The Aftermath of Civil War

Siyan Chen, Norman V. Loayza, and Marta Reynal-Querol

Using an event-study methodology, the article analyzes the aftermath of civil war in a cross-section of countries. It focuses on cases where the end of conflict marks the beginning of relatively lasting peace. The analysis considers 41 countries involved in internal wars over the period 1960–2003. To provide a comprehensive evaluation of the aftermath of war, a range of social areas is considered: basic indicators of economic performance, health and education, political development, demographic trends, and conflict and security issues. For each indicator the post- and pre-war situations are compared and their dynamic trends during the post-conflict period are examined. The analysis is conducted in both absolute terms and relative to control groups of countries that are similar except for conflict. The findings indicate 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 achieved. JEL code: O11

War has devastating consequences, including death, displacement of people, and destruction of public infrastructure and physical and social capital. Two comprehensive analyzes of post-conflict situations conclude that the economic and social costs of civil wars are not only deep but also persistent, lasting for years after the end of conflict (World Bank 2003; Fosu and Collier 2005). However, when the end of war represents the beginning of lasting peace, there are good reasons to believe that recovery is possible, albeit gradual. This is what neoclassical models of economic growth and convergence would predict and what the evidence of recovery in Europe, the Republic of Korea, and Vietnam, among other examples, would seem to indicate.

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Most of the scarce literature on the consequences of civil war focuses on the costs during conflict; few studies analyze the costs of civil war after peace agreements are signed. Working with a cross-section of countries with well-defined pre- and post-war periods, this study uses an event-study methodology to evaluate the economic, social, and political effects in the aftermath of civil wars. Although mainly descriptive, the article provides motivation and evidence on various hypotheses concerning the consequences of internal wars. It is hoped that this study will induce more specific and more analytical research on these issues.

The article is organized as follows. Section I reviews the literature on the costs of civil wars. Section II describes the data, their sources, and the methodology used. Section III presents the results on pre-war–post-war changes and identifies trends after the war. Section IV offers some concluding remarks.

I. REVIEW OF THE LITERATURE

Wars kill people, destroy infrastructure, weaken institutions, and erode social trust. The destruction of infrastructure and institutions leaves the population living in conditions that increase the risk of disease, crime, political instability, and further conflict. The World Bank (2003) reviews the literature on the costs of civil war. The collection of articles in Fosu and Collier (2005) provides a critical analysis of post-conflict situations, with a particular focus on Sub-Saharan Africa. These articles examine the conditions and policies that support or undermine sustainable peace after conflict. Collier (1999) finds that economic growth is 2.2 percent points lower during civil wars than it is during peace. Using World Health Organization data on 23 major diseases, Ghobarah, Huth, and Russett (2003) find that civil war significantly increases the incidence of death and disability resulting from contagious diseases. Soares (2006) estimates the welfare cost of violence in a sample of countries applying a willingness-to-pay approach to account for the health consequences of war. He estimates that the civil conflict in Colombia, which reduced life expectancy at birth by 2.2 years, cost the country 9.7 percent of GDP.

Other studies focus on the effects of civil war on neighboring countries. Murdoch and Sandler (2002, 2004) show that civil wars reduce growth over an entire region of neighboring countries. Montalvo and Reynal-Querol (2007) explore the influence of refugees from civil wars on the incidence of malaria in refugee-receiving countries. They show that for every 1,000 refugees, 2,000–2,700 cases of malaria occur 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.

Organski and Kugler (1977, 1980) analyze the economic effects of both world wars on a sample of mainly European countries. They find that the

effects of war dissipate in the long run (15–20 years) for both losers and winners, with both types of countries usually returning to pre-war growth trends.

Barro and Sala-i-Martin (1995) explain post-war recoveries in Germany and Japan. They claim that whenever a war impairs one factor of production more than others, the rate of return of the other factors increases, creating the forces of convergence that spur rapid growth.

In a cross-country empirical analysis Przeworski and others (2000) find that post-war economic recovery is rapid. Their results indicate that the average annual rate of growth during the 5 years following a war is 5.98 percent. They also find that wars cause more damage under dictatorships than under democracies but that recoveries are more rapid under dictatorships than under democracies.

Collier and Hoeffler (2004) provide a systematic empirical analysis of aid and policy reform in the post-conflict growth process, 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 absorptive capacity during the first three post-conflict years is no greater than normal but roughly doubles over the next 7 years. They also find that growth is more sensitive to policy in post-conflict societies.

Miguel and Roland (2005) analyze the impact of the U.S. bombing of Vietnam on that country's subsequent economic development. Comparing heavily bombed districts with the rest of the country, they find that U.S. bombing did not have a lasting negative impact on poverty rates, consumption levels, infrastructure, literacy, or population density, as measured in 2002. They conclude that local recovery from the damage of war can be achieved if "certain conditions" are met.

Several studies use the methodology adopted here. Davis and Weinstein (2002) consider the Allied bombing of Japanese cities in World War II as a shock to the relative size of the cities. They find evidence of an extremely powerful recovery in the wake of the destruction, with the relative sizes of most cities returning to their pre-war levels within about 15 years.

Abadie and Gardeazabal (2003) analyze the impact of terrorism on firms in the Basque country. They find that firms with a significant presence there performed better than other firms did when the truce became credible and worse when the ceasefire ended.

Chen and Siems (2004) assess the effects of terrorism on global capital markets. They examine the U.S. capital market's response to 14 terrorist attacks since 1915 and the response of global capital markets to Iraq's invasion of Kuwait in 1990 and the September 11, 2001, terrorist attacks in the United States. They find that terrorist attacks and military invasions have great potential to affect international capital markets over a short period of time and that U.S. capital markets recover sooner than other global capital markets.

