# Electoral Performance in a Multilevel Context: A Test of Regime Type and Electoral System on Nationalization

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**Abstract:**

In this methodological paper, we propose a multi level growth model to fit electoral data in a cross-national context in order to estimate the influence of predictors at the levels of country, party, or district on the variance components of the data. The variance components represent values of conceptual interest; namely volatility, dynamic nationalization, and static nationalization. We replicate tests of two institutional hypotheses to demonstrate the behavior of the model, confirming that parties in presidential regimes have lower levels of dynamic nationalization than parties in parliamentary regimes, and that parties competing under single member district plurality electoral systems have lower levels of static nationalization than parties competing under proportional representation systems.

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## 1. Introduction

Political party electoral performance is a phenomena which permits a wide range of measurement and theorizing. In the field of comparative politics, it is used to compare and contrast the behavior of parties and party systems, which in turn are used to draw conclusions about the democratic regime. Electoral returns are a versatile object of study because they are routinely observed over time, across space both sub-nationally and cross-nationally, on parties which themselves are highly variable, and under all sorts of environmental conditions.

Many measures political scientists compute using electoral returns, however, may be imperfect. In a key assessment of the use of electoral data in the study of political systems, Morgenstern and Potthoff (2005) identify an important substantive and methodological flaw in the way the field of comparative politics has typically used these data in the construction of measures for concepts of interest. In particular, they show that the study of the variance in electoral results over time (volatility), across space (nationalization), and in idiosyncratic ways at the level of electoral district (local effects) must be modeled together so as not to mistakenly conflate variance of one type with variance of another type.

The analysis presented here extends that framework in three ways. First, it incorporates observations of multiple parties and countries into one analysis, rather than estimating the variance components one party at a time, by taking advantage of the multi-level nesting structure of the data. Second, it accounts for the fact that observations of vote performance over time by a party in a district are correlated and not independent using multilevel growth curve modeling. We estimate models of party electoral performance on a sample of 33 parties in 16 countries. After estimating an unconditional model without predictors, we add a set of predictors and assess

their influence on the variance components. Finally, we estimate a model with a complex variance structure in which we use country-level variables to condition the district and time variances.

The contributions here are primarily, but only for the time being, methodological. Our goal is to propose a multilevel growth curve model that is both parsimonious and conceptually consistent with the structure of district-level electoral data. The four-level model we settle upon is rarely discussed in any scientific or methodological literature, and electoral data are distinctive in many respects, a topic we will take up later. Here, we use data and hypotheses that exist in the literature to demonstrate how the model behaves, and how to test hypotheses in this framework. The added value of this paper arises because the model we propose is adaptable to a wide range of research questions. We are able to retain all of the original data, without constructing measures which are then output to other analytic frameworks as is typically done. In this respect, the approach is parsimonious. As a four level model, it can test the impact of country, party, and district-level variables on various dimensions of electoral performance. As a model with a complex variance structure, we are able to examine group differences in the variances within the model itself. Here we test the effect of two country level variables, presidentialism and electoral systems, on two aspects of party nationalization.

Our larger ambition beyond this paper is to gather new data and test new hypotheses. In future versions of this project, we will test the effect of party level variables related to party organization and party strategy and we will incorporate district level attributes such as ethnic composition which may influence the degree of party support across time and space (Cox 1997, Morgenstern, Swindle and Castagnola forthcoming).

