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Do electoral institutions have an impact on population health?

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Abstract There is an emerging political economics literature which purports to show that legislatures elected based on proportional electoral rules spend more and redistribute more than legislatures elected based on majoritarian electoral rules. Going a step further the authors of this paper consider whether degree of electoral proportionality has an impact on population health and, in particular, the health of the least advantaged members of society. A panel of 24 parliamentary democracies for the years 1960–2004 is used to examine the relationship between electoral institutions and health. The authors find that greater electoral proportionality is positively associated with overall population health (as indicated by life expectancy) and with the health of the poorest (as indicated by a reduction in infant mortality). A panel of 17 countries for the years 1970–2004 is then used to show to that electoral permissiveness modifies the impact of health spending on infant mortality.

Keywords Electoral disproportionality · Redistributive policy · Infant mortality · Life expectancy

1 Introduction

There is an extensive and rich body of research in comparative politics on the relationship between electoral systems and party systems. The received wisdom is that electoral rules that induce proportionality tend to result in multi-party systems and coalition or minority governments, while majoritarian electoral rules tend to result in two-party systems and single-party governments (Duverger 1964; Taagepera and Shugart 1989; Lijphart 1994;

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Cox 1997). Recently political economists have begun to examine the effect of electoral institutions on government spending and redistribution. Empirical evidence has been presented in support of the claim that legislatures elected under proportional representation (i) spend more (or run a larger budget deficit) (Persson et al. 2007; Bawn and Rosenbluth 2006; Blume et al. 2009), (ii) spend more on social security and welfare (Persson and Tabellini 2003, 2004; Milesi-Ferretti et al. 2002; Alesina and Glaeser 2004: 81–87) and (iii) redistribute more (Iversen and Soskice 2006; Ticchi and Vindigni 2010) than legislatures elected under majoritarian rules.

Going a step further we consider what impact, if any, electoral institutions have on human well-being as measured by population health. There is a growing body of research which purports to show that democracies devote more resources to health-promoting resources such as health care and education than their more autocratic counterparts (see, for example, Brown and Hunter 1999; Deacon 2009; Ghobarah et al. 2004; Kaufman and Segura-Ubiergo 2001; Lake and Baum 2001; Przeworski et al. 2000). More recently scholars have presented cross-country evidence in support of the claim that democratic governance leads to lower infant mortality rates and higher life expectancies than autocratic governance (Besley and Kudamatsu 2006; Franco et al. 2004; Gerring et al. 2007; Zweifel and Navia 2000).[1] In this paper we examine the extent to which, if at all, the health dividend of democratic rule is conditioned by electoral procedures.

2 Electoral rules, government spending and health

Meltzer and Richard (1981) have formulated perhaps the most influential model of the relationship between democratic governance and public redistributive policies.[2] They contend that the usual skewing of the income distribution towards the upper-income quintile will lead to redistribution up to the point at which the distortionary effects of taxation entails that the voter with the median income (whose vote is decisive) no longer benefits. Thus, the model predicts that democracies with greater inequality in pre-tax and transfer earnings will typically be more redistributive. However, there are two related problems with the Meltzer-Richard model. Firstly, because the median voter occupies the middle-income quintile it is not strictly necessary that legislators must also redistribute to the lower-income quintile—that is to say, a political party may win enough seats to govern even if it lacks the support of lower-income voters. Secondly, it turns out that advanced democracies with less income inequality actually redistribute more than democracies with more income inequality (Iversen and Soskice 2009: 440–441). Thus, the standard model in the political economy literature does not adequately explain why some democracies are more redistributive than others.

An alternative explanation for the observed variation in redistributive policies is the differing democratic institutions that have been adopted in each country. In keeping with that institutionalist approach a growing number of scholars have argued that electoral rules can

[1] Although Ross (2006) has presented cross-country evidence which casts doubt on the claim that democratic rule has a greater reductive effect on infant and child mortality than autocratic rule.

[2] Their approach builds on the seminal studies on collective decision-making and redistribution by Downs (1957), Tullock (1959), Buchanan and Tullock (1962) and Riker (1962). For a detailed review of the literature see Mueller (2003, especially Chaps. 5 & 21). Recent examples of scholars who have adopted the Meltzer-Richard model include Acemoglu and Robinson (2005) and Boix (2003).

play a particularly important role in determining the magnitude and distribution of government spending.[3] From the literature it is possible to distinguish a direct and indirect explanation for that linkage. The first type of explanation emphasizes the incentives that electoral rules place on individual politicians, whereas the second emphasizes the effect of those rules on the party system as well as government type and partisanship.

In keeping with the direct explanation Persson and Tabellini (2003: 17–18; also Lizzeri and Persico 2001) contend that legislatures elected based on proportional electoral rules tend to spend more on redistributive programs in virtue of the incentives created by district magnitude (number of seats per electoral district). Majoritarian electoral systems are characterized by single member districts. This encourages politicians to target spending on those swing districts required to obtain a winning number of seats in the legislature. By contrast PR electoral systems typically have large, often national, districts. That encourages politicians to spend on universalistic benefit programs and general public goods such as health care. In addition, the PR electoral formula means a party requires a comparatively greater proportion of the national vote (i.e. 50%) in order to control the legislature—thus there is a further incentive to provide benefits and public goods, and to provide them to a larger proportion of the population.

The indirect explanation taps into the rich vein of research in comparative politics on the impact of electoral rules on party fragmentation and government type. Democracies that utilize a winner-takes-all formula are typically characterized by a two-party system and single-party governments, whereas countries with proportional electoral formula tend to be characterized by a multi-party system and coalition governments. However, the degree to which a proportional electoral formula actually permits party fragmentation is significantly dependent on district magnitude (Taagepera and Shugart 1989: 112–125). Drawing on those findings Bawn and Rosenbluth (2006) and Persson and colleagues (2007) argue that conflict within the coalition governments that are typically produced by PR leads to higher levels of government spending than the single-party governments that are typically produced by majoritarian rules. Coalition governments create a common pool problem in virtue of the fact that the cost of spending is spread amongst the supporters of all parties. However, this does not in itself show that legislatures elected under a PR system are more redistributive than their majoritarian counterparts.