II. Data and Methodology

An event-study methodology is used to analyze the aftermath of war in a cross-section of countries. Calendar time is transformed into "event time" in order to aggregate a collection of experiences that share a particular event in common and extract meaningful statistics from them.[1]

A host of social areas is examined, measured by basic indicators of economic performance, health and education, political development, demographic trends, and conflict and security issues. Each indicator is compared before and after the war, and dynamic trends during the post-conflict period are identified.[2] The aim is to understand the nature of the recovery from war in order to document the costs of war and the extent of any peace dividend.

In exploring the patterns of behavior of various economic, social, and political variables in post-war countries, the study focuses on internal (or civil) conflicts. Information on these conflicts comes from the armed conflict data set of the International Peace Research Institute (PRIO) in Oslo. Internal and internationalized internal armed conflicts are classified as internal wars.[3] The analysis focuses on major conflicts, limiting the sample to countries with more than 1,000 battle-related deaths a year.

The study examines the following variables (defined in appendix table A-1):

(1) 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.
(2) Health and education, represented by the rates of infant mortality, adult female mortality, adult male mortality, and primary- and secondary-school enrollment.
(3) Political development, including indices of democracy and autocracy, civil liberties and political rights, and law and order.
(4) Demographic development, measured by the old-age dependency ratio, the youth dependency ratio, and the female–male ratio.
(5) Other forms of conflict, specifically the incidence of terrorist attacks.

The occurrence of a war is the event that anchors the data. The last year before the start of a war is defined as event year −1, the next-to-last year as event

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1. For other presentations of this methodology, see Bruno and Easterly (1998) and Wacziarg and Welch (2003).

2. As explained later in the text, the comparative analysis takes into account unobserved country-specific effects. Moreover, it considers the experience of conflict countries both on their own and with respect to two control groups of countries.

3. 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 by other states.

year −2, and so on; the first year after the end of a war is defined as event year 1, the second year as event year 2, and so on. Given the nature of the comparative exercise and the availability of data, the war years are excluded from the analysis.

The definition of the war event is crucial to the empirical evaluation. It is defined so that the pre- and post-conflict periods can be characterized as relatively free of war. At least 10 years of peace after the war are needed to ensure that the aftermath following the true resolution of an armed conflict is analyzed. This means that in cases of prolonged conflicts with temporary ceasefire periods, the "war event" includes the war, a (short) interwar peace, and the resumption of war. Where a country undergoes two wars with more than 10 years of peace in between, the wars are treated as independent events.[4]

The pre-conflict period is defined as the 7 years before the war and the post-conflict period as the 7 years after the war. One problem in applying the event-study methodology is that the sample changes across event years. Ideally, one should have a constant sample made up of the same countries for all event years. Unfortunately, for each variable, data on several countries are available only for a subset of the years under consideration. Data on per capita GDP growth, for example, may be available for the first 3 years after the war but not thereafter. Moreover, because the sample period is 1960–2003 and the analysis looks at 7 years before and after the war, conflicts had to begin no earlier than 1967 and end no later than 1996 to be included. If, in addition, the requirement of a perfectly constant sample were imposed, the sample could end up being too small.

Given these tradeoffs, the criteria for inclusion in the sample are set in the following way. For the comparison of pre- and post-war periods a country is included in the sample for a particular variable if it has at least 7 years of observations on the variable during the 7-year period before the war and the 7-year period after the war. (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 imposed only on event years after the war (that is, a country need not have full pre-war data). It is likely that a country meets the requirement for one variable but fails to do so for another.

The empirical analysis studies the typical patterns of countries that experienced civil war, examining first the average difference between the pre- and post-war periods and then the average rates of change in the years after the war. The analysis considers the experience of conflict countries both on their own and with respect to two control groups of countries: the full sample of non-conflict developing countries and the subset located in the geographic

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4. A concern arises when some countries experience external war during the period before or after the civil conflict. In such cases the periods around the war event cannot be characterized as peaceful. To eliminate this contamination, these countries are excluded from the samples for all variables.

region of the conflict country. As some of the variables under consideration may follow world trends (the wave of democratization in the case of political development variables, the discovery of new vaccines in the case of health indicators), comparison with the full sample of developing countries is necessary to separate these trends from the real costs of war and the merits of pacification. The comparison with respect to countries in the region is relevant because it can capture some of these 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 countries in the group susceptible to the effects of war.

The potential disadvantages of both control groups are reduced by the way in which the comparisons are made. For each indicator variable the control value is measured as the median for the control group in the calendar year corresponding to the event year. The difference between the conflict-country value and the control value in a given event year is then calculated for each variable. A series of differences is generated for each of the control groups.

Seventeen countries are examined in the comparison of the per capita GDP growth rate before and after the war; these countries, together with another seven on which pre-war information is not available, are used to evaluate the post-war period only. (Summary information on the country samples is presented in table S.1 in the supplemental appendix to this article, available at http://wber.oxfordjournals.org/.) Because of the lack of data in the pre-war period, three variables—military expenditure, law and order, and terrorist attacks—are examined only in the years after the war.[5]

The sample includes 41 countries (17 in Asia, 15 in Africa, 6 in Latin America, and 3 in Europe) for the period 1960–2003. Six of these countries (Cambodia, Iraq, Liberia, Myanmar, Sri Lanka, and Sudan) were entangled in two internal conflicts.

III. RESULTS

This section reports results on two complementary exercises. First, it estimates and compares the central tendency of each variable before and after the war, both by itself and with respect to the two control groups. It also analyzes the extent to which the duration of the war affects the difference between pre- and post-war growth in per capita GDP. Second, it estimates the average rate of change of each variable during the post-conflict period both by itself and with respect to the two control groups. The analysis also examines whether the duration of the war affects the level and the rate of change of per capita GDP in the post-war period.