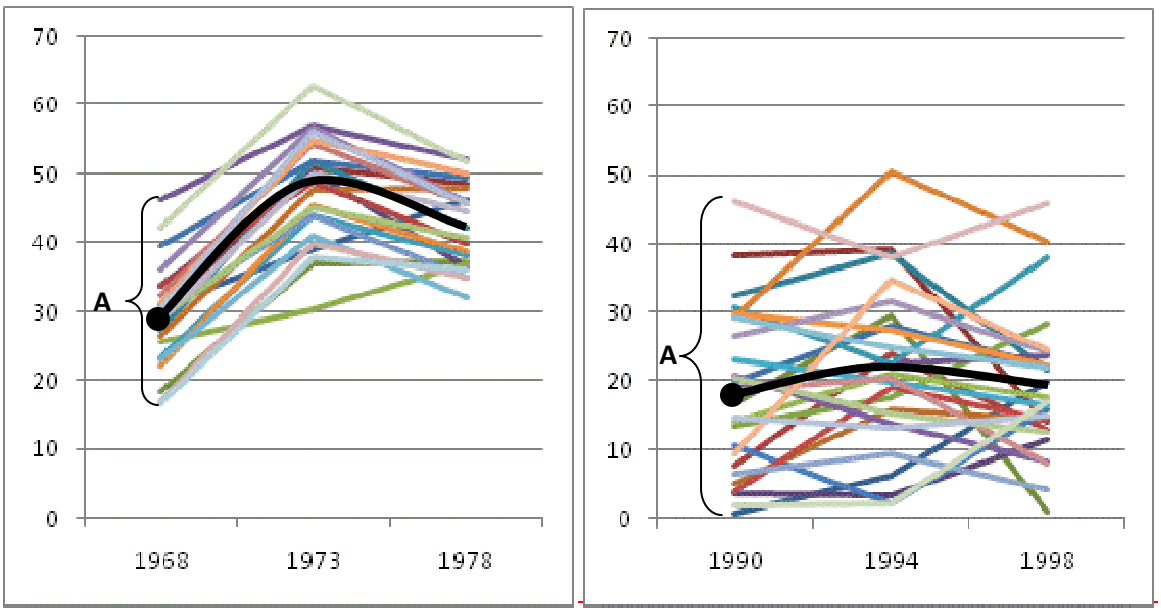
## 2. Volatility, Dynamic Nationalization, and Static Nationalization

Three fundamental concepts derived from electoral data and of interest to political scientists are electoral volatility, dynamic nationalization, and static nationalization. These phenomena are fundamentally derived from party performance, though it often useful to aggregate them to country level summaries, and many works do so (citations). Within the framework of multilevel growth curve models, it is illustrative to derive the quantities which capture these attributes by looking at one party at a time.

Figure 1 below is the actual performance of the Venezuelan party, AD, across 23 districts and three elections beginning in 1968 and the Brazilian party, PMDB, across 27 districts and three elections beginning in 1990. The figure reveals that AD is more nationalized in two respects. First, at each time point, the distribution of the party's vote is more even across the districts, ranging from 16% to 46% in 1968. Second, from year to year, the gains and losses are more uniform. From 1968 to 1973, for example, the party gained 18% in each district on average, with a minimum gain of 4% and a maximum gain of 26%.

PMDB, on the other hand, is less nationalized in both respects. First, at each time point, the distribution of the party's vote is less even across districts, ranging from less than 1% to 46% in 1990. Second, there is no obvious national trend in the party's gains and losses from year to year across districts. On average, the party gained almost 4% between 1990 and 1994, but its gains and losses ranged from a loss of 8% to a gain of 25%. In both party cases, the mean slope across districts captures the party's volatility.

Figure 1: Vote Percentage of AD and PMDB, by district and year




The goal is then to estimate a model which captures these three dimensions of variation. We model change for each party by nesting time within district. That is, vote percentage within each district is observed over three elections. We include fixed effects for the mean intercept and for time and time squared, which yields three estimates to describe the mean growth curve: an intercept, a slope, and a quadratic term. Then, we include estimates for random effects on the intercept and slope. The random effects are estimates of the standard deviations around the mean intercept and the mean slope. In Figure 1, these three values are visible and intuitive. Volatility is the fitted line, drawn in bold. Static nationalization is visible along the left axis as the degree to which the intercepts are tightly or widely clustered, labeled as A, around the mean intercept, marked with a bold dot. Finally, dynamic nationalization is the degree to which the observed district lines correspond in shape to the mean fitted line.

The results in Table 1 yield estimates of these values. First, the fixed effects together estimate the party's mean performance across districts and time. AD had a mean vote of 29.3% in 1968 and gained on average 18.4% (derived from the sum of the slope and the quadratic)

between 1968 and 1973. This value corresponds to the volatility between the two years. Second, the random effect for the intercept, 7.0, is the standard deviation of the party's performance around the mean of 29.3% in 1968. In a normally distributed variable, 68% of the observed values lie within one standard deviation plus and minus the mean; thus, in 68% of the districts, AD won between 22% and 36% of the vote (29.3%+/-7.0%). This random effect corresponds to the static nationalization of AD in 1968. The random effect around the slope, 0.8, is the standard deviation around the linear trend between two time points and suggests that the gains and losses of AD vary little from the estimated mean. This value corresponds to the dynamic nationalization of AD over time.

