The Political Economy of Comparative Human Misery and Well-being*

Hazem Ghobarah, Harvard University
hmg@latte.harvard.edu

Paul Huth, University of Michigan
phuth@umich.edu

Bruce Russett, Yale University
bruce.russett@yale.edu
Political Science Department
New Haven, CT 06520-8301
Tel. 203-432-5233
Fax 203-432-6916

Gary King, Harvard University
gking@harvard.edu

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Abstract

Nearly 10 percent of the world's economic resources are devoted to health care. But why do certain countries devote more resources to public health? Why are some countries better than others at achieving tangible health outcomes using the same level of economic resources? In this preliminary investigation, we use new data and measures from the World Health Organization (WHO) to examine cross-national variation first in the level of public and private expenditures on health, and then in the level of achievement of health outcomes. We find that autocracy, income inequality, ethnic heterogeneity, and persistent international hostilities significantly depress the amount of public resources allocated to health care. We also find that while private expenditures tend to be higher in unequal and heterogeneous societies, total health expenditures still fall far short of those in countries with similar income levels levels but that are more equal and homogenous. We further find, all other things equal, that countries that are rapidly urbanizing or have experienced a civil war tend to have poorer health.

The health of humanity varies enormously: by genetic endowment, environmental conditions, and access to health care; by age, gender, income level, and country (Gakidou and King 2001). Some people live long healthy lives in peace and affluence; many others' lives are briefer and burdened by major disabilities from disease or injury, and often the characterization "nasty, brutish, and short" is all too apt. "Country" is itself a catch-all of macro-influences, including type of political regime, decisions to devote public and private resources to health, the distribution as well as the level of income within the country, urbanization, the privileged or un-empowered position of racial, linguistic, or religious groups in the country, and the state's experience of violent civil conflict or military threats from neighboring states. Some of these influences are familiar to public health specialists and are part of their customary analyses, but *all* are concerns of political scientists. Yet systematic cross-national analyses of the determinants of human health and misery by political scientists are sparse. We aim to focus the attention of our discipline on these influences, in the hope of stimulating further analyses that will refine and extend what is here. This is just the beginning of our understanding.[1]

What is to be explained?

Previous work in political science has concentrated on measures of overall mortality, as these have been the only data available for most countries. Recently, Kuritsky and Davis (2001) report that severe military conflict in sub-Saharan Africa cut life expectancy by 4 to 6 years and raised infant mortality by up to 30 per thousand. In a global sample, Zweifel and Navia (2000) find democracies have an infant mortality rate about 10 per thousand below that of comparable non-democracies. Przeworski et al. (2000: 241) report the same difference in infant mortality rates, with a gap of about 5 years in life expectancy. Similarly, Lake and Baum (2001) report substantial differences in both measures, as well as in measures of citizens' access to health

resources related to both contemporaneous comparison of regimes and changes in regimes over time.

In this article we use new data compiled by the World Health Organization (WHO) that are more comprehensive and more reliable than information on life expectancy and infant mortality rates. The unit of analysis is the nation-state, since our interest is in the systemic and institutional influences that are characteristic of national political systems. Many of our explanatory variables reflect the characteristics of institutions of the whole society (e.g., regime type, level of expenditure on health, the experience of civil war or international tension) and in some degree affect virtually all its members. But we also examine the effects on the average level of health conditions in the society stemming from the distribution of income within states, their ethnic heterogeneity, urbanization, and levels of education. Some variables (e.g., regime type) are obviously political variables, but all reflect the political power--or lack of it--of various groups and their ability to secure better health through public and private resources.

Our principal analysis attempts to explain outputs of the health system across countries, as expressed by WHO's measure of overall health—the Disability Adjusted Life Expectancy (DALE). It discounts the total life expectancy at birth in each country by the number of years the average individual spends with a major disability as the burden of disease or injury—the gap between total life expectancy and expected years without disability. It is estimated from three kinds of information: the fraction of the population surviving to each age level (calculated from birth and death rates), individual-level data on the incidence and prevalence of various diseases and disabilities at each age, and the weight assigned to debilitation from each type of condition. The result is the proportion of the population suffering from disabilities, giving the average number of years of healthy life that a newborn member of the population could expect to live.

The measure, tapping the concept of years of healthy and productive life, is expressed in intuitively meaningful units. It varies substantially by region of the world and income level. In rich countries, more disabilities are associated with chronic conditions of old age, when life expectancy is short. By contrast, in poor countries infant mortality is much higher and many health problems derive from the burden of infectious diseases like malaria and schistosomiasis, which are carried by children who may live a long time with seriously impaired health and quality of life. Empirically, the share of simple life expectancy lost to disability varies from under 9 percent in the healthiest regions of the world to over 14 percent in the least healthy ones (WHO 2000:28). Adjusting life span by time spent with disability comports with psychological findings that people do not simply seek long life, but sharply discount the value of years at the end of life spent with major physical and psychological disabilities (Diener et al. 2001).

This information-intensive measure requires not just vital registration data for births and deaths, but expensive health surveys of death, disease, and disability by age and gender--in principle in each country. While widely used for monitoring and forecasting in the United States (e.g., Cutler and Richardson 1997), data only began to be collected on a global basis by WHO for the year 1990 (Murray and Lopez, eds. 1996), with the most comprehensive report being its 1999 survey (WHO 2000). Life tables for 1999 for all 191 WHO members were developed from surveys that were supplemented by censuses, sample registration systems, and epidemiological analyses of specific conditions. WHO specialists provided estimates of their degree of uncertainty about the accuracy of the information. They subjected the data to a variety of statistical tests for incompleteness and bias in low-coverage areas, and adjusted the information accordingly. Then information on disease-specific disability rates was estimated for all countries within each of 14 regions of the world defined geographically and epidemiologically, and WHO

then used these to adjust available data on death rates at different age levels and life expectancy for each country (Mathers et al. 2000). The index—of expected healthy life years (i.e. disability-free life)--ranges from 74.5 (Japan) to 29.5 (Sierra Leone), with a median of 60.9 (Belize). While the limitations of these data need to be borne in mind, they are the best that have ever been available, and do permit us to make some plausible systematic inferences about the influences on health conditions across countries across countries (see for example, Williams 1999, Murray et al. 2000, and Filmer and Pritchett 1999:1312).

To understand why there is so much cross-national variation in health outputs, we draw on existing theory and evidence regarding the influence of a variety of economic, social, and political variables. The total pattern of linkages doubtless contains interactive elements and proceeds through several stages where one variable affects another not directly but through a third variable. Because this analysis is an early one in the study of this topic, we limit it to two stages where these complications are most manageable.

First, we try to understand the *influences on the amount of resources devoted to improving the health of the population*. This is a key variable to explain health conditions in a country, and so warrants attention to determine what influences help produce relatively high health spending. The amount of resources devoted to health is determined both by the *total resources available in the economy* and by *public and private allocation decisions* on how much of the resources to allocate to health care. Second, we investigate what affects a health system's effectiveness or "productivity." Among these influences are not only the level of expenditures, but also the social and political factors that influence what particular health conditions are targeted and which segments of the population are the greatest beneficiaries.

