

Annex to “Autocratization Is Hazardous for Your Health”  
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## **1. Data**

### **1.0 Introduction**

The objective of this research is to examine the relationship between autocracy and population health. Our primary indicators come from the Global Burden of Disease (GBD) project and the Varieties of Democracy (V-Dem) project.

#### **1.1 Health Indicators**

We extract updated 2017 Global Burden of Disease health variables as used in Bollyky et al. (2019). A more comprehensive summary of these variables is available in the supplementary annex to that work. It is replicated here for ease of access.

Death and disability-adjusted life year (DALY) estimates are from the Global Burden of Disease 2017 study. The GBD 2017 reports age- and sex-specific DALY estimates for 333 diseases in 195 countries and territories from 1990 to 2017. The GBD 2017 also reports mortality estimates for 264 causes in 195 countries and territories from 1980 to 2016 and life expectancy from 1970 to 2016, both by age and sex. We use national cardiovascular mortality rates (per 100,000 population).

Additionally, we extract HIV-free life expectancy at birth, which provides an estimation of what life expectancy in each country and year would have been had the HIV/AIDS pandemic not occurred. The HIV-free life expectancy estimates also did not include mortality shocks caused by war and natural disasters.

#### **1.2 Political Indicators**

Our democracy indicators are drawn from the Varieties of Democracy data set (version nine). That data set provides over 450 indicators of regime characteristics for 201 countries in the world from 1789 to 2017. Each of the political indicators in that data set is based on the responses of multiple country experts to a range of specific survey questions. The ratings of those experts were aggregated using Bayesian item response modeling techniques. We use four different democracy indicators in this study.

*Autocratization and Democratization Episodes:* Each episode reflects a substantial decline or increase in V-Dem’s electoral democracy index (v2x\_polyachy). Autocratization and democratization can occur in democracies and in autocracies. An autocratic transition occurs when autocratization leads to a transition from a democratic regime to an autocratic regime. Equally, a democratic transition occurs when democratization leads to a transition from an autocratic regime to a democratic regime (see Luhrmann and Lindberg, 2019).

*Regime Type:* We use a fourfold classification of political regimes: closed autocracies, electoral autocracies, electoral democracies, and liberal democracies (v2x\_regime). These are differentiated based on the presence of multiparty elections, free and fair elections, the equal protection of rights, and constraints on the executive. Closed autocracies lack multiparty elections. Electoral autocracies have multiparty elections but lack free and fair elections. Electoral democracies have free and fair multiparty elections but do not provide sufficient protection to individual rights and/or constraints on the executive. Only liberal democracies have achieved a sufficient level with respect to all these criteria (see Luhrmann, Tannenberg, and Lindberg, 2018).

*Democratic Experience:* Our democratic experience variable is based on V-Dem's multiplicative polyarchy index (v2x\_mpi). That index is the product of the five core components of electoral democracy: suffrage, free and fair elections, elected officials, freedom of civil and political organization—including opposition political parties—and freedom of expression, including access to alternative information sources. The five components are multiplied so as to capture the intuition that each is a necessary and complementary ingredient of democratic rule. We constructed a stock measure of democracy by taking the sum of each country's multiplicative polyarchy index score from 1900 to the observation year, applying a 1 percent annual depreciation rate (see Bollyky et al., 2019).

*Election Turnover:* Election turnover is the change in the head of the government, such as a president or prime minister, due to an election (v2eltturnhog). Regimes that have free and fair multiparty elections will typically experience more changes in the head of government than regimes that lack free and fair multiparty elections.

## **2. Methods**

### **2.1 Synthetic Control Method**

The second visualization compares the HIV-free life expectancy at birth of those countries that unambiguously transitioned from electoral democracy to electoral autocracy during the last twenty years with a synthetic control of weighted comparator countries (Abadie et al., 2010; Galiani and Quistorff, 2017). Electoral democracies and electoral autocracies both have multiparty elections, but the latter lack free and fair elections (Luhrmann, Tannenberg, and Lindberg, 2018). The treatment year was identified as the start of the autocratization process (Luhrmann and Lindberg, 2019) that led to the transition to electoral autocracy. Only those countries that started the process between 1999 and 2009, and that remained electoral autocracies until at least 2017, were retained for the analysis. This was done to ensure a sufficient number of pre- and posttreatment periods. The pool of comparator countries are the countries that have remained electoral democracies continuously since at least 1990.