Table 1: Two Level Growth Curve Model

| | AD | | PMDB | |
|---|---|---|---|---|
| Fixed Effects | Coef. (SE) | | | |
| Constant | 29.3 | (1.6) | 18.3 | (2.4) |
| Slope | 30.2 | (2.0) | 6.8 | (3.5) |
| Quadratic | -11.8 | (0.9) | -3.2 | (1.7) |
| District Level Random Effects | | | | |
| intercept | 7.0 | (1.3) | 10.3 | (2.1) |
| Slope | 0.8 | (0.6) | 1.9 | (2.7) |
| Residual | 3.7 | (0.4) | 7.1 | (1.0) |

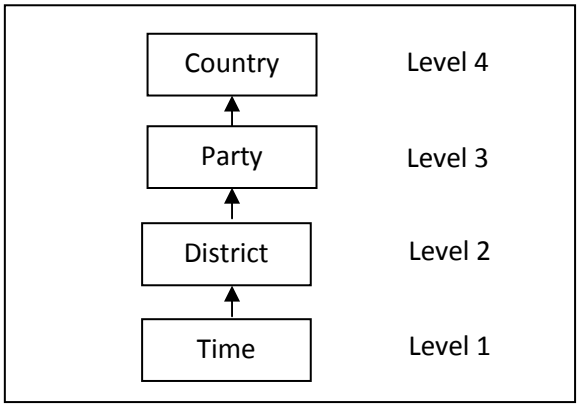
Contrasting the results from the model on PMDB in Brazil with the results for AD, the fixed effects reveal that the mean volatility for PMDB is less than then mean volatility for AD. PMDB gained on average 3.6% between 1990 and 1994 whereas AD gained on average 18.4%. Second, the standard deviation around the mean intercept for PMDB is higher than it is for AD, suggesting a lower level of static nationalization for PMDB in 1990 than from AD in 1968.

Third, the standard deviation around the mean slope for PMDB is much higher than it is for AD, revealing a much lower level of dynamic nationalization for PMDB than for AD.

Lastly, it is worth noting that net all these effects, the residual variance for AD is much lower than the residual variance of PMDB. The random effects are collectively the known as the variance components in that they distribute the variance in vote percentage into three components. The slope component captures the variance in performance between time points within each district. The intercept component captures the variance between districts, net the slope component. The variance that remains is reported as the residual.

The main purpose of this project is to incorporate this two level model (time nested in district) into a larger four level model, nesting district in party, and party in country. See Figure 2. In this fashion, we will assess two hypotheses developed and tested by Morgenstern, Swindle, and Castagnola (forthcoming). Briefly stated, parties in presidential regimes are expected to have higher variance around than slope (lower levels of dynamic nationalization) than parties in parliamentary regimes. Second, parties in countries competing with SMD electoral systems are expected to have higher variance around the intercept (lower levels of static nationalization) than parties competing under PR electoral rules.

Figure 2: Four-Level Hierarchical Data Structure



## 3. Sample and Variables

Our sample includes vote percentages of 33 parties by district in 16 countries over three elections. See Table 2 below. Germany and Mexico have mixed electoral systems and we use the single member district result in Mexico and the proportional representation result in Germany. We follow Morgenstern and Potthoff (2005) (and in many cases use their data) and only use results from single member districts where the district was competitive. Other sources of data include Caramani (2000).

We use a series of three elections because longer series require higher order polynomials to capture the shape of the curves and higher order polynomials become more cumbersome to interpret while offering no additional leverage on the hypotheses of interest.

