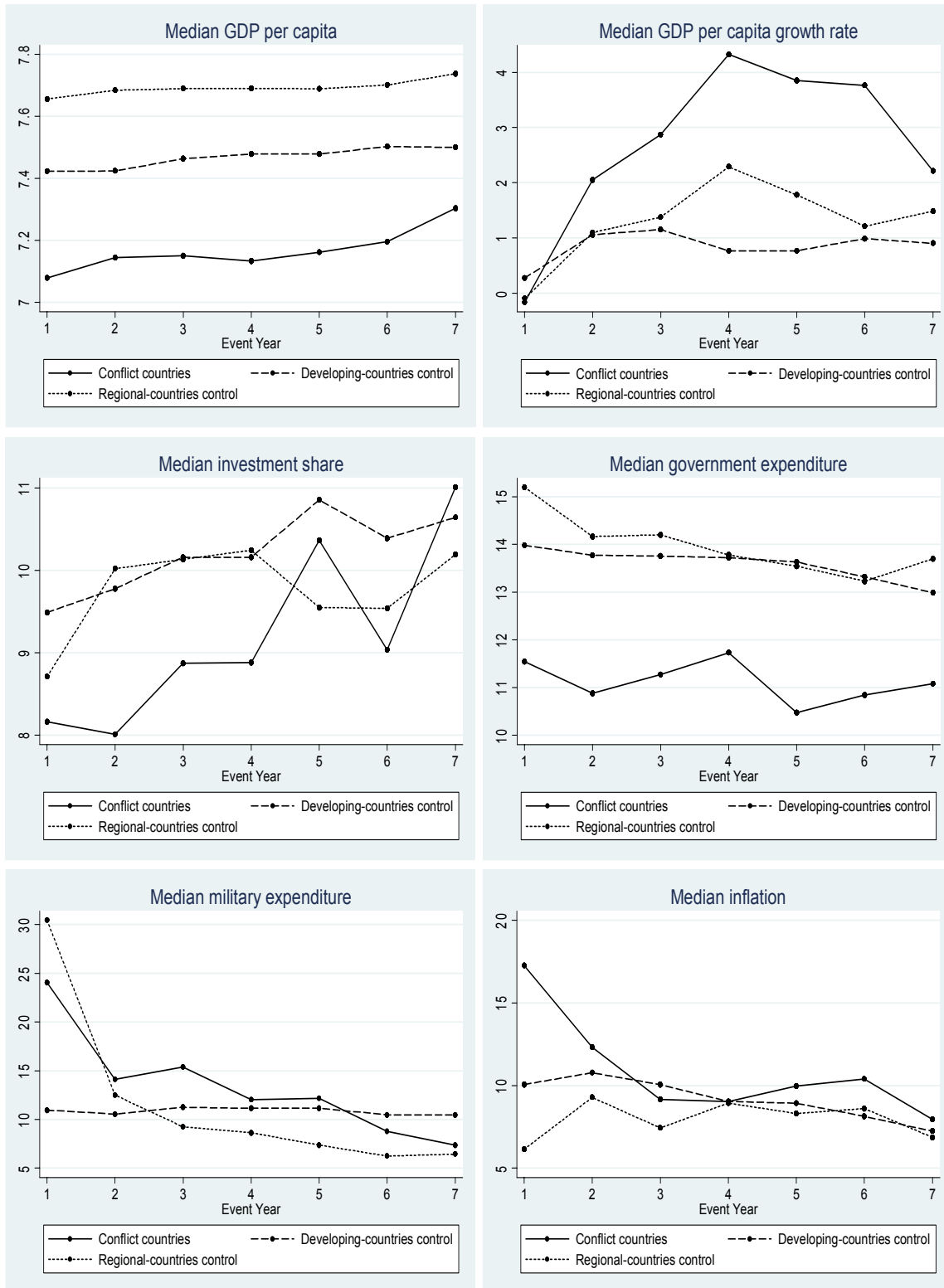
Figure 2: The aftermath of conflicts
Sample median by event year

Figure 2 (continued)

Figure 2 (continued)