**Table 1: Countries Used in the Synthetic Control Analysis**

<b>Country</b>	<b>Regime status</b>
Argentina	Electoral democracy
Bulgaria	Electoral democracy
Bolivia	Electoral democracy
Brazil	Electoral democracy
Barbados	Electoral democracy
Botswana	Electoral democracy
Colombia	Electoral democracy
Ecuador	Electoral democracy
Honduras	Autocratic transition started: 2009
India	Electoral democracy
Israel	Electoral democracy
Italy	Electoral democracy
Jamaica	Electoral democracy
Malta	Electoral democracy
Mongolia	Electoral democracy
Mauritius	Electoral democracy
Nicaragua	Autocratic transition started: 2003
Panama	Electoral democracy
Romania	Electoral democracy
Senegal	Electoral democracy
Suriname	Electoral democracy
Turkey	Autocratic transition started: 2008
Venezuela	Autocratic transition started: 1999
Vanuatu	Electoral democracy

Weights were set such that the synthetic control compares directly to corresponding treatment countries with the most similar pretreatment characteristics described below.

**Table 2: Predictor Variables in the Synthetic Control Analysis**

<b>Variable</b>	<b>Description</b>	<b>Source</b>
GDP per capita	Gross domestic product per capita	Institute for Health Metrics and Evaluations
Maternal education	Mean level of maternal education attainment	GBD 2017 covariates
Educational attainment	Mean level of educational attainment at ages 15–19 (by sex)	GBD 2017 covariates
Agricultural activity	Proportion of population involved in agricultural activities (by sex)	GBD 2017 covariates
Indoor air pollution	Household prevalence of cooking with coal or biomass	GBD 2017 covariates
Cholesterol	Mean serum total cholesterol (mmol/L) for individuals above age 25 (by sex)	GBD 2017 covariates
Binge drinking	Alcohol binge drinker proportion, age standardized (by sex)	GBD 2017 covariates
Smoking	Smoking prevalence at ages 15–19 (proportion between zero and one) (by sex)	GBD 2017 covariates
Diabetes	Mean diabetes fasting plasma glucose (mmol/L) by age group (by sex)	GBD 2017 covariates
Physical activity	Total physical activity (MET-min/week) for individuals above age 25 (by sex)	GBD 2017 covariates
Obesity	Prevalence of obesity at age 25 (by sex)	GBD 2017 covariates
Blood pressure	Mean systolic blood pressure (mmHg) for individuals above age 25 (by sex)	GBD 2017 covariates

The effect of autocratic transitions was estimated by comparing the life expectancy trajectories of the autocratizing countries and their synthetic controls. Our test for statistical significance is the proportion of untreated countries that produced the same or greater estimated effect as the treated countries.

## 2.2 Long Difference Analysis for the Effect of Democracy on Cardiovascular Mortality

The main regression specification for this analysis is described in further detail in Bollyky et al. (2019), which is summarized here.

For cardiovascular mortality, we estimate a structural equation model of the form:

$$\begin{aligned}\Delta(\text{Government Health Expenditure as Source}_{it}) &= \beta_{10} + \beta_{11}\Delta(\text{Democratic Stock}_{it}) + \varepsilon_{it} \\ \% \Delta(\text{Urbanicity}_{it}) &= \beta_{20} + \beta_{21}\Delta(\text{Democratic Stock}_{it}) + \varepsilon_{it} \\ \% \Delta(\text{GDP per Capita}_{it}) &= \beta_{30} + \beta_{31}\Delta(\text{Democratic Stock}_{it}) + \varepsilon_{it} \\ \% \Delta(\text{Death Rate}_{it}) &= \beta_{40} + \beta_{41}\Delta(\text{Democratic Stock}_{it}) + \\ &\quad \beta_{42}\Delta(\text{Government Health Expenditure as Source}_{it}) + \\ &\quad \beta_{43}\% \Delta(\text{Urbanicity}_{it}) \\ &\quad \beta_{44}\% \Delta(\text{GDP per Capita}_{it}) \\ &\quad \beta_{45}\Delta(\text{Skilled Birth Attendance}_{it}) + \\ &\quad \beta_{46}\Delta(\text{Maternal Education}_{it}) + \\ &\quad \beta_{47}\Delta(\text{Obesity Prevalence}_{it}) + \\ &\quad \beta_{48}\text{Death Rate}_{it} + \varepsilon_{it}\end{aligned}$$

where  $i$  is country,  $t$  is year, and  $\Delta$  denotes difference over twenty years. For this analysis, we used data from 165 countries, observing data from 1995 and 2015, and taking the difference. Five countries were dropped from the analysis due to missing data in recent years.

Average effects are presented in Bollyky et al. (2019). Our interactive maps display these regression results in two ways: (1) based on the observed change in democratic experience (democratic stock), this would be the average associated change in cardiovascular mortality; (2) if all countries experienced fifteen full years of democratic experience, this would be the average reduction in mortality.

## References

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