Effect of democratic reforms on child mortality: a synthetic control analysis

Hannah Pieters, Daniele Curzi, Alessandro Olper, Johan Swinnen

Summary

Background The effects of political regimes on health are unclear because empirical evidence is neither strong nor robust. Traditional econometric tools do not allow the direction of causality to be established clearly. We used a new method to investigate whether political transition into democracy affected child mortality.

Methods We used a synthetic control method to assess the effects of democratisation on child mortality as a proxy of health in countries that underwent transition from autocracy to democracy that lasted for at least 10 years between 1960 and 2010. Democracy was indicated by a score greater than 0 in the Polity2 index. We constructed synthetic controls (counterfactuals) based on weighted averages for factors such as child mortality, economic development, openess to trade, conflict, rural population, and female education from a pool of countries that remained autocracies during the study period.

Results Of 60 countries that underwent democratic transition in the study period, 33 met our inclusion criteria. We were able to construct good counterfactuals for 24 of these. On average, democratisation reduced child mortality, and the effect increased over time. Significant reductions in child mortality were seen in nine (38%) countries, with the average reduction 10 years after democratisation being 13%. In the other 15 countries the effects were not significant. At the country level yhe effects were heterogeneous, but the differences did not correlate with geographic, economic, or political indicators. The effect of democratisation, however, was stronger in countries with above average child mortality before transition than in countries with below average child mortality.

Interpretation Our results are consistent with the interpretation that democratic reforms have the greatest effects when child mortality is a direct concern for a large part of the population. Future research could focus on identifying the precise mechanism through which the effects emerge.

Funding European Union 7th Framework Programme and KU Leuven Methusalem Fund.

Lancet Glob Health 2016

Published Online
August 1, 2016
http://dx.doi.org/10.1016/S2214-109X(16)30104-8

See Online/Comment
http://dx.doi.org/10.1016/S2214-109X(16)30153-X

LICOS Centre for Institutions and Economic Performance, Leuven, Belgium (H Pieters MSc, A Olper PhD, J Swinnen PhD); **Department of Economics, Management and Quantitative Methods, University of Milan, Milan, Italy** (D Curzi PhD, A Olper); **and Centre for Food Security and the Environment, Stanford University, Stanford, CA, USA** (J Swinnen)

Correspondence to:
Dr Hannah Pieters, LICOS Centre for Institutions and Economic Performance, KU Leuven, Waaistraat 6 bus 3511, 3000 Leuven, Belgium
hannah.pieters@kuleuven.be

Introduction

The effects of political regimes on health are unclear. Democracy is argued to be good for health because it gives the poor a stronger voice in political decision-making than other regimes, leading to improved public health policies, or because it stimulates economic growth and, therefore, income and health.[1,2] Not everybody, however, agrees that democratisation necessarily improves people's health.[3] The empirical evidence is neither strong nor robust[4] and establishing causality is difficult.[5,6]

Few studies have quantitatively assessed the effects of democracy on health. Besley and Kudamatsu,[4] and Franco and colleagues[7] have reported positive correlations between democracy and health indicators, such as life expectancy and mortality, with global data.[2,7,8] Alvarez-Dardet and Franco-Giraldo[9] also showed a positive relation between democracy and health in postcommunist countries, with the fall of the Berlin Wall used as a natural experiment. By contrast, Ross[8] found no significant effect of democracy on child mortality in a global dataset.

Causality is unclear because health and prosperity might themselves affect political systems, and both could be affected by other factors. In one study by Kudamatsu,[10] who used panel data from various African countries, causality is clearer. He showed an association between democratic transition and reduced infant mortality, although the analysis was limited to a few countries from one continent and generalisation of the results should be viewed with caution.

We used a new method to assess data from multiple countries and different continents and investigate the effects of democratic reforms on health, represented by child mortality. The synthetic control method (SCM) developed by Abadie and colleagues,[11,12] allows identification of heterogeneity and causality in health effects related to democratisation, unlike traditional statistical methods. We used the SCM to assess the health effects of 33 democratic reforms between 1960 and 2010.

Methods

Synthetic control method

SCM allows estimation of the effect of an event, termed the treatment, within a country, despite the fact that the counterfactual for the treated country is not observed.