Table 2: Sample of Countries, Parties, and Elections

| Country | Party | Election 1 | Election 3 | # Districts | Presidential | SMD |
|---|---|---|---|---|---|---|
| Argentina | PJ | 1991 | 1995 | 24 | 1 | 0 |
| Argentina | UCR | 1991 | 1995 | 24 | 1 | 0 |
| Austria | People's Party | 1971 | 1979 | 9 | 0 | 0 |
| Austria | Socialists | 1971 | 1979 | 9 | 0 | 0 |
| Bolivia | A D N | 1985 | 1989 | 9 | 1 | 0 |
| Bolivia | MNR | 1985 | 1993 | 9 | 1 | 0 |
| Brazil | PFL | 1990 | 1998 | 27 | 1 | 0 |
| Brazil | PMDB | 1990 | 1998 | 27 | 1 | 0 |
| Brazil | PT | 1990 | 1998 | 27 | 1 | 0 |
| Chile | Concertación | 1989 | 1997 | 60 | 1 | 0 |
| Colombia | Conservatives | 1974 | 1982 | 26 | 1 | 0 |
| Colombia | Liberals | 1974 | 1982 | 26 | 1 | 0 |
| Denmark | Liberals | 1971 | 1975 | 17 | 0 | 0 |
| Denmark | Social Democrats | 1971 | 1975 | 17 | 0 | 0 |
| Germany | CDU-CSU | 1980 | 1987 | 10 | 0 | 0 |
| Germany | SDP | 1980 | 1987 | 10 | 0 | 0 |
| Italy | Communists | 1972 | 1979 | 31-32 | 0 | 0 |
| Italy | Christian Democrats | 1972 | 1979 | 31-32 | 0 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Mexico | PAN | 1997 | 2003 | 300 | 1 | 1 |
| Mexico | PRD | 1997 | 2003 | 300 | 1 | 1 |
| Mexico | PRI | 1997 | 2003 | 300 | 1 | 1 |
| Spain | Conservatives | 1982 | 1989 | 52 | 0 | 0 |
| Spain | Socialists | 1982 | 1989 | 52 | 0 | 0 |
| Sweden | Moderates | 1948 | 1956 | 28 | 0 | 0 |
| Sweden | Social Democrats | 1948 | 1956 | 28 | 0 | 0 |
| UK | Conservatives | 1955 | 1964 | 235 | 0 | 1 |
| UK | Labour | 1955 | 1964 | 235 | 0 | 1 |
| Uruguay | Colorados | 1984 | 1994 | 19 | 1 | 0 |
| Uruguay | Frente Amplio | 1984 | 1994 | 19 | 1 | 0 |
| Uruguay | Nacional | 1984 | 1994 | 19 | 1 | 0 |
| US | Democrats | 1984 | 1988 | 234 | 1 | 1 |
| Venezuela | AD | 1968 | 1978 | 23 | 1 | 0 |
| Venezuela | COPEI | 1968 | 1978 | 23 | 1 | 0 |

## 4. Methods

We estimated a four-level growth model with a random intercept and slope that allowed individual districts to vary on their initial VS and their rate of change over time with time nested in district, district nested in party, and party nested in country.[1] In this type of linear mixed model (also known as a random coefficients model and a linear mixed model), we can specify both fixed effects and random effects. The unconditional model (Model 1 in Table 3) allows each district to vary with respect to their initial value on vote share as well as their trajectory over time and the random components estimate the variability around the intercept and slope. The conditional models (Models 2 and 3 in Table 3) then add covariates at various levels to predict the intercept and slope and also to explain variance in the random effects. In this case, the individual growth trajectories make up the Level 1 model; the variation in growth parameters

[1] We considered several alternative specifications for this model. One notable specification included crossed and nested random effects rather than nested alone. Because districts are not technically nested within parties, we estimated a model with time nested in the cross of district and party which was then nested in country. While this specification may be more theoretically appropriate given the structure of the data, it was difficult to test for covariate differences in the random effects at level 1 and 2. The nested specification presented here was much more straightforward and interpretable. When we compared the crossed and nested model with the nested-only model, the results were comparable. Therefore, given the research questions of interest, we decided to go with the model that better tested the group differences in variability.

among districts in a party make up Level 2; the variation in growth parameters among parties in a country make up Level 3; and the variation in growth parameters among countries make up Level 4. With two time-invariant covariates at the country level, presidential and single member district dummies, the composite equation in the four level model is:

$$y_{tijk} = \beta_0 + \beta_1 X_{1tijk} + \beta_2 X_{2k} + \beta_3 X_{3k} + \beta_4 X_{2k} X_{1tijk} + \beta_5 X_{3k} X_{1tijk} + (W_k + V_{jk} + U_{ijk} + e_{tijk})$$

where $Y_{ijkt}$ is the response variable for district *i* in party *j* in country *k* at time *t*; $\beta_0$ is a district-specific intercept term; $\beta_1 X_{1tijk}$ is the district-specific slope multiplied by time; $\beta_2 X_{2k}$ and $\beta_3 X_{3k}$are the coefficients and covariates for Presidentialism and Single Member District; $\beta_4 X_{2k} X_{1tijk}$ and $\beta_5 X_{3k} X_{1tijk}$ are the coefficients and cross-products for Presidentialism and Single Member District multiplied by time; and $W_k$, $V_{jk,}$ $U_{ijk}$, and $e_{tijk}$ are the residual variances at the country, party, district and time level, respectively.