Figure 1 about here

Figure 1 summarizes the conceptual framework we draw on to study the comparative political economy of health. At its center, four primary causal factors are critical to explaining differences in levels of health across countries. Each of the hypotheses we will present concerns the impact of politics and economics on health as mediated by one or more of these primary causal factors. At the most basic level, populations across and within counties are exposed in varying degrees to the threat of disease and injury. We develop hypotheses about how political institutions and practices can increase these risk factors due to the inequalities, discrimination, and disadvantages confronted by ethnic minorities and lower income groups. In addition, we hypothesize that civil wars threaten health care systems in multiple ways and thereby increase risk factors for civilian populations that have suffered from such armed conflicts.

The other three primary causal factors focus on the commitment of and effective use of human and financial resources to support a health care system. First, it is essential to examine the overall level of resources a society devotes to private and public expenditures for health care. A larger pool of resources should provide the foundation for a stronger health care system. Second, the extent to which public and private actors actually allocate available resources to health care varies substantially across countries. We develop arguments about how politics can influence private sector and government choices about how much to spend on health care given competing demands for the use of financial resources. Third, countries vary greatly in their efficiency in utilizing available resources to provide health. We hypothesize that differences in educational levels matter, that the damage inflicted by civil war on public infrastructure can

erode the efficiency of the health care system, and that the political marginalization of new urban residents, low income groups, and ethnic minorities may restrict their access to health care.

We begin by trying to explain what we believe is an under-explored influence on outputs of the health system in a country: the total amount of expenditures (public and private) on health, and then look at influences on private and public spending separately. Since the choice to devote resources—especially public ones--to health care is fundamentally a political one, beyond the pure availability of resources in the whole economy, it is important to know what helps to determine that choice. Having identified total health expenditures as a product largely of the variables we use to model it, it becomes a critical explanatory variable in a model to explain health outputs, notably DALE. This modeling sequence allows us to ask whether the principal effect of regime type on outputs is direct, or indirect through the level of expenditure.

Explanatory variables and hypotheses for health expenditures

For health expenditures (total, and public and private separately) we use WHO estimates which began with IMF and national sources, supplemented by national accounts data from United Nations and OECD sources and household surveys and WHO estimates (Pouillier and Hernandez 2000). WHO analysts regard the estimates of public health expenditures—derived largely from published budgetary information--as somewhat more reliable than those for private expenditures by citizens and corporations. Nevertheless, since health attainment clearly depends on both public and private expenditures, the proportion of which varies widely between countries even at similar levels of income, we analyze the three classes of expenditure separately. This gives us important information about the determinants of expenditures in their own right, and feeds into the second stage of analysis explaining health outputs.

Public expenditures per capita (1997) in internationally adjusted dollars range from $1833 (Switzerland) to $1 (Congo, Kinshasa), with a median of $98 (Peru). Private expenditures per capita range from $2,081 (United States) to $3 (Somalia), with a median of $66 (Fiji). Total spending per capita ranges from $3,724 (United States) to $11 (Somalia), with a median of $193 (Bulgaria). WHO authors estimate that it is very difficult for countries to provide good health outputs below a total expenditure of about $60 per capita, and that it would cost just over $6 billion per year to bring up to this threshold the 41 countries with lower expenditures (Evans et al., 2000a: 24). Because these distributions are so skewed we used the natural logarithms in all equations; as an explanatory variable that also reflects the declining marginal product of additional dollars at higher levels of national expenditure. Although we do try to explain public and private health expenditures alone, we follow WHO in using total health expenditures per capita as the preferred measure in our subsequent equations to explain DALEs.

We begin then with our hypotheses to explain total public health expenditures, modifying them as necessary to distinguish between effects on public and private health spending. For consistency we use the same explanatory variables in all equations, both those for health spending and for DALEs, even though we do not always have the same hypothesis for a particular variable in all equations. (Except, of course, later we use health expenditures as an independent variable in the equations explaining outputs.) We start with hypotheses for the three explanatory variables at the core of WHO analyses.

* The higher the level of per capita income, the higher will be total health spending. Both public and private health expenditures will be positively related to income.

These hypotheses follow from a straightforward combination of income and demand effects. The higher the level of per capita income, the more tax revenues are potentially

available to spend on the health of the public. Higher incomes also imply greater demand: the populace will expect greater public support for health in richer countries. In addition to the effect on public resources, higher incomes mean more resources for private actors to spend on health care, and higher expectations among the populace for employer support for health.

Gross Domestic Product per capita is measured for 1998 in PPP-adjusted $ (U. S. Central Intelligence Agency, 1999) and its range is from $530 (Sierra Leone) to $32,700 (Luxembourg), with a median of $3,500 (Jordan). We use the natural logarithm of GDP per capita to reduce skewness.

* The more educated the population, the higher will be total health expenditures. Both public and private health expenditures will be positively related to education.

In addition to the effects of income, we expect educational levels to exercise a separate effect. The more educated the population, the better informed it is likely to be about the potential benefits of various programs and expenditures, and thus to demand greater public inputs. Similarly, the population will demand greater employer inputs and be more willing to spend personal resources.

These hypotheses also follow the lead of WHO analysts, who use the level of educational attainment as their second explanatory variable. WHO regards average level of schooling in the adult population as the most widely available and sensitive measure, logged to correct skewness and to reflect the declining marginal impact of education.[2] It ranges from only 1.04 years of education (Mali) to 11.5 years (United States), with a median of 6.03 years (Costa Rica).

To add a substantial socio-political dimension to the variables employed by WHO analysts, we propose several hypotheses. All the independent variables apply to one or more years prior to the dependent variable. That is a necessary condition for reasonable causal

inference, and necessary to make interesting statements. For example, later we will ask whether deaths in civil wars lower disability-adjusted life expectancy. Of course they do, during the war and for those injured in the war. The interesting question is whether the destruction, disruption, and diversion of resources by war inflict longer-term damage on individuals not concurrently affected by the war and even on those not born until a year or more after the war ended.

* The higher the rate of urbanization, the lower will be total health expenditures. Both public and private health expenditures will be negatively related to urbanization.

Rapid urbanization creates both a need and a demand for greater health expenditures, as new city residents require new supplies of clean water and prevention and treatment of diseases associated with high population densities. Yet we hypothesize that recent growth in the urban population will reduce the *effective* demand and supply of health spending. Rapid urbanization often reflects an influx of poor and marginalized people from rural areas. Consequently these new city dwellers are under-organized in unions and underrepresented in established political parties that have already developed a base of political support among other urban constituencies. Since they will be poorly organized politically to obtain resources in the short term, public spending for health will be lower than in less-rapidly urbanizing countries. Similarly, new urban residents will lack the ability, either directly or through the political system, to demand more employer benefits or personal resources. Thus total health spending will be lower, as will both its components (public and private spending).

Our measure of recent urbanization is the average annual percentage change in the urban portion of the population, 1990-95 (United Nations 1998: 132-35). It ranges from –0.41 percent (Belize) to 7.35 percent (Botswana), with a median of 0.88 percent (Grenada).

* The more democratic the state, the higher will be total public health expenditures. Both public and private health expenditures will be positively related to degree of democracy.