Research in context

Evidence before this study

Between September, 2011, and December, 2015, we regularly searched for published papers in Google Scholar and JSTOR, with the terms "health" and "democracy". We found only a few studies that have empirically assessed the relations between democracy and health. The evidence on a causal effect is neither strong nor robust. One study did not find a significant correlation between democracy and child mortality, whereas three others showed positive relations between democracy and health indicators. None of these studies, however, could demonstrate causality. Another study showed a causal effect of democratisation on health by using retrospective fertility surveys for a subset of African countries.

Added value of this study

In this study we have used a new method, the synthetic control method, and used data from a large set of countries to assess the causal effects of democratisation on health, assigned as child mortality. We found important heterogeneity in the effects of democratic transition between countries, with effects being significant in 40% and non-significant in the others, although none had an increase in child mortality. The difference in effects did not correlate with geographic, economic, or political indicators, but in countries with initial child mortality higher than average, the effect was greater than in countries where it was lower than average.

Implications of all the available evidence

A political transition into democracy reduces child mortality on average, but the results are heterogeneous across countries. This difference might explain why results have varied in previous studies. The health situation before democratisation seems to be a factor in the effects afterwards. Reforms that improve the political power of the poor might, therefore, be particularly important when health problems are severe.

In the case of this study, the treatments are democratic transitions. SCM allows comparison of child mortality in a treated country before and after political reform with the weighted average child mortality constructed from a pool of countries without political reform.[12] The weights are calculated such that the synthetic control resembles the characteristics of the treated country before the regime change. The SCM minimises the distance between the vector of characteristics of the treated country and that of the synthetic control before treatment.

The use of the SCM is an improvement on other parametric and semiparametric estimators for several reasons: the characteristics before treatment between the treated country and its counterfactual fit in a transparent way; its selection of potential control countries is flexible; and the method implies weaker identification assumptions than traditional estimation techniques, which also provides flexibility.[13] Additionally, this method allows exclusion of observations for which it is not possible to build a proper counterfactual, as the inclusion of these countries would lead to biased results.[13] Through combining the properties of large cross-country studies, which often lack internal validity, and case studies, the findings of which often cannot be generalised, the SCM estimator gains external and internal validity.[13]

A limitation of the method is that standard inference techniques are not suitable to assess the significance of the results because the number of permanent regimes in the control group is small. Abadie and colleagues, therefore, suggested the use of a placebo test[12] to compute p values in order to assesses whether the effect of political reform on child mortality in the treated country is larger than that if the political reform is randomly assigned to a country in the control group. Furthermore, as suggested by Cavallo and colleagues,[14] we extended the method to compute an average treatment effect that we used to estimate the average effect and joint significance of the treatments in different countries compared with any potential combination of placebo effects.[13]

For more on **Group for Child Mortality Estimation** see http://www.childmortality.org

Main indicators

We used panel data to calculate annual indicators for health and political reforms in Asian, African, and Latin American countries from 1960 to 2010. The political reform indicator is based on the Polity2 index from the Polity IV database,[15] and has been used in several other studies on political reforms.[16–19] The Polity2 index ranges from –10 to 10. A country is classified as a democracy when the Polity2 value is greater than 0, with higher values indicating an increasing degree of democracy, and otherwise is classified as an autocracy. The threshold of 0 corresponds to a broad definition of democracy, but as stressed by Persson and Tabellini,[16] it captures many large changes in the Polity2 index that are clustered around 0. We used two additional criteria for political reform. First, as it might take several years before political transition affects health, we only included transitions that lasted at least 10 years in the treated sample. Second, the sample of treated countries had to have at least 10 years of observations under autocracy before the democratic transition.

Child mortality was used as indicator of health, and was measured as the number of children who died before age 5 years per 1000 livebirths. This factor is a good indicator of overall health because 20% of all deaths occur before this age.[20] We used data from the UN Inter-agency Group for Child Mortality Estimation. To test whether the effect of democratic reforms is stronger in countries with higher child mortality, we compared countries with above average and those with below average child mortality in the year of the reform.