By focusing on the effects of electoral rules on government partisanship Iversen and Soskice (2006) have developed a model to account for the prediction that PR-elected governments are more redistributive. Their explanation begins from the observation that PR systems tend to produce center-left governments, whereas majoritarian systems tend to produce center-right governments. They argue that this tendency is because of the effect of electoral institutions on government partisanship. Middle-income voters in a majoritarian system prefer low taxes (and less benefits) by a center-right party for fear that an elected left party would veer away from its centrist electoral platform and tax both the wealthy and middle class. Under a PR system, by contrast, the middle-class party has an incentive to form a coalition with the left party so they can both 'exploit' the rich.

The partisanship model can also be adapted to explain public subsidies for health and education.[4] Under PR the middle-income party will collude with the lower-income party to

[3] For a review of the literature see Persson and Tabellini (2004).

[4] On the extension of the partisanship model to public education see Iversen and Stephens (2008), Iversen and Soskice (2009: 454–455) and Ansell (2006). As with redistribution those studies find that PR-elected legislatures tend to spend more on public education than majoritarian-elected legislatures.

ensure their supporters have access to education and health care (e.g. more spending on preschool, primary and secondary education, greater investment in public health care). Whereas under a majoritarian system middle-income voters will prefer the center-right party so as to avoid the possibility of being taxed to fund schooling and health care for the lower-income class (thus, partially subsidized higher education, greater reliance on private health insurance and out-of-pocket health payments etc.).

Our contention in this article is that the theorized effect of electoral rules on government spending will, in turn, have an impact on population health. That is to say, PR-elected legislatures are more likely to ensure that health-enhancing resources such as income transfers, medical care and education are available to a broader segment of the population and to ensure that they reach the poorest segment of the population. That prediction is consistent with the direct and indirect explanations introduced above. According to the first explanation, majoritarian rules will encourage politicians to target health-promoting resources towards pivotal groups of voters. According to the partisanship reading of the second explanation, majoritarian rules will tend to produce center-right governments and, therefore, less spending on health-promoting resources for the middle and lower-income classes. In the statistical analysis that follows we were unable to rule out the possibility that electoral institutions have an effect on population health via both these channels.

There are two important arguments for using health outcomes to assess democratic institutions such as electoral rules. The first draws on the human capabilities approach developed by the economist and philosopher Amartya Sen, whereas the second draws on the human capital approach which prevails in the economics literature on income growth. The first line of argument is that mortality and morbidity represent a more accurate metric of human well-being than resource-based metrics such as disposable income. This is because the capability to avoid premature death and preventable illness is valued in itself, it typically results from other capabilities that we have independent reason to value highly (e.g. the acquisition of cognitive abilities), and it is crucial to the achievement of other capabilities (e.g. productive agency) (Sen 1992, 1998; see also Wigley and Akkoyunlu-Wigley, 2006). Resources matter according to this approach, but only insofar as they enable improvements in health.

The instrumental role of health hints at the second reason for using health outcomes to assess democratic institutions. As a number of authors have noted, improvements in health can have a significant impact on human capital formation—primarily, but not only, because the incentive to privately invest in education increases as survival rates improve (see e.g. Soares 2005). Some political economists have considered the impact of electoral rules on public investment in education and, thereby, the distribution of income (Iversen and Stephens 2008; Ansell 2006). It seems reasonable to assume, however, that public investments in health will also have a positive effect on private investments in education and, as a result, the distribution of income. For example, public provisioning that successfully extends the longevity of the least advantaged members of society will encourage an increase educational attainment, thereby, leveling-up household income. Alternatively, public provisioning of health-enhancing resources may directly affect the distribution of income because improved health will have a positive impact on marginal productivity (e.g. reduces the likelihood of leaving the labor force or taking early retirement) (Cutler et al. 2006: 114). Thus, health status represents a normatively more satisfying basis for assessing the public policy implications of electoral rules and, at the same time, it constitutes an important determinant of income growth and the distribution of income.

Besley and Kudamatsu (2006, long version) have presented what appears to be the only existing analysis of electoral institutions and population health. Based on a panel of countries that were democratic between 1956 and 2002 they found no evidence that life ex-

pectancy is affected by whether a country has adopted a majoritarian or proportional electoral formula. Our approach in the cross-country analysis that follows differs in two important respects. Firstly, our key dependent variable is infant mortality. Infant mortality tends to afflict the poorest segment of the population. Moreover, it typically arises because of causes that are both easier and less expensive to prevent than the causes of adult mortality. In theory, therefore, infant mortality ought to be more sensitive than longevity to the effects of electoral rules on public policy. Secondly, rather than type of electoral formula we employ degree of disproportionality in the translation of share of electoral votes into share of legislative seats as our indicator of electoral rules. The advantage of using electoral disproportionality is that it is more sensitive to the variety of factors, other than just electoral formula, that define each country's electoral system. The permissiveness of a PR electoral system, for example, is to a significant extent dependent upon district magnitude.

3 Empirical evidence

In order to test the hypothesis that PR electoral systems tend to produce healthier populations than majoritarian electoral systems we use a panel of 28 democracies that have been independent since 1950 and have experienced uninterrupted democratic rule for each year during the period 1960–2004. Our criterion for democratic rule is a score of above zero on the Polity2 index compiled by the Polity IV project (Marshall and Jaggers 2007).[5]

3.1 Model specification

We use country fixed-effects in the model specification so as to help mitigate any omitted variable bias. One drawback of fixed-effect models is that they tend to underestimate the impact of variables that move slowly over time. During the sample period significant electoral reforms were relatively rare—only New Zealand, Japan, Italy, South Africa, Sri Lanka, France and Venezuela changed type of electoral formula between 1960 and 2004. It is partly for that reason that we use electoral disproportionality as our proxy for electoral rules. Disproportionality captures changes in all the components that comprise the electoral system and, therefore, is more likely to vary over time within each country. Note that a significant shortcoming of the existing political economy literature on electoral institutions is that it almost exclusively relies on a dichotomous variable for electoral rules (i.e. PR or majoritarian) and does not adequately control for the possibility of omitted variable bias.[6] To control for the upward trend in life expectancy and downward trend in infant mortality during the sample period we also include period fixed-effects in the specification.

