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Cornell University, Ithaca, New York 14853-7801 USA

CIVIL WAR, PUBLIC GOODS AND THE SOCIAL WEALTH OF NATIONS

David Pottebaum and Ravi Kanbur

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CIVIL WAR, PUBLIC GOODS AND THE SOCIAL WEALTH OF NATIONS [*]

by

David Pottebaum[+] and Ravi Kanbur[#]
Cornell University

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Abstract. — This paper establishes and explores the implications of a somewhat surprising empirical finding. Although civil war adversely affects the performance of social indicators in general, poorer countries lose less, in absolute and relative terms, than richer countries. It is argued that the explanation may lie in the extent to which richer countries have better social (and economic) indicators because of more public goods, and adaptation of economic and social mechanisms to the greater abundance of public goods such as physical infrastructure. Civil war destroys public goods, and therefore damages disproportionately the countries most dependent on them. A further implication of this framework is that the post-conflict rebound in social indicators should be relatively stronger in poorer countries. The data bear out this prediction. Our results should not of course be read as implying that poorer countries need less support to avoid civil war and to cope with its aftermath. Although their losses are less, they start from a lower base; so even small declines severely impact human well being. Properly understood, our results highlight the central role that public goods play in underpinning the social (and economic) wealth of nations.

Keywords — civil war, public goods, post-conflict, social indicators

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Contents

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[+] dap12@cornell.edu

[#] sk145@cornell.edu

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1. INTRODUCTION

During the last fifty years, conflict between nations has shifted to conflict within nations: nearly 90 percent of on-going conflicts in 1999 were within nations.[1] The impact of war also shifted from military personnel to civilians: at the beginning of the 20th century, 90 percent of war casualties were military; today about 90 percent are civilian.[2] Furthermore, conflict has become a phenomenon of less-developed countries: from 1960 to 1990, 60 percent of all conflicts occurred in low-income countries.[3]

At the start of the 1990's, Frances Stewart (1993) noted that "economic analysis of developing countries at war is rare". But research by economists on the characteristics of conflict and its impact on society and human development has gathered pace in the past decade.[4] It is self-evident that civil war retards development. But what are the magnitudes of this effect? Recent research seeks to answer these questions. Research shows that the impact of civil war on socio-economic performance is large, and that the magnitude is determined by factors such as the intensity, duration and spread of the conflict.[5] For example, Collier's (1999) cross-country econometric analysis shows that during civil war annual gross domestic product growth is reduced by 2.2 percentage points. However, the analysis of the impact of civil war on social indicators is not as far advanced in the cross-country econometrics literature, relying instead on specific case studies.[6]

Working in this tradition of investigating the magnitudes of the socio-economic costs of civil war, this paper establishes and explores the implications of a somewhat surprising empirical finding. Although civil war adversely affects social indicator performance in general, poorer countries lose less, in absolute and relative terms, than richer countries. This finding is established in Section 2. Section 3 argues that the explanation may lie in the extent to which richer countries attain higher levels of social (and economic) welfare because they have more public goods, and have adapted economic and social mechanisms to the greater abundance of public goods such as physical infrastructure. Civil war destroys public goods, and therefore damages disproportionately the countries most dependent on them. A further implication of this framework is that the post-conflict rebound in social indicators should be stronger in poorer countries. Section 4 examines patterns of post-conflict rebound, and shows that the data bear out this prediction. Section 5 concludes the paper with a note of caution. Our results should not of course be read as

[1] Wallensteen and Sollenberg (2000).
[2] UNDP (1994).
[3] Stewart, Humphreys and Lea (1997).
[4] See, for example, the special issue of the *Journal of African Economies*, the Economics of Conflict in Africa (October 2000).
[5] The best known recent papers include Stewart, Humphreys and Lea (1997), and Collier (1999).
[6] For example, Stewart et al. (1997) review 16 countries; Cranna (1994) describes the destruction of health and education services during wars in Sudan and Mozambique, while Green and Ahmed (1999) look at the impact of war on social institutions in Somalia.

implying that poorer countries need less support to avoid civil war and to cope with its aftermath. Although their losses are less, they start from a lower base; so even small declines severely impact the well-being of the people. Properly understood, our results highlight the central role that public goods play in underpinning the social wealth of nations.

2. CIVIL WAR AND SOCIO-ECONOMIC PERFORMANCE IN POORER AND RICHER COUNTRIES

2.1. A First Look at the Data

The definition of civil war is problematic, and definitions are evolving. Building on the basic notion of armed conflict, we follow much of recent quantitative literature in using the following definition by Wallensteen and Sollenberg (2000)[7]:

"Civil War is a contested incompatibility which concerns type of political system, the replacement of central government or the change of its composition, secession and/or autonomy where the use of armed force between two parties, of which at least one is the government and the state, results in at least 1,000 battle-related deaths per year."

The main sources of conflict information used in this study are the Correlates of War Project (Singer and Small 1994; Small and Singer 1982) and Wallensteen and Sollenberg (2000).[8] From these sources, our data set covers 102 countries over the period 1960 to 1999.

The basic statistical observation for this study is a "country-year", and each of the potential (102 x 40 =) 4080 country-years is characterized as either "war" or "stable" using the definition and data sources given above. This designation is not entirely straightforward, and Appendix I contains a discussion of this and other data problems. By this definition, 43 countries suffered a total of 65 civil wars over the 40 year period. Meticulous year-by-year allocation of country status leads to a potential total of 535 "war country-year" observations and 3505 "stable country-year" observations. The main constraints on our ability to use the full range of potential country-years come from socio-economic data availability. The social indicators we use are infant mortality rate, life expectancy, literacy rate, and secondary school enrollment ratio, supplemented by real per capita GDP (at market prices, constant 1995 US Dollars).[9] A key problem is missing data for several countries, especially in the early years. The sources of, and problems with, such data are laid out in Appendix I.

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[7] With minor variations, this is the definition of civil war used, for example, by Collier and Hoeffler (1998), Singer and Small (1994) and Stewart, Humphreys and Lea (1997). Others have refined this definition, separating civil war into types, such as ethnic or political conflicts (Licklider 1995; Sambanis 2000).

[8] These sources were supplemented by several other data sets, including Licklider (1995), Sambanis (2000), Sivard (1996), Stockholm International Peace Research Institute (Various Years), and the State Failure Project (Gurr, Harff, and Marshall 1997).

[9] A range of other indicators are considered in Pottebaum (2001).

A first cut tabulation of the data is provided in Table 1, which shows averages of social indicators, and of the level and growth of real per capita GDP, for stable country-years and war country-years. These figures confirm the common perception of the devastating impact of war on human development, and also indicate why econometric studies such as those of Collier (1999), which use a similar data set, find large average effects of war on economic growth.

However, Figure 1 tells us to be cautious in drawing such inferences across the whole sample. It shows that the distribution of war years across income levels is highly skewed. There is an almost total lack of civil war in countries having levels of real per capita GDP greater that US $ 9,655 (1995 US Dollars), which is the World Bank's (1999) cut-off for defining "upper-income" countries. Only 2 out of the 513 war country-year observations (less than 1 percent) come from this group, while it accounts for more than 22 percent of all stable country-years.

Table 2 replicates Table 1, except that the upper-income group is excluded. The result is striking: the differences between war and non-war averages drop dramatically for all indicators. Table 3 goes one step further, and presents results for low-income (less than U.S $ 786) countries and middle-income (between low-income and upper-income) countries separately, again using standard World Bank (1999) definitions. The tabulations are again remarkable. All countries lose, but middle-income countries lose more for all but one indicator, the growth rate, where the difference is not very great.

It has been argued that differences in absolute values of social indicators are problematic because they have finite upper limits. For these, Kakwani (1993) proposes a transformation leading to an "achievement index".[10] Using infant survival instead of infant mortality, Table 4 replicates Table 3 for achievement indices of the social indicators. These transformed values reveal an even more striking picture: social welfare in middle-income war observations is overwhelmingly lower than in the middle-income stable observations, but low-income observations remain relatively unchanged. In fact, for low-income countries social achievement indices were paradoxically a little higher during war than during stable years.

2.2. Econometric Analysis

We now attempt to confirm the broad picture revealed by the tabulations through econometric analysis. The basic strategy is to estimate conventional equations for determinants of the achievement indicators, using independent variables (not necessarily the same for each indicator) suggested by the literature, augmented by a dummy variable WAR to distinguish war years from stable years, and regional dummies.[11] The specific independent variables for each indicator follow the standard specifications in Barlow and

[10] The transformation formula is: $f(x, M_0, M) = [\ln(M - M_0) - \ln(M - x)] / \ln(M - M_0)$, where x is the reported value of the indicator, and M and M_0 represent upper and lower bounds of the indicator (e.g., 100 and 0, respectively, for literacy).

[11] These distinguish between East Asia and the Pacific, Central and South Asia, the Americas, the Middle East, North Africa, and Sub-Saharan Africa.

Vissandjee (1999), Hertz et al. (1994), Flegg (1982), and Psacharopoulos and Arriagada (1989).

The GLS regressions results (correcting for heteroskedasticity and autocorrelated disturbances) for the four social indicators are presented in Table 5 through Table 8. All regressions contain real per capita GDP as an explanatory variable, as suggested by the specific theories. Along with the regional dummies and the war dummy, in each equation we have also introduced a WAR x Real per capita GDP interaction variable, to test whether the impact of WAR itself depends income level—the crucial question being posed in this section. Each equation is estimated twice: once excluding the WAR variables in order to confirm results with those found in the literature, and the second including the conflict variables.[12]

The first two columns in each Table show estimates for the full data set. All non-conflict explanatory variables in each model are highly significant and of the expected sign. Inclusion of conflict variables does not change coefficient estimates, or their significance, very much. But the coefficients on the conflict variables, although of the expected sign, are insignificant. On the face of it, therefore, war does not seem to affect the performance of social indicators.