All political leaders want to retain power. They must form a winning coalition and satisfy a sufficient portion of those who are politically active. To do so they distribute special benefits (private goods) to their supporters, and provide collective goods widely for the population. All leaders provide both private and collective goods in some degree. But because democratic leaders have to satisfy a wider range of supporters, not just a small segment of their cronies and the military, they are less able than authoritarian ones to extract rents for the private benefit of small groups, and must respond more to broad demands for public well-being (Olson 1993, Bueno de Mesquita et al. 1999, Lake and Baum 2001). For example, famines are much more common in authoritarian states (Sen 1981), which spend less either to prevent them or to relieve their consequences. Similarly, by politically empowering widespread interests democracy may increase private expenditures through legislation and regulation encouraging employers to spend more on employee health care.

Political system type is measured by the Polity project, using the average score for 1997 and 1998. This is the Polity IV dataset from their website (www.bsos.umd.edu/cidcm/polity/). For the 22 countries in our sample with no regime score in the Polity database we imputed a regime score from the Freedom House scores (www.freedomhouse.org/ratings/index.htm), which correlate highly ($r = .95$) with Polity where both exist. Following common practice (e.g., Maoz and Russett 1993) we create a 21-point index for each state from a scale for degree of autocracy ranging from –10 (most autocratic) to 0 (least autocratic) and one for degree of democracy from 0 (least democratic) to + 10 (most democratic), and then produce the composite index by

summing the two components. This scale, which we treat as interval, of course runs from –10 (e.g., North Korea, Myanmar) to +10 (e.g., Japan, Norway), with a median of 7 (e.g., Ukraine).[3]

* The more unequal the distribution of income, the lower will be the level of total health expenditures. Both public and private health expenditures will be negatively related to income inequality.

High income inequality indicates a greater ability of economically privileged groups to dominate the political system for their own benefit rather than that of the majority. As a result, state expenditures will be diverted from public to private goods, heavily concentrated on economically privileged and hence politically powerful segments of the population. In addition, high inequality will depress overall levels of private expenditure by concentrating wealth. The large poor segment of the population will have lower incomes, less leverage with employers, and fewer private resources for health.

Our measure of inequality is the Gini index of inequality of income distribution in 1997. This common index is derived from a Lorenz curve of the actual distribution of income by households, with the index representing the total area between the curve and the 45 degree line representing a totally equal distribution of income. The variable begins with estimates for 111 countries published by the World Bank, supplemented by WHO with multiple imputation estimates using information on socio-economic development and life expectancy at birth (Evans et al. 2000b; an early effort is Russett et al. 1981). Theoretically the Gini index ranges from zero (complete equality) to 1.00 (one person has all the income); in practice our national Gini indices range from a very equal .187 (Slovakia) to .609 (Sierra Leone), with a median of .374 (Uganda).

* The more racially/linguistically/religiously diverse the population, the lower will be the level of total health expenditures. Both public and private health expenditures will be negatively related to ethnic diversity.

Substantial differences in the ethnic and racial makeup of a country's population are often a source of political conflict that shapes the political system, producing various forms of discrimination and unequal access to political power. Political inequality in turn skews the distribution of resources committed to public policy programs, including the health care system. As a result, public expenditures will be concentrated on the politically more powerful groups, and politically weak groups will be neglected. Overall, public health expenditures will reflect the political weakness of groups discriminated against, and thus will be lower than in more homogenous populations. In addition, groups discriminated against will have lower incomes, less leverage with employers, and fewer private resources for health.

To test this we use Vanhanen's (1999) index of racial-linguistic-religious heterogeneity. This index, stable over moderate time-periods, measures the percentage of the largest ethnic group identified by each of these three criteria, giving each equal weight by summing the three percentages and subtracting that sum from 300 (a completely homogeneous state by all three criteria). Conceptually this is somewhat different than that of Gurr (1993), when logged correlating with an r of .69 with Gurr's index. But it was created with Gurr's effort in mind, and is more complete in number of countries covered, so we prefer it. It ranges from a high of 177 (Suriname, very heterogeneous) to a low of 0 (North Korea, completely homogeneous), with a median of 38 (Uzbekistan). Because the index is quite skewed, we use its natural log.

* The occurrence and severity of civil wars in states will reduce total spending on health. Both public and private expenditures will be reduced by civil war.

Civil wars reduce the productivity of the entire economy, and especially damage and disrupt the administrative and economic infrastructure necessary to maintain previous levels of health expenditure. They typically have a severe short-term (about 5-years) negative impact on economic growth (Murdoch and Sandler 2002). Both tax revenues and private resources available for healthcare expenditure will suffer. Despite greater demand effects--to care for direct and indirect victims of the war-- we expect that public facilities available for health care will be diminished for some time (see Braveman et al. 2000 on Nicaragua, Grobar and Gnanaselvam 1993 on Sri Lanka), and economic decline will reduce employers' and individuals' available expenditures for private health care.

Deaths from civil war in the years 1991 to 1997 represents a measure of both the existence and severity of civil war, expressed as the number of deaths per 100 people in the country to measure the war's intensity. Civil wars are defined as armed conflicts producing 1,000 or more fatalities per year among regular armed forces, rebel forces, and civilians directly targeted by either. Civil war years and fatality figures are derived from leading data sets on civil war compiled by scholars (COW data on civil wars website: http://www.umich.edu/~cowproj/, Licklider 1995, Regan 2000, Doyle and Sambanis 2000, Wallensteen and Sollenberg 2000). For most countries its value is 0; for the 34 countries experiencing civil war during the period it ranges from .02 to 96.9 (Rwanda).

* The presence of civil war in a geographically contiguous country will increase a state's own public expenditures for health. But while the impacted *government* may need to spend to cope with the impact, we do not expect *private* actors within the country to be so motivated (spending by transnational relief agencies is not included). We do, however, expect the rise in public spending to increase total health expenditures.

The principal effect is likely to be from refugees. Whereas many displaced persons stay within their own countries, many others flee across national borders to become international refugees: their own countries lack the means to care for them, and they often are fleeing political or ethnic persecution from those who have the upper hand in the war. The Rwanda civil war generated not only 1.4 million internally displaced persons, but a total of 1.5 million refugees into neighboring Zaire, Tanzania, and Burundi (Toole: 98). Refugees both present a potential burden on their neighbors' healthcare systems and become new vectors for infectious disease in those countries. Such burdens are likely to result in more public expenditures on health.

It is nevertheless possible that public spending on health will be constrained by security expenditures. A civil war in one state often imposes military costs on its near neighbors, which may fear the contagion of rebellion onto their territory, perhaps including ethnic groups that overlap the borders as developed from the fighting that began in Rwanda. They may increase their own military spending, in turn creating the possibility of an arms race. One study estimates that such arms races cost 7.9 percent of a typical African country's GDP as long as the civil conflict lasts (Collier and Hoeffler 2001). Nor does the arms race end as soon as the war is over.

The explanatory variable is dichotomous, coded 1 if any contiguous state experienced a civil war in the period 1989-1998, and 0 if not. Contiguity is defined as sharing a land border or separated by no more than 12 miles of water.

* Involvement in an enduring international rivalry will reduce public health expenditures. But involvement in an enduring international rivalry is likely to cause an increase in private health spending to compensate for the loss in public expenditures. The net result on total health expenditures will be of *no* systematic effect.

