

How Does Proportional Representation Influence Government Composition?

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This paper discusses the relationship between proportional representation (PR) voting system and government composition in a cross-country setting. More precisely it asks whether the use of PR systems leads to greater numbers of parties in government, as measured by the government fractionalisation index. To ensure a correct causal interpretation of the results, confounders that may bias the relationship are controlled for. The results indicate a robust positive effect by PR systems on government party numbers, even after keeping the ethnic heterogeneity, income level, economic inequality and political system quality of the countries constant.

A secondary research question of the paper is whether ethnic heterogeneity mediates the relationship between PR and government composition. Interactive model finds no statistical evidence for such mediating effect. It does not show the multiplying effect of PR to be more pronounced in countries with greater ethnic fragmentation.

These findings are linked to the literature on the fractionalising effect of PR voting system on government formation (Duverger, 1954; Katz, 1997; Persson and Tabellini, 2003). This literature argues that PR systems facilitate the election of larger numbers of parties than non-PR systems, lead to greater numbers of parties needed to form governing coalitions and consequently more parties in government. This paper shows that this is indeed the case. The findings have major implications for electoral systems design as they indicate different electoral systems have differential impacts on government composition.

The rest of the paper proceeds as follows. It first reviews the existing literature on the topic, then presents its own theoretical model. These are followed by a description of the data and methods used, a discussion of the results and finally some concluding remarks.

Literature Review

In the literature on electoral system and government composition, Duverger (1954) is the first to establish a causal connection between the two. Based on comparative analysis of national electoral and party systems, he suggests that the use of PR systems leads to multiparty systems and coalition governments. He reasons that this is because a PR system allows smaller parties with lower vote shares to win seats in elections and also encourages voters to vote according to their diverse partisan preferences. These effects lead to more parties being elected and forming coalition governments. Similar findings have since been made by many subsequent studies. Lijphart (1994), for example, finds that the use of non-proportional voting systems reduces the numbers of parties elected and increases chances of a single party winning a majority. A proportional system has the opposite effect, increasing the likelihood of more parties elected and hence greater numbers of parties in coalition.

Norris (2004) also reports similar results. Her study shows that countries using PR systems generally have greater numbers of parties in parliaments, and are thus more likely to form coalition governments with a larger number of parties. This is echoed in Blais and Bodet's study (2006), which finds strong association between the proportionality (measure of congruence between seat share and vote share, which is typically higher in PR systems) of elections and the number of parties in government. In their study, Persson, Roland and Tabellini (2007) find PR systems to

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increase party numbers in parliament and likelihood of multiparty coalition as well.

To summarise, previous research generally find PR systems to favour multiparty representation and coalition governments. Drawing on this literature, the paper now presents its theory and main hypotheses on PR's causal effect on government composition.

Theory

This paper proposes that PR systems increase the numbers of parties in government through three main mechanisms: (1) it allows many parties to gain representation in elections; (2) it encourages voters to vote for a larger number of parties; and (3) it reduces the likelihood of single-party majority victories. PR systems are electoral systems which allocate seats to parties according to their actual vote shares in elections (Gallagher, 2011). Hence under this system any political party that has succeeded in gaining a minimum amount of votes in elections (subject to constitutional requirements in each country, known as electoral thresholds) can gain representation in the legislature. Voters are also more likely to vote for more parties, since the proportional basis of the PR system ensures that votes for smaller parties will not be wasted and can transfer into actual seats. The electorate is then encouraged to vote according to its different interests, which returns a larger number of parties in elections than in non-PR systems.

The increase in the number of parties elected makes it more difficult for any single party to win a majority of seats, as the total fixed number of seats has to be divided among a larger number of parties. The result is a multiparty parliament where each party has some seats but none with a majority. More parties are then needed to form a coalition government with an at least workable majority. Accordingly, this paper's main hypothesis is as follows:

H1: The use of PR voting systems leads to greater numbers of government parties.

The paper's secondary research question concerns the possible mediating effect of ethnic heterogeneity on this relationship. The literature has often argued that greater ethnic heterogeneity (more ethno-linguistic groups in the society) amplifies the fragmenting effect of PR: more ethnically diverse countries' governments may comprise more parties under PR, as their diverse ethnic groups have more varied partisan preferences and vote for more parties (Caramani, 2011; Neto and Cox, 1997). To find out if this is the case, the secondary hypothesis is formulated as follows:

H2: Ethnic heterogeneity has a positive interactive effect on the relationship between the use of PR systems and government party numbers.

Data and Methods

This paper uses data from The Quality of Government (QoG) Basic Dataset. The dataset compiled by Dahlberg et al. (2016) contains approximately 300 cross-country variables on major social science topics. The dataset's unit of analysis is country (independent state) and has a sample size (N) of 194.