However, a number of diagnostic tests[13] show that the conflict observations for South Africa (1989-94), Turkey (1992-97) and Romania (1989) are very influential and critical in explaining the results generated with the full data set. We argue that there is good reason to remove these outliers from the data set—the most important issue being whether these conflict events have been correctly classified. In Romania, the events of 1989 barely classify as a civil war. The war lasted for one month, with a total of 1,014 deaths, compared to the threshold figure of 1,000. The fighting displaced fewer than 5,000 and affected a small geographic area.[14] In South Africa, although the conflict lasted several years (117 months), there were no battle deaths, while "other" deaths averaged between 100-1,000 annually—barely above the threshold. The conflict was not widespread, affecting less than a quarter of the country, and displacing very few persons.[15] In Turkey, fighting lasted more than six years but battle deaths were low (approximately 2,000) and less than one-quarter of the geographic area of the country was affected. It is perhaps not surprising that both Murdoch and Sandler (2001) and Stewart, Humphreys and Lea (1997) exclude Romania, South Africa and Turkey from their analyses, while Collier and Hoeffler (1998) exclude Romania and South Africa.

[12] Each equation was also estimated using a fixed effects model controlling for country effects (regional dummy variables were omitted in this exercise). These results are not presented here, but the basic conclusions of this paper remain unchanged.

[13] In particular, DFBETA (the normalized change in an OLS coefficient estimate resulting from omitting the *i*th observation), Leverage (h_t, the diagonal element of the hat matrix that indicates the explanatory value of the observation), and Cooks Distance (an index that is affected by the size of the residuals and the Leverage).

[14] See Gurr, Harff and Marshall (1997) and Sambanis (2000).

[15] See Gurr, Harff and Marshall (1997) and Sambanis (2000).

With this background, we exclude these three countries (18 observations); the results are presented in the last two columns in each of Table 5 through Table 8 under the heading "Reduced Data Set." Now the WAR variables become significant for infant survival, life expectancy and secondary school enrollment models. However, they remain insignificant for the literacy model. Furthermore, the signs on the coefficients—positive for WAR and, most importantly, negative for WAR x Real per capita GDP—support the argument that the impact of war on human development is greater in wealthier than in poorer countries.

Using the Reduced Data Set as the base, we again conducted tests to detect outliers. We found only one set of observations to affect the significance of the coefficient on the war variables—the conflict in Iraq during 1970-75. But the conflict in Iraq was long—165 months—and resulted in many battle and other related deaths (over 100,000). The conflict displaced more than a million persons. We found no relevant study that excluded this case from its analysis. For these reasons, we saw no case for removal of these observations. Our Reduced Data Set results stand.

3. PUBLIC GOODS AND SOCIO-ECONOMIC DEVELOPMENT

3.1. A Simple Framework

What explains the finding that wealthier countries seem to lose more than poorer ones, absolutely and relatively, from civil war? What do wealthier countries disproportionately and intricately depend upon which civil war destroys? One possible answer leaps out—public goods. Public goods can affect achievement on social indicators directly, by improving the delivery of social services. But the factors which have been shown to determine achievements in social indicators—nutrition, access to health and education services, environmental contamination, etc.—are themselves determined by public goods such as physical and social infrastructure. It is probable, therefore, that the very thing that underpins economic and social wealth is vulnerable to destruction during civil war.

The relationship between public goods and economic development became an active area of research for economists in the late 1980s. Aschauer's (1989) influential study showed that U.S. productivity growth was largely determined by, *inter alia*, a core infrastructure of road, airports, sewage and water systems. Easterly and Rebelo (1993), in a cross-national study of more than 100 countries, found that investments in transport and communications were consistently correlated with economic growth. Canning, Fay and Perotti (1994) used data on stocks of public goods and found that physical infrastructure, particularly telephones and electricity, have a significant positive effect on growth. These findings were used and further confirmed by the World Bank's World Development Report (1994). Studies by Easterly and Levine (1997), and Collier and Gunning (1999) confirm the importance of infrastructure for African growth.

Recent thinking has broadened the concept of public goods to include non-physical infrastructure. Locally provided public goods—farmer cooperatives, village development banks and credit schemes, and community managed property—are all seen as vital for

local level growth and development. But all of these depend upon mutual trust, which can be the first casualty of civil war, and can be damaged as severely as the more visible effects of physical infrastructure. At the other end, state capacity to deliver vital social services is no less a public good. As this comes under attack, social indicators suffer.

Let us accept for the moment that civil war destroys public goods—physical infrastructure, state capacity, and networks of commerce, trade and local management. All countries will suffer from this. Why might richer countries suffer disproportionately more? The answer is based on the following reasoning. Imagine a world in which collective action problems remain unsolved, so that no public goods are provided. In such a society, production, distribution and commerce are adjusted to the lack of public goods, and reflect the associated inefficiency, leading to low levels of economic and social indicators. Suppose now, somehow, the collective action problems are resolved. This society will become wealthier, directly through the availability of public goods, and indirectly as production and distribution patterns adjust to take advantage of the presence of public goods.

This adjustment—for example a shift to cash crops from food crops as a port is constructed to facilitate export—will improve the quality of life, but it will also increase the dependency of prosperity on the public good. If the port were to be destroyed overnight, production would be stuck in a pattern inappropriate to the new infrastructure realities. The drop in income could then be absolutely and proportionately sharper than for a poor country because it does not have a port, but then neither is it vulnerable to the port suddenly disappearing. A formal model of this type of infrastructural effect on income is presented in Kanbur and Pottebaum (2001).

It should be clear that the same argument applies in a general sense to public goods such as state capacity and local management, which affect both social indicators and income. Wealthy countries enjoy high standards of health and education, *inter alia*, because of their stocks of public goods. The presence of quality education and health services, extensive infrastructure networks, and well articulated and enforced laws and regulations illustrate the degree to which these countries have marshaled their resources and solved the problems surrounding the development and provision of public goods. But, by the same token, they also become dependent upon these same systems to maintain their standard of living. This is one way of understanding the empirical regularity that when wealthier countries fall into civil war, they lose disproportionately.

3.2. The Impact of Civil War on Public Goods

The above argument relies on the proposition that civil war destroys public goods. Although the link between public goods and development is well-established, less research has been done on the impact of civil war on public goods. Kumar (1997) lists physical infrastructure as one of the casualties of civil war. He notes that road, railways, power generation, sewage and water supply, and irrigation, are often deliberately destroyed during the fighting for military and political reasons. Stewart (1993) points to the destruction of transport systems and energy projects during war in Mozambique (where

approximately 44 per cent of the rail fleet was destroyed) and in Angola. Segovia (1996) notes that in El Salvador damages to infrastructure alone were estimated to be U.S. $1.5 billion. The experience of Cambodia is particularly striking: heavy fighting from 1970-1975 destroyed many schools, hospitals, roads and bridges, telecommunications and transport. Continued fighting and neglect during the late 1970s and 1980s depleted the remaining stocks (Lake 1990). The World Bank (1992) noted that "more than half of the primary road network needs urgent repair," and that rail lines were "approaching the point of near collapse."

As noted above, war can destroy the relationships, trust and faith that facilitated community initiatives such as village banks and farmer cooperatives. The War-torn Societies Project (Stiefel 1999) states that losses of faith and trust were "particularly apparent and serious in cases like Rwanda or the former-Yugoslavia, where the scale of horrors perpetrated during the war left deep and seriously indelible scars in the collective memory of the people." War can also destroy social networks—relationships and interaction among individuals and communities. In the case of communal conflict, Maynard (1999)describes how a village shop might no longer be able to buy goods from producers across ethnic or religious lines. The lack of trust across groups implies that "only those from the same identity group might patronize the store, diminishing the income of the owner." Distrust, continues Maynard (1999), can also debilitate community legal procedures and elders councils, rendering them unable to guide the community as before conflict.

3.3. A Further Implication of the Framework

Our finding that wealthier countries lose disproportionately from civil war can be explained, in principle, by a framework that sees social and economic wealth to be intricately bound with the supply and maintenance of public goods. This in turn makes wealthier countries more vulnerable to their destruction, which inevitably happens in civil war. We cannot test directly the relationship between the destruction of public goods and its differential impact on richer and poorer countries. But our framework has an immediate implication which is in principle testable, and which could in fact provide a second indirect route to testing the public goods dependence hypothesis. The implication is this: when civil war ends, social and economic indicators will rebound faster in poorer countries, which are less dependent upon public goods. Wealthier countries will stay mired at disproportionately low standards of living, given a common rate of reconstruction of public goods, since their production and distribution structures had adjusted to a (high) pre-civil war level of public goods. The next section develops such a test on our data set.

4. POST-CONFLICT REBOUNDS

4.1. Broad Patterns

The empirical framework used in Section 2 characterized country-year observations as either "war" or "stable". But, clearly, there is a distinction between a non-war year for a

country just emerging from a war, and a non-war year distant from a time of war. Adapting Collier's (1999) discussion, we define post-conflict as follows:

A post-conflict period begins upon the cessation of war and ends when armed hostility between warring parties has ceased for five consecutive years; that is, less than 1,000 battle-related deaths per year for five consecutive years (or, alternatively, when war resumes).

One problem with this definition is the assumption that five years after the end of war things revert to "normal". This is clearly arbitrary and requires some sensitivity analysis.[16] But given this definition, a "stable" year can in turn be classified as either a "post-conflict" year or a "normal" year.

Table 9 shows the broad patterns of social achievement indices for our four social indicators and real income for middle-income and low-income categories. The comparisons between low- and middle-income countries across normal, war and post-conflict years is as might be expected. Average annual levels for each of the indicators are higher during post-conflict than in war. The absolute change in average values of each indicator from war to post-conflict were nearly the same in both income groups. The exception to this generalization is real per capita income, which increased dramatically in middle-income countries. However, five observations attributable to Iraq account for this. Without these observations, middle-income real per capita gross domestic product was slightly less in post-conflict than in war observations.

In proportional terms, therefore, the change in human welfare from war to post-conflict was greater in low-income countries than in middle-income countries. In low-income countries, annual values for each of the social welfare indicators were at least 17 percent higher in post-conflict country-years (more than 20 percent higher for life expectancy and secondary school enrollment). Although middle-income countries recorded similar absolute increases in social welfare, the percentage increase over war levels was more modest: the greatest improvement was 14 percent for both secondary school enrollment and infant survival.