5. *World Development Indicators* (World Bank, 2005), for example, began collecting military expenditure data (as a percentage of central government expenditures) in 1990; the International Country Risk Guide (PRS Group, 2005) began providing ratings on law and order only after 1984.

The following regression equations are used. For the pre-war–post-war comparison:

(1)
$$y_{i,t} = \alpha_1 + \alpha_2^* \text{Post}_{i,t} + \mu_i + \varepsilon_{i,t}$$

(2)
$$y_{i,t} = \alpha_1 + \alpha_2^* \text{Post}_{i,t} + \alpha_3^* \text{Dur}_i^* \text{Post}_{i,t} + \mu_i + \varepsilon_{i,t}$$

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

For the post-war exercise, the following regression equations are used:

(3)
$$y_{i,t} = \beta_1 + \beta_2^* \text{Year}_t + \mu_i + \varepsilon_{i,t}$$

(4)
$$y_{i,t} = \beta_1 + \beta_2^* \text{Year}_t + \beta_3^* \text{Dur}_i^* \text{Year}_t + \mu_i + \varepsilon_{i,t}$$

where Year indicates the event year after the war (1–7); β_2, the main coefficient of interest, 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 terms of its deviation from the median of each control group. It can take three values:

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

where $\bar{y}_{i,\,t}$ represents the median of the non-conflict developing-country control group associated with country i in year t, and $\tilde{y}_{i,\,t}$ 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 only the estimated α_2 and β_2 coefficients and associated standard errors for the three versions of each dependent variable.

Two sets of figures are provided as complements to the tables. In figure 1 are plotted the medians in each event year (7 years before the war and 7 years after) for the conflict countries and the control groups. In figure 2 are plotted the medians in each event year after the war (the sample for post-war analysis

TABLE 1. Pre-war−Post-war Changes in Economic, Social, and Political Indicators in Conflict Countries

Dependent Variable	Absolute Pre-war−Post-war Difference	Pre-war−Post-war Difference relative to Developing-Country Control Group	Pre-war−Post-war Difference relative to Regional-Country Control Group	Number of Observations/ Number of Countries
Economic				
GDP per capita	−0.150** (0.046)	−0.252** (0.044)	−0.283** (0.043)	249/18
GDP per capita growth rate	2.381* (1.299)	3.395** (1.277)	4.609** (1.537)	235/17
Investment Share	0.166 (0.477)	1.387** (0.432)	1.014* (0.589)	192/14
Government expenditure	0.957** (0.341)	0.137 (0.357)	−0.782 (0.512)	165/12
Inflation	13.048** (5.404)	10.643** (5.319)	11.673** (5.350)	176/13
Health and education				
Infant mortality	−24.311** (1.259)	−3.314** (0.924)	2.095 (1.565)	280/20
Adult female Mortality	−32.202** (5.332)	−5.129 (4.956)	6.219 (4.663)	292/21
Adult male Mortality	−32.966** (4.932)	22.962** (4.670)	10.356** (4.665)	292/21
Primary-school enrollment	13.207** (1.679)	5.814** (1.515)	3.613** (1.799)	292/21
Secondary-school enrollment	16.680** (1.235)	−5.853** (1.343)	−1.907 (1.368)	276/20
Political				
Polity2	4.437** (0.531)	−3.128** (0.469)	−1.067** (0.474)	227/17
Civil liberties and political rights	−0.853** (0.130)	0.342** (0.127)	0.073 (0.153)	165/12
Demographic				
Old-age dependency ratio	0.510** (0.067)	0.372** (0.067)	0.111 (0.071)	333/24
Youth dependency ratio	−5.321** (0.745)	0.540 (0.725)	2.940** (0.712)	333/24
Female−male ratio	0.741** (0.216)	1.025** (0.221)	1.606** (0.280)	333/24
Conflict				
Terrorist attacks	0.634 (1.421)	0.634 (1.421)	0.677 (1.410)	265/19

Note: Numbers in parentheses are standard errors.

*Significant at the 10 percent level; **significant at the 5 percent level.

Source: Authors' calculations based on data described in the text.

in figure 2 is larger than that for the pre-war−post-war comparisons in figure 1).

Pre- and Post-war Comparisons

Visual examination of the trends before and after war can be illustrative and motivate more precise statistical analyzes. Three types of behavior are

T A B L E 2 . Effect of Duration of War on Pre-war–Post-war Changes in the Level and Growth of per Capita GDP in Conflict Countries

Explanatory Variable	Absolute	Relative to Developing-Country Control Group	Relative to Regional-country Control Group	Number of Observations/ Number of Countries
Dependent variable: GDP per capita				
Constant	7.071** (0.032)	−0.394** (0.030)	−0.705** (0.029)	249/18
Post-war dummy variable	−0.144 (0.091)	−0.189** (0.087)	−0.136* (0.082)	249/18
Interaction term (post-war dummy variable* years of war)	−0.001 (0.007)	−0.008 (0.007)	−0.017** (0.006)	249/18
Dependent variable: GDP per capita growth rate				
Constant	2.868** (1.123)	2.010* (1.099)	2.153* (1.159)	235/17
Post-war dummy variable	2.499 (2.676)	2.502 (2.634)	4.858 (2.981)	235/17
Interaction term (post-war dummy variable* years of war)	−0.015 (0.202)	0.118 (0.200)	−0.033 (0.217)	235/17

Note: Numbers in parentheses are standard errors.

*Significant at the 10 percent level; **significant at the 5 percent level.