Although we specify a four-level model, we only include explanatory covariates that vary by country. The model could easily be expanded to account for party and district level covariates as well. Because we are interested in *differential variability* in party performance across districts and over time by presidentialism v. parliamentarism and by SMD v. PR rather than the effects of these variables on the overall mean intercept and slope of vote percentage, we are most interested in the second conditional model, Model 3, where we add random effects for these covariates. The fixed effects for these covariates are unimportant because the mean intercept and slope of vote share across all districts is an artifact of the cases included in the

sample. For example, Model 3's estimated mean vote percentage at the first election, the constant value of 36.5%, results from the fact that we have analyzed a sample that includes parties that are estimated to have performed on average at that level; had we included more less competitive parties this value would have been lower. We only include the first conditional model, Model 2, which includes fixed effects for these covariates and these covariates crossed with time, to show the random effects when they are not conditioned on the predictors. The key substantive results of our analysis are found in the random effects portion of Model 3.

Ideally, we would specify a model with a grouped covariance structure based on the two variables of interest. Such an approach would yield group specific random effects for each group (presidential, parliamentary, PR and SMD); however there are both practical and statistical issues with a specification with more than one variable of interest. As such, we employ a more straightforward additive specification here that consists of adding random coefficients for smd and presidentialism at the district and time level, respectively (Goldstein 2003) in order to estimate district-level differences in the variability of SMD and differences in the variability over time of regime type. When specified with no constant term at Level 1, it is acceptable to use higher level covariates (in this case our two country level variables) to condition the lower level variances (Goldstein 2003). In this model, the level 2 and level 1 residual variances get decomposed into:

$$U_{ijk} = U_{0ijk} + U_{2ijk}Z_{2ijk}$$

and

$$e_{tijk} = e_{0tijk} + e_{1tijk}Z_{1tijk}$$

where $U_{0ijk}$ is the variance of districts in parties in countries with a PR electoral system and $U_{0ijk} + U_{2ijk}Z_{2ijk}$ is the variance of districts in parties in countries with a SMD system; while $e_{0tijk}$ is the variance for time of districts in parties in parliamentary countries and $e_{0tijk} + e_{1tijk}Z_{1tijk}$ for time of districts in parties within presidential countries. To test for significant differences in the variability of smd compared to pr and presidentialism compared to parliamentarism, we use nonlinear wald tests. All models were estimated using Stata 10 (Statacorp 2007).

**5. Results**

Table 3 presents results from the unconditional linear mixed model (technically, conditioned on time but generally referred to in longitudinal models as unconditional) and the two conditional models. In Model 1, the intercept, slope, and quadratic term are all significant; however, as described above, we are less concerned with the fixed effects than the random effects. The random effects indicate significant variability at the country, party, district and time levels, with the largest components (e.g., the most variability) at the party and district levels. The party component indicates that the average initial vote share varies by party with a standard deviation of 10.34, while the district component indicates that the average initial vote share varies around district with a standard deviation of 11.78. The country level and time level components, while lower, are still substantial with a standard deviation of 5.8 for country and 6.6 for time within district within party within country.