Table 9 broadly supports the prediction of the framework developed in the last section that the post-conflict rebound would be proportionately stronger for low-income countries. However, the disaggregation of "stable" years into "normal" and "post-conflict" years reveals a pattern that contradicts general received wisdom. For low-income countries, average indicator values were greater for war and post-conflict years than for normal years! This is a perplexing result which we will discuss in detail later in this section.

[16] It is also open to the standard problem that historical data on conflict are notoriously inaccurate, making it difficult to characterize a period as "post-conflict" (or "war").

4.2. Post-Conflict Econometrics

The broad patterns identified above need to be confirmed econometrically. Following the discussion in Section 2, we estimated regression equations for each of the social indicators: infant survival, life expectancy, literacy and secondary school enrollment. As before, regional dummies are included as explanatory variables. In addition to the conventional variables suggested by the literature for "normal" circumstances, we use the following war related variables: WAR, WAR x Real per capita GDP, POST-CONFLICT and POST-CONFLICT x REAL per capita GDP. As we ended up doing in Section 2, outlier tests suggested removing some observations, this time Romania (1989-94), South Africa (1984-99) and Turkey (1992-99), and we present results only for this Reduced Data Set.

Table 10 through Table 13 present the GLS regression results. The coefficients for all non-conflict explanatory variables in each model are highly significant and of the expected sign. The WAR coefficients are significant and the signs—positive for WAR and negative for WAR interacted with real per capita income—continue to support the argument that the impact of war on social welfare is greater in wealthier than in poorer countries.

However, the coefficients on the POST-CONFLICT variables are insignificant. While their signs support the post-war implication of our framework discussed in the previous section, they remain robustly insignificant to the removal of numerous combinations of outliers. It would seem, then, that our theoretical finding—that poorer countries will rebound more quickly from war than wealthier countries—does not have statistical support. But before concluding this, we need to show deep concern with the definition of "post-conflict".

The concern arises, essentially, out of the arbitrariness of the five-year cut off. In general, we would expect that any year would bear the scars of previous war years, perhaps with declining weights as we go further back into time. Assigning a weight of one to events of the preceding five years, and then zero thereafter is arbitrary indeed. This definitional problem is also related to the perplexing finding in Table 9 that for low-income countries social indicators are higher during war than in normal years, and the same finding (though less marked) when comparing war and stable years (Table 4).

Part of the reason for the seeming anomaly is that for low-income countries such as Sri Lanka, social indicators did indeed continue to improve despite a long and protracted war. This might be attributable to the fact that conflict was concentrated in particular sub-regions of the country, and did not directly affect social advances elsewhere. However, as Table 18 shows, another reason for the anomaly may be that many wars in low-income countries are short in duration and likely cause minimal disruption to social indicators. Furthermore, and if the general trend is for improvement (e.g., in better health because of international advances in medicine), we may get an anomalous situation where war years following normal years may show better social indicators. A close look at the data shows

that this is the case, for example, for such low-income countries as the Dominican Republic, India and Nigeria. Each of these countries experienced wars lasting less than one year, and for each the year of conflict occurred during a period of social progress. Because these conflicts were not long (or particularly intense) they did not disrupt on-going improvements in, for example, school enrollment, infant survival and life expectancy.

Closely linked with this issue is how to properly conceptualize the impact of past conflict on current levels of social and economic welfare. It would seem that every year is burdened by its legacy of war. Following Collier (1999) we view the legacy of war as enduring over time. For any given year we construct a HISTORY variable for each country-year which is a weighted sum of war months in the years preceding, with weights and the time cut-off chosen by the data themselves. There are two general forms of HISTORY, the first being:

$$\text{HISTORY}_{i,t} = x_{i,t-1} + \lambda x_{i,t-2} + \lambda^2 x_{i,t-3} + ... + \lambda^n x_{i,t-n-1}$$

where "i" indicates the country, and "t" the year. Note that this form of HISTORY *does not include conflict during the current period* (i.e., year t). The impact of current is captured by the WAR variables described earlier.

It is important to note that when the number of years used to calculate HISTORY is small (i.e., n<5), HISTORY was found to be closely correlated with WAR. In order to avoid problems with multicollinearity, a second form of HISTORY was defined:

$$\text{HISTORY (C)}_{i,t} = x_{i,t} + \lambda x_{i,t-1} + \lambda^2 x_{i,t-2} + ... + \lambda^k x_{i,t-k}$$

Here, conflict during the current period is included in the calculation of HISTORY(C).

This framework provided some flexibility in incorporating the legacy of conflict into our regressions. Finally, with λ set at 1, HISTORY and HISTORY(C) were calculated for 3 years, 5 years, 7 years and 10 years (i.e., n=2,4,6 and 9; and k=3,5,7 and 10). With the time period set at 10 years, the value of λ was also varied to 0.2, 0.5 and 0.75.

The results of GLS estimation using the reduced data set are presented in Table 14 through Table 17. As alluded to earlier, when HISTORY is used, the WAR dummy is used to capture the effects of conflict in the current period. Of course, by definition HISTORY(C) captures the impact of conflict history *and* current war; when it is used the WAR dummy is not introduced. We also introduce interaction terms for HISTORY and HISTORY(C) with per capita GDP, to test whether the burden of history is different for richer and poorer countries. The results shown are for the best fitting functional forms for the HISTORY and HISTORY(C) variables, among the alternatives described above. The details of choice of functional form are provided in Appendix II.

In each of the Tables, the conventional variables are significant and of the expected signs. Conflict is also found to be a significant determinant, but in different ways for each of the four indicators. For infant survival and secondary school enrollment, HISTORY(C) proved to be the best functional form (with λ set at 0.5 and 0.75, respectively). This implies that war in the current period and the history of conflict in the most recent past (i.e., 3 to 5 years preceding the current year) impact current levels of these indicators. This is not surprising given that infant survival and school enrollment can change rapidly, and are influenced by recent events more than the distant past. They are very much like "flow" variables.

Conflict was also found to be a significant determinant of life expectancy and literacy. For these indicators, HISTORY proved to be the best functional form, with λ set at 0.75 for life expectancy and 1.0 for literacy. Again, these results are not surprising as the values of these indicators do not change quickly—these are more like stock variables. A long history of conflict is what matters; the longer the history, the further life expectancy and literacy will decline.

Most importantly, when HISTORY and HISTORY(C) are significant, the associated interaction variables (with per capita income) were also significant, and the signs and magnitudes of their coefficients confirm our two basic hypotheses: that poor countries lose less from civil war, and that the burden of war history is less for poorer countries than for richer countries. Another way of putting the latter, in the context of our post-conflict discussion, is that poorer countries rebound faster after war than do richer ones, other things being equal.[17]

5. CONCLUSION

The empirical results presented in this paper are surprising at first sight. How can it be that poorer countries lose less, absolutely and proportionately, from civil war? There is no doubt that the data show this in the large and in the small. The averages across rich and poor countries strongly suggest a phenomenon in need of investigation. Why do the data show such patterns? There could be many reasons, including quirks of the data arising from the definition of civil war, or the way that official data series for social indicators are constructed. Without denying these factors, we have considered a particular economic explanation—that civil war destroys public goods. Richer nations are rich because they have more public goods and have adapted to them, but for this very same reason they are more vulnerable to their destruction. A further implication is that, at least in the short run, the burden of a history of war will lie heavier on rich than on poorer countries. Our empirical analysis confirms both of these implications.

There are, of course, alternatives to the public goods focus on the consequences of civil war. For example, macroeconomic stability has been shown to be important for socio-economic development, and is adversely affected by civil war. Governance, broadly

[17] Again, each equation was re-estimated using a fixed effects model controlling for country effects (regional dummy variables were omitted in this exercise). The basic conclusions of this paper remain unchanged.

defined, has also been shown to be an important determinant of improvements in economic and social outcomes and this, too, is a casualty of civil war. We do not deny other explanations, although in each case we would ask what it is about that factor which means that rich countries are *disproportionately* reliant upon it. A more general analysis which incorporates these other factors is an area for further research.

We cannot emphasize enough that our results DO NOT mean that poorer countries should be given less support to avoid civil war or in post-conflict periods. Their losses are lower, but since they start from a lower base the implications of the decline for human welfare are more severe. Properly understood, our results further highlight the channel through which civil wars reap havoc—the destruction of public goods. And, perhaps most importantly, this glimpse through the dismal prism of civil war throws into sharp relief a basic truth—the significant extent to which the social and economic wealth of nations is founded upon economic and social public goods.

Figures and Tables

Figure 1. Distribution of War Years Over Real Per Capita GDP

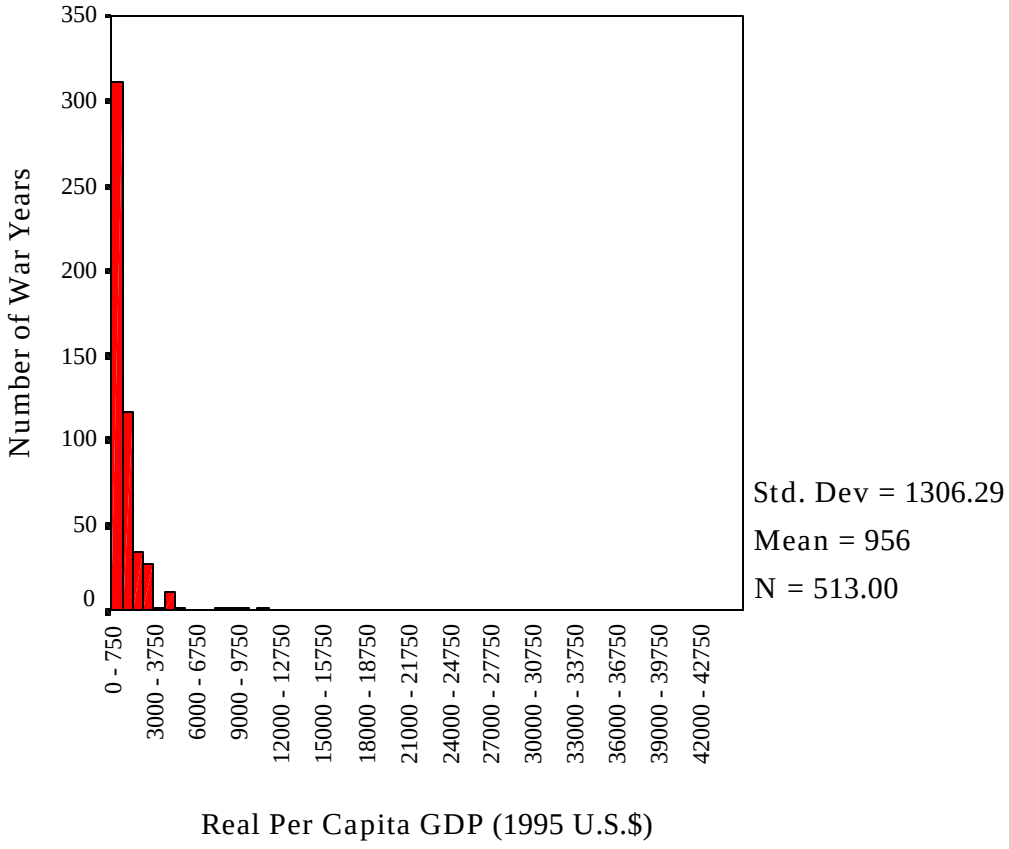

Table 1. Human Development in War-Affected and Stable Countries, 1960-1999
(average annual levels, N = number of country-years)