[5] Country list: Australia, Austria, Belgium, Canada, Colombia, Costa Rica, Denmark, Finland, France, Germany, Iceland, India, Ireland, Israel, Italy, Japan, Luxembourg, Malta, Netherlands, New Zealand, Norway, South Africa, Sri Lanka, Sweden, Switzerland, United States, United Kingdom and Venezuela. Malta is included even though it was not independent until 1964 because it has been internally self-governing polity since 1947. It may be argued that Colombia, Costa Rica, India, South Africa, Sri Lanka and Venezuela should not be included because they are significantly less democratized and/or economically developed than the other countries in the sample. We introduce controls to address that concern and in the robustness section we test to see whether those six countries are driving the results. In the robustness section we also examine whether the results are sensitive to the inclusion of the four presidential democracies (i.e. Colombia, Costa Rica, United States and Venezuela).

[6] On the latter concern see Acemoglu (2005). For a notable exception to the rule see Persson et al. (2007).

3.2 Variables

Because we are primarily interested in effectiveness of public policy in promoting health we focus on outcome (i.e. mortality rates), rather than provisioning variables (e.g. public expenditure on health and education, immunization rates, health practitioners per capita, etc). Health outcomes enable us to take into account the effect of electoral rules on the targeting of government provisioning and not just the extent of government provisioning. With that in mind, our dependent variables are *infant mortality* (number of infants who perish during the first year of life, per 1,000 live births) and *life expectancy at birth*.[7] Infant mortality is of particular interest because it is tends to be concentrated amongst the least-advantaged members of society in both developing and developed countries (Gwatkin et al. 2007; de Looper and Lafortune 2009: 21–22). What is more, infant mortality typically results from causes that are comparatively easier and less costly to prevent (e.g. through access to clean water, immunization, antibiotics, nutritional needs, perinatal and postnatal medical care etc.). We would expect, therefore, that infant mortality rates will be more responsive to the effect (if any) of electoral procedures on the distribution of health-promoting resources. On the other hand, testing for the effect of electoral rules on life expectancy enables us to at least partially capture the incidence of morbidity across the entire population—even non-fatal illnesses will tend to have a negative impact on an individual's lifespan.

Our key independent variable is the degree of disproportionality in the conversion of share of electoral votes into share of legislative seats. The measure of disproportionality that we use is the least squares index (*LSq*) developed by Michael Gallagher (1991).[8] In theory the index ranges from 0 (perfect proportionality) to 100 (candidate without any votes obtains a seat). The advantage of using electoral disproportionality is that it captures in one index all the key components of the electoral system (i.e. formula, district magnitude, assembly size, national or district threshold etc). In addition, it provides a suitable way of accounting for those countries that employ a two-tier electoral system—especially in those cases such as Germany, Japan since 1996, Italy since 1994 and New Zealand since 1996 where a plurality rule is used in the lower tier and a proportional rule is used in the upper tier. Although disproportionality is explicitly concerned with the mechanical effect of electoral rules (i.e. conversion of vote shares into seat shares), it will also at least partially capture the so-called psychological effect of electoral rules on voters (i.e. the effect on the decision whether to vote and, if so, which party to vote for) (Duverger 1964). As disproportionality increases we would expect increasingly more voters to be dissuaded from voting for small parties.

Electoral disproportionality may be influenced by exogenous determinants of the number of electoral parties (e.g. social heterogeneity), rather than just the permissiveness of the electoral system. The persistence of a large number of parties in a country with a PR system may result in an unexpectedly high level of disproportionality. Equally, the absence of small parties in a country with a majoritarian system may result in an unexpectedly low level of

[7] Both mortality variables are taken from the World Bank's World Development Indicators (2009).

[8] *LSq* is the average divergence between the share of votes received and the share of seats obtained:

$$LSq = \sqrt{\frac{1}{2}\sum(v_i - s_i)},$$

where v_i is the vote share of the i-th party and s_i is the seat share of the i-th party. The *LSq* data is drawn from Appendix B of Gallagher and Mitchell (2008). Note that an updated version of that data set can be found on Michael Gallagher's electoral system website at http://www.tcd.ie/Political_Science/staff/michael_gallagher/ElSystems/index.php.

disproportionality (Taagepera and Shugart, 1989: 123). Note, however, that the presence of that phenomenon amongst the countries in the sample will mean that the regression results underestimate the health effects of electoral permissiveness. Nevertheless, we take explicit steps to control for the exogenous determinants of electoral fragmentation in the robustness section below.

We also consider the impact of party fragmentation and government type on infant mortality and life expectancy. Given the theories discussed above we would expect that the multipartism and coalition governments that are typically produced by PR electoral systems will have more of a pro-health effect than the twopartism and single-party governments that are typically produced by majoritarian electoral systems. Our measure of party fragmentation is the effective number of parliamentary parties index (ENPP) developed by Laakso and Taagepera (1979).[9] For our indicator of government type we use number of parties in the government (*government parties*).[10]

The fixed-effect specification of the panel data helps to control for the possibility of unmeasured country-specific factors. This is necessary given that countries may self-select into electoral systems based on unmeasured factors (e.g. colonial origin and social cleavages) that are also correlated with population health. Nevertheless, it still remains necessary to control for those time-varying factors that might be determining both the electoral variables and population health. For that reason we include the following four control variables in each of the regressions. *GDP per capita* (logged) is included as a control for level of economic development.[11] Total *population* (logged) is included because there is some evidence to suggest that size may influence the degree of party fragmentation.[12] Anckar (2000), for example, argues that larger populations are characterized by a higher degree of diversity. In addition, smaller countries (such as Malta, Iceland and Luxembourg) may exhibit a greater degree of disproportionality in virtue of the small size of their assemblies (Lijphart 1999: 154–155). Proportion of the total population voting in elections (*participation*, logged) is included so as to control for the absence of universal suffrage in Switzerland before 1971 and South Africa before 1994.[13] Finally, we control for the age and quality of democracy in each country given that democratic experience may influence the number of political parties as well as population health. Our *democratic stock* (logged) variable is based on the Polity2 index produced by the Polity IV project. We constructed this variable by converting the Polity2 scale of −10 to +10 into a positive scale ranging from 1–21. Then for each year from 1960–2004 we calculated each country's total score since 1950.[14]

[9] ENPP is the number of parliamentary parties weighted by their shares of seats:

$$N_1 = 1/\sum(s_i),$$

where s_i is the seat share of the i-th party. For the elections from 1960–2000 the ENPP data is drawn from Matt Golder's data set (2005). For elections from 2001–2004 we rely on Appendix B of Gallagher and Mitchell (2008).