Source: Authors' calculations based on data described in the text.

evident (figure 1). Some variables (per capita GDP level and growth, investment share, inflation rate, Polity 2, civil and political rights, female–male ratio, and incidence of terrorism) exhibit different patterns (including different levels) before and after the war. Other variables (mortality rates, educational enrolment 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. Two other variables (investment rate and government expenditures) display no discernible level change.

Statistical analysis can reveal whether average or typical patterns are representative of the sample or if cross-country heterogeneity prevents any summary conclusion. For this purpose fixed-effects regressions are used to estimate and compare the means per period. Estimation through country fixed-effects allows to control for inherent country characteristics that are unrelated to the transition from war to peace.

MACROECONOMIC INDICATORS. The average level of per capita GDP is significantly lower after the war than before it, particularly in relation to the control groups (table 1). This is undoubtedly a direct reflection of the cost of war. In contrast, the average growth rate of per capita GDP in conflict countries appears to be significantly higher after than before it (by about 2.4 percent points). The increase is even more pronounced when compared with the

TABLE 3. Post-war Trends in Economic, Social and Political Indicators in Conflict Countries

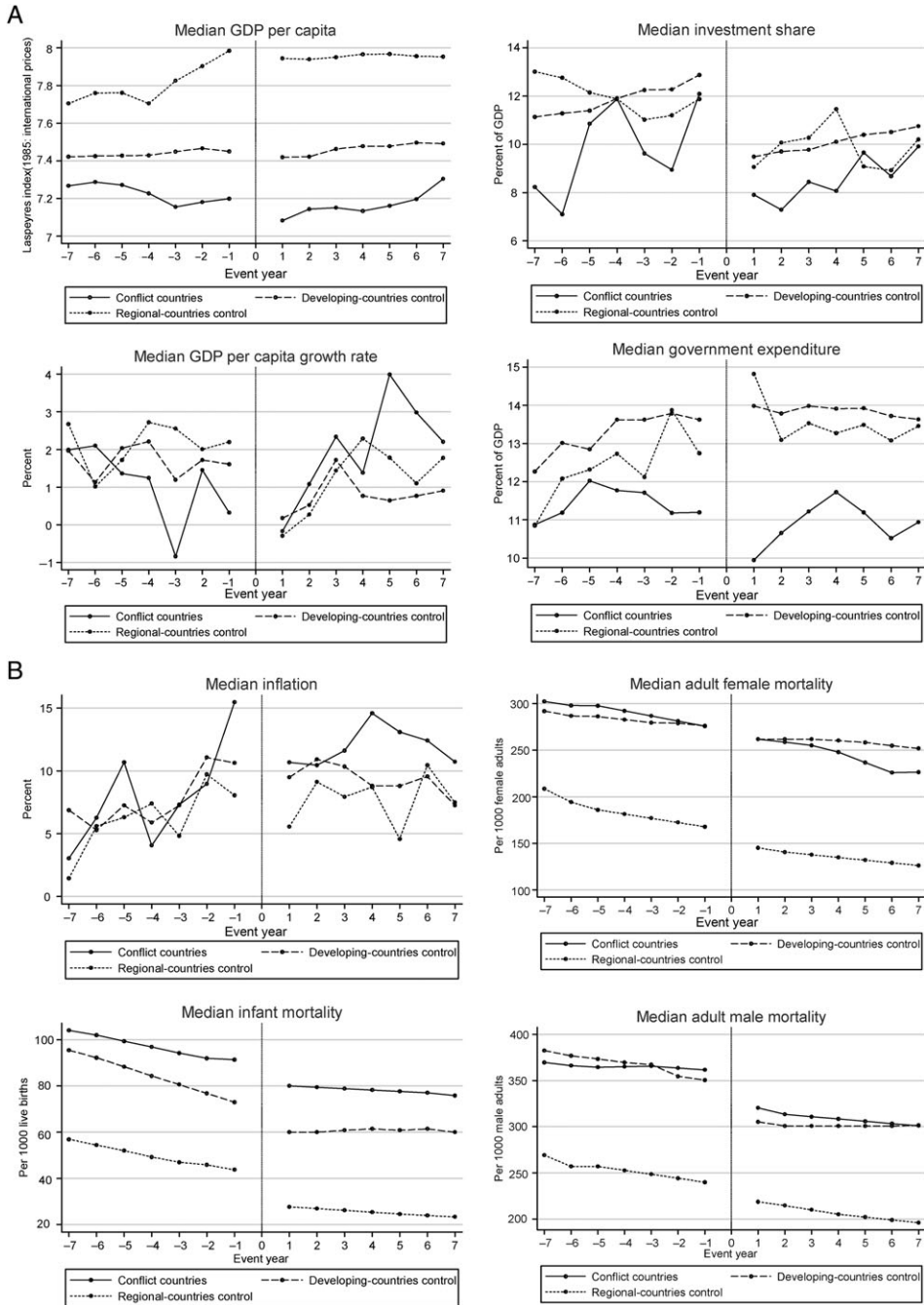| Dependent Variable	Absolute Trend	Trend Relative to Developing-Country Control Group	Trend Relative to Regional-Country Control Group	Number of Observations/ Number of Countries
Economic				
GDP per capita	0.036** (0.006)	0.026** (0.006)	0.027** (0.006)	167/24
GDP per capita growth rate	0.458 (0.492)	0.349 (0.487)	0.372 (0.493)	166/24
Investment share	0.141 (0.111)	0.017 (0.100)	0.275* (0.163)	129/19
Government expenditure	−0.259** (0.092)	−0.136 (0.094)	−0.185 (0.121)	139//20
Military expenditure	−1.355** (0.415)	−0.923** (0.417)	−0.627 (0.503)	26/5
Inflation	−6.931** (2.753)	−6.391** (2.732)	−4.905* (2.770)	156/23
Health and education				
Infant mortality	−1.155** (0.197)	−0.317 (0.201)	0.151 (0.197)	195/28
Adult female mortality	−2.459** (0.538)	−0.335 (0.571)	−0.666 (0.592)	181/26
Adult male mortality	−2.038** (0.555)	−0.616 (0.525)	−0.227 (0.558)	181/26
Primary-school enrollment	2.064** (0.478)	1.592** (0.478)	1.684** (0.509)	189/27
Secondary-school enrollment	0.820** (0.213)	−1.695** (0.242)	−1.206** (0.256)	187/27
Political				
Polity2	0.059 (0.092)	−0.242** (0.114)	0.054 (0.113)	181/26
Civil liberties and political rights	−0.058** (0.023)	−0.017 (0.024)	−0.035 (0.025)	202/29
Law and order	0.176** (0.042)	0.151** (0.034)	0.111** (0.038)	104/15
Demographic				
Old-age dependency ratio	0.030** (0.015)	0.022 (0.014)	−0.016 (0.014)	202/29
Youth dependency ratio	−0.559** (0.120)	−0.124 (0.127)	0.073 (0.142)	202/29
Female−male ratio	−0.066** (0.029)	−0.041 (0.029)	−0.122** (0.039)	202/29
Conflict				
Terrorist attacks	−1.047** (0.398)	−1.047** (0.398)	−0.995** (0.396)	202/29