Variable	Stable Country-Years	War Country-Years	Difference War minus Stable	War as % of Stable
Infant Mortality	76.2 (N=3490)	101.7 (N=535)	25.5	133.4%
Life Expectancy	59.4 (N=3505)	53.2 (N=535)	-6.2	89.5%
Literacy	63.9 (N=3441)	53.6 (N=510)	-10.3	83.8%
Secondary School Enrollment	41.5 (N=3392)	29.0 (N=514)	-12.5	69.8%
Real per capita GDP	5605 (N=3288)	956 (N=513)	-4649	17.1%
Growth, Real per capita GDP (%)	1.9	-1.2	-3.1	

Table 2. Human Development in Low- and Middle-Income War-Affected and Stable Countries (combined), 1960-1999
(average annual levels, N = number of country-years)

Variable	Stable Country-Years	War Country-Years	Difference War minus Stable	War as % of Stable
Infant Mortality	90.3 (N=2564)	100.5 (N=507)	10.3	111.4%
Life Expectancy	55.9 (N=2564)	53.3 (N=507)	-2.6	95.3%
Literacy	55.8 (N=2535)	53.8 (N=482)	-2.0	96.4%
Secondary School Enrollment	29.5 (N=2503)	29.1 (N=486)	-0.4	98.8%
Real per capita GDP	1513 (N=2564)	900 (N=507)	-613	59.5%
Growth, Real per capita GDP (%)	1.7	-1.0	-2.7	

Table 3. Human Development in Middle- and Low-Income War-Affected and Stable Countries, 1960-1999

(average annual levels, N = number of country-years)

Variable	Stable Country-Years	War Country-Years	Difference War minus Stable	Difference War as % of Stable
Middle-Income				
Infant Mortality	60.9 (N=1206)	73.0 (N=192)	12.0	119.7%
Life Expectancy	63.4 (N=1206)	60.3 (N=192)	-3.1	95.0%
Literacy	73.5 (N=1198)	64.8 (N=192)	-8.7	88.2%
Secondary School Enrollment	43.2 (N=1189)	43.5 (N=192)	0.3	100.7%
Real per capita GDP	2797 (N=1206)	1849 (N=192)	-948	66.1%
Growth, Real per capita GDP (%)	2.4	-0.1	-2.5	
Low-Income				
Infant Mortality	116.4 (N=1358)	117.3 (N=315)	0.9	100.8%
Life Expectancy	49.2 (N=1358)	49.0 (N=315)	-0.2	99.6%
Literacy	40.0 (N=1337)	46.5 (N=290)	6.5	116.2%
Secondary School Enrollment	17.0 (N=1314)	19.7 (N=294)	2.7	115.7%
Real per capita GDP	373 (N=1358)	322 (N=315)	-52	86.2%
Growth, Real per capita GDP (%)	1.1	-1.6	-2.7	

Table 4. Social Welfare Achievement in Middle- and Low-Income War-Affected and Stable Countries, 1960-1999.

(average annual levels, N = number of country-years)

Variable	Stable Country-Years	War Country-Years	Difference War minus Stable	Difference War as % of Stable
Middle-Income				
Infant Survival	31.6 (N=1206)	26.7 (N=192)	-4.9	-15.5%
Life Expectancy	25.3 (N=1206)	21.5 (N=192)	-3.8	-15.1%
Literacy	37.6 (N=1198)	28.1 (N=192)	-9.5	-25.4%
Secondary School Enrollment	6.6 (N=1189)	6.6 (N=192)	0.0	0.7%
Low-Income				
Infant Survival	17.0 (N=1358)	17.5 (N=315)	0.5	2.9%
Life Expectancy	11.9 (N=1358)	12.1 (N=315)	0.2	1.7%
Literacy	13.7 (N=1337)	16.8 (N=290)	3.1	22.8%
Secondary School Enrollment	2.3 (N=1314)	2.8 (N=294)	0.5	19.4%

Table 5. GLS Regression Results: Relating Infant Survival with Socio-economic & War Variables in Low- & Middle-Income Countries, 1960-1999

Explanatory Variables	Coefficient Estimates (P>|z|) All Data		Reduced Data Set [3]	
Constant	9.161	8.185	7.992	7.483
	(0.000)	(0.000)	(0.000)	(0.000)
Real per Capita GDP (ln)	0.639	0.824	0.718	0.809
	(0.000)	(0.000)	(0.000)	(0.000)
Physicians	2.998	1.925	2.033	2.014
	(0.000)	(0.000)	(0.000)	(0.000)
Secondary School Enrollment	0.092	0.091	0.095	0.096
	(0.000)	(0.000)	(0.000)	(0.000)
Fat Supply	0.018	0.017	0.018	0.018
	(0.000)	(0.000)	(0.000)	(0.000)
Literacy	0.165	0.158	0.166	0.163
	(0.000)	(0.000)	(0.000)	(0.000)
Asia-East & Pacific (dummy)	-1.684	-1.351	-1.121	-0.900
	(0.044)	(0.096)	(0.174)	(0.271)
Asia-Central & South (dummy)	-7.798	-7.563	-7.073	-6.973
	(0.000)	(0.000)	(0.000)	(0.000)
Americas (dummy)	-8.448	-8.268	-7.962	-7.836
	(0.000)	(0.000)	(0.000)	(0.000)
Middle-East (dummy)	-3.761	-1.356	-3.705	-2.387
	(0.000)	(0.059)	(0.000)	(0.000)
N. Africa (dummy)	-8.618	-10.142	-8.195	-8.681
	(0.000)	(0.000)	(0.000)	(0.000)
Sub-Saharan Africa (dummy)	-5.563	-5.359	-4.735	-4.624
	(0.000)	(0.000)	(0.000)	(0.000)
WAR (dummy)		0.248		0.631
		(0.459)		(0.046)
WAR x Real per Capita GDP (ln)		-0.046		-0.114
		(0.408)		(0.031)
Wald chi2 [5]	6169.76	6858.06	6860.40	7000.96
N	2951	2951	2933	2933

(1) Dependant Variable—Infant Survival Rate, transformed (IMR is Infant Mortality Rate): $[(\ln (IMR_{max} - IMR_{min})) - (\ln (IMR_{t,y} - IMR_{min}))] / [\ln (IMR_{max} - IMR_{min})]$

(2) Low- and middle-income implies real per capita GDP (constant 1995 U.S.$) less than U.S.$9656.

(3) Reduced Data Set omits Turkey (1992-97), S. Africa (1984-94) and Romania (1989).

(4) Base geographic dummy variable is Europe.

(5) prob > chi2 = 0.000 for each regression.

Table 6. GLS Regression Results: Relating Life Expectancy with Socio-economic & War Variables in Low- & Middle-Income Countries, 1960-1999

Explanatory Variables	Coefficient Estimates (P>|z|) All Data		Reduced Data Set [3]	
Constant	5.094	4.836	5.146	4.895
	(0.000)	(0.000)	(0.000)	(0.000)
Real per Capita GDP (ln)	1.053	1.083	1.042	1.073
	(0.000)	(0.000)	(0.000)	(0.000)
Physicians	1.880	1.914	1.889	1.916
	(0.000)	(0.000)	(0.000)	(0.000)
Literacy	0.149	0.148	0.150	0.149
	(0.000)	(0.000)	(0.000)	(0.000)
Calorie Supply/1000 (Animal Products)	2.804	2.780	2.997	2.913
	(0.000)	(0.001)	(0.000)	(0.000)
[Calorie Supply/1000]^2 (Animal Products)	-0.424	-0.383	-.671	-0.551
	(0.556)	(0.594)	(0.364)	(0.454)
Asia-East & Pacific (dummy)	-4.443	-4.328	-4.686	-4.525
	(0.000)	(0.000)	(0.174)	(0.000)
Asia-Central & South (dummy)	-4.648	-3.739	-4.812	-3.874
	(0.000)	(0.000)	(0.000)	(0.000)
Americas (dummy)	-3.095	-3.142	-3.117	-3.138
	(0.000)	(0.000)	(0.000)	(0.000)
Middle-East (dummy)	-2.260	-1.501	-2.300	-1.477
	(0.008)	(0.056)	(0.018)	(0.093)
N. Africa (dummy)	-5.684	-6.288	-5.682	-6.122
	(0.000)	(0.000)	(0.000)	(0.000)
Sub-Saharan Africa (dummy)	-7.832	-7.693	-7.843	-7.720
	(0.000)	(0.000)	(0.000)	(0.000)
WAR (dummy)		0.258		0.478
		(0.285)		(0.072)
WAR x Real per Capita GDP (ln)		-0.042		-0.081
		(0.306)		(0.072)
Wald chi2 [5]	9694.50	9984.06	9314.04	9510.09
N	2948	2948	2930	2930

(1) Dependant Variable—Life Expectancy (LEXP), transformed:
$[(\ln (LEXP_{max} - LEXP_{min})) - (\ln (LEXP_{max} - LEXP_{t,y}))] / [\ln (LEXP_{max} - LEXP_{min})]$.