[10] Our primary source for this variable is the annual political data produced by the *European Journal of Political Research*. For the countries not included in that data set we referred to Nohlen et al. (1999, 2001), Nohlen (2005).

[11] GDP per capita (PPP converted and in thousand constant 2000 international dollars) is based on the chain series index of the Penn World Table 6.2 (variable RGDPCH) (Heston et al. 2006).

[12] The population data is drawn from World Development Indicators 2009.

[13] The participation data is taken from Vanhanen (2008).

[14] Because the Polity IV data set does not include information for countries with populations less than 500,000 (i.e. Iceland, Luxembourg, Malta) we used the expanded Polity2 index compiled by Kristian Skrede Gleditsch at http://privatewww.essex.ac.uk/~ksg/polity.html.

Table 1 Summary statistics for first panel

Variable	Obs.	Missing (%)	Mean	Std. Dev.	Min.	Max.	Skewness	Kurtosis
Infant Mortality	1260	27.86	16.00	17.81	2.80	156.60	3.63471	19.32118
Life expectancy	1260	22.46	73.67	5.11	42.26	82.03	−2.278712	10.9161
Government parties	1260	0.56	2.06	1.42	0.00	9.00	1.508545	5.452818
ENPP	1260	3.17	3.43	1.39	1.41	9.05	1.209324	4.550065
LSq	1260	14.84	5.34	4.89	0.26	25.25	1.642364	5.255183
ENEP	1260	3.17	3.98	1.52	1.97	10.29	1.253809	5.03011
GDP per capita	1260	0.32	15230.00	8066.00	866.10	50760.00	0.388817	3.492706
Population	1260	0.00	5.47E+07	1.44E+08	1.76E+05	1.08E+09	4.737352	27.00425
Participation	1260	0.32	49.53	13.78	3.90	70.00	−1.17096	4.333959
Democratic stock	1260	0.00	665.10	270.90	114.00	1155.00	0.045852	1.878444

3.3 Data set and multiple imputation

After constructing the data set we found that observations were missing for a non-trivial number of country-years (Table 1 presents the summary statistics for the non-imputed panel). Deleting those cases with missing values would significantly undermine the efficiency of the model and may bias the results. Thus, we used the Amelia multiple imputation program to generate a balanced panel (Honaker et al. 2009). Multiple imputation uses the observed values to generate multiple estimates for each missing value. The variation between each imputed value is intended to reflect the estimated level of uncertainty in predicting each missing value (King et al. 2001; Schafer 1997). We used an imputation model that was multivariate normal to generate five 'complete' data sets. We then ran our fixed-effect models for each of those data sets. Finally, we combined the estimation results by using a procedure outlined by King et al. (2001: 53). A single coefficient was produced for each independent variable by taking the average of the estimates produced by each imputed data set, while a single standard error for each coefficient was produced by using a formula that takes into account variance both within and across each imputed data set.

4 Empirical results

Do countries where the legislature is selected based on electoral rules that encourage proportionality have healthier populations? Does electoral proportionality have a positive impact on the health of the least advantaged members of society? Table 2 present the results of our statistical analysis for infant mortality and life expectancy respectively. As we can see from columns 1 and 2 there is a strong and significant correlation between both the number of government parties and the degree of party fragmentation and infant mortality. This provides at least indirect confirmation that PR electoral systems have a greater reductive effect on infant mortality than majoritarian electoral systems. This evidence is only indirect, however, because factors other than electoral system permissiveness may be contributing to the degree of party fragmentation (e.g. social cleavages).

More explicit evidence for our hypothesis is provided by our indicator of electoral rules. From column 3 we can see that the coefficient for *LSq* carries the expected sign and is significant at 1%. Other things being equal, a decrease in *LSq* by 10 points (which is, for example,

Table 2 Electoral institutions and mortality

Dependent variable:	Infant mortality				Life expectancy			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Government	−0.388[a]				0.060[c]			
parties	(0.113)				(0.030)			
ENPP		−0.653[a]				0.095[a]		
		(0.116)				(0.040)		
LSq			0.226[a]	0.226[a]			−0.016[c]	−0.017[b]
			(0.038)	(0.0378)			(0.009)	(0.009)
ENEP				−0.567[a]				0.121[a]
				(0.109)				(0.039)
GDP per capita	−7.734[a]	−5.623[a]	−6.452[a]	−6.262[a]	1.578[a]	1.620[a]	1.513[a]	1.582[a]
(logged)	(0.899)	(0.893)	(0.875)	(0.879)	(0.239)	(0.239)	(0.239)	(0.240)
Population	−15.905[a]	−12.836[a]	−12.149[a]	−13.902[a]	1.416[a]	1.385[a]	1.332[a]	1.375[a]
(logged)	(1.314)	(1.261)	(1.371)	(1.391)	(0.322)	(0.322)	(0.332)	(0.333)
Participation	−1.794[b]	−1.673[b]	−0.450	−0.757	0.591[a]	0.616[a]	0.564[a]	0.602[a]
(logged)	(0.725)	(0.707)	(0.759)	(0.756)	(0.174)	(0.178)	(0.181)	(0.184)
Democratic stock	−24.722[a]	−20.210[a]	−28.307[a]	−28.355[a]	9.311[a]	9.693[a]	9.215[a]	9.471[a]
(logged)	(6.144)	(6.112)	(6.348)	(6.332)	(1.446)	(1.450)	(1.446)	(1.443)
Countries	28	28	28	28	28	28	28	28
Observations	1260	1260	1260	1260	1260	1260	1260	1260

Notes: Includes country fixed-effects and period fixed effects. Robust standard clustered at country level errors are reported in brackets below regression coefficients. Sample period: 1960–2004. Each country year represents a single observation

[a]significant at 1%

[b]5%

[c]10%

the average difference in proportionality between Australia and the Netherlands) is, on average, associated with approximately 2.5 less infant deaths per 1,000 live births. Given that infant mortality tends to be concentrated amongst the poorest, these results are consistent with the claim that the less advantaged will have greater access to health-promoting resources (e.g. food, health care, education etc) under PR-elected legislatures than majoritarian-elected legislatures.