Control variables

To construct the synthetic controls, we included variables that have been shown in previous studies to capture factors other than democratic transition likely to affect the prevalence of child mortality. Economic development (real gross domestic product per person[21]) affects child health because of the amount it allows governments to spend on health and sanitation facilities, education, and so on. The share of the rural population captures the fact that providing such public goods in rural areas is more difficult than in urban areas,[22] and that the highest proportion of poor people live in remote areas where availability and access to health infrastructure is limited.[8]

Female education (in particular for mothers), measured as the percentage of female children who have completed the last year of primary school or higher,[23] can be an important factor in children's health.[24] A country's openness to trade[21] might increase income, immunisation rates, and public health spending.[25] Shocks, such as conflicts and wars,[26] can have a direct effect on child mortality, but also indirect effects, for instance through reduced access to food. Thus, as suggested by Kudamatsu,[10] we defined conflict as a dummy that is equal to 1 if the country was involved in a conflict with more than 1000 deaths. Population growth[21] was also included as a control. Finally, we included child mortality in the year of the reform and in the 5 and 10 years before the democratic transition.

Statistical analysis

The SCM allows estimation of the overall fit of the selected synthetic control in comparison with that of the treated unit by measuring the root mean square prediction error. Values of 3 or lower show a good fit between the treated unit and the synthetic control. We excluded countries with values higher than 3. To test the robustness of our results, we repeated the analysis with a shorter treatment period (democracy lasting 6 years) and using a different indicator for the political transitions (Cheibub-Gandhi-Vreeland indicator[27]).

We calculated p values for aggregated effects by considering the ratio between the number of any potential average placebo effect showing an effect higher than the aggregation of the actual treated countries, and the total number of potential average aggregation of placebo effects.[14] The statistical analyses were done with Stata (version 13) and Matlab (version 2015).

Role of the funding source

The funder of the study had no role in the study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

	Full sample	Democracy	Autocracy
1970–79	153·8	143·3	157·7
1980–89	117·3	89·6	124·6
1990–99	90·4	86·1	97·7
2000–09	64·8	65·1	64·5

Data are simple unweighted averages across political regimes for the 33 treated countries and 29 controls in the sample. The samples vary over time due to entry into and exit from democracy.

***Table 1*: Average number of child deaths per 1000 livebirths by decade and political regime**

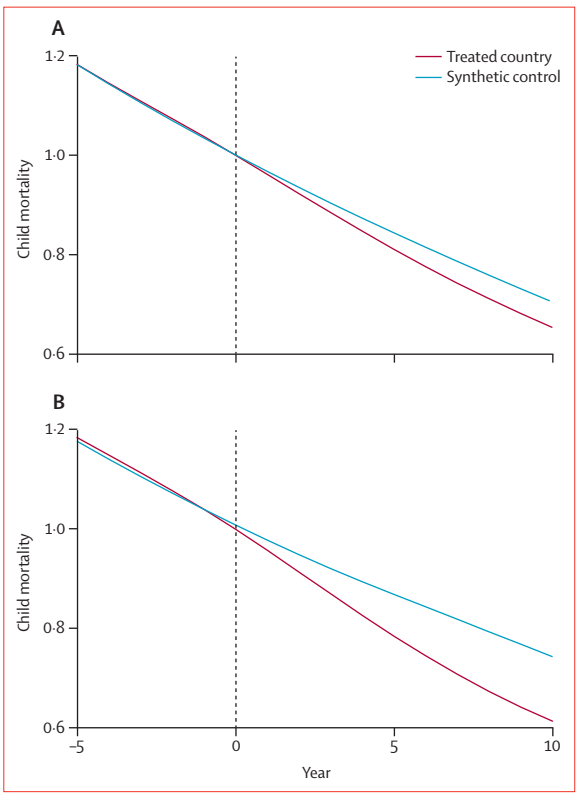

***Figure 1*: Average effects of democratisation on child mortality**
(A) 24 countries with good synthetic controls. (B) Nine countries in which the effect was significant . The estimated effects were normalised by setting child mortality equal to 1 in the year of the reform.

Results

Of 60 countries that underwent democratic transition between 1960 and 2010, 33 met our inclusion criteria. The control pool consisted of 29 permanent autocracies. From the control pool we were able to construct good counterfactuals for 24 of the 33 treated countries.