International wars, like civil wars, are widely understood to have major short and long-term impacts on public health spending, not all of them in the same direction. We cannot, however, investigate those effects here. By standard criteria there was only a single international war during the period 1989-1997; i.e., the Gulf War 1990-91. This is not enough to give us reliable estimates of the effect of international wars on health, more so as the human effects of that war were vastly compounded by the application of severe international sanctions against Iraq before and especially after the war.

To provide an international conflict dimension to this analysis, we focus instead on international rivalries, an indicator of international conflict and security threats that may affect societies by diverting resources from improving health to military purposes. We expect that during an enduring international rivalry, involving repeated threats or use of force short of war between states, public expenditures will be diverted from social welfare programs—including health—to military purposes (FitzSimmons and Whiteside 1994: 25-26, UNDP 1994, Chan 1995, World Bank 1993).

Our hypotheses for the effect on total health and private expenditures differ from that for public spending. Whereas we expect enduring international rivalries to divert public expenditures from the health system, both governments and private citizens have incentives to increase private sector spending on health care to compensate for a drop in public spending. Success in doing so may vary according to variables that are not measured here, notably the relative size of the public and private sectors of the economy, the willingness of employers to use resources for such purposes, and the ability of employees and the state to pressure private firms to increase contributions to health care. Nevertheless we expect to see an increase in private

spending overall. Accordingly, it is plausible that net effect of public decreases and private increases will be that enduring rivalries exert no systematic effect on total health expenditures.

An enduring international rivalry is defined as a relationship between two states experiencing at least 6 militarized international disputes during a 20 year period, and in which fewer than 11 years have elapsed since the last dispute. We extend data from Diehl and Goertz (2000) to recent years from Wallensteen and Sollenberg (2000). We code as 1 each of the 25 countries involved in an enduring international rivalry during 1989-97, and all others as 0.

Results for influences on health expenditures

We test these hypotheses using ordinary least squares regression on data for 175 countries: nearly all the 191 members of the WHO, omitting only those small states lacking data on one or more of the explanatory variables. Table 1 shows the results for *public health expenditures*. The columns show, respectively: 1) the estimated coefficients, 2) the standard errors, 3), the probability levels, 4 through 7) the actual dollar value and the percentage change from the median dollar value ($98 per capita) moving to the 5th and 95th percentiles. The last is especially useful to illustrate the impact of the highly skewed variables (civil wars and enduring interstate rivalries) which affect less than 20 percent of all states. Overall, the explanatory power of the equation is high (adjusted $R^2 = .86$, $\sigma = 0.570$).

Table 1 about here

Not surprisingly, by far the strongest effect is exerted by per capita income. National poverty severely constricts a government's ability to spend on health care. A level of income per capita in the 5th percentile leads to a level of public expenditure on health that is 83 percent (or

$85) below the median. Average level of education makes a difference, but its substantive impact is relatively small, at $13 for increasing the level of education from the median to the 95th percentile. And we find no significant effect for rapid urbanization ($p = 0.16$).[4]

Most of our hypotheses about the effects of political variables are supported. Democracy has an independent positive impact on public health expenditures, with democratic governments spending more for their citizens' health than do autocracies. Other things equal, a dictatorship (at the 5th percentile on the polity scale) spent about 30 per cent less on health than did a democratic government (at the 95th percentile on the polity score). Anecdotally, the relatively democratic Philippine government spent twice as much per capita on public health as the Suharto-led Indonesian government even though the two countries have roughly similar income per capita. By contrast, income inequality and ethnic heterogeneity substantially reduce public health spending, presumably because politically less-empowered groups are less targeted. The significance of an enduring international rivalry is higher than that of any other variable except income, and its impact is great, producing a 29 percent reduction in public funds allocated to health expenditures.

We find an insignificant positive effect for civil wars, contrary to the direction of our hypothesis ($p = 0 .19$ for a two-tailed test). Public spending may rise slightly to address treat war casualties and those displaced by war, but the substantive importance of this variable is marginal at best. For a state recently experiencing civil war, in the 95th percentile in the number of deaths (1.16 per hundred, in Tajikistan), public expenditures are only $6 per capita above average. And we find no effect whatever of a civil war in a neighboring country. Very possibly any demand effect to increase public expenditures is countered by arms race pressures to reduce them. Any strong negative effects of an arms race are probably better captured by the enduring rivalry

measure, which is designed to identify international security relationships marked by a high degree of military tension.

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Table 2 about here

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Table 2 shows the results for our parallel effort to identify the influences on *private health expenditures*. The adjusted R^2 is .75, and σ is 0.631. Whereas per capita income continues to exert a strong effect in increasing spending, most of the other variables are statistically insignificant.

For example, our hypothesis about the effect of education fared badly. Although educational levels were associated with greater public spending on health, there is no evidence that a more educated population is better able to obtain health benefits from private employers and more willing to spend their personal resources if they do not deem public expenditures to be adequate. The same is true for democracy. While democracy extends rights to workers in the workplace and the political arena, democratic governments do not seem to make more effective use of legislation and regulation to encourage employer and worker health spending.

As with public spending, for private health expenditures no significant negative effect is discernible for urbanization (a trivially positive sign), or for a civil war either at home or in a neighboring country. More surprisingly, there is no evidence of a negative impact of ethnic heterogeneity on private health spending. Ethnic diversity does not seem to reduce the ability of minority private sector actors to spend on health. Neither, however, does it contribute to an ability of the private sector to compensate for the shortcomings of the public sector.

Another unexpected effect is the positive sign ($p = .10$, two-tailed test) for income inequality. Private actors do partially compensate for public neglect, but the dollar increment in private spending associated with greater inequality is half the corresponding drop in public health spending. Similarly, in situations of enduring international rivalry private expenditures tend to rise ($p = .05$), as we hypothesized they might so as to compensate for cuts in public health spending. Even so, compensation by the private sector is incomplete, again representing only about half the dollar drop in public expenditures. Although most of our hypotheses about influences on public health spending were supported, most of those about private spending find little support.

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Table 3 about here

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Overall, our equation to explain *total health spending* is the most successful (adjusted $R^2 = .86$, $\sigma = 0.375$); the observations cluster even more tightly around a regression line (Figure 3). Much of this reflects the especially powerful effect of income; both public and private expenditures rise with income. Rapid urbanization, however, continues to have no general, systematic effect on spending, as is true of civil wars at home (weakly positive, $p = .22$ with a two-tailed test) or in a neighboring country.

Education makes a positive difference ($p = .02$) on total health expenditures, and the same is true for democracy ($p = .01$). But since neither education nor democracy had an impact on private health expenditures analyzed separately, it is clear that their overall positive effects are exerted by expanding the *public* health sector. Similarly, the expected negative effect of ethnic heterogeneity shows up for total health expenditures, as does a weak effect of income

inequality (p = .09). Both appear due largely to the inability of disempowered groups to affect the political process of allocating public spending—with but limited (for income inequality) or no (for ethnic diversity) compensation from the private sector. For many of these influences, then, their hypothesized effects on public health expenditures dominate any impact they may have on private health spending.

One partial contrast is our supported hypothesis about the effect of enduring international rivalry. Whereas we expected (and found) that an extended military-diplomatic confrontation would divert public expenditures from health, here we hypothesized that much of those lost expenditures would be made up by the private sector, and that the net effect would be of no systematic impact by international rivalries. The zero coefficient supports the expectation of substantial private substitution.