(2) Low- and middle-income implies real per capita GDP (constant 1995 U.S.$) less than U.S.$9656.

(3) Reduced Data Set omits Turkey (1992-97), S. Africa (1984-94) and Romania (1989).

(4) Base geographic dummy variable is Europe.

(5) prob > chi2 = 0.000 for each regression.

Table 7. GLS Regression Results: Relating Literacy with Socio-economic & War Variables in Low- & Middle-Income Countries, 1960-1999

Explanatory Variables	Coefficient Estimates (P>|z|) All Data		Reduced Data Set [3]	
Constant	37.605	36.957	38.227	37.859
	(0.000)	(0.000)	(0.000)	(0.000)
Real per Capita GDP (ln)	1.676	1.735	1.537	1.558
	(0.000)	(0.000)	(0.000)	(0.000)
Primary School Enrollment	0.020	0.021	0.021	0.023
	(0.000)	(0.000)	(0.000)	(0.000)
Asia-East & Pacific (dummy)	-25.401	-24.998	-25.275	-25.032
	(0.000)	(0.000)	(0.000)	(0.000)
Asia-Central & South (dummy)	-46.431	-48.534	-46.347	-48.022
	(0.000)	(0.000)	(0.000)	(0.000)
Americas (dummy)	-23.945	-23.800	-23.701	-23.654
	(0.000)	(0.000)	(0.000)	(0.000)
Middle-East (dummy)	-50.815	-51.061	-48.848	-48.244
	(0.000)	(0.000)	(0.000)	(0.000)
N. Africa (dummy)	-42.266	-42.215	-42.002	-42.129
	(0.000)	(0.000)	(0.000)	(0.000)
Sub-Saharan Africa (dummy)	-41.161	-40.846	-41.277	-40.952
	(0.000)	(0.000)	(0.000)	(0.000)
WAR (dummy)		-0.064		0.118
		(0.844)		(0.731)
WAR x Real per Capita GDP (ln)		0.016		-0.017
		(0.772)		(0.767)
Wald chi2 [5]	4385.59	4327.46	3901.79	3862.45
N	2960	2960	2942	2942

(1) Dependant Variable—Literacy (LIT), transformed:
$[(\ln (LIT_{max} - LIT_{min})) - (\ln (LIT_{max} - LIT_{t,y}))] / [\ln (LIT_{max} - LIT_{min})]$.
(2) Low- and middle-income implies real per capita GDP (constant 1995 U.S.$) less than U.S.$9656.
(3) Reduced Data Set omits Turkey (1992-97), S. Africa (1984-94) and Romania (1989).
(4) Base geographic dummy variable is Europe.
(5) prob > chi2 = 0.000 for each regression.

Table 8. GLS Regression Results: Relating Secondary School Enrollment with Socio-economic & War Variables in Low- & Middle-Income Countries, 1960-1999

Explanatory Variables	Coefficient Estimates (P>|z|)			
	All Data		Reduced Data Set [3]	
Constant	2.668	2.375	2.568	2.453
	(0.001)	(0.004)	(0.002)	(0.003)
Real per Capita GDP (ln)	0.630	0.659	0.631	0.645
	(0.000)	(0.000)	(0.000)	(0.000)
Asia-East & Pacific (dummy)	-2.544	-2.424	-2.374	-2.353
	(0.001)	(0.001)	(0.001)	(0.002)
Asia-Central & South (dummy)	-3.925	-3.706	-3.799	-3.713
	(0.000)	(0.000)	(0.000)	(0.000)
Americas (dummy)	-3.638	-3.371	-3.510	-3.407
	(0.000)	(0.000)	(0.000)	(0.000)
Middle-East (dummy)	-2.842	-2.715	-2.985	-2.918
	(0.002)	(0.003)	(0.002)	(0.002)
N. Africa (dummy)	-3.906	-3.849	-3.826	-3.838
	(0.000)	(0.000)	(0.000)	(0.000)
Sub-Saharan Africa (dummy)	-5.237	-5.109	-5.139	-5.088
	(0.000)	(0.000)	(0.000)	(0.000)
WAR (dummy)		0.251		0.366
		(0.099)		(0.019)
WAR x Real per Capita GDP (ln)		-0.036		-0.058
		(0.183)		(0.039)
Wald chi2 [5]	691.30	729.35	703.38	707.68
N	2987	2987	2969	2969

(1) Dependant Variable—Secondary School Enrollment (ENROLS), Transformed: $[(\ln (ENROLS_{max} - ENROLS_{min})) - (\ln (ENROLS_{max} - ENROLS_{t,y}))] / [\ln (ENROLS_{max} - ENROLS_{min})]$.

(2) Low- and middle-income implies real per capita GDP (constant 1995 U.S.$) less than U.S.$9656.

(3) Reduced Data Set omits Turkey (1992-97), S. Africa (1984-94) and Romania (1989).

(4) Base geographic dummy variable is Europe.

(5) prob > chi2 = 0.000 for each regression.

Table 9. Social Welfare Achievement in War, Post-Conflict and Normal Low- and Middle Income Countries, 1960-1999

(average annual levels, N=number of country-years)

Variable	Normal Country-Years	War Country-Years	Post-Conflict Country-years	Post-Conflict minus War	Post-Conflict as % War
Middle-Income					
Infant Survival	31.7 (N=1148)	26.7 (N=192)	30.4 (N=58)	3.7	113.9%
Life Expectancy	25.4 (N=1148)	21.5 (N=192)	24.4 (N=58)	2.9	113.7%
Literacy	37.9 (N=1140)	28.1 (N=192)	31.4 (N=58)	3.4	111.9%
Secondary School Enrollment	6.5 (N=1131)	6.6 (N=192)	7.5 (N=58)	0.9	114.3%
Real per Capita GDP	2804 (N=1148)	1849 (N=192)	2655 (N=58)	807	143.6%
Real per Capita GDP; excluding Iraq	2804	1665	1659	-6	99.6%
Low-Income					
Infant Survival	16.6 (N=1208)	17.5 (N=315)	20.6 (N=150)	3.1	117.7%
Life Expectancy	11.5 (N=1208)	12.1 (N=315)	14.5 (N=150)	2.4	120.1%
Literacy	13.0 (N=1193)	16.8 (N=290)	19.8 (N=144)	3.0	117.7%
Secondary School Enrollment	2.2 (N=1181)	2.8 (N=294)	3.4 (N=133)	0.6	121.4%
Real per Capita GDP	378 (N=1208)	322 (N=315)	337 (N=150)	15	104.6%

Table 10. GLS Regression Results: Relating Infant Survival with Socio-economic, War & Post-Conflict Variables in Low- & Middle-Income Countries, 1960-99

Explanatory Variables	Coefficient Estimates (P>|z|) Reduced Data Set [3]	
Constant	7.483	6.737
	(0.000)	(0.000)
Real per Capita GDP (ln)	0.809	0.852
	(0.000)	(0.000)
Physicians	2.014	2.010
	(0.000)	(0.000)
Secondary School Enrollment	0.096	0.095
	(0.000)	(0.000)
Fat Supply	0.018	0.018
	(0.000)	(0.000)
Literacy	0.163	0.166
	(0.000)	(0.000)
Asia-East & Pacific (dummy)	-0.900	-0.360
	(0.271)	(0.655)
Asia-Central & South (dummy)	-6.973	-6.640
	(0.000)	(0.000)
Americas (dummy)	-7.836	-7.578
	(0.000)	(0.000)
Middle-East (dummy)	-2.387	-2.387
	(0.000)	(0.000)
N. Africa (dummy)	-8.681	-8.238
	(0.000)	(0.000)
Sub-Saharan Africa (dummy)	-4.624	-4.066
	(0.000)	(0.000)
WAR (dummy)	0.631	0.744
	(0.046)	(0.083)
WAR x Real per Capita GDP (ln)	-0.114	-0.127
	(0.031)	(0.074)
POST-CONFLICT (dummy)		0.378
		(0.408)
POST-CONFLICT x Real per Capita GDP (ln)		-0.056
		(0.455)
Wald chi2 [5]	7000.96	7481.85
N	2933	2921

(1) Dependant Variable—Infant Survival Rate, transformed (IMR is Infant Mortality Rate): $[(\ln (IMR_{max} - IMR_{min})) - (\ln (IMR_{t,y} - IMR_{min}))] / [\ln (IMR_{max} - IMR_{min})]$

(2) Low- and middle-income implies real per capita GDP (constant 1995 US$) less than US$9656.

(3) Reduced Data Set omits Turkey (1992-99), S. Africa (1984-99), Romania (1989-94).

(4) Base geographic dummy variable is Europe.

(5) Prob > chi2 = 0.0000 for each regression.

Table 11. GLS Regression Results: Relating Life Expectancy with Socio-economic, War & Post-Conflict Variables in Low- & Middle-Income Countries, 1960-99

Explanatory Variables	Coefficient Estimates (P>|z|) Reduced Data Set [3]	
Constant	4.895 (0.000)	4.815 (0.000)
Real per Capita GDP (ln)	1.073 (0.000)	1.109 (0.000)
Physicians	1.916 (0.000)	1.919 (0.000)
Literacy	0.149 (0.000)	0.148 (0.000)
Calorie Supply/1000 (Animal Products)	2.913 (0.000)	2.894 (0.000)
[Calorie Supply/1000]^2 (Animal Products)	-0.551 (0.454)	-0.314 (0.658)
Asia-East & Pacific (dummy)	-4.525 (0.000)	-4.553 (0.000)
Asia-Central & South (dummy)	-3.874 (0.000)	-3.945 (0.000)
Americas (dummy)	-3.138 (0.000)	-3.399 (0.000)
Middle-East (dummy)	-1.477 (0.093)	-2.055 (0.001)
N. Africa (dummy)	-6.122 (0.000)	-6.153 (0.000)
Sub-Saharan Africa (dummy)	-7.720 (0.000)	-7.868 (0.000)
WAR (dummy)	0.478 (0.072)	0.588 (0.068)
WAR x Real per Capita GDP (ln)	-0.081 (0.072)	-0.090 (0.094)
POST-CONFLICT (dummy)		0.489 (0.154)
POST-CONFLICT x Real per Capita GDP (ln)		-0.70 (0.220)
Wald chi2 [5]	9510.09	10499.31
N	2930	2918

(1) Dependant Variable—Life Expectancy (LEXP), transformed:
$[(\ln (LEXP_{max} - LEXP_{min})) - (\ln (LEXP_{max} - LEXP_{t,y}))] / [\ln (LEXP_{max} - LEXP_{min})]$.