Note: Numbers in parentheses are standard errors.

*Significant at the 10 percent level; **significant at the 5 percent level.
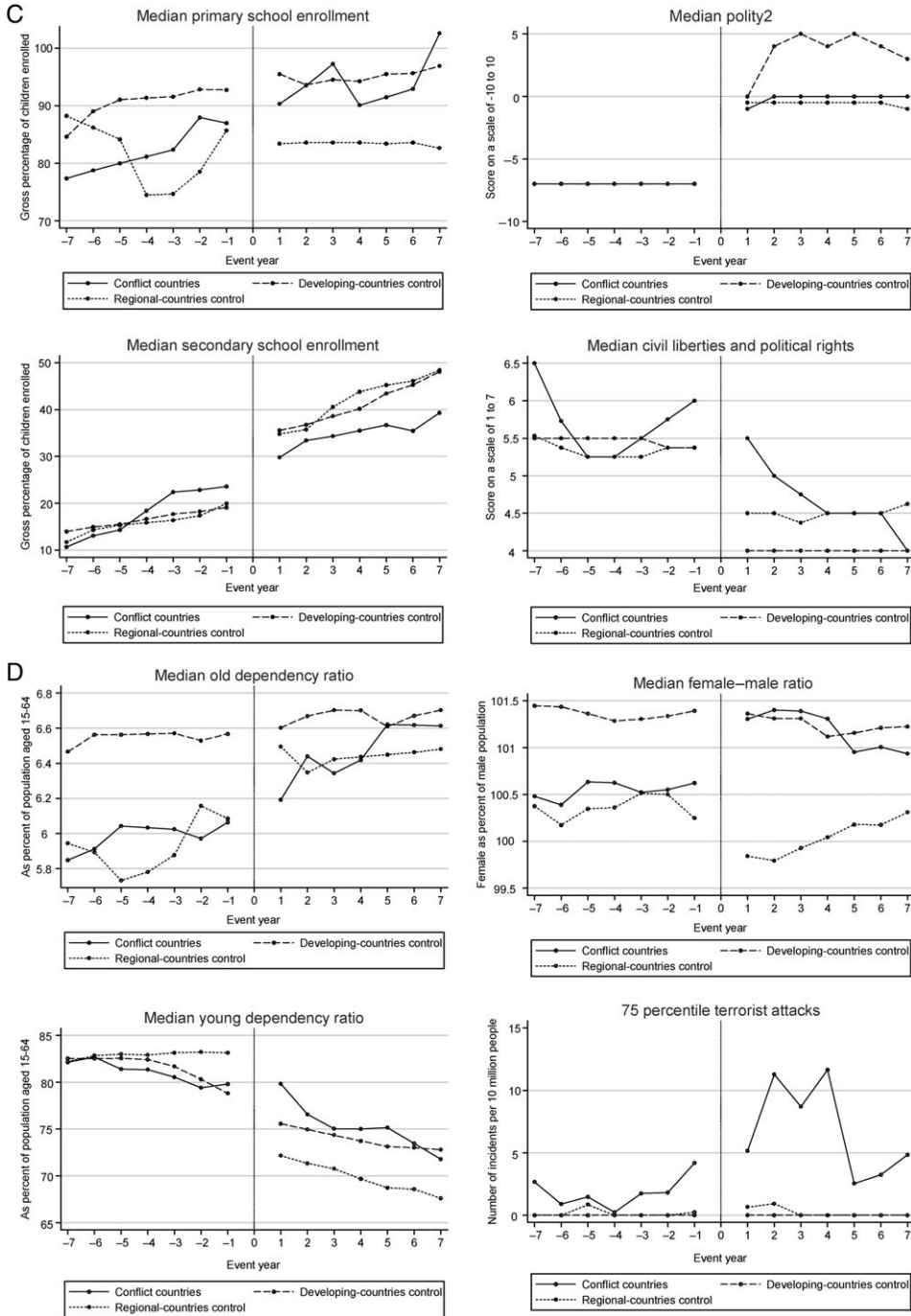
Source: Authors' calculations based on data described in the text.

change experienced by the control groups. These two results are in line with those reported by Barro and Sala-i-Martin (1995) and Przeworski and others (2000): after the destruction from war, recovery is achieved through above average growth. The increase in growth is supported by an increase in the

FIGURE 1. Economic and Social Indicators in Conflict and Non-conflict Countries

Continued

C

Median primary school enrollment

Median polity2

Median secondary school enrollment

Median civil liberties and political rights

D

Median old dependency ratio

Median female–male ratio

Median young dependency ratio

75 percentile terrorist attacks

Source: Authors' analysis based on data described in the text.

investment rate. The contribution from capital accumulation, however, seems to be weak and significant only compared with the control groups, suggesting that the increase in growth also reflects a recovery in capacity utilization and, possibly, improved factor productivity.