Hypotheses for explaining health care outputs

Here we examine the level of health achievement in a population. Our dependent variable for this portion of the analysis is DALE, the WHO measure for *disability-adjusted life expectancy* at age zero, discussed at the beginning of the article. Our explanatory variables are the same as for explaining health expenditures, with one important exception, and our hypotheses generally parallel those listed above, though with some differences. We begin with the basic WHO model to explain DALEs; namely with total health expenditures and education as explanatory variables, and then add our political variables to increase its explanatory power.

* The higher the level of total health expenditures the higher will be the DALE.

Higher total health expenditures enable a health system to improve prevention and treatment throughout the population. In the previous analyses the independent variable for the first hypotheses was income per capita. But income is not a direct determinant of the production

of health. Because the two are collinear (r = 0.90) we cannot include both as explanatory variables in the same regression.[5] In the economics tradition of production function analysis income is treated as an uncontrollable variable outside the direct process that produces good public health outputs. Concurring with WHO (Evans et al. 2000a: 13), we substitute total health expenditures per capita--a more satisfactory variable theoretically because it better captures the effect of political choices and influences. It was precisely to model those effects, beyond income alone, that we carried out the prior analysis to explain total expenditures. As we have seen, both total health expenditures and public health expenditures are strongly affected by political regime type, which has implications for our hypothesis below about regime type.

We use total health expenditures as an explanatory variable in this equation, rather than public or private expenditures alone. The results for previous hypotheses suggest there is a degree, although quite incomplete, of complementarity between public and private health expenditures in achieving health goals, and the total should therefore be a better predictor than either component alone. As will be evident, total health expenditure does have greater explanatory power for DALEs than does either public or private health expenditures alone. We will, however, in a supplementary equation separate public and private health expenditures to ask if they have different marginal effects. We expect the marginal impact of public health spending to be greater because it is mostly devoted to producing public goods for a wider population, whereas private spending is overwhelmingly for private goods benefiting the spender.

* The more educated the population the higher will be the DALE.

At higher levels of education, preventive and treatment programs become more widespread and effective; i.e., demand for better health care rises as does more knowledgeable and effective consumption throughout the population. It is strongly associated with the health of

both children and adults in both rich and poor countries. It constitutes the other independent variable, with total health expenditures, in WHO analyses of health attainment (Evans et al. 2000a: 13). Since it is strongly correlated with income per capita it may pick up some variance that would be attributed to income if it were in the equation.

* The higher the rate of urbanization the lower will be the DALE.

Although urbanization rates had no impact on health expenditures, we still expect them to affect the output of the health system. New urban residents will be exposed to new disease vectors, and will lack adequate access to care since the supply of health services to large numbers of new residents is likely to lag behind the surge in need. Surveillance, immunization, and the provision of safe water all become more difficult. This will be especially true in urban slums where the new residents are unlikely to be well organized in unions to create effective pressure for services either politically or in the workplace. This gap between need and delivery largely reflects the relative neglect of new city dwellers by the health care system. Marginal utility analysis predicts that individuals or groups receiving less than an equal share of health care lose more disability-adjusted life expectancy than is gained by individuals or groups receiving more than an equal share of health care. That should be especially true when the disadvantaged group is exposed to the diseases experienced by urban slum dwellers.

* Democracy will have *no* strong and direct impact on the level of DALE.

We have already found a strong impact of democracy in increasing the level of public and total health expenditure. Przeworski et al. (2000: 239) note that the strong effect of democracy in lowering infant mortality operates largely through health expenditures. We therefore expect that the effect of democracy in improving health conditions will already be represented in its role in increasing health spending. Any additional effect will be marginal.

* The more unequal the distribution of income, the lower will be the DALE.

The more unequal the distribution of income, the more unequal will be the distribution of access to health facilities, and fewer resources will be committed to the health care system (see the hypotheses for health expenditure). The provision of high quality health care services is thus limited to a smaller segment of the general population, producing lower overall levels of health performance. The rich get more access—at low marginal utility, and the poor get less access—at a level of income at which the marginal utility of greater access would be high. A strong effect of income inequality on levels of total, and especially public health expenditure, was documented above; here we posit an additional effect on overall health achievement due to the differential access to services.

* The more ethnically/linguistically/religiously diverse the population, the lower will be the DALE.

As we previously argued, ethnic differences often result in discrimination and unequal access to political power. Political inequality in turn skews the distribution of resources committed to the public health care system. Care will be focused on politically powerful groups, and politically weak groups will be neglected. Also, groups discriminated against will have less leverage with employers, and fewer private resources for health. The negative effect of ethnic heterogeneity on public and total health expenditure was documented above; here we posit additional effects on health achievement due to the differential access to services.

* The occurrence and severity of civil wars will reduce the level of DALE.

We expect civil wars to kill and maim people. But that is more than just a tautology. Crime and homicide rates rise during international wars, tending to peak in the first year after the war and then re-equilibrating at a level higher than before the war. The experience of war makes

the use of violence within states more common (Stein 1980, Archer and Gartner 1976). If international war has this effect, we should expect the direct and near-term experience of civil war to do the same, even more strongly, abetted by the widespread availability of small arms after civil war.

Moreover, we anticipate death and disability as indirect consequences of war. Wars continue to kill people well after the shooting stops. Civil wars do so by destroying property and infrastructure that cannot rapidly be replaced, by disrupting normal economic activity and health care delivery, and by diverting resources from health care both during the war and afterward for reconstruction (Collier 1999; also Stewart 1993). Military forces often deliberately target health care so as to weaken the opposition.

The destruction and disruption from the fighting reduces refugees' access to clean water and food, and that of others who stay in place. In many countries ravaged by civil wars the crude mortality rates among newly arrived refugees were 5 to 12 times above the normal rate. Common epidemics are of diarrheal diseases, measles, acute respiratory infections, malaria, and other diseases. Malnutrition is common, weakening peoples' defenses against infection. (On much of the above see Toole 2000). Armed conflict has been labeled as the predominant cause of famine in the 1990s. Even after the fighting subsides, epidemic diseases may become rampant, extending far beyond the displaced population, and immunization and treatment programs are overwhelmed (FitzSimmons and Whiteside 1994). Just as health delivery breaks down, many refugees wind up in the cities where sanitation and health services are already limited (Noji and Burkholder 1999). Many of these effects are long-lasting.

* The presence of civil war in a geographically contiguous country will lower the DALE.

The principal effect will likely be from refugees fleeing the war across the border. They bring infectious diseases associated with the disruptions of war and the poor living conditions in which they find themselves in their host countries. If the refugees must be cared for mainly by the medical resources of the receiving country, those resources will in large part be diverted from care of the host country's own population. (Our results above showed that most countries do not increase either public or private health expenditures in response to civil war in a neighbor.) Additionally, the refugees are likely to become vectors for transmitting infectious diseases to the host population.

* Enduring rivalries will have *no* strong and direct impact on the level of DALE.

Whereas enduring international rivalries do divert public health expenditures from the system, they have no systematic effect on total health spending—see the above results for public and total expenditures. Both governments and private citizens have incentives to increase private sector spending on health care to compensate for the reduction in public spending—and a substantial amount of compensation seems to occur. Thus we anticipate no systematic effect of enduring rivalries on health outputs.

