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Mortality and Conflict in the Developing World

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Abstract

To varying extents, the world one is born into does not provide equal opportunities. This study measures the extent to which survivability across the developing world is affected by factors outside of the health and lifestyle choices one can make: industry, foreign markets, conflict, and the demographics around them. These variables are tested for a balanced panel of 102 countries over 7 years, allowing country-specific factors to be controlled.

Keywords: conflict, developing countries, well-being, natural resources

JEL Codes: O110, Z130, I310, F500

I

Individuals, families, and communities may undertake a variety of activities to better their lives, if such are available. The notion of one's life as one's project reflects the world that most know in high-income countries. It is a relatively stable, peaceful world of careers open to talents. In contrast is the notion of one's life as one's inheritance—this is a world characterized by a seemingly unpredictable environment and the difficulties of maintaining a "life project" therein. This is generally the world that is beneficiary of a host of interventions—notably, the World Bank—which are active in the developing world to enhance opportunities for the worse-off. But there are still significant barriers to wellbeing that individuals may have no control over. Higher mortality in the developing world reflects the increased risk of "life projects" facing interruption and chronic discouragement.

Many communities suffer from persistent violent conflict, representing a potentially large effect on the mortality of the broader population. Sociologists and Political Scientists found structural economic conditions to strongly influence conflict.[1] And while the number of non-state-based conflict events have risen relative to state-based, those involving government forces remain the most fatal by far, accounting for 72.8% of such deaths between 1989 and 2014.[2] It follows that government intervention has a substantially escalated outcome. This extraordinarily deterministic factor, to the extent that it affects a population's life-chances, is naturally expressed as a probability. Thus, the first research question models mortality, and the second models the probability of a state-based battle occurring.

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[1] See: Daniel Meierrieks, "Rooted in Urban Poverty? Failed Modernization and Terrorism," *Peace Economics, Peace Science, and Public Policy* (18, no. 3: 2012).
John Foran, *Taking Power: On the Origins of Third World Revolutions* (Cambridge, 2005).
Mike Lebson, "Why Refugees Rebel: Toward a Comprehensive Theory of Refugee Militarization," *International Migration* (51, no. 5: 2013).

[2] Erik Melander, "Organized Violence in the World 2015," Uppsala Conflict Data Program, 3.

The results reveal a complex interaction of variables. Trade and high-income trade partners have varying effects on mortality, but strongly affect state aggression. Demographic factors and unemployment increased mortality and conflict across each model. Section two provides an overview of the data structure, their interpretations, and descriptive statistics. Section three provides the theoretical methodology for nonlinearity, fixed effects, and interactions. Section four provides the test results, their significance, and interpretations. A conclusion follows.

II

Mortality fell drastically between 1967 and 2015. It fell the most for low-income countries:[3] by 182.1 deaths per 1,000 to the current level of 283.8. It fell the least, however, for the next category, lower-middle-income countries,[4] whose mortality fell by 136.2 to the current level of 222.9. These values remain very high compared to Lebanon's lowest recent value of 73.7. There are a number of other coincidences: the same group experienced 53,672 more battle-related deaths in 2015 than the next group (upper-middle-income at 11,791); had 86.9 more people living per square kilometer than the next group (low-income at 47.7); and the middle-income group as a whole exported 66% of its merchandise to high income countries. Together, lower- to middle-income countries are considered Lesser Developed Countries (LDCs). Demographic trends are assumed to strongly coincide with vital resources like clean water and sanitation that mitigate disease. A tighter labor market, represented by low unemployment, represents job opportunities that transfer into steady income and other market benefits. A high income export market and natural resource industry provide additional opportunities for economic growth.

[3] Classified by the World Bank as those with a GNI per capita of $1,025 or less in 2015, according to the World Bank Atlas Method.
[4] Classified as those with an income between $1,026 and $4,035.