Child mortality declined over time, with the average falling from 154 to 65 children per 1000 livebirths (change 58%). Average child mortality differed between political regimes, being 35% higher in autocratic regimes than in democracies (table 1). Child mortality in the 24 countries with good counterfactuals changed from being very close

	Effect after 10 years	Effect after 5 years	Child mortality* at year of reform	RMSPE	Average p value after 10 years
Senegal	–39%	–21%	139	2·1	<0·001
Philippines	–21%	–15%	72·2	1·8	<0·001
Bangladesh	–21%	–14%	137·7	3·0	<0·001
Nicaragua	–18%	–9%	66·1	0·5	0·02
Peru	–16%	–2%	126·2	0·6	0·650
Guatemala	–15%	–7%	96·9	0·1	<0·001
Ecuador	–15%	–7%	97·7	0·2	0·18
Bolivia	–15%	–5%	160·3	0·2	<0·001
Mongolia	–15%	–6%	106·6	0·7	0·13
Mexico	–11%	–6%	36·9	0·1	<0·001
Honduras	–10%	–4%	94·7	0·2	<0·001
Brazil	–8%	0%	75·4	0·4	0·43
Nigeria	–8%	–8%	209·5	1·9	0·08
El Salvador	–7%	–3%	97·2	0·7	0·23
Djibouti	–5%	–1%	109·4	0·3	0·60
Dominican Republic	–4%	1%	93·4	0·3	0·60
Cape Verde	–1%	1%	59·1	0·1	0·23
Indonesia	0%	0%	54·9	0·1	0·30
Chile	0%	–6%	20·4	1·1	0·38
Pakistan	2%	0%	143·3	0·9	0·47
Paraguay	4%	–1%	47·2	0·3	0·44
Ghana	12%	6%	111·6	1·4	0·79
Guyana	16%	1%	56·8	0·3	0·63
Panama	18%	6%	32·6	0·2	1·00

*Number of child deaths per 1000 livebirths. RMSPE=root mean square prediction error.

***Table 2*: Effects of democratic transition on child mortality in 24 countries, compared with synthetic controls**

before democratic transition to being an average of 5% lower in the treated countries 10 years after transition (p=0·001, figure 1). The effect was significant within the 10% threshold in nine (38%) of the 24 countries. Changes after democratisation were not significant in 15 (63%) countries, but no country had a significant increase in child mortality (table 2). The difference between treated countries and controls after democratisation grew over time. In those countries with significant changes, 5 years after the transition started the mean difference was 8% (p<0·001) and after 10 years it was 13% (p<0·0001).

When we assessed democratisation that lasted for at least 6 years, we could construct good counterfactuals for 28 treated countries. Ten (36%) countries showed significant reductions in child mortality after 6 years, 18 (64%) countries had changes that were not significant, and no country had a significant increase in child mortality. The overall average reduction in child mortality after 6 years was 3% (p=0·0054), and for the countries with a significant effect the mean reduction was 10% (p<0·0001, appendix). The treatment effects were lower than in the original model, in line with the increasing effect of democratisation over time.

See Online for appendix

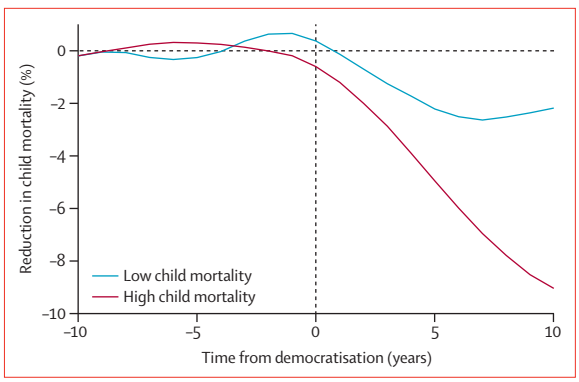

***Figure 2*: Average treatment effect for countries with child mortality above and below average in the year of democratisation, compared with synthetic control**

With use of the Cheibub-Gandhi-Vreeland indicator for political transition, the years of the transition in some countries differed from the years assigned by Polity2, and four that were shown by Polity2 to have undergone transition were reclassified as having no transition. We were able to construct good counterfactuals for 25 treated countries, of which nine (36%) showed significant reductions in child mortality and 16 (64%) had changes that were not significant. None had a significant increase. 10 years after democratisation, child mortality was a mean of 5% lower in treated countries than in the synthetic controls (p=0·0071), and in countries with significant effects the average difference was 16% (p<0·0001, appendix). These effects are similar to, or possibly stronger than, those with the Polity2 indicator.