Results for influences on health outputs

As for health expenditures, we compute the estimates for all countries. (This time for 177 countries, as we have information on all other variables for two countries without data for income per capita—St. Kitts-Nevis and St. Lucia.) Table 4 shows the results for the *DALE* equation in the same format as the previous tables. All our hypotheses are supported, in an

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Table 4 about here

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equation with an adjusted R^2 of .77, and σ of 6.04. The only two variables that make no significant contribution are democracy and enduring international rivalry—as expected.

The effect of ethnic heterogeneity is barely significant ($p = .10$), but with some substantive effect: moving from the median of the heterogeneity index to the 95 percentile reduces DALE by more than one year. This reinforces the separate stronger negative impact of ethnic diversity on both public and health expenditures. Together, these results suggest that ethnic diversity operates to diminish the overall level of health achievement primarily by reducing overall expenditures, but also through some discrimination in the distribution of those expenditures and hence access to health care.

The impact of income inequality on DALE is highly significant and substantively strong. A shift from the median Gini index to the 95th percentile reduces average years of healthy life expectancy by over 3 years (i.e.; people on average live 3 fewer years of healthy life due to income inequality). This is in addition to the separate weak impact of income inequality on DALE through reducing total health expenditures. It had a much more substantial effect on public expenditures. Together, these results indicate a substantial impact of income inequality on health conditions (DALE) that operates both through lowering overall expenditures and through discrimination in the distribution of those expenditures, and hence on access to health overall. The strong indirect negative impact of income inequality on DALE through lowering public health expenditures is not adequately compensated by private spending. In unequal societies, the overall level of life expectancy is lower and the level of disability is higher.

The experience of the United States may provide an example. The United States is about in the middle of the world scale on ethnic heterogeneity (87th, with an index of 35), and distinctly low in income equality (110th). Despite being the richest country on the globe, in per

capita public spending on health it ranks below Switzerland, Germany, and Luxembourg, and is less than $10 above Denmark and France. Perhaps because of these factors, 24 countries have better DALE than does the United States.

The strongest impact in the equation, not surprisingly, is from the level of total health spending—with a shift from the median to the 95th percentile bringing 7.8 years of healthy life. It is also worth noting that the marginal impact of public health spending is greater than that of private spending. Since they are only moderately correlated ($r = 0.76$), both can be entered into the DALE equation in place of total health expenditure. In that equation (not shown) both have a significant impact ($p < .01$), but a shift from the median to the 95th percentile of public health spending brings 5.2 years of healthy life, whereas a shift to the 95th percentile of private health spending brings only 3.2 years. The additional dollars of private spending go to a small range of people, most of whom are already healthier than the rest of the populace. The other variables are essentially unchanged from Table 4.

The impact of education follows that of total health spending rather closely, and is much more substantial than in the expenditure equations. If Benin somehow were able to provide its people with an average of 6 years of schooling instead of the actual 1.7 years; i.e., if it were at the median level of schooling rather than at the 5th percentile from the bottom, we would expect its citizens to have nearly 8 more years of healthy life. Partly that reflects the absence of per capita income in this equation, as education--more highly correlated with income than with health expenditures—is likely picking up some effect of income here. Nevertheless, educational attainment was fairly strongly associated with total health spending, and these two results together indicate that education affects both the supply of health expenditures and the achievement of better health through greater access and effective use of health services.

A high rate of urbanization also has a strong impact, cutting the level of DALE by over 5 years. This is very different from what emerged in our analyses of influences on levels of health spending. In those equations the effect of urbanization was statistically insignificant and substantively trivial—our hypotheses were unsupported. The effect of rapid urbanization is not through level of public or private health spending, but rather on the susceptibility of new urban dwellers to disease and the inability of the health care system to deliver adequate prevention and treatment to them. Poor housing, sanitation, and water quality bring more health problems.

Finally, the matter of civil war. We previously found that the effect of civil wars on public health spending was weakly positive, due probably to the need for more health spending to address the problems of war casualties and those displaced by war. Here however, in the achievement of good health conditions, the negative impact of civil war is evident ($p = .02$) in the form of losing nearly a full year of healthy life at the 95th percentile. Not surprisingly, civil wars do kill people—but not just during the course of the war.[6] The negative consequences for life and well-being linger for years after the war is fought due to the disruption of institutions and the infrastructure. Truly severe civil wars (rare events to be sure) are even more detrimental. These can reduce healthy life expectancy by nearly 10 full years (e.g. Rwanda and Liberia).[7]

Moreover, it is not just civil war in one's own country that matters. A country's DALE is typically more than a year and a half lower if a neighboring state recently suffered from a civil war ($p = .06$).[8] The relationship is even stronger if we exclude all countries that themselves experienced a civil war. That equation (not shown) improves the significance level ($p = .03$), and raises the impact to almost two full years. While we do not yet know exactly why this happens, the impact of large cross-border refugee flows, especially vulnerable to infectious disease, is the likely major culprit.

Table 5 summarizes our key findings for both DALE and health expenditures (private and public), and shows which variables have the strongest impact on each.[9]

Table 5 about here

A cluster of eight countries (Zambia, South Africa, Namibia, Zimbabwe, Malawi, Sierra Leone, Botswana, and Uganda, in declining magnitude of the residual) in southern Africa are outliers, with predicted DALES far above their actual achievement. All but Sierra Leone and Uganda were also in the top eight for per capita HIV/AIDS cases in 1999. It is commonly believed that the incidence of AIDS in Africa has been greatly abetted by civil wars (Reid 1998, Epstein 2001). Of the cluster of eight with high residuals, only Sierra Leone experienced major civil conflict in the 1991-97 period, but several (Namibia, South Africa, Uganda) had civil wars a few years earlier, and the manifestation of HIV infection is often delayed. All of them also border on states that experienced civil wars either in 1991-97 or somewhat earlier.

Other than civil war, a variety of cultural and other explanations have been proposed for the prevalence of AIDS in these countries (UN Program on HIV/AIDS, http://www.unaids.org/epidemic_update/report/index.html). No one or two of these explanations is satisfactory. Public health researchers do not agree on why AIDS is so common in this region. We do not show an equation that includes an HIV/AIDS variable, since to do so would merely put a label on a disease without providing a socio-economic explanation of its prevalence.[10] This concurs with the decision of Evans et al. (2000a: 22), who decline to use an HIV variable to predict DALE as a measure of efficiency of the health system. Their view is that the health system should be held at least partly accountable for the failure to control AIDS.

Conclusions, limitations, and future research

In trying to explain expenditure inputs into the health system, and outputs in the form of the reduction of human misery, we combined variables commonly used by public health analysts with economic, social, and political influences much less commonly studied in this context. The phenomena we tried to explain were measured by newly available cross-national data from WHO. Though preliminary, the results showed the utility of modeling health expenditures and then using those expenditures as an explanatory variable for achievement in health care. Forecasting as well as explanation can benefit. Politics matters, in ways that illuminate the subfields of both comparative politics and international relations.

Our models to explain variation in per capita health expenditures—both public and total—found them to be strongly and positively related to per capita income and degree of democracy in the country, and also positively related to the population's level of educational attainment. Ethnically diverse countries and those experiencing great income inequality also showed significantly lower levels of both kinds of spending. Countries engaged in enduring international rivalries had lower levels of public spending on health, but this was largely compensated by private spending. Civil wars had little effect on health spending, and rates of urbanization made no difference.