Table 3: Multi Level Growth Model of Electoral Performance

| | Model 1 Coef (SE) | | | Model 2 | | | Model 3 | | |
|---|---|---|---|---|---|---|---|---|---|
| Fixed Effects | | | | | | | | | |
| Time | 1.602 | -0.354 | *** | 0.259 | -0.398 | | -0.0238 | -0.28 | |
| Time Squared | -0.345 | -0.17 | * | -0.341 | -0.168 | *** | -0.137 | -0.125 | |
| Presidential | | | | -5.399 | -4.586 | | -5.48 | -4.572 | |
| Presidential x Time | | | | 2.303 | -0.208 | *** | 2.333 | -0.165 | *** |
| SMD | | | | 6.818 | -5.83 | | 6.985 | -5.869 | |
| SMD x Time | | | | -0.262 | -0.217 | | -0.465 | -0.153 | *** |
| Constant | 34.7 | -2.379 | *** | 36.48 | -3.553 | *** | 36.48 | -3.527 | *** |
| | | | | | | | | | |
| Random Effects+ | | | | | | | | | |
| Country-level Intercept | 5.801 | -2.93 | | 5.06 | -3.151 | | 5.078 | -3.127 | |
| Party-level Intercept | 10.34 | -1.788 | | 10.32 | -1.796 | | 10.45 | -1.764 | |
| District-level Intercept | 11.78 | -0.195 | | 11.8 | -0.195 | | 7.485 | -0.251 | |
| SMD | | | | | | | 10.84 | -0.351 | |
| Time Residual | 6.605 | -0.0696 | | 6.516 | -0.0686 | | 3.29 | -0.0596 | |
| Presidentialism | | | | | | | 6.904 | -0.113 | |
| N | 6765 | | | 6765 | | | 6765 | | |

***p<.001, **p<.01, *p<.05

+ all random components are significantly different from zero

When the fixed effects for presidentialism, single member district, and their cross-products with time are added to the model (Model 2, Table 3). The random effects remain largely the same.

In Model 3, we model the complex variability by adding a random effect for SMD at Level 2 and for presidentialism at Level 1. In the random effects, the components for country and

party remain largely the same, while the components for district and time get decomposed into SMD v. PR and presidentialism v. parliamentarism. The standard deviation for PR is simply the intercept term at that level, 7.49 (because SMD=0), while the standard deviation for SMD is the intercept term plus the standard deviation for SMD (7.49 + 10.84 = 18.33). This difference indicates that there is more variability in initial value for districts in parties in SMD countries; in other words, less static nationalization.

The standard deviation for parliamentarism is the value of the Level 1 residual or 3.29 (because presidentialism = 0), while the standard deviation for presidentialism is that residual plus the standard deviation for presidentialism (3.29 + 6.90 = 10.19). This difference indicates that there is much higher variability over time for districts in parties in presidential countries; in other words, less dynamic nationalization. Nonlinear Wald Tests indicate that both differences are significant at $p<.001$.

**6. Discussion and Conclusion**

Many important studies in comparative politics have assessed hypotheses concerning nationalization and electoral volatility by manipulating electoral data in ways that are not necessary with the model used here. For example, Roberts and Wibbles (1999) test the influence of institutional, structural and economic variables on electoral volatility. They use the common Pederson Index as their principle measure volatility. As Morgenstern and Potthoff (2005) have shown, this measure of volatility produces biased results because it may mask volatility that is only visible at the sub-national level. Our model satisfies Morgenstern and Potthoff's requirement to simultaneously model spatial as well as temporal variability in electoral performance. Second, the model used here is specifically designed for measuring change over time, eliminating the need to manipulate predictors through the use of arbitrary (if theoretically

informed) lags, as Roberts and Wibbles' do with their measures of economic growth and inflation. Furthermore, there is no need to employ techniques which correct for serial autocorrelation and heteroscedasticity which arise when using OLS regression on pooled time series data. Third, we specifically model the multilevel structure of electoral data, and can capture between and within group influences across levels of the model. For example, Roberts and Wibbles use the average age of parties in the party system to measure institutionalization because they measure volatility at the level of country. With the model used here, we could use the actual age of individual parties because we are able to retain individual parties as a unit of analysis, nested as they are within countries. In sum, while we do not dispute their findings because we do not retest their hypotheses, we do argue that a multilevel growth curve model is a preferred approach for answering the questions they pose.

We have pursued this work as a preliminary step in testing party-level explanations of electoral performance. In particular, we are interested in studying new party systems of the developing world to assess the influence that party organizations and their electoral strategies have on the ability of parties to stabilize their electoral support over time and build national constituencies. Students of party politics are well aware that party level decisions are influential, and cases where individual parties defy national norms, as with the Worker's Party in Brazil, are suggestive. Using the methods developed here, we aspire to explore the influence of party attributes systematically across countries and across time.

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