We were able to generate similar results with regard to life expectancy. As predicted fragmentation and government type are positively associated with longevity (columns 5 and 6), while electoral disproportionality is negatively associated with longevity (column 7). Although note that the coefficients and significance levels are lower than was the case with infant mortality. That is consistent with the observation that infant mortality is comparatively easier and inexpensive to prevent and, therefore, more responsive to the targeting of health-enhancing resources.

The coefficient for electoral disproportionality decreased but remained significant when the number of parliamentary or government parties was included amongst the explanatory variables. Thus, we are unable to rule out the possibility that the impact of electoral rules on health is both direct (e.g. via incentive-effect on individual politicians) and indirect (e.g. via government partisanship).

5 Robustness checks

It may be argued that electoral disproportionality is affected by factors other than electoral rules which also determine mortality. Social cleavages, for example, have been shown to be an important condition for the number of parties (Ordeshook and Shvetsova 1994; Neto and Cox 1997) as well as a significant determinant of infant and child mortality (Filmer and Pritchett 1999). The impact of social heterogeneity on disproportionality is likely to be more pronounced in those countries where the electoral rules are restrictive. In democracies with single-member districts, for example, an increase in the number of electoral parties as a result of social fragmentation will typically mean that more parties will fail to achieve a plurality of votes in each district (Lijphart 1994: 76–77; Taagepera and Shugart 1989: 123). The fixed-effect specification we employ will control for unmeasured factors such as social cleavages insofar as they are time-invariant. Nevertheless, to control for the possibility that such factors are time-varying within countries in our sample we include the degree of electoral party fragmentation amongst the independent variables. Our measure of fragmentation is the effective number of electoral parties index (ENEP) outlined by Laakso and Taagepera (1979).[15] Note that the inclusion of electoral fragmentation means that the regression will no longer capture the psychological effect of electoral rules. It does, however, mean that the disproportionality variable is not reflecting changes in the number of electoral parties that are not due to changes in electoral permissiveness. As can be seen from column 4 and 8 in Table 2, disproportionality remains negatively correlated with infant mortality and positively correlated with life expectancy even when we control for the fragmentation of electoral parties.

It may also be argued that changes in income inequality during the sample period are driving changes in electoral rules (see e.g. Ticchi and Vindigni 2010), as well as population health (see e.g. Wilkinson 1996). Alternatively it may be argued that changes in the population structure are influencing electoral rule changes as well as health outcomes. We controlled for both of those possibilities by including distribution of income as measured by the GINI coefficient, as well as proportion of population aged 14 and below and proportion of the population aged 65 and above in the baseline regressions.[16] Our results were not substantially altered by the introduction of those additional control variables.

It remains possible that time-varying factors, other than those already controlled for, are determining the degree of electoral permissiveness. To control for the potential presence of endogeniety the Hausman test was applied using the number of government parties and ENPP as instruments for *LSq*. To carry out the Hausman test, we run two OLS regressions. For the first regression, *LSq* was regressed on all the exogenous variables and instruments. For the second regression the infant mortality and life expectancy equations were re-estimated with the residuals from the first-stage regression as additional regressors. The coefficients for the residuals were not statistically significant, thus the hypothesis that *LSq* is endogenous is rejected.

It might also be argued that presidential democracies should be excluded from the analysis on the grounds that government spending in those countries is a product of bargaining

[15] ENEP is the number of electoral parties weighted by their shares of votes:

$$N_1 = 1/\sum(s_i),$$

where v_i is the vote share of the i-th party. The data sources are the same as those listed in footnote 8.

[16] GINI data taken from UTIP (2008) and population data taken from World Development Indicators 2009.

between the legislature and executive and, as a result, is less sensitive to the electoral rules that select the former. In order to accommodate that concern we ran each of the baseline regressions without those countries where the executive is not subject to a confidence vote by the legislature (i.e. Colombia, Costa Rica, United States and Venezuela). The results were not significantly altered when we removed those four countries from the sample.

Finally, it may be argued that Colombia, Costa Rica, India, Sri Lanka, South Africa and Venezuela should not be included in the baseline analysis on the grounds that they are less democratized and significantly poorer than the remaining 24 countries in the sample. We have included GDP per capita, democratic stock and electoral participation in order to at least partly control for that discrepancy. Reassuringly there was not a significant change in our results when we ran each of the baseline regressions without those six countries in the panel.

6 Electoral rules and the targeting of health-promoting resources

Thus far we have presented evidence in support of the claim that electoral proportionality has a reductive effect on mortality. This is consistent with the theoretical claim that the pro-health effect of electoral permissiveness is at least partly explained by the effect of electoral rules on policy-making that determines the distribution of health-promoting resources (such as health care, education, welfare transfers etc.). We now turn to provide explicit evidence for that distributional pathway.

A number of authors have noted that aggregate measures of health provisioning (public expenditure on health, births attended, immunization rates, health practitioners per capita etc) are not particularly good predictors of health outcomes (Bidani and Ravallion 1997; Filmer and Pritchett 1999; McGuire 2005). They contend that much depends on the whether those health-enhancing resources actually reach those who need them the most. With regard to health spending, for example, the existing evidence suggests that additional spending on health leads to better health outcomes among low spending countries, but not amongst high spending countries. Moreover, there is a considerable degree of variation in performance amongst low spending countries and high spending countries respectively, suggesting that effective targeting is a crucial factor (see Evans et al. 2001; Poullier et al. 2003). That in turn suggests that the observed pro-health effect of electoral permissiveness is to a large extent explained by its impact on the distribution of health-enhancing resources, rather than its impact on how much is invested in those resources. We test that claim by examining whether electoral rules modify the effect of health spending on infant mortality.