The mean treatment effect was substantially greater for countries that had child mortality above average in the year of transition than in countries where child mortality was below average (figure 2).

Discussion

Our analysis of 33 democratic transitions in the past four decades suggests that, on average, political reforms reduce child mortality and that the effect increases over time. The results were shown to be robust by the use of different time periods for democracy and different political indicators. The increasing decline in child mortality over time is consistent with the argument that it takes time to change health policies and see the effects. We noted that at the country level, the effect is highly heterogeneous. The 10-year democratisation effect ranged from a reduction of 39% to an increase, albeit not significant, of 18%.

Whether there are structural differences between the groups of countries with and without significant effects would be of interest to assess. We saw no clear regional differences: the nine countries for which there was significant improvements in child mortality are in Africa (Nigeria and Senegal), Asia (Bangladesh and Philippines), and Latin America (Bolivia, Guatemala, Honduras, Nicaragua, and Mexico). Political situation

(according to the Polity2 index) and economic status also did not differ between countries with and without significant changes in child mortality at the time of transition.

When assessed in the year of the reform, child mortality was on average almost 35% higher in the countries with significant changes in child mortality than in those where the changes were not significant. This difference supports the theory that democratic reforms have stronger effects in countries with high and very high child mortality in the year of transition and less impact when child mortality is already low. Democratisation reduced child mortality by an average of 9% 10 years after transition in countries with child mortality above average in the year of transition, compared with synthetic controls. 10 years after transition, the average reduction in child mortality of only 2% in countries with below average child mortality in the year of democratic transmission suggests that democratic reforms have the greatest effects when health is an important concern for a larger part of the population. Thus, democratisation might have effects through improved health policies, which benefits the poorest people, whose political power is increased by the regime change.[9] Another potential explanation is that democratisation stimulates economic growth,[28] which enhances the effects on health in the poorest countries.[29] These two mechanisms might also reinforce one other, although our data and method cannot disentangle these mechanisms. We have done regression analyses (unpublished) which suggest that both factors play a role, but causality remains difficult to identify.

Our analysis has limitations. First, as for other studies, the external validity is limited by using aggregate health data. Of 60 democratic transitions in the observed period, only 33 satisfied the SCM properties. Second, there is a trade-off between the length of the pretreatment period and the number of usable experiments; the SCM controls for unobserved heterogeneity better with longer pretreatment periods. To optimise our results, we used a minimum of 10 years before democratic transition and only used countries that had very good pretreatment fit with synthetic controls. Third, the effects of democratic reform might depend on the ideology of the autocratic government, but there are no data on ideologies of such regimes and, therefore, we were unable to control for this factor. Despite these limitations, the causal effects and correlations identified in our analysis are robust across different specifications and tests. We did not use life expectancy because the reductions in mortality occur in very different age groups between rich and poor countries, making it unsuitable to assess population health in countries with different incomes and health levels.[30] In summary, our analysis shows that political regime changes do sometimes affect health, but not always. Although our method provides evidence on the causality of the effects, it cannot identify the precise causal mechanism. Our results are consistent with the interpretation that democratic reforms have the greatest effects when child mortality is a direct concern for a large part of the population. Future research could focus on identifying the mechanisms through which the effects emerge.

Contributors

All authors were involved in the conception of the study, data interpretation, revisions, and approval of the final version. HP and DC constructed the dataset and did the quantitative analyses.

Declaration of interests

We declare no competing interests.

Acknowledgments

This work was supported by the European Union 7th Framework Programme (290693 FOODSECURE) and the KU Leuven Methusalem Fund. The views expressed are the those of the authors and do not necessarily reflect the views of the European Commission.