When we moved to explaining outputs of the health system, the patterns were similar in some respects but importantly different in others. Total health expenditures strongly raised the level of disability-adjusted life expectancy, as did education. Income inequality strongly depressed DALEs, and ethnic heterogeneity had a small, barely significant depressing effect. Income inequality seems to reduce DALEs more by its direct effect than by its indirect effect in depressing health spending, whereas the primary effect of heterogeneity seems to be indirect in

lowering public and total health spending. By different causal routes, however, both show what happens when large parts of the population have little political power. In contrast with their lack of impact on health spending, however, the direct negative effects of civil wars and urbanization on DALE were strong. Also by contrast, neither democracy nor international rivalries had much direct impact on DALE. Their impact comes earlier, on public on health spending.

This examination of some of the causes of human misery and its alleviation is still in an early stage. Better time-series information is needed to permit stronger causal inferences. Certainly we need to better comprehend micro-level political and social processes. We are also challenged to elaborate theories that accommodate complex interrelations, and to drive backward in the full system of influences to better understand the causes of phenomena such as educational levels, income inequality, and income inequality. Democracy, for example, is plausibly an important causal influence on all three. The relative impact of per capita income and per capita health expenditures on health outcomes also needs further exploration.

Improved data are essential—and are likely to be forthcoming. One avenue for our own research will be to employ a new data set from WHO on so-called DALYs—that is, disability-adjusted life years lost from various particular diseases and conditions, applied separately to both genders and various age groups. This will allow us to better estimate the correct time lags, and to focus much more effectively; for example, on the effect of civil wars or income inequality on women and children, and on the burden imposed by particular diseases. Some of these data are discussed in WHO (2000), and more are rapidly becoming available. The result should be a far deeper understanding of which groups are especially afflicted, and why.

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Figure 1: Conceptual Framework for Studying The Impact of Political, Economic, and Military Factors on Public Health

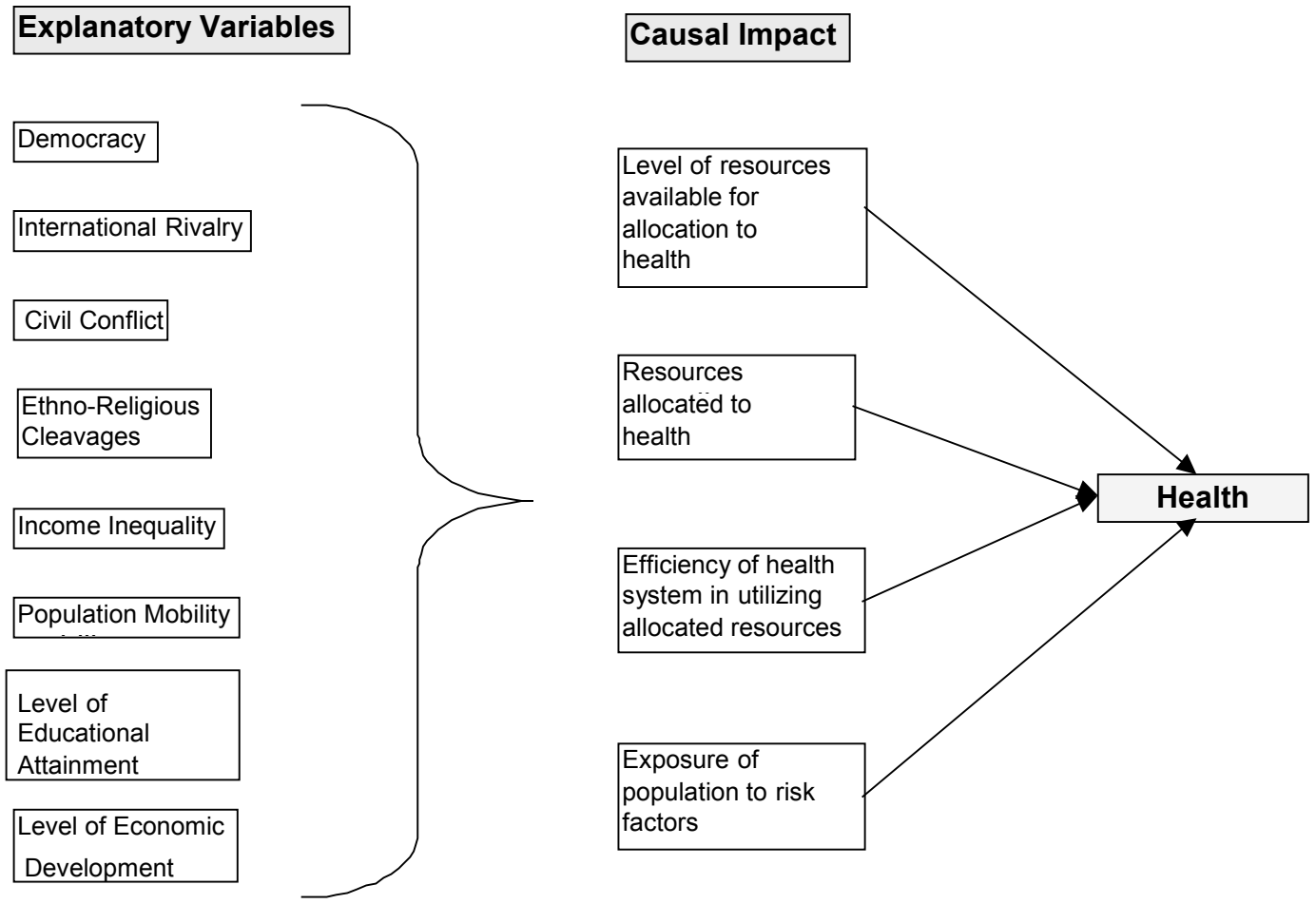

Table 1: Explaining Public Expenditures on Health

Explanatory Variables	Coefficient	Standard Error	p-value	Change in expenditures when explanatory variable moves from median down to 5th percentile	Percentage Change	Change in expenditures when explanatory variable moves from median up to 95th percentile	Percentage Change
GDP per capita	1.064	0.0605	0.000	-85.84	-82.9%	562.93	543.7%
Urban growth	-0.0471	0.0476	0.160	5.35	5.2%	-7.97	-7.7%
Income Gini	-1.314	0.5605	0.011	19.61	18.9%	-19.08	-18.4%
Education	0.191	0.1230	0.062	-19.70	-19.0%	13.46	13.0%
Ethnic heterogeneity	-0.0985	0.0430	0.012	13.25	12.8%	-25.18	-24.3%
Enduring rivalry	-0.39	0.1280	0.001	5.68	5.5%	-29.59	-28.6%
Polity score	0.018	0.0075	0.009	-20.04	-19.4%	14.01	13.5%
Civil war deaths 1991-1997	0.0580	0.0432	0.091	-1.27	-1.2%	5.87	5.7%
Contiguous Civil War	-0.0018	0.0965	0.490	0.09	0.1%	-0.10	-0.1%