Mortality is expected to be shaped by a lack of opportunities one could use to maximize wellbeing: steady employment, a livelihood unmolested by conflict, resources unstressed by demography, and the fair rule of law. A panel was created to mimic that environment. The mortality rate is constrained by gender in the World Bank, prompting male mortality to be chosen due to an expected higher sensitivity to these factors. The political and economic environment is formed with: unemployment, GDP per capita, population density and growth, export opportunities to high income countries, oil and mineral rents, and a governance index. Uppsala University furnishes the UCDP/PRIO Armed Conflict Dataset, which provides "a conflict-year dataset with information on armed conflict where at least one party is the government of a state."[5] The dataset is incorporated into the World Bank's World Development Indicators. Political rights and civil liberties are provided by Freedom House. The rest are provided by the World Bank.

Although bias does not arise from randomly missing values, a balanced panel has the benefit of minimizing standard errors. Some important decisions were made to that end. Firstly, some variables could not be used (e.g. natural resource rents, poverty ratio, fuel exports, access to clean water) due to missing data. Failed states and those undergoing all-out civil war (Eritrea, Somalia, South Sudan, and Syria) were removed due to missing data, but their uniqueness also exclude them from the theoretical design. Then states with populations less than 1 million were removed. Many of these are small island nations that are heavily dependent on a single economic activity, isolated from trade, dependent on international assistance, and so on. Finally, once a time period was determined to have the fullest observations, a final few countries were removed due to their not meeting this last standard (Bulgaria, Russia, Myanmar, Venezuela, Equatorial

[5] Therése Pettersson, and Peter Wallensteen, "Armed Conflicts 1946-2014," *Journal of Peace Research* (53, no.5: 2016).

Guinea, and Turkmenistan). The former restrictions were made on behalf of theory, so these final six countries are the only ones removed "arbitrarily." A balanced panel of 102 LDCs from 2007 to 2013 remains. The variables' basic interpretations follow in Table 1, with summary statistics in Table 2.

Table 1

Mortality	Mortality rate of male adults (per 1,000)
B_Deaths	Battle-related deaths (number of people, UCDP's best est.)
Density	Population density (people per sq. km. of land area)
Urb_Growth	Urban population growth (annual %)
Pop_Growth	Population growth (annual %)
Ex_HighInc	Exports to high-income countries (% total merchandise exports)
Unempl	Unemployment, total (% of total labor force)
GDP_Cap	GDP per capita (constant 2010 US dollars)
Oil_Rents	Oil rents (% of GDP)
Min_Rents	Mineral rents (% of GDP)
FH	Freedom House (avg. between pol. rights, civil liberties scores)

Table 2: Summary Statistics

Variable	Mean	Median	Std. Dev.	Min	Max
Mortality	260.045	242.595	106.934	73.690 (Lebanon)	677.853 (Zimbabwe)
Pop_Dens	108.963	67.531	152.448	1.669 (Mongolia)	1,207.320 (Bangladesh)
Pop_Grow	1.772	1.701	1.165	-1.666 (Romania)	7.108 (Lebanon)
Urb_Grow	2.763	2.826	1.698	-1.422 (Romania)	7.247 (Lebanon)
B_Deaths	217.364	0.000	970.814	0.0 (Kenya)	10,165.0 (Sri Lanka)
Exp_HighInc	54.269	58.788	23.832	0.0 (Botswana)	98.114 (Chad)
Unemp	8.988	7.0	6.868	0.10 (Cambodia)	37.600 (Lebanon)
GDP_Capita	3,235.90	2,237.180	2,930.550	211.022 (Burundi)	11,933.80 (Libya)
Oil_Rents	5.981	0.153	12.861	0.0 (Burundi)	65.603 (Congo, R.)
Min_Rents	2.658	0.481	5.858	0.0 (Afghanistan)	44.644 (Mauritania)
FH	24.978	26.000	11.076	1.50 (Uzbekistan)	45.50 (Costa Rica)
Battle_dum	0.220	0.0	0.414	0.0 (NA)	1.0 (NA)

Note: These are for the original data and do not include subsequent alterations as found below.