Table 1 presents the summary statistics for the variables used in this paper. To measure government composition (number of incumbent parties), the paper adopts the government fractionalisation index (*dpi_gf*). This index measures the probability that two deputies picked at random from among the government parties will be of different parties (Beck et al., 2001). A higher score indicates a greater probability of finding officials from different parties and thus more parties in government. The index ranges from 0 to 1.

The use of PR system is measured by a dummy variable (*dpi_pr*). Countries where candidates are elected using the PR system get a '1' and those with non-PR systems get a '0' (Beck et al., 2001). The definition of PR in the dataset is largely identical to the one used by this paper in the theory section. The mode of this variable is '1', which indicates that a plurality of countries in this dataset uses some form of proportional representation for elections.

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To exclude any possible confounding influence, this paper controls for ethnic heterogeneity, economic inequality, income level, and three variables on political system quality. Ethnic heterogeneity (*al_ethnic*) measures the degree of ethno-linguistic diversity in a society, with higher scores indicating more different ethnic groups and greater ethnic diversity (Alesina et al., 2003). Economic inequality (*ffp_ued*) is a composite index that measures the extent of unequal economic development among social groups in a country, again with higher scores indicating larger income and living standard gaps across social groups (Haken et al., 2015). The paper controls their effect since greater ethno-economic differences in society have been found to both favour the adoption of PR systems for better representation of diverse social interests, and elect more parties to form more fragmented coalition governments (Lipset and Rokkan, 1967; Colomer, 2004).

Income level is calculated by taking the natural log of GDP per capita (current US dollar). The experience of many Western European countries suggests as countries grow richer, their electorates start voting for more parties, which encourages the use of PR systems and coalition governments to accommodate these new parties (Gallagher, 2011).

The three political system quality variables measure a country's political stability, freedom and electoral integrity. Political stability measures the likelihood of a country's government being destabilised or overthrown militarily, and a high score indicates a more unstable political system (Kaufmann et al., 2010). Political freedom measures a country's freedoms of speech, religion, political participation and legal rights. Higher scores indicate better overall performance in these areas (The Economist, 2015). Electoral integrity measures the degree of fairness of national legislative and executive elections, with countries ranked from 0 (worst) to 12 (best) (Freedom House, 2015). This is an ordinal variable, but used as a numerical variable in this paper. These factors are controlled because more stable political systems with greater liberties and fairer elections may encourage the formation and election of more parties, which again might lead to PR's use and coalition governments to manage enlarged party constellation.

For testing H2, an interactive term of PR usage and ethnic heterogeneity (*PRxEthHetero*) is constructed. It is calculated by taking the product of the two variables.

The paper will use bivariate and multivariate regressions to test the main hypothesis. It will also run an interactive regression model to test ethnic heterogeneity's interactive effect. The methods and models used should be valid, as the basic conditions for applying linear regression are met: the paper has checked heteroscedasticity using robust standard errors, and has found no meaningful difference; collinearity diagnostics suggest the models do not suffer from multicollinearity; and no problematic outlier has been identified for the variables used. Finally, to address any potential bias due to missing data, the models will be re-run on multiple imputed datasets.

Table 1. Summary Statistics

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Variable Name	QoG Code	Variable Type	Count Nonmissing	Mean/Median/ Mode	Standard deviation	Range
Government Fractionalisation	dpi_gf	Scale	172	0.22	0.276	0 – 1
PR System	dpi_pr	Nominal	162	1	NA	0/1
Ethnic Heterogeneity	al_ethnic	Scale	186	0.44	0.257	0 – 1
Income Level	une_gdpc	Scale	155	8.5402	1.53766	5.53 – 11.55
Economic Inequality	ffp_ued	Scale	155	6.36	1.854	1 – 9
Political Stability	wbgi_pse	Scale	155	-0.18	0.927	-3 – 1
Political Freedom	eiu_cl	Scale	155	6.3401	2.68241	0 – 10
Electoral Integrity	fh_ep	Scale	155	7.40	4.295	0 – 12
PRxEthHetero	NA	Scale	160	0.2556	0.27719	0 – 0.88

Note: the mean is displayed for scale variables, median for ordinal variables, and mode for nominal variables.

Results

Table 2 presents the results of the statistical analysis. Model 1 is a bivariate regression of government fractionalisation score on the use of PR systems. As earlier expected, it finds a strong and positive relation between the two measures. The use of PR system predicts a 0.145-point increase in a country's government fractionalisation score. The magnitude of the effect should not be considered as small, since the range of the fractionalisation score is only from 0 to 1. A 0.145 points increase thus represents a 14.5% increase in the country's fractionalisation score. As the score measures the probability of having an official from a different political party in the government, this means it is 14.5% more likely to find a new political party in power under PR. In a cross-country setting, this would mean that *ceteris paribus*, a country using the PR system is 14.5% more likely to have at least one more different party in its government than a non-PR one. The result is highly statistically significant.