(2) Low- and middle-income implies real per capita GDP (constant 1995 US$) less than US$9656.

(3) Reduced Data Set omits Turkey (1992-99), S. Africa (1984-99), Romania (1989-94).

(4) Base geographic dummy variable is Europe.

(5) Prob > chi2 = 0.0000 for each regression.

Table 12. GLS Regression Results: Relating Literacy with Socio-economic, War & Post-Conflict Variables in Low- & Middle-Income Countries, 1960-99

Explanatory Variables	Coefficient Estimates (P>|z|) Reduced Data Set [3]	
Constant	37.859 (0.000)	38.828 (0.000)
Real per Capita GDP (ln)	1.558 (0.000)	1.406 (0.000)
Primary School Enrollment	0.023 (0.000)	0.023 (0.000)
Asia-East & Pacific (dummy)	-25.032 (0.000)	-25.153 (0.000)
Asia-Central & South (dummy)	-48.022 (0.000)	-48.011 (0.000)
Americas (dummy)	-23.654 (0.000)	-24.244 (0.000)
Middle-East (dummy)	-48.244 (0.000)	-47.357 (0.000)
N. Africa (dummy)	-42.129 (0.000)	-41.832 (0.000)
Sub-Saharan Africa (dummy)	-40.952 (0.000)	-40.724 (0.000)
WAR (dummy)	0.118 (0.731)	0.179 (0.680)
WAR x Real per Capita GDP (ln)	-0.017 (0.767)	-0.026 (0.722)
POST-CONFLICT (dummy)		0.185 (0.663)
POST-CONFLICT x Real per Capita GDP (ln)		-0.030 (0.666)
Wald chi2 [5]	3862.45	3558.05
N	2942	2930

(1) Dependant Variable—Literacy (LIT), transformed:
$[(\ln (LIT_{max} - LIT_{min})) - (\ln (LIT_{max} - LIT_{t,y}))] / [\ln (LIT_{max} - LIT_{min})]$.
(2) Low- and middle-income implies real per capita GDP (constant 1995 US$) less than US$9656.
(3) Reduced Data Set omits Turkey (1992-99), S. Africa (1984-99), Romania (1989-94).
(4) Base geographic dummy variable is Europe.
(5) Prob > chi2 = 0.0000 for each regression.

Table 13. GLS Regression Results: Relating Secondary School Enrollment with Socio-economic, War & Post-Conflict Variables in Low- & Middle-Income Countries, 1960-99

Explanatory Variables	Coefficient Estimates (P>|z|) Reduced Data Set [3]	
Constant	2.453	2.021
	(0.003)	(0.015)
Real per Capita GDP (ln)	0.645	0.691
	(0.000)	(0.000)
Asia-East & Pacific (dummy)	-2.353	-2.011
	(0.002)	(0.008)
Asia-Central & South (dummy)	-3.713	-3.400
	(0.000)	(0.000)
Americas (dummy)	-3.407	-3.285
	(0.000)	(0.000)
Middle-East (dummy)	-2.918	-3.018
	(0.002)	(0.001)
N. Africa (dummy)	-3.838	-3.740
	(0.000)	(0.000)
Sub-Saharan Africa (dummy)	-5.088	-4.929
	(0.000)	(0.000)
WAR (dummy)	0.366	0.495
	(0.019)	(0.012)
WAR x Real per Capita GDP (ln)	-0.058	-0.074
	(0.039)	(0.033)
POST-CONFLICT (dummy)		0.322
		(0.160)
POST-CONFLICT x Real per Capita GDP (ln)		-0.049
		(0.223)
Wald chi2 [5]	707.68	810.10
N	2969	2957

(1) Dependant Variable—Secondary School Enrollment (ENROLS), Transformed: $[(\ln (ENROLS_{max} - ENROLS_{min})) - (\ln (ENROLS_{max} - ENROLS_{t,y}))] / [\ln (ENROLS_{max} - ENROLS_{min})]$.

(2) Low- and middle-income implies real per capita GDP (constant 1995 US$) less than US$9656.

(3) Reduced Data Set omits Turkey (1992-99), S. Africa (1984-99), Romania (1989-94).

(4) Base geographic dummy variable is Europe.

(5) Prob > chi2 = 0.0000 for each regression.

Table 14. GLS Regression Results: Relating Infant Survival with Socio-economic & Conflict Variables in Low- & Middle-Income Countries, 1960-99

Explanatory Variables	Coefficient Estimates (P>|z|) Reduced Data Set [3]	
	HISTORY	HISTORY(C)
Constant	6.000 (0.000)	6.766 (0.000)
Real per Capita GDP (ln)	0.992 (0.000)	0.844 (0.000)
Physicians	1.952 (0.000)	2.002 (0.000)
Secondary School Enrollment	0.094 (0.000)	0.096 (0.000)
Fat Supply	0.018 (0.000)	0.019 (0.000)
Literacy	0.161 (0.000)	0.165 (0.000)
Asia-East & Pacific (dummy)	-0.125 (0.878)	-0.248 (0.760)
Asia-Central & South (dummy)	-6.378 (0.000)	-6.641 (0.000)
Americas (dummy)	-7.479 (0.000)	-7.507 (0.000)
Middle-East (dummy)	-1.384 (0.055)	-2.574 (0.000)
N. Africa (dummy)	-7.906 (0.000)	-8.269 (0.000)
Sub-Saharan Africa (dummy)	-4.043 (0.000)	-4.035 (0.000)
WAR (dummy)	0.241 (0.524)	
WAR x Real per Capita GDP (ln)	-0.045 (0.484)	
HISTORY (λ=0.5; n=9) (or HISTORY(C); λ=0.5; k=10)	-0.005 (0.857)	0.048 (0.032)
HISTORY x Real per Capita GDP (ln) (or HISTORY(C) x …)	0.000 (0.896)	-0.009 (0.009)
Wald chi2 [5]	6940.69	7073.63
N	2916	2916

(1) Dependant Variable—Infant Survival Rate, transformed (IMR is Infant Mortality Rate):
$[(\ln (IMR_{max} - IMR_{min})) - (\ln (IMR_{t,y} - IMR_{min}))] / [\ln (IMR_{max} - IMR_{min})]$

(2) Low- and middle-income implies real per capita GDP (constant 1995 US$) less than US$9656.

(3) Reduced Data Set omits Turkey (1992-99), S. Africa (1984-99), Romania (1989-99).

(4) Base geographic dummy variable is Europe.

(5) Prob > chi2 = 0.0000 for each regression.

Table 15. GLS Regression Results: Relating Life Expectancy with Socio-economic & Conflict Variables in Low- & Middle-Income Countries, 1960-99

Explanatory Variables	Coefficient Estimates (P>|z|) Reduced Data Set [3]	
	HISTORY	HISTORY(C)
Constant	4.865 (0.000)	6.171 (0.000)
Real per Capita GDP (ln)	1.132 (0.000)	1.045 (0.000)
Physicians	2.000 (0.000)	1.924 (0.000)
Literacy	0.154 (0.000)	0.149 (0.000)
Calorie Supply/1000 (Animal Products)	2.866 (0.000)	2.466 (0.002)
[Calorie Supply/1000]^2 (Animal Products)	-0.120 (0.857)	-0.320 (0.638)
Asia-East & Pacific (dummy)	-5.306 (0.000)	-5.287 (0.000)
Asia-Central & South (dummy)	-5.024 (0.000)	-5.275 (0.000)
Americas (dummy)	-4.179 (0.000)	-4.106 (0.000)
Middle-East (dummy)	-2.240 (0.000)	-3.921 (0.000)
N. Africa (dummy)	-5.702 (0.000)	-6.693 (0.000)
Sub-Saharan Africa (dummy)	-8.236 (0.000)	-8.816 (0.000)
WAR (dummy)	0.511 (0.070)	
WAR x Real per Capita GDP (ln)	-0.087 (0.073)	
HISTORY (λ=0.75; n=9) (or HISTORY(C); λ=0.75; k=10)	0.012 (0.409)	0.013 (0.390)
HISTORY x Real per Capita GDP (ln) (or HISTORY(C) x …)	-0.002 (0.502)	-0.002 (0.422)
Wald chi2 [5]	37402.40	18242.78
N	2913	2913

(1) Dependant Variable—Life Expectancy (LEXP), transformed:
$[(\ln (LEXP_{max} - LEXP_{min})) - (\ln (LEXP_{max} - LEXP_{t,y}))] / [\ln (LEXP_{max} - LEXP_{min})]$.
(2) Low- and middle-income implies real per capita GDP (constant 1995 US$) less than US$9656.
(3) Reduced Data Set omits Turkey (1992-99), S. Africa (1984-99), Romania (1989-99).
(4) Base geographic dummy variable is Europe.
(5) Prob > chi2 = 0.0000 for each regression.