The panel structure introduces danger that a variable's estimated value is strongly correlated with a past trend. The results of Augmented Dickey-Fuller tests are presented in Table 3, testing the joint hypothesis that each cross section is nonstationary including a constant and one lag. The program could not conduct the test on *B_Deaths* because it is mostly zeros.

Table 3: ADF

Variable	Statistic	.1st Dif.
Mortality	-2.896**	--
Pop_Growth	-3.372**	--
Density	-3.096**	--
Urb_Growth	-3.331**	--
Exp_HighInc	-2.470	-2.974*
Unempl	-3.095**	--
GDP_Cap	-3.515***	--
Oil_Rents	-4.921***	--
Min_Rents	-3.611***	--
FH	-2.857*	--
***,**,* = 1%, 5%, 10% significance level		

The results that reject the joint null hypothesis prove there is variation across time and country for each of those variables. Conversion to first differences would make the variable stationary which originally failed the test, as indicated by the corresponding column. However, it also reduces the observations from 714 to 612, due to some differences becoming negative or zero. In order to maintain a balanced panel, the logarithm of *Exp_HighInc* was used instead, and is interpreted as the $.01\beta$ change.

III

Methodology followed the goals of maximizing the R-squared for each estimated model and including the most precise specifications. For example, a cubic variable that is not statistically significant would be excluded, leaving the linear and quadratic. Beginning with this assumption, the specifications used are desbribed in their most general form below, along with the theoretical reasoning leading thereto. The particular models estimated from these are presented in the next section.

It is predicted that the structural conditions do not impose a high cost on human life until it reaches a certain threshold. There is a boundary between moderation and severity. For example, a low unemployment rate signifies that there is just enough slack for firms to hire with discretion, whereas a higher rate indicates that many people are searching for work but cannot

attain it. Moderate population density indicates little else than an organized society, but decreasing returns to scale for benefits coincide with increasing externalities, such as resource and infrastructural strain. Nonlinear specifications of these variables investigate the significance of these dynamic relationships. A polynomial regression model estimates the nonlinear relationship:

$$Y_{it} = \beta_0 + \beta_{it}^{r} + u_{it},$$

where $i = 1, \ldots, 102$ and $t = 1, \ldots, 7$ and r is the power of the variable.

In addition, there is reason to believe factors exist which do not vary across time. In the media religion is commonly associated with ongoing violence in certain areas. A glance at the Uppsala Conflict Encyclopedia map seems to corroborate this anecdote from the extremist Taliban in Afghanistan, to the persecution of Muslims in Myanmar, to the border between Muslim majority and non-Muslim majority states in sub-Saharan Africa. Strong religious views are almost universal to the sample. A Pew survey shows that respondents in LDCs overwhelmingly believed that religion is essential to morality, with slight variance among countries.[6] These values may interact with others to create unmeasured cultural differences. These vary little, if any, across time, and can thus be assumed artifacts of the intercepts. This is estimated as a fixed-effects regression model:

$$Y_{it} = \alpha_i + \beta_{it} + u_{it}$$

Alpha incorporates the omitted qualities of country i that do not vary across time into the intercept. The coefficients on the observed variables are thus the effect on mortality holding constant any unobserved variables, such as cultural attitudes.

[6] "Worldwide, Many See Belief in God as Essential to Morality." (March 2014). Pew Research. http://www.pewglobal.org/2014/03/13/worldwide-many-see-belief-in-god-as-essential-to-morality/

It is suspected that trade partners matter more for countries rich in precious resources. Access to a high income export market ensures a higher level of confidence in a stable market over time. A country with poorer infrastructure and governance will have a harder time establishing trade relations with richer countries. Interaction between the continuous variables *Ex_HighInc*, *Oil_Rents*, and *Min_Rents* is tested by adding the following equation:

$$Y = \beta_0 + \beta_1(Exp\_HighInc) + \beta_2(Oil\_Rents) + \beta_3(Exp\_HighInc*Oil\_Rents) + \beta_4(Min\_Rents) + \beta_5(Exp\_HighInc*Min\_Rents)$$

This represents the effect that these resources may have on mortality when the levels of these resources are also allowed to be affected by the level of relationship with the high-income world. Said differently, the effect on Y of oil rents, holding all else constant, is β_2; the extra effect on Y given a change in both oil rents *and* a high-income relationship is β_3.