References

1 Sen AK. Development as freedom. New York, NY: Knopf, 1999.
2 Ruger JP. Democracy and health. *QJM* 2005; **98:** 299–304.
3 Ncayiyana, D. Is democracy good for people's health? A South African perspective. *BMJ* 2004; **329:** 1425.
4 Besley T, Kudamatsu M. Health and democracy. *Am Econ Rev* 2006; **96:** 313–18.
5 Martyn C. Politics as a determinant of health. *BMJ* 2004; **329:** 1423–24.
6 McKee M, Nolte E. Lessons from health during the transition from communism. *BMJ* 2004; **329:** 1428–29.
7 Franco A, Álvarez-Dardet C, Ruiz MT. Effect of democracy on health: ecological study. *BMJ* 2004; **329:** 1421–23.
8 Ross ML. Is democracy good for the poor? *Am J Polit Sci* 2006; **50:** 860–74.
9 Álvarez-Dardet C, Franco-Giraldo A. Democratisation and health after the fall of the Wall. *J Epidemiol Community Health* 2006; **60:** 669–71.
10 Kudamatsu M. Has democratization reduced infant mortality in sub-Saharan Africa? Evidence from micro data. *J Eur Econ Assoc* 2012; **10:** 1294–317.
11 Abadie A, Gardeazabal J. The economic costs of conflict: a case study of the Basque country. *Am Econ Rev* 2003; **93:** 113–32.
12 Abadie A, Diamond A, Hainmueller J. Synthetic control methods for comparative case studies: estimating the effect of California's tobacco control program. *J Am Stat Assoc* 2010; **105:** 493–505.
13 Billmeier A, Nannicini T. Assessing economic liberalization episodes: a synthetic control approach. *Rev Econ Stat* 2013; **95:** 983–1001.
14 Cavallo E, Galiani S, Noy I, Pantano, J. Catastrophic natural disasters and economic growth. *Rev Econ Stat* 2013; **95:** 1549–61.
15 Center for Systemic Peace. About Polity. http://www.systemicpeace.org/polityproject.html (accessed June 6, 2016).
16 Persson T, Tabellini G. The growth effect of democracy: is it heterogeneous and how can it be estimated? In: Helpman E, ed. Institutions and economic performance. Cambridge, MA: Harvard University Press, 2008: 544–85.
17 Giavazzi F, Tabellini G. Economic and political liberalization. *J Monetary Econ* 2005; **52:** 1297–330.
18 Olper A, Falkowski J, Swinnen JFM. Political reforms and public policy: evidence from agricultural and food policies. *World Bank Econ Rev* 2014; **28:** 21–47.
19 Marshall MG, Jaggers K. Polity IV Project: dataset users' manual. Sept 25, 2002. http://www3.nd.edu/~mcoppedg/crd/PolityIVUsersManualv2002.pdf (accessed Dec 2, 2013).
20 WHO. World health statistics 2012. Geneva: World Health Organization, 2012.
21 Heston A, Summers R, Aten B. Penn world table version 7.1. Pennsylvania, PA: Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania, 2012.

22 Food and Agriculture Organization of the United Nations. FAOSTAT. Food balance sheet dataset. http://www.foastat3.fao.org/browse/FB/*/E (accessed July 22, 2016).

23 Barro R, Lee J-W. A new data set of educational attainment in the world, 1950–2010. NBER working paper no. 15902. http://www.nber.org/papers/w15902.pdf (accessed June 2, 2016).

24 Wang L. Determinants of child mortality in LDCs: Empirical findings from demographic and health surveys. *Health Policy* 2003; **65:** 277–99.

25 Levine DI, Rothman D. Does trade affect child health? *J Health Econ* 2007; **25:** 538–54.

26 Gleditsch NP, Wallensteen P, Eriksson M, Sollenberg M, Strand H. Armed conflict 1946–2001: a new dataset. *J Peace Res* 2002; **39:** 615–37.

27 Cheibub JA, Gandhi J, Vreeland JR. Democracy and dictatorship revisited. *Public Choice* 2010; **143:** 67–101.

28 Acemoglu D, Naidu S, Restrepo P, Robinson JA. Democracy does cause growth. NBER working papers no. 20004. Cambridge, MA: National Bureau of Economic Research, 2014.

29 Preston SH. The changing relation between mortality and level of economic development. *Popul Stud (Camb)* 1975; **29:** 231–48.

30 Deaton A. WIDER annual lecture 10: global patterns of income and health: facts, interpretations, and policies. 2007. https://www.princeton.edu/rpds/papers/pdfs/deaton_WIDER_annual-lecture-2006.pdf (accessed June 2, 2016).