N = 175 , Adjusted R-square = 0. 86 , Sigma = 0.570

Table 2: Explaining Private Expenditures on Health

Explanatory Variables	Coefficient	Standard Error	p-value	Change in expenditures when explanatory variable moves from median down to 5th percentile	Percentage Change	Change in expenditures when explanatory variable moves from median up to 95th percentile	Percentage Change
GDP per capita	0.976	0.0670	0.000	-56.80	-80.2%	319.91	451.8%
Urban growth	0.0524	0.0532	0.236	-3.86	-5.5%	6.60	9.3%
Income Gini	1.04	0.6250	0.048	-9.08	-12.8%	12.39	17.5%
Education	0.0333	0.1360	0.404	-2.56	-3.6%	1.53	2.2%
Ethnic heterogeneity	-0.0147	0.0476	0.379	-1.43	-2.0%	2.34	3.3%
Enduring rivalry	0.231	0.1410	0.052	-2.21	-3.1%	15.62	22.1%
Polity score	0.00569	0.0083	0.248	-4.65	-6.6%	2.90	4.1%
Civil war deaths 1991-1997	-0.0125	0.048	0.397	0.19	0.3%	-0.84	-1.2%
Contiguous Civil War	-0.0773	0.1070	0.236	2.67	3.8%	-2.80	-4.0%

N = 174 , Adjusted R-square = 0.75 , Sigma = 0.631

Table 3: Explaining Total Expenditures on Health

Explanatory Variables	Coefficient	Standard Error	p-value	Change in expenditures when explanatory variable moves from median down to 5th percentile	Percentage Change	Change in expenditures when explanatory variable moves from median up to 95th percentile	Percentage Change
GDP per capita	0.987	0.0397	0.0001	-157.43	-80.6%	903.71	462.5%
Urban growth	-0.0252	0.0313	0.21	5.34	2.7%	-8.19	-4.2%
Income Gini	-0.491	0.371	0.0935	13.08	6.7%	-14.32	-7.3%
Education	0.176	0.081	0.0155	-34.53	-17.7%	23.30	11.9%
Ethnic heterogeneity	-0.0618	0.0283	0.015	-16.08	-8.2%	28.59	14.6%
Enduring rivalry	-0.0002	0.083	0.5	0.01	0.0%	-0.03	0.0%
Polity score	0.0117	0.0049	0.0093	-25.49	-13.0%	16.80	8.6%
Civil war deaths 1991-97	0.0351	0.0284	0.109	-1.45	-0.7%	6.63	3.4%
Contiguous Civil War	-0.0143	0.0634	0.41	1.34	0.7%	-1.45	-0.7%

N = 175 , Adjusted R-square = 0.86 , Sigma = 0.375

Table 4: Explaining Years of Healthy Life Expectancy (DALE)

Explanatory Variables	Coefficient	Standard Error	p-value	Change in years of healthy life expectancy when the explanatory variable moves from median down to 5th percentile	Percentage Change	Change in years of healthy life expectancy when the explanatory variable moves from median up to 95th percentile	Percentage Change
Total health expenditure	3.51	0.574	0.000	-6.28	-11.0%	7.83	13.8%
Urban growth	-2.11	0.497	0.000	2.26	4.0%	-3.59	-6.3%
Income Gini	-21.4	5.97	0.000	2.82	5.0%	-3.32	-5.8%
Education	6.85	1.32	0.000	-7.57	-13.3%	4.38	7.7%
Ethnic heterogeneity	-0.585	0.453	0.099	0.81	1.4%	-1.29	-2.3%
Enduring rivalry	-0.0164	1.35	0.499	0.00	0.0%	-0.01	0.0%
Polity score	0.0211	0.0805	0.397	-0.25	-0.4%	0.15	0.3%
Civil war deaths 1991- 97	-1.003	0.453	0.014	0.21	0.4%	-0.95	-1.7%
Contiguous Civil War	-1.578	1.017	0.061	0.75	1.3%	-0.82	-1.4%

N = 177 , Adjusted R-square = 0.77 , Sigma = 6.04

Table 5: Do Causal Impacts Overlap?

Marginal impact when the explanatory variable moves from median up to the 95th percentile (only statistically significant impacts are displayed)

Explanatory Variables	Impact on DALE	Impact on public expenditure on health	Impact on private expenditure on health
Urban growth	-6.3% ***		
Income Gini	-5.8% ***	-18.4% **	17.4% *
Education	7.7% ***		
Ethnic heterogeneity		-24.3% **	
Enduring rivalry		-28.6% ***	
Polity score		13.5% **	
Civil war deaths 1991- 97	-1.7% **		
Contiguous Civil War			

Significance: * at 0.05 one-tailed , ** at .02 one-tailed, ***at .001 two-tailed

[1] In this we respond to the call of King and Murray 2001 for systematic analysis of human misery. Also see Russett 1978, Pritchett.and Summers 1996.

[2] Some observations were estimated by multiple imputation from other data on educational attainment. For sources and methods see Evans et al 2000b.

[3] Despite debate over the appropriate concept and measure of democracy, most measures for recent decades correlate very highly with each other (Vanhanen 2000).

[4] Since virtually all our hypotheses specify a direction of relationship, the p-values in the tables are for one-tailed tests. In the few instances when the evidence suggests a relationship opposite in direction to our hypothesis, the text gives values for a two-tailed test.

[5] Whereas either alone shows a very high t-value in virtually any multiple regression equation to explain DALEs, when entered together both their t-values typically drop to about 2.00 and their coefficients are cut in half.

[6] Suppose that a civil war kills all except one person in a country during the war, but that remaining person is very healthy and is expected to live long. DALE would then drop in the first year due to all the war deaths, but would rise in the next year because it is based only on people alive. In fact, however, we see low DALEs for several years after the war, reflecting new deaths and disabilities.

[7] Theory does not tell us just what the correct lag should be. For most infectious diseases—which we hypothesize as the principal cause of indirect civil war deaths--the lag time would seem short. Effects of damage to the health care system would probably

last longer, and the lag for cancers would be so long and varied that we cannot reasonably test for it. Experimentation with the lag structure indicates that the coefficient for wars in the 1977-90 period is only about one-fourth as large as for the 91-97 period in our basic equation, and not statistically significant. If we make a break between 1991-95 and 1996-97 the impact of the coefficient for the latter period is higher, but the standard error is very much higher. Eliminating all countries whose civil wars extended past 1997 reduces the impact of wars in 1996-97, but not that of earlier wars. Until more detailed data are available the 1991-97 lag to the 1999 DALEs seems about right.

[8] The metrics are only approximately comparable between the continuous civil war variable and the dummy variable for presence of a civil war in an adjacent state. One death from civil war per 100 people represents the 95th percentile of civil war deaths (34 countries out of 177 experienced civil wars, of which 9 were at or above this level of severity, so the comparison is reasonable but underestimates the effect of very severe civil wars at home.

[9] Variables that are at low levels of significance or clearly not significant are omitted in this summary table, but can be found in Tables 1-4.

[10] If a variable for the adult HIV rate in 1999 is added, it is highly significant and raises the predictive power of the equation. The explanatory variables that lose power do offer some hints as to what may be behind the AIDS effect: the rate of urbanization becomes statistically insignificant, and the significance level of income inequality drops to $p = .08$. Conditions of rapid urbanization and inequality may well promote HIV/AIDS, though we cannot establish a causal effect here.