A second model will estimate the probability of state involvement in conflict. Given the prevalence of what may appear to be "missing data," the variable may be more useful if all battle deaths are reduced to the value of 1. Creating a dummy variable out of *B_Deaths* enables a limited dependent variable regression model predicting the conditional probability that a state-based conflict occurs:

$$\Pr(Y=1 \mid X_k) = \phi(\beta_o + \beta_{it} + u_{it}),$$

where ϕ represents the standard normal distribution function.

IV

The results show the effect on mortality of the selected variables. The specifications described above are reported in separate columns in the below tables. For Table 4, the columns progressing from left to right are: linear OLS, linear OLS with interaction, nonlinear OLS with interaction, and fixed-effects with the previous specifications. Each column, then, is a different

functional form with the same base variables. Table 5 shows the difference in the probability model between linear and probit forms.

Table 4: Regression Model of Mortality

Variable	(1)	(2)	(3)	(4)
Intercept	368.376***	379.933***	384.805***	391.486***
	(24.597)	(29.395)	(27.369)	(28.375)
Pop_Dens	-0.077 ***	-0.076 ***	-0.003	0.019
	(0.015)	(0.015)	(0.040)	(0.044)
Pop_Grow	13.542***	13.734***	20.564 ***	21.296***
	(3.941)	(.3.908)	(5.955)	(5.787)
Unemp	1.522 **	1.453**	2.512***	2.582***
	(0.603)	(0.600)	(0.601)	(0.573)
lnExp_HighInc	-28.990***	-32.083***	-29.650***	-33.825 ***
	(4.494)	(5.939)	(5.461)	(5.530)
GDP_Capita	-0.014***	-0.014***	-0.039***	-0.040***
	(0.002)	(0.002)	(0.004)	(0.005)
Oil_Rents	0.782**	-6.311**	-2.259	.002
	(0.312)	(2.440)	(-0.830)	(3.518)
Min_Rents	-.883	-4.907	-1.635	-2.051
	(0.532)	(3.689)	(3.830)	(3.814)
FH	0.505	0.521	0.751*	0.892*
	(0.366)	(0.370)	(0.385)	(0.465)
*ExHi*Oil*		1.721 ***	0.838*	0.343
		(0.601)	(0.656)	(0.837)
*ExHi*Min*		1.137	1.061	-1.222
		(1.003)	(1.073)	(1.069)
GDP_Capita^2			2.49e-6***	2.60e-6***
			(3.67e-7)	(4.12e-7)
Pop_Grow^2			-3.943***	-3.804***
			(1.162)	(1.127)
Pop_Dens^2			-6.76e-5***	-8.66e-5**
			(2.98e-5)	(3.61e-5)
Min_Rents^2			-.105***	-.109***
			(.034)	(.035)
F-Test, linearity:			17.468***	13.590***
			(6.73e-11)	(6.97e-9)
Adj/Pseudo R^2:	0.316	0.320	0.362	0.465

Table 5: Probability Regressions of State-Based Conflict

Variable	LPM	Probit
Intercept	-0.337***	-3.788***
	(0.072)	(.500)
Urb_Growth	0.113***	0.551***
	(0.023)	(0.142)
Urb_Growth^2	-0.012***	-0.061***
	(0.004)	(0.021)
Pop_Dens	0.001**	0.002**
	(0.000)	(0.001)
Pop_Dens^2	-6.12e-7***	-2.88e-6***
	(2.30e-7)	(8.35e-7)
Unempl	0.009***	0.041***
	(0.002)	(.009)
*ExHi*Oil*	-0.001	-0.007
	(0.004)	(0.011)
*ExHi*Min*	-0.007*	-0.036**
	(0.004)	(0.018)
lnEx_HighInc	0.076***	0.448***
	(0.009)	(.074)
Oil_Rents	0.021	0.076
	(0.015)	(0.047)
Min_Rents	0.029**	0.163**
	(0.013)	(0.064)
Oil_Rents^2	-0.000***	-0.001***
	(6.41e-5)	(0.000)
Min_Rents^2	-0.000	-0.002*
	(0.000)	(0.001)
FH	-0.003**	-0.013**
	(0.001)	(0.005)
F-Test, linearity:	6.937	7.310
	(5.70e-5)	(9.05e-6)
Adj/Pseudo R^2:	0.097	0.122