In order to capture the conditioning effect we employ a model specification that includes the interaction between *LSq* and *public expenditure on health (% GDP)*. Public expenditure data for the years 1970–2004 is available for the 17 European countries in our original sample (WHO 2010).[17] As before, we use a fixed-effect specification and the same time-varying control variables. We also included electoral fragmentation (ENEP) so as to control for the impact of social heterogeneity on electoral proportionality and health. In addition, we employed a first-order autoregressive process to correct for the detected presence of autocorrelation and a time trend variable so as to control for the concurrent downward trend in infant mortality and upward trend in health spending. In order to estimate the missing values in the data set we used exactly the same multiple imputation process as the previous model (Table 3 presents the summary statistics for the non-imputed panel).

[17] Country list: Austria, Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Israel, Italy, Luxembourg, Malta, Netherlands, Norway, Sweden, Switzerland and United Kingdom.

Table 3 Summary statistics for second panel

Variable	Obs.	Missing (%)	Mean	Std. Dev.	Min.	Max.	Skewness	Kurtosis
Infant Mortality	595	18.32	9.09	4.89	2.80	29.60	1.516308	5.411992
LSq	595	0.00	4.14	4.48	0.34	25.25	2.455169	8.860502
Public expenditure on health (% GDP)	595	21.01	5.97	1.22	2.76	8.72	0.184964	2.329077
ENEP	595	0.00	4.56	1.70	2.00	10.29	0.955591	4.072165
GDP per capita	595	0.00	19810.00	6302.00	2997.00	50760.00	1.017014	6.765446
Population	595	0.00	1.88E+07	2.49E+07	2.04E+05	8.25E+07	1.334973	3.167443
Participation	595	0.00	57.27	7.16	27.70	70.00	-0.650761	3.85499
Democratic stock	595	0.00	790.40	211.30	382.00	1155.00	0.012958	1.819133

Table 4 Modifying effect of electoral disproportionality

Dependent variable: infant mortality	(1)
Public health expenditure (% GDP) * *LSq*	0.039[b]
	(0.018)
Public health expenditure (% GDP)	−1.138[a]
	(0.133)
LSq	−0.254[c]
	(0.131)
ENEP	−0.404[a]
	(0.128)
GDP per capita (logged)	−1.591
	(1.097)
Population (logged)	2.394
	(2.434)
Participation (logged)	−0.446
	(0.972)
Democratic stock (logged)	−17.128[a]
	(4.344)
Trend	0.174
	(0.121)
AR(1)	0.520[a]
	(0.036)
Countries	17
Observations	578

Notes: Includes country fixed-effects. Robust standard clustered at country level errors are reported in brackets below regression coefficients. Sample period: 1970–2004. Each country year represents a single observation

[a] significant at 1%

[b] 5%

[c] 10%

From the interaction term in Table 4 we can see that the reductive effect of health spending diminishes as electoral disproportionality increases. Note that the constitutive terms for *LSq* and public expenditure represent the marginal effect under the unrealistic assumption that, respectively, public health expenditure is zero and *LSq* is zero (i.e. perfect proportion-

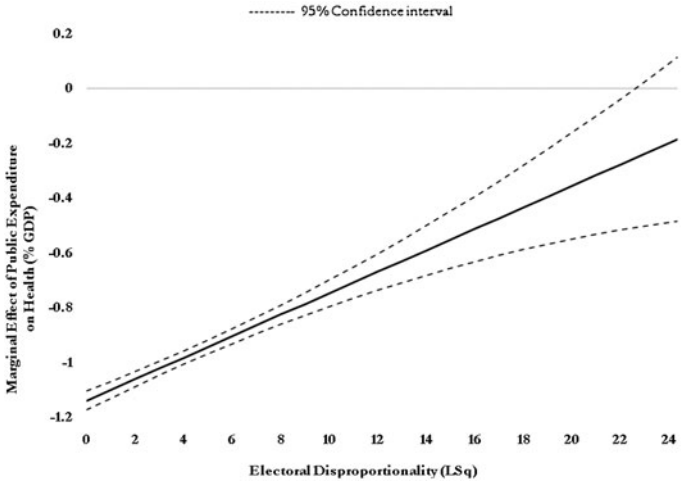

Fig. 1 Marginal effect of public health expenditure on infant mortality

ality).[18] Figure 1 captures the marginal effect of expenditure for a more plausible set of disproportionality scores—namely, the range of *LSq* values in our sample. The upper and lower 95% confidence intervals indicate that the modifying effect remains significant until the degree of disproportionality reaches 23 (only France exceeds that score and only during the 1993–1996 legislative term). These results confirm that the impact of electoral institutions on the way in which government health spending is distributed at least partly explains the linkage between those institutions and population health.

7 Conclusion

In this paper we have used the comparative electoral systems and comparative political economy literature to develop the theoretical predication that degree of electoral proportionality has a positive impact on population health. A small but growing number of political economists have studied the impact of electoral rules on the magnitude and distribution of government spending. They provide evidence in support of the prediction that electoral proportionality leads to greater redistribution. In this study we have gone a step further and examined whether greater proportionality has a beneficial impact on population health and, more specifically, the health of the least advantaged members of society. Population health

[18] Thus, the coefficient for *LSq* in Table 4 appears to indicate that, contrary to theoretical expectations, electoral disproportionality has a reductive effect on infant mortality. However, that only follows if we incorrectly interpret the constitutive term as the unconditional or average effect of *LSq* (see Brambor et al. 2006). Indeed the linear-additive specification of the model (i.e. same specification as Table 2) shows that (for the sample of European countries) *LSq* has a positive average effect on infant mortality. Moreover, it seems reasonable to expect that the health effect of electoral rules will also be conditioned by the burden that the prevention of child mortality places on the adult population. When we tested that claim by adding the interaction between *LSq* and share of the population aged 14 and below to the multiplicative model we found that the marginal effect of *LSq* for the mean levels of population aged 14 and below and health expenditure in our sample is positive. In addition, the results for the conditioning effect of *LSq* on health expenditure were not significantly altered by the inclusion of the second interaction term.