Table 16. GLS Regression Results: Relating Literacy with Socio-economic & Conflict Variables in Low- & Middle-Income Countries, 1960-99

Explanatory Variables	Coefficient Estimates (P>|z|) Reduced Data Set [3]	
	HISTORY	HISTORY(C)
Constant	38.351 (0.000)	38.764 (0.000)
Real per Capita GDP (ln)	1.611 (0.000)	1.568 (0.000)
Primary School Enrollment	0.021 (0.000)	0.020 (0.000)
Asia-East & Pacific (dummy)	-25.230 (0.000)	-25.327 (0.000)
Asia-Central & South (dummy)	-48.190 (0.000)	-47.807 (0.000)
Americas (dummy)	-24.469 (0.000)	-24.542 (0.000)
Middle-East (dummy)	-48.119 (0.000)	-50.516 (0.000)
N. Africa (dummy)	-42.570 (0.000)	-43.251 (0.000)
Sub-Saharan Africa (dummy)	-41.896 (0.000)	-41.959 (0.000)
WAR (dummy)	-0.125 (0.736)	
WAR x Real per Capita GDP (ln)	0.028 (0.661)	
HISTORY (λ=1.0; n=9) (or HISTORY(C); λ=1.0; k=10)	0.024 (0.041)	0.011 (0.336)
HISTORY x Real per Capita GDP (ln) (or HISTORY(C) x …)	-0.003 (0.085)	-0.001 (0.582)
Wald chi2 [5]	5055.00	5115.31
N	2925	2925

(1) Dependant Variable—Literacy (LIT), transformed:
$[(\ln (LIT_{max} - LIT_{min})) - (\ln (LIT_{max} - LIT_{t,y}))] / [\ln (LIT_{max} - LIT_{min})]$.
(2) Low- and middle-income implies real per capita GDP (constant 1995 US$) less than US$9656.
(3) Reduced Data Set omits Turkey (1992-99), S. Africa (1984-99), Romania (1989-99).
(4) Base geographic dummy variable is Europe.
(5) Prob > chi2 = 0.0000 for each regression.

Table 17. GLS Regression Results: Relating Secondary School Enrollment with Socio-economic & Conflict Variables in Low- & Middle-Income Countries, 1960-99

Explanatory Variables	Coefficient Estimates (P>|z|) Reduced Data Set [3]	
	HISTORY	HISTORY(C)
Constant	1.105	1.256
	(0.167)	(0.116)
Real per Capita GDP (ln)	0.733	0.716
	(0.000)	(0.000)
Asia-East & Pacific (dummy)	-1.328	-1.364
	(0.066)	(0.059)
Asia-Central & South (dummy)	-2.922	-2.969
	(0.001)	(0.001)
Americas (dummy)	-2.608	-2.623
	(0.000)	(0.000)
Middle-East (dummy)	-2.365	-2.366
	(0.005)	(0.006)
N. Africa (dummy)	-3.116	-3.142
	(0.001)	(0.000)
Sub-Saharan Africa (dummy)	-4.317	-4.323
	(0.000)	(0.000)
WAR (dummy)	0.234	
	(0.139)	
WAR x Real per Capita GDP (ln)	-0.034	
	(0.232)	
HISTORY (λ=0.75; n=9)	0.028	0.033
(or HISTORY(C); λ=0.75; k=10)	(0.001)	(0.000)
HISTORY x Real per Capita GDP (ln)	-0.004	-0.005
(or HISTORY(C) x …)	(0.005)	(0.001)
Wald chi2 [5]	907.71	857.93
N	2952	2952

(1) Dependant Variable—Secondary School Enrollment (ENROLS), Transformed: $[(\ln (ENROLS_{max} - ENROLS_{min})) - (\ln (ENROLS_{max} - ENROLS_{t,y}))] / [\ln (ENROLS_{max} - ENROLS_{min})]$.

(2) Low- and middle-income implies real per capita GDP (constant 1995 US$) less than US$9656.

(3) Reduced Data Set omits Turkey (1992-99), S. Africa (1984-99), Romania (1989-99).

(4) Base geographic dummy variable is Europe.

(5) Prob > chi2 = 0.0000 for each regression.

Table 18. Civil Wars Between 1950 and 1999

("Years of War" between 1960 and 1999)

No.	Country	Start Date		End Date [a]		Years of War
		Mon	Year	Mon	Year	
1	Afghanistan	6	1978	99	1999	22
2	Algeria	5	1991	99	1999	9
3	Algeria	8	1962	1	1963	1
4	Angola	1	1998	99	1999	2
5	Angola	11	1975	12	1995	20
6	Argentina	6	1955	9	1955	0
7	Bolivia	4	1952	4	1952	0
8	Bosnia	3	1992	12	1995	4
9	Burundi	12	1991	99	1999	8
10	Burundi	8	1988	8	1988	1
11	Burundi	5	1972	5	1972	1
12	Burundi	10	1965	12	1969	4
13	Cambodia	4	1970	10	1991	22
14	Chad	10	1965	12	1994	29
15	China	1	1967	8	1968	2
16	China	1	1956	12	1959	0
17	China	2	1950	4	1951	0
18	Columbia	3	1984	99	1999	16
19	Columbia	9	1949	12	1962	3
20	Congo DR	10	1996	99	1999	3
21	Congo DR	7	1960	8	1965	6
22	Congo Rep	1	1997	99	1999	3
23	Dominican Rep	5	1965	8	1965	1
24	El Salvador	7	1979	1	1992	13
25	Ethiopia	1	1974	5	1991	18
26	Guatemala	10	1966	12	1994	28
27	Guatemala	6	1954	6	1954	0
28	Haiti	1	1991	12	1994	4
29	India	1	1999	99	1999	1
30	India	1	1984	12	1994	11
31	India	6	1965	11	1965	1
32	Indonesia	1	1975	12	1982	8
33	Indonesia	12	1956	12	1960	1
34	Indonesia	9	1953	11	1953	0
35	Indonesia	6	1950	10	1950	0
36	Iran	6	1981	4	1982	2
37	Iran	9	1978	12	1979	2
38	Iraq	1	1988	12	1994	7
39	Iraq	7	1961	3	1975	5
40	Iraq	3	1959	3	1959	0

Note: the End Date of Mon=99, Year=1999 implies conflict on-going as of December 1999.

Table 18. (Continued)
("Years of War" between 1960 and 1999)

No.	Country	Start Date		End Date		Years
		Mon	Year	Mon	Year	of War
41	Korea	6	1950	7	1953	0
42	Lebanon	4	1975	12	1991	17
43	Lebanon	5	1958	9	1958	0
44	Liberia	12	1989	12	1995	6
45	Malaysia	1	1948	12	1959	0
46	Mali	6	1990	12	1994	5
47	Morocco	10	1975	11	1989	14
48	Mozambique	11	1979	10	1992	13
49	Myanmar	2	1983	12	1995	13
50	Myanmar	1	1968	10	1980	11
51	Myanmar	9	1948	7	1951	0
52	Nicaragua	2	1981	6	1990	10
53	Nicaragua	10	1978	7	1979	1
54	Nigeria	2	1984	3	1984	1
55	Nigeria	12	1980	1	1981	1
56	Nigeria	7	1967	1	1970	3
57	Pakistan	2	1973	7	1977	5
58	Pakistan	3	1971	11	1971	1
59	Peru	3	1982	99	1999	18
60	Philippines	10	1972	12	1994	22
61	Philippines	9	1950	6	1952	0
62	Romania	12	1989	12	1989	1
63	Rwanda	1	1998	99	1999	2
64	Rwanda	10	1990	7	1994	4
65	Sierra Leone	3	1991	12	1999	9
66	Somalia	5	1988	12	1999	12
67	South Africa	8	1984	3	1994	11
68	Sri Lanka	8	1983	99	1999	17
69	Sri Lanka	3	1971	5	1971	1
70	Sudan	12	1983	99	1999	16
71	Sudan	10	1963	2	1972	8
72	Tajikistan	5	1992	12	1994	3
73	Turkey	7	1991	12	1997	7
74	Uganda	10	1980	7	1992	12
75	Uganda	6	1966	6	1966	1
76	Vietnam	1	1960	3	1975	5
77	Zimbabwe	1	1983	12	1984	2
78	Zimbabwe	1	1973	12	1979	7

Note: the End Date of Mon=99, Year=1999 implies conflict on-going as of December 1999

Appendix I—Data Issues and Concerns

Conflict Data

Our main sources of conflict information are the Correlates of War Project (COW); (Singer and Small 1994; Small and Singer 1982) and Wallensteen and Sollenberg (2000). These sources were selected because together they cover the period 1960-1999, they were constructed as "data bases of conflict" (as opposed to those made for specific research tasks which might be biased by research design), and they have been used as main sources of information in the construction of other comprehensive conflict data sets. These sources were supplemented by several other data sets, including Licklider (1995), Sambanis (2000), Sivard (1996), SIPRI yearbooks (Stockholm International Peace Research Institute Various Years), and the State Failure Project (Gurr, Harff, and Marshall 1997).

Despite the fact that most data sets use similar definitions for war, there remains some variation in opinion regarding the starting and ending dates for many conflicts (there is greater consensus regarding which conflicts are civil wars). The starting and ending dates of the conflicts analyzed in this study were finalized as follows. Conflict dates in COW and Wallensteen and Sollenberg data sets were compared with those provided in other sources. When starting and or ending dates for a given conflict differed between data sets, final dates were chosen based on the most convincing argument presented, and by consensus of opinion among as many data sets as possible. When no information was available regarding the starting or ending months of a conflict (i.e., only the year was recorded), January was used as a starting month, and December as the ending month. Table 18 presents a list of civil wars that occurred between 1950 and 1999.

Before analysis could proceed it was necessary to define each year for each country in the data set as being either "war" or "not war". This is relatively straight-forward in most cases. For example, consider the conflict in Haiti that began in January 1991 and ended in December 1994. Clearly, 1991, 1992, 1993 and 1994 are "war" years. Less straight-forward is the characterization of a year during which conflict occurred only for a few months. In such cases the rule of thumb used was if war lasted a short duration and fell entirely within one calendar year, then that year is considered a "war" year (e.g., war occurred in Sri Lanka between April and May 1971; as a result, 1971 is a "war" year). This allows the inclusion of short, violent wars in the data set (there were 2 civil wars that lasted two months, and 4 that lasted one month).