Government expenditure (as a percentage of GDP) increases about 1 percentage point between the pre- and post-war periods and may contribute to higher growth. The change is not significantly different from that experienced in the control groups however, perhaps because the expansion in government expenditures has less potential to increase growth in countries that are not suffering the consequences of war.

The inflation rate is significantly higher after the war, both absolutely and compared with the control groups. For the few cases for which reliable inflation data during the war are available, inflation increases sharply during the war, as government revenue sources dwindle and then decreases at the onset of peace. (The rate of inflation in the aftermath of war is discussed in the next section.)

HEALTH AND EDUCATION INDICATORS. Considered by themselves (that is, without reference to the control groups), conflict countries display marked improvement in health and education in the post-war period compared with the pre-war period. Compared with the control groups the improvements are less clear-cut. In the case of primary-school enrolment, conflict countries improve not only with respect to their pre-war level but also with respect to the control group. For the other indicators, improvement is the same as or lower than in at least one of the control groups. In the case of infant and adult female mortality, improvement in conflict countries is not significantly different from that of either control group. For adult male mortality and secondary-school enrolment—two variables related to direct combatants—improvement in conflict countries is significantly below that of the control groups. That these health and education indicators improve in absolute terms signals the important influence of world trends even for conflict-ridden countries. That the improvements fall below international standards reflects the unquestionable cost of war.
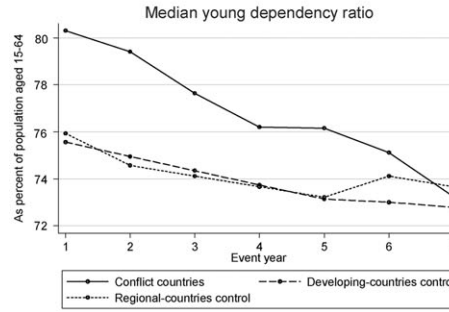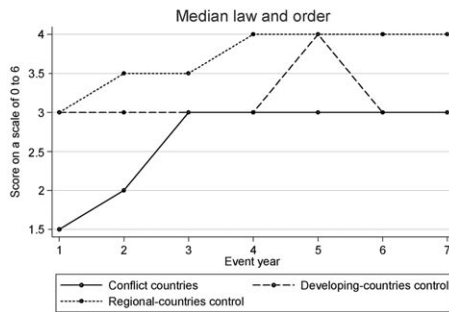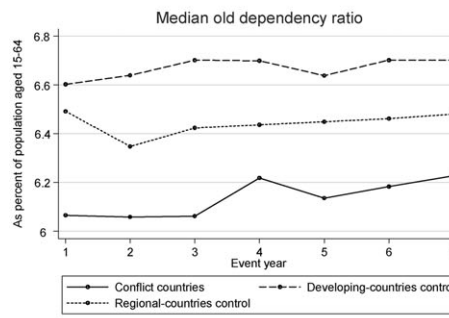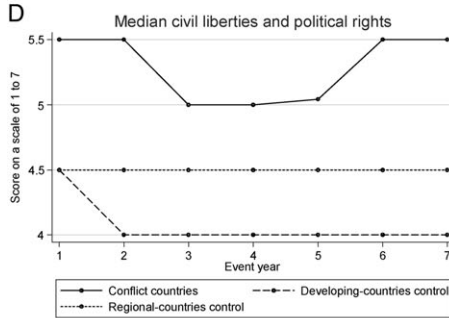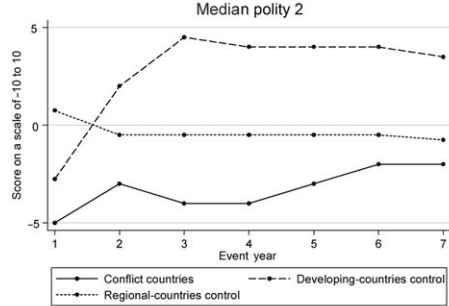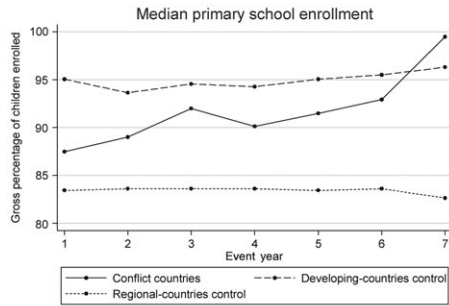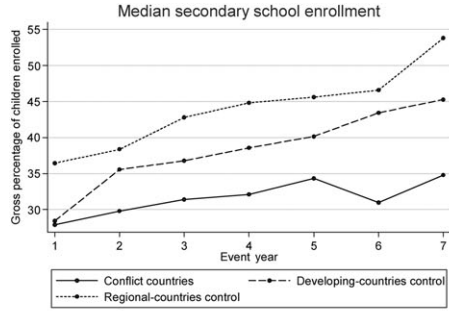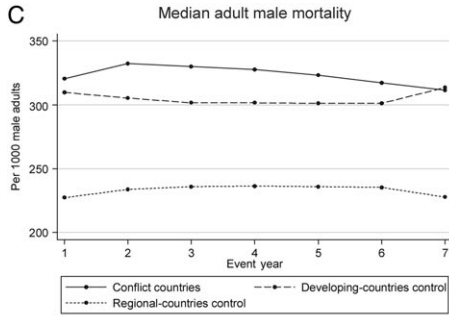
POLITICAL INDICATORS. Polity2, which measures the prevalence of democracy and the absence of autocracy, is higher after the war than before. Freedom House's Gastil measure of civil liberties and political rights (in which a smaller number represents an improvement) also indicates improvement. For both variables, however, improvement falls short of that achieved by the control groups, indicating that the cost of the war is reflected in the failure of conflict countries to achieve international standards.