represents an important basis for assessing electoral institutions both because it provides a direct measure of human well-being and because of its effect on human capital formation. We have found that greater electoral proportionality is positively associated with overall population health (as indicated by life expectancy) and with the health of the poorest (as indicated by a reduction in infant mortality). Significantly those results held even when a number of steps were taken to control for the potential presence of unmeasured factors that may be simultaneously determining electoral institutions as well as population health. In addition, we presented evidence that electoral proportionality conditions the effect of health spending on infant mortality. This is in keeping with the theoretical claim that electoral rules effect health in virtue of their impact on the distribution of health-promoting resources.

References

Acemoglu, D. (2005). Constitutions, politics and economics: a review essay on Persson and Tabellini's. *The Economic Effects of Constitutions Journal of Economic Literature*, *43*(4), 1025–1048.

Acemoglu, D., & Robinson, J. A. (2005). *Economic origins of dictatorship and democracy*. Cambridge: Cambridge University Press.

Alesina, A., & Glaeser, E. L. (2004). *Fighting poverty in the US and Europe: a world of difference*. New York: Oxford University Press.

Anckar, C. (2000). Size and party system fragmentation. *Party Politics*, *6*(3), 305–328.

Ansell, B. (2006). From the ballot to the blackboard: partisan and institutional effects on education policy in the OECD, unpublished manuscript retrieved from http://www.polisci.umn.edu/~ansell/papers/From%20the%20Ballot%20to%20the%20Blackboard.pdf.

Bawn, K., & Rosenbluth, F. (2006). Short versus long coalitions: electoral accountability and the size of the public sector. *American Journal of Political Science*, *50*(2), 251–265.

Besley, T., & Kudamatsu, M. (2006). Health and democracy. *American Economic Review*, *96*(2), 313–318 [long version retrieved from http://econ.lse.ac.uk/staff/tbesley/papers/healthanddemocracy.pdf].

Bidani, B., & Ravallion, M. (1997). Decomposing social indicators using distributional data. *Journal of Econometrics*, *77*(1), 125–139.

Blume, L., Müller, J., Voigt, S., & Wolf, C. (2009). The economic effects of constitutions: replicating—and extending—Persson and Tabellini. *Public Choice*, *139*(1–2), 179–225.

Boix, C. (2003). *Democracy and redistribution*. Cambridge: Cambridge University Press.

Brambor, T., Clark, W. R., & Golder, M. (2006). Understanding interaction models: improving empirical analysis. *Political Analysis*, *14*(1), 63–82.

Brown, D. S., & Hunter, W. (1999). Democracy and social spending in Latin America, 1980–1992. *American Political Science Review*, *93*, 779–790.

Buchanan, J. N., & Tullock, G. (1962). *The calculus of consent: logical foundations of constitutional democracy*. Ann Arbor: University of Michigan Press.

Cox, G. W. (1997). *Making votes count: strategic coordination in the world's electoral systems*. New York: Cambridge University Press.

Cutler, D., Angus, D., & Lleras-Muney, A. (2006). The determinants of mortality. *Journal of Economic Perspectives*, *20*(3), 97–120.

de Looper, & Lafortune, G. (2009). *Measuring disparities in health status and in access and use of health care in OECD countries (OECD Health Working Paper No. 43)*. Paris: OECD.

Deacon, R. T. (2009). Public good provision under dictatorship and democracy. *Public Choice*, *139*(1–2), 241–262.

Downs, A. (1957). *An economic theory of democracy*. New York: Harper & Row.

Duverger, M. (1964). *Political parties: their organization and activity in the modern state trans. B. and R. North*. London: Methuen.

Evans, D. B., Tandon, A., Murray, C. J., & Lauer, J. A. (2001). Comparative efficiency of national health systems: cross-national econometric analysis. *British Medical Journal*, *323*(7308), 307–310.

Filmer, D., & Pritchett, L. (1999). The impact of public spending on health: does money matter? *Social Science & Medicine*, *49*(10), 1309–1323.

Franco, A., Alvarez-Dardet, C., & Ruiz, M.T. (2004). Effect of democracy on health: ecological study. *British Medical Journal*, *329*, 1421–1423.

Gallagher, M. (1991). Proportionality, disproportionality and electoral systems. *Electoral Studies*, *10*(1), 33–51.