Another rule of thumb used was that, for conflicts that began during one calendar year and continued into the next, at least four months of war must occur in a given year for that year to be considered a "war" year. For example, in Mozambique war began in November 1979 and ended in October 1992. Clearly, 1980 through 1991 are "war" years. The year 1979 is not a "war" year because only two months of war occurred during the year. The rationale here is that it is unlikely that these two months of war had a great

impact on the level of social or economic welfare in Mozambique during that year. The year 1992, however, is a "war" year because 10 months of war occurred within it.

Social Welfare Data

As is well known, social welfare data in developing countries are problematic. Information on many important indicators is not collected on an annual basis, and is often non-existent for long periods in less-developed countries. Moreover, standard data sets (e.g., the World Development Indicators) often include estimates or extrapolations from previous year observations rather than data based on actual observations for the year in question (World Bank 2000, p. 317). In addition, the reliability of social welfare data, particularly data from war-affected countries, is often questionable. As a result, even though data for this study are drawn from standard sources, care must be taken to interpret results as indications of trends and not precise differences across countries.

Social welfare indicators used in this study are: infant mortality rate (per 1,000 live births) and life expectancy (at birth, total years) as indicators of the general level of health of a country; literacy rate (adult total, percent of people age 15 and above) and secondary school enrollment (percent gross) as indicators of the general level of education of a country. Real per capita gross domestic product (at market prices, constant 1995 US$), an indicator of economic welfare, is also analyzed. Although these indicators are the focus of this study, several additional variables are included in the analysis, including primary school enrollment, number of physicians, and calorie, fat and protein availability.

The World Bank's World Development Indicators (1999) was the main source of social and economic data for this project. Education data were supplemented by information from the United Nations Educational, Scientific and Cultural Organization (UNESCO Various years), health data by information from the World Health Organization (Various years), nutrition data by information from the Food and Agriculture Organization (FAO 2000), and economic data from the United Nations Statistics Division (1999).

Considerable effort was made to collect all available data, and to ensure that the data were as comparable and reliable as possible. Nonetheless, the resulting data set was plagued by numerous gaps that needed to be filled before analysis could proceed. The method used to estimate missing data points was as follows. When information was missing at the beginning or ending of a time series (e.g., the early 1960s or late 1990s), data values were simply taken from the nearest available observation. Suppose, for example, there were no observations for 1960, 1961 and 1962, and that the first available observation was for 1963. In this case, the missing observations for 1960-62 were assigned values equal to the observation in 1963. This procedure was implemented in only a few circumstances, and for these cases the typical "nearest observation" was only one or two years removed from the missing data point. Five years was, for limited cases of literacy, the greatest period over which missing data were estimated in this manner.

When data were missing between two existing observations, linear interpolation was used to estimate missing observations. For example, observations for 1967 and 1970 were

used to estimate missing values for 1968 and 1969. In most instances, data no more than five years apart were used to interpolate between year figures. Ten years, in limited cases for literacy and school enrollment, was the greatest period between two observations used to interpolate between year figures. In the final data set, 47 percent of the infant mortality figures, 66 percent of the life expectancy figures, 77 percent of the literacy figures, 39 percent of the secondary school enrollment figures, and 3 percent of the real per capita gross domestic product figures were interpolated from actual observations.

Statistical inference with missing data is an important problem that has received much attention in the literature. Kennedy (1998) likens the problem of missing data to that of an extreme form of measurement error. In the case of missing explanatory variables, observations for which one (or more) values are missing can be dropped from the analysis. This can be done as long as it is known that the missing observations occur randomly; otherwise, this procedure results in sample selection bias. Dropping observations, however, is not entirely appealing as we lose important information in the process. An alternative technique is to replace the missing values with an estimated or proxy value (as done in this study). This technique does not change the coefficient estimate of the variable with missing observations; it can, however, improve estimates of the other coefficients because of the increased sample size. These gains are achieved, however, at the cost of introducing bias due to measurement error (Kennedy 1998, p. 149).[18]

Green (1997) proposes two techniques for the case of missing dependent variables. First, missing dependent variable values can be replaced by the mean of the observed values. This is not entirely satisfactory as correlation between the error term and independent variables is likely to result. The second technique estimates the missing dependent variables using complete observations of both dependent and independent variables. Although the resulting estimators are unbiased, there are no gains in efficiency.

The characteristics of social welfare indicators pose an additional problem for studies of social welfare based on empirical data. Empirical studies must take into account the fact that indicators of well-being have finite limits. Infant mortality, for example, cannot fall below zero deaths per unit of population. Similarly, literacy rates cannot exceed one hundred percent. An additional concern is that as higher levels of social welfare are attained, incremental (absolute) improvements represent greater achievement than similar improvements from a lower base.

Kakwani (1993) addresses these problems in his study of performance in living standards. Specifically, Kakwani develops and tests an "achievement index" that provides a method of measuring the level, or "achievement", of social welfare.

[18] Little (1992) presents an excellent literature review and summary of this problem and proposed solutions.

The achievement function is defined as follows:

$$f(x, M_0, M) = \frac{\ln(M - M_0) - \ln(M - x)}{\ln(M - M_0)}$$

where ln stands for natural logarithm, M and M_0 represent upper and lower bounds of the indicator (e.g., 100 and 0, respectively, for literacy), and x is the reported value of the indicator.[19] The minimum and maximum levels for each index represent either absolute bounds on the index (e.g., a minimum of 0 and maximum of 100 for literacy) or levels that have not been reached by any country in the data set and which can be regarded as reasonable limits for the indicator (e.g., a minimum of 3 and maximum of 277 for infant mortality).

National Statistics, Data Collection and Exclusion

A special problem for data collection and of national statistics in war-affected countries is the large population movements associated with conflict. By way of example, consider the case of Cambodia in the late 1960s and early 1970s. During this period, intense war in the country-side drove many educators and medical practitioners away from their villages of work and into the relative safety of the capital. In terms of national statistics, access to physicians and teacher-to-student rations did not change. The impact of war on Cambodia, in terms of these indicators, was therefore neutral. However, access to the services of these professionals fell dramatically in the areas that they left behind. National statistics, in this case, *underestimate* the impact of war on Cambodia, particularly so in areas directly affected by fighting. Population movements can also affect enrollment figures as children move into and out of school districts and the reach of data collectors. Infant mortality might also rise or fall in specific locales, depending on who is moving in or out of the area. Thus, problems of exclusion must be kept in mind when interpreting the results of empirical analysis that relies on national statistics. We must continually question whether or not our results are truly indicative of "reality".

[19] Kakwani defines his indices in terms of a positive measure of welfare. As a result infant mortality is converted to infant survival. This is done by the subtracting infant mortality from 1000.

Appendix II—Functional Forms for HISTORY Variables

As indicated in the text, we used a variety of functional forms of the HISTORY variable (and HISTORY interacted with per capita income). The results provided the basis for determining the functional form that provided the best fit given the full data set. We tested two broad groups of functional forms: (1) two variables, WAR and HISTORY, respectively, represented conflict information for the current year and past years, and (2) we combined conflict information for the current and past years in the variable HISTORY(C).

We used four lengths of history—3, 5, 7, and 10 years— to calculate HISTORY and HISTORY(C). For the ten-year length of history, we analyzed four geometrically decreasing forms: that is, the value of λ was fixed at 0.2, 0.5, 0.75 and 1.0. Selection of the best type (i.e., (1) or (2) above) and form of all alternatives was based on theoretical consistency, Bozdogan's index of informational complexity[20], and factual conformity.

The functional form that provided the best fit for the Life Expectancy and Literacy models were easily selected. Regardless of the functional form used, estimates of coefficients for the conflict variables—size and sign—did not change meaningfully, and were robust to the removal of influential observations. For life expectancy, the current conflict environment was almost always a significant predictor of current levels of life expectancy. Conflict history, regardless of length or weight given to recent relative to past conflict events, was almost never significant.

The opposite was true for literacy: the current conflict environment was never a significant predictor of current levels of literacy; on the other hand, conflict history was always significant, and, the longer the period of history considered, the greater the fit of the overall model and higher the level of significance of the conflict history variable.

The results for both models provide strong support for the argument that poorer countries lose less during war, and rebound more quickly after war, than wealthier countries. Equations that provided the best fit were selected using the criteria alluded to earlier.

The best functional form of HISTORY for the secondary school enrollment model was not as easily selected. The current environment and recent history of conflict were clearly important determinants of secondary school enrollment. The coefficients on the conflict variables remained significant and did not change sign regardless of functional form (and were robust to the removal of influential observations); however, the *size* of the

[20] The best model minimizes Bozdogan's index, which takes into account the covariance structure of the model and, therefore, for collinearity between the factors and dependence among the parameter estimates (Stata Corporation 2001).

coefficients changed when we considered different lengths of history or rates of geometric decay. Nonetheless, as with the Life Expectancy and Literacy models, the results for the Secondary School model are the same regardless of the functional form of HISTORY: poorer countries lose less during war, and rebound after war more quickly than wealthier countries.

Given that estimated coefficients on HISTORY varied in size with changes in functional forms, we based our selection of the best fitting functional form on the additional criteria in which the estimates represented a middle-ground regarding the size of the coefficients among all estimated forms (this is, of course, in addition to the criteria alluded to earlier).

The infant survival model provided the most mixed results, making it difficult to determine how—if at all—conflict history influences current levels of infant survival. Long periods of history were not significant. Shorter periods were significant but not robust to the removal of influential observations. The current conflict environment was important, but only when combined with recent conflict history. Given the approximate linear relationship between current and recent levels of conflict [21], and the resulting low level of independent variation between the WAR and HISTORY observations, it is likely that the GLS estimation procedure cannot calculate with confidence the effect that these variables have on Infant Survival. With this in mind, it is perhaps not surprising that the best results were from models that *combined* current and recent conflict history provided (i.e., models that used the HISTORY(C) variable).

Despite the relatively mixed results for the Infant Survival model, we were able to select a best fit among the various functional forms that were tested. The findings presented in the paper, representative of the majority of functional forms tested, provide support for the central argument of this paper.

[21] The correlation coefficient is 0.84 between WAR and the three year history variable with λ=1.0, and 0.89 between WAR and the ten year history variable with λ=0.2

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