DEMOGRAPHIC INDICATORS. The old-age dependency ratio (the ratio of the number of people over 65 to the number of people in the ages 15–64) increases following war, changing in a manner similar to the demographic transition.

FIGURE 2. Aftermath of Conflicts

Continued

C

Median adult male mortality

Median secondary school enrollment

Median primary school enrollment

Median polity 2

D

Median civil liberties and political rights

Median old dependency ratio

Median law and order

Median young dependency ratio

Continued

Source: Authors' analysis based on data described in the text.

The increase is more pronounced than that of the developing-country control group but not significantly different from that of countries in the same region. The youth dependency ratio (the ratio of the number of people under age 14 to the number of people in the ages 15–64) declines in absolute terms, which may also be consistent with a demographic transition. However, the youth dependency ratio increases in relative terms relative to other countries in the same region, suggesting a higher death toll among working-age adults during war.

The female–male ratio also changes in a statistically significant manner, with the ratio of women to men larger after the war than before it. 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 most war fatalities are men.

CONFLICT INDICATORS. During the post-war period, the level of terrorist attacks rises over the pre-war level, but the change is not statistically significant in absolute or relative terms (largely because of the large variation across countries). (Figure 1 shows not the median for the variable, which is always 0, but the 75th percentile.)

Table 2 examines 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 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 medians for each indicator for the conflict countries and the two control groups for each of the 7 years after the war reveal several interesting findings (figure 2). Most striking 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 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 recovery does not always represent progress relative to the control groups, it is nonetheless remarkable.

The average trend (or slope) of each indicator is estimated for the sample of conflict countries (table 3). A fixed-effects estimator is used 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 as deviations from the control groups.)

MACROECONOMIC GROWTH INDICATORS. Per capita GDP in conflict countries has a significantly positive trend that is larger than that of any of the control groups. This gradual improvement reflects the higher levels of GDP growth in conflict countries after war. Per capita GDP growth shows no significant linear trend; its pattern appears to follow an inverted *U*, with the strongest results achieved in the fourth or fifth 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 is initially lower than in the regional-country control group, but the two rates converge within a decade of the end of the war. Conflict countries thus appear to raise their per capita GDP to the average levels in their region partly through higher investment rates in the years after the war.

Public finances also changes in the aftermath of civil wars. Government expenditure (as a percentage of GDP) reveals a declining trend that is statistically significant in absolute terms but not relative to the control groups. Military expenditure (as a percentage of government expenditure) reveals a clear and significant declining trend in the aftermath of war, both absolutely and with respect to the developing-country control group. It does not hold when conflict countries are compared with the regional-control groups, possibly because the threat of a civil war becoming an international war may induce countries in the region to increase their military expenditure during the war and decrease it afterward. In brief, after peace is achieved conflict countries gradually reduce their government expenditures and sharply de-emphasize the importance of military expenditure in the use of fiscal resources.[6]

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6. Notable is the contrast between sustainable peace 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.

HEALTH AND EDUCATION INDICATORS. Health and education indicators display a statistically significant improving trend over time in absolute terms. Regarding relative improvement, the average recovery rate for primary-school enrolment is larger in conflict countries than in either of the control groups. In contrast, for secondary-school enrolment, conflict countries underperform compared with both control groups. 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.

POLITICAL INDICATORS. There are some signs of absolute improvement in the political indicators, as measured by the democracy index of Polity2 (positive slope) and the Gastil civil liberties index (negative slope). Only the Gastil civil liberties index is statistically significant, however. Conflict countries do not perform better than the control groups however, especially countries in the same region. In contrast, the International Country Risk Guide Index on law and order shows a marked and significant rate of progress in conflict countries, both in absolute terms and in comparison with the control groups. This result suggests that in the aftermath of civil war, when political rights are slow to advance, police and judicial systems improve at an accelerated rate.

DEMOGRAPHIC INDICATORS. The demographic transition continues in conflict countries in the aftermath of war. In absolute terms, the old-age dependency ratio rises and the youth dependency ratio falls. Relative to both control groups, there is no discernible trend in either ratio, indicating that the pattern of demographic transition in post-conflict countries is the same as in otherwise similar countries. In contrast, the female–male ratio, which rises during the war, exhibits a statistically significant declining trend in its aftermath, both in absolute terms and relative to the regional-country control group. This trend reflects the gradual recovery of the male population from its losses during the war.

CONFLICT INDICATOR. The incidence of terrorist attacks decreases significantly in the aftermath of civil wars, in both absolute terms and in relation to both control groups.[7] 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 marked decline subsequently. The end of the civil war appears to eventually lead to pacification of other types of internal strife.

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

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7. The terrorism data come from the ITERATE project (Mickolus and others 2004). These data largely cover incidents of terrorism with a transnational component. They may therefore imperfectly reflect the domestic nature of terrorist attacks that characterizes post-conflict situations.

TABLE 4. Effect of Duration of War on the Post-war Trends in the Level and Growth of per Capita GDP in Conflict Countries

Variable	Absolute	Relative to Developing-Country Control Group	Relative to Regional-country Control group	Number of Observations/ Countries
Dependent variable: GDP per capita				
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 (post-war trend * years of war)	−0.002** (0.001)	−0.002** (0.001)	−0.002** (0.001)	167/24
Dependent variable: growth of GDP per capita				
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 (post-war trend * years of war)	−0.125* (0.067)	−0.141** (0.066)	−0.106 (0.068)	166/24

Note: Numbers in parentheses are standard errors.