Gallagher, M., & Mitchell, P. (Eds.) (2008). *The politics of electoral systems*. Oxford: Oxford University Press.
Gerring, J., Thacker, S. C., & Alfaro, R. (2007). *Democracy and human development*. Unpublished manuscript retrieved from http://www.bu.edu/sthacker/.
Ghobarah, H. A., Huth, P., & Russett, B. (2004). Comparative public health: the political economy of human misery and well-being. *International Studies Quarterly*, *48*, 73–94.
Golder, M. (2005). Democratic electoral systems around the world, 1946-2000. *Electoral Studies*, *24*(1), 103–121 Data set retrieved from http://homepages.nyu.edu/~mrg217/elections.html.
Gwatkin, D. R., Rutstein, S., Johnson, K., Suliman, E., Wagstaff, A., & Amouzou, A. (2007). *Socio-economic differences in health, nutrition, and population*. Washington: World Bank.
Heston, A., Summers, R., & Aten, B. (2006) *Penn World Table* Version 6.2, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania.
Honaker, J., King, G., & Blackwell, M. (2009) *Amelia II: A Program for Missing Data* at http://gking.harvard.edu/amelia/.
Iversen, T., & Soskice, D. (2006). Electoral institutions and the politics of coalitions: why some democracies redistribute more than others. *American Political Science Review*, *100*(2), 165–181.
Iversen, T., & Soskice, D. (2009). Distribution and redistribution: the shadow of the nineteenth century. *World Politics*, *61*(3), 438–486.
Iversen, T., & Stephens, J. D. (2008). Partisan politics, the welfare state, and three worlds of human capital formation. *Comparative Political Studies*, *41*(4/5), 601–637.
Kaufman, R. R., & Segura-Ubiergo, A. (2001). Globalization, domestic politics, and social spending in Latin America: a time-series cross-section analysis, 1973-97. *World Politics*, *53*, 553–587.
King, G., Honaker, J., Joseph, A., & Scheve, K. (2001). Analyzing incomplete political science data: an alternative algorithm for multiple imputation. *American Political Science Review*, *17*, 49–69.
Laakso, M., & Taagepera, R. (1979). "Effective" number of parties: a measure with application to west Europe. *Comparative Political Studies*, *12*(1), 3–27.
Lake, D. A., & Baum, M. A. (2001). The invisible hand of democracy: political control and the provision of public services. *Comparative Political Studies*, *34*, 587–621.
Lijphart, A. (1994). *Electoral systems and party systems: a study of twenty-seven democracies*. Oxford: Oxford University Press.
Lijphart, A. (1999). *Patterns of democracy: government forms and performance in thirty-six countries*. New Haven: Yale University Press.
Lizzeri, A., & Persico, N. (2001). The provision of public goods under alternative electoral incentives. *American Economic Review*, *91*(1), 225–239.
Marshall, M. G., & Jaggers, K. (2007) *Polity IV Project: Political Regime Characteristics and Transitions, 1800-2004. The Polity IV Dataset*. Retrieved from http://www.systemicpeace.org/polity/polity4.htm.
McGuire, J. W. (2005). Basic health care provision and under-5 mortality: a cross-national study of developing states. *World Development*, *34*(3), 405–425.
Meltzer, A. H., & Richard, S. F. (1981). A rational theory of the size of government. *Journal of Political Economy*, *89*, 914–927.
Mueller, D. C. (2003). *Public choice III*. Cambridge: Cambridge University Press.
Milesi-Ferretti, G.-M., Perotti, R., & Rostagno, M. (2002). Electoral systems and the composition of public spending. *Quarterly Journal of Economics*, *117*(2), 609–657.
Neto, O. A., & Cox, G. W. (1997). Electoral institutions, cleavage structures and the number of parties. *American Journal of Political Science*, *41*(1), 149–174.
Nohlen, D. (Ed.) (2005). *Elections in the Americas: a data handbook*. Oxford: Oxford University Press.
Nohlen, D., Krennerich, M., & Thibaut, B. (Eds.) (1999). *Elections in Africa: a data handbook*. Oxford: Oxford University Press.
Nohlen, D., Grotz, F., & Hartmann, C. (Eds.) (2001). *Elections in Asia and the Pacific: a data handbook*. Oxford: Oxford University Press.
Ordeshook, P., & Shvetsova, O. (1994). Ethnic heterogeneity, district magnitude and the number of parties. *American Journal of Political Science*, *38*(1), 100–123.
Persson, T., & Tabellini, G. (2003). *The economic effects of constitutions*. Cambridge: MIT Press.
Persson, T., & Tabellini, G. (2004). Constitutions and economics policy. *Journal of Economic Perspectives*, *18*(1), 75–98.
Persson, T., Roland, G., & Tabellini, G. (2007). Electoral rules and government spending in parliamentary democracies. *Quarterly Journal of Political Science*, *2*(2), 155–188.
Poullier, J.-P., Hernandez, P., Kawataba, K., & Savedoff, W. D. (2003). Patterns of global health expenditures: results for 191 countries. In C. J. L. Murray, & D. B. Evans (Eds.), *Health systems performance assessment: debates, methods, and empiricism* (pp. 195–203). Geneva: World Health Organization.

Przeworski, A., Alvarez, M. E., Cheibub, J. A., & Limongi, F. (2000). *Democracy and development: political institutions and well-being in the world, 1950–1990*. Cambridge: Cambridge University Press.
Riker, W. H. (1962). *The theory of political coalitions*. New Haven: Yale University Press.
Ross, M. (2006). Is democracy good for the poor? *American Journal of Political Science*, *50*(4), 860–874.
Schafer, J. L. (1997). *Analysis of incomplete multivariate data*. Boca Raton: Chapman & Hall/ CRC.
Sen, A. (1992). *Inequality reexamined*. Cambridge: Harvard University Press.
Sen, A. (1998). Mortality as an indicator of economic success and failure. *The Economic Journal*, *108*(1998), 1–25.
Soares, R. R. (2005). Mortality reductions, educational attainment, and fertility choice. *American Economic Review*, *95*(3), 580–601.
Taagepera, R., & Shugart, M. (1989). *Seats and votes: the effects and determinants of electoral systems*. New Haven: Yale University Press.
Ticchi, D., & Vindigni, A. (2010). Endogenous constitutions. *Economic Journal*, *120*(543), 1–39.
Tullock, G. (1959). Problems of majority voting. *The Journal of Political Economy*, *67*(6), 571–579.
UTIP (2008). Estimated household income inequality data set, 2008. University of Texas Inequality Project, data retrieved from http://utip.gov.utexas.edu/data.html.
Vanhanen, T. (2008). *Measures of democracy 1810–2006*. Data retrieved from http://www.fsd.uta.fi/english/data/catalogue/FSD1289/meF1289e.html.
WHO (2010). *European health for all database (HFA-DB)* (January 2010 update). Copenhagen, WHO regional office for europe retrieved from http://www.euro.who.int/hfadb.
Wigley, S., & Wigley-Akkoyunlu, A. (2006). Human capabilities versus human capital: guaging the value of education in developing countries. *Social Indicators Research*, *78*(2), 287–304.
Wilkinson, R. G. (1996). *Unhealthy societies: the afflictions of inequality*. London: Routledge.
World Bank (2009). *World development indicators 2009*, online at www.worldbank.org/data.
Zweifel, T. D., & Navia, P. (2000). Democracy, dictatorship, and infant mortality. *Journal of Democracy*, *11*, 99–114.