Table 4 contains both expected and unexpected results. *FH* shows a positive relationship with mortality, meaning that a higher governance rating is associated with higher mortality, which is not intuitive. The most misleading result is for *Oil_Rents*, where the sign changes between functional forms. Adding the interaction clearly accounts for this. When the effect on mortality from changing both *Oil_Rents* and *Exp_HighInc* is added, it accounts for the positive conditional relationship on Y of the two, and the effect of a change separately from either of

them increases in negativity. This interaction captured the hypothesized relationship. The separate marginal effect on mortality of oil and mineral rents for form (1) is given by the coefficient of *Oil_Rents*, .782. For an increase in the share of GDP occupied by oil rents by 1%, there is an increase in mortality by .782 per 1,000 males. The partial derivative for form (2) adds the product of the interaction term and the share of merchandise being exported to a high-income country:

$$\frac{\Delta Mortality}{\Delta Oil\_Rents} = -6.311 + 1.721(Exp\_HighInc)$$

When *Exp_HighInc* is at its median (58.788), form (2) predicts a marginal change in the mortality rate of 84.863.

Population growth has the largest effect on mortality. The nonlinear form (3) added statistically significant quadratic variables. The nonlinear effect on mortality after a marginal change in *Pop_Grow*th is represented by the equation:

$$\Delta Y = \hat{f}(X_k + \Delta X_k) - \hat{f}(X_k),$$

$$\frac{\Delta Mortality}{\Delta Pop\_Grow} = [20.564(1.7) + 20.564(1.8) - 3.943(1.7)^2 - 3.943(1.8)^2] - [20.564(1.7) - 3.943(1.8)^2]$$

An increase in population growth from 1.7 (the median) to 1.8 is predicted to increase the mortality rate by 25.620. Each form improves the R-squared, and an F-statistic, testing the null hypothesis that the slopes of the quadratic variables are zero, is rejected.

Table 5 provides probit and linear probability model (LPM) forms predicting the probability that a state-based conflict occurs. While the two appear very similar, the probit form contains higher coefficients and a higher pseudo-R-squared. Urban growth appears to have the largest effect. The effect on mortality of urban growth at its median (2.826) is:

$$\frac{\Delta ConflictProb}{\Delta Urb\_Grow} = \phi(.551(2.826) - .061(2.826)) = .9162$$

Including the intercept decreases the probability to .0094. The probit correctly predicted 79.0% of cases. Finally increased trade with the developed world is predicted to increase the probability of a state-based conflict, in contrast to Table 4. *Min_Rents* has the second highest direct effect on *phi*, .163(X)-.002(X)^2. *Exp_HighInc* also has a positive impact. It follows that, although there is a weak relationship between these structural factors and personal opportunities, there is a strong relationship between these factors and state-based conflict.

V

The results reveal significant barriers to labor markets in LDCs, adding another nuance to the so-called middle-income trap. The trade relationship to high-income countries is complex, providing opportunities for industrial growth with natural resources, but increasing state aggression. Unemployment and demographic factors are additional barriers to well-being. This study indicates that the primary challenge for governance vis-à-vis wellbeing is not just growth, but to manage the interactions between economic activities and to anticipate negative reciprocity. To wrest free of a middle-income trap is to potentially expose a growing population to additional constraints. Otherwise beneficial, an increasing rate of economic growth may provide negative feedback against the members for whom it should function. In that case, market benefits alone are not sufficient.