*Significant at the 10 percent level; **significant at the 5 percent level.

Source: Authors' calculations based on data described in the text.

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. However, when the end of war marks the beginning of lasting peace, recovery and improvement are feasible.

The cost of war is reflected in the substantial drop in per capita income suffered by conflict countries during war and in their failure to make as rapid progress 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 enrolment) as countries that did not experience civil war. In other, more basic areas of social development (such as infant mortality and primary-school

enrolment), conflict countries have been able to participate in international progress, despite the war. This is arguably a testament to the beneficial impact of medical innovations, educational programs, and the international campaigns to promote them.

The problems associated with war do not start when the fighting begins. They would have been present before and may have precipitated or generated the civil conflict. It therefore stands to reason that the resolution of war, when it promotes enduring peace, may signal the start of the solution to these problems. The behavior of economic growth provides evidence of this notion: economic growth is low (or negative) before the war. After the war, growth is strongly positive, with an average rate that is 2.4 percent points higher than that 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. Recovery occurs swiftly in macroeconomic areas: output per capita increases, capital investment rises, and inflation decreases at rates that are high enough that conflict countries gradually converge with otherwise comparable non-conflict countries.

Some social and political indicators also display this pattern of relative improvement (and thus convergence). Measures of primary-school enrolment, demographic imbalances, the rule of law, and the incidence of terrorist attacks improve more rapidly than in other developing countries. This progress is accompanied by a continuous reallocation of public resources away from military expenditure. In contrast, indicators directly related to victims, combatants, and political processes (such as mortality, secondary-school enrolment, and democratic rights) improve no more rapidly (and often less rapidly) than otherwise similar non-conflict countries.

Several lessons can be learned from the behavior of social and political variables in post-conflict situations. Democratic rights, for example, are slow to advance and may require the foundation of long-run institutions to be consolidated. In contrast, the perception of law and order can be improved rapidly by a variety of strong government regimes. Even then, pacification after civil war does not occur overnight: terrorist attacks can be pervasive in the years immediately following the cessation of hostilities, although this trend tends to subside over time, giving way to a true resolution of the war.

These conclusions are based on the responses of typical conflict countries. This article has also attempted to account for 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. The results indicate that the decline in per capita GDP during the war is greater the longer the war persists; the rate of increase and even acceleration of per capita GDP in the aftermath of war declines significantly with the length of conflict.

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

Supplementary Material

Supplementary Material is available at The World Bank Economic Review Online.

Funding

Appendix

Table A-1. Definitions and Sources of Variables

Variable	Definition	Source
Internal/external wars	Conflicts resulting in more than 1,000 battle-related deaths a year during every year in the period	International Peace Research Institute (PRIO), Oslo Freedom House, 2005
GDP per capita	Real GDP per capita	Authors' calculation based on data from Penn World Tables 5.6 and *World Development Indicators* (World Bank 2005)
GDP per capita growth rate	Real GDP per capita growth rate (percent)	Authors' calculation with data from Penn World Tables 5.6 and *World Development Indicators* (World Bank), 2005
Investment share	Investment share of real GDP per capita (percent of GDP)	Penn World Tables 6.1
Government expenditure	General government expenditure on final consumption (percent of GDP)	*World Development Indicators* (World Bank 2005)
Inflation	GDP deflator (annual percent)	*World Development Indicators* (World Bank 2005)
Military expenditure	Percent of central government expenditure	*World Development Indicators* (World Bank 2005)
Infant mortality	Number of infant deaths per 1,000 live births	*World Development Indicators* (World Bank 2005)
Female mortality	Number of adult female deaths per 1,000 female adults	*World Development Indicators* (World Bank 2005)

(Continued)

TABLE A-1. Continued

Variable	Definition	Source
Male mortality	Number of adult male deaths per 1,000 male adults	*World Development Indicators* (World Bank 2005)
Primary school enrollment	Gross percentage of children enrolled in primary school	*World Development Indicators* (World Bank 2005); Barro and Lee (1994) data set
Secondary school enrollment	Gross percentage of children enrolled in secondary school	*World Development Indicators* (World Bank 2005); Barro and Lee (1994) data set
Polity2	Combined Polity score (computed by subtracting autocracy score from democracy score); additive 21-point scale (−10 to 10), on which 10 represents the highest degree of democracy and −10 the lowest	Polity IV (2005)
Civil liberties and political rights	Sum of political rights and civil liberties divided by two; countries whose combined average ratings are 1.0−3.0 are designated "free," countries with rankings of 3.0−5.5 are designated "partly free," countries with ranking of 5.5−7.0 designated "not free"	Freedom House (2005)
Law and order	Measured on 0−6 scale, on which 6 represents the highest quality of law and order and 0 the lowest	International Country Risk Guide (PRS Group 2005); monthly data for June are selected to represent the whole year
Old-age dependency ratio	Population over 65 divided by population 15−64, stated as percent	Authors' calculation from *World Development Indicators* (World Bank)
Youth dependency ratio	Population under 14 divided by population 15−64, stated as percent	Authors' calculation from *World Development Indicators* (World Bank)
Female−male ratio	Female population divided by male population, stated as percent	Authors' calculation from *World Development Indicators* (World Bank)
Terrorism	Number of terrorism incidents per 10 million people. A terrorism incident is ascribed to the country where it occurs or, in the case of a hijacking, where it starts.	ITERATE (Mickolus and others 2004)

Source: Authors' compilation from sources indicated.

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