To address concerns about possible confounding effects, models 2 and 3 present multivariate regression, where factors that may influence both PR system usage and government composition are controlled for. Model 2 enters as controls ethnic heterogeneity, economic inequality and income level. The size of the coefficient on the dependent variable slightly decreases, but only by around 0.01 points (1% of total score). However the variable remains statistically significant at the 0.01 level, and the predicted effect is still considerable. In this case, the use of PR system increases the country's government fractionalisation by 0.131 points or 13.1% of total score. The model thus suggests it is 13.1% more likely to find one different party in government in a PR-system country than a non-PR one.

Model 3 includes more suspected confounders. The three factors of political system quality are entered, controlling for the effects by political stability, freedom and electoral fairness. The coefficient of the main independent variable further decreases in magnitude, but remains significant at 0.05 level of significance. The use of PR is now associated with a 0.117 points, or 11.7%, increase in a country's fractionalisation score. This suggests it is 11.7% more likely to find an additional party in government for a country using the proportional system. To put this in an empirical context, for two countries each with 10 ministerial posts in its government, the PR-system country is likely to have at least 1 more party in its government than the non-PR one.

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Table 2. Results

Independent variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
PR System	0.145 (0.001)	0.131 (0.005)	0.117 (0.020)	0.084 (0.429)	0.143 (0.005)	0.118 (0.020)
Ethnic Heterogeneity		0.015 (0.884)	0.094 (0.366)	0.058 (0.688)		-0.004 (0.970)
Income Level		-0.016 (0.453)	-0.014 (0.536)	-0.014 (0.531)		-0.029 (0.138)
Economic Inequality		-0.031 (0.085)	-0.047 (0.021)	-0.048 (0.020)		-0.040 (0.030)
Political Stability			-0.069 (0.061)	-0.069 (0.059)		-0.035 (0.267)
Political Freedom			0.021 (0.289)	0.021 (0.294)		0.016 (0.450)
Electoral Integrity			0.000 (0.985)	0.001 (0.961)		0.001 (0.961)
<u>PRxEthHetero</u>				0.067 (0.723)		
Intercept	0.139 (0.000)	0.473 (0.093)	0.375 (0.182)	0.405 (0.169)	0.137 (0.001)	0.547 (0.026)
N	160	151	145	145	193	193
R-squared	0.064	0.086	0.131	0.132	NA	NA

In addition, the model also finds that economic inequality has a small, but statistically significant, negative effect on a country's government composition. One point increase in economic inequality is found to decrease government fractionalisation by approximately 5%, significant at the 0.05 level. This finding contradicts previous expectation: greater economic inequality actually decreases numbers of parties in government. This might be a spurious correlation, as this paper suspects that in this case economic inequality serves as a proxy for regime type. It may be that greater economic inequality indicates more dictatorial and repressive regimes, as the latter's rule often results in the escalation of the former. And given that such regimes are typically single-party or non-party (personal), the corresponding fractionalisation scores become lower. However it may also be the case that economic inequality does possess a reducing effect on government fractionalisation. This paper thus invites further studies on this particular issue. Note: Models 1-8 are linear regressions. P-values displayed in parentheses below the coefficients.

Taken together, results of the three bivariate and multivariate models lend support to the main hypothesis of the paper, namely that the use of PR voting systems increases the number of parties in government.

To test for the interactive effect of ethnic heterogeneity, model 4 enters an interactive term between this and the PR system variable. The result shows that the interactive term is not statistically significant. In fact the previously significant effect by PR system on the variable of interest diminishes as well. These indicate that contrary to the claims by some studies, ethnic heterogeneity does not exercise an interactive effect on the causal relationship between the use of PR systems and the number of parties in power. H2 is therefore rejected.

To address concerns about possible bias due to missing data, models 5 and 6 re-estimate the bivariate and multivariate regressions by models 1 and 2, using multiple imputed datasets. The results are still statistically significant at 0.01 and 0.05 levels, respectively. This suggests that missing data has had minimal biasing impact on the previous figures.

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Discussion and conclusions

This paper finds that the use of PR system increases the number of government parties. It also finds no statistical evidence of ethnic heterogeneity's mediating effect on this causal relationship. Three final points need to be raised regarding research design and causal interpretation:

First, with respect to research design, the results in this paper may be improved if an ideal experiment can be performed. This would involve choosing a country which does not use PR systems for its elections at the moment, and then let it change into a PR system and record the changes in its government composition. However this is highly unachievable and uncommendable, as it is both unrealistic to ask a country to switch its electoral system for research purposes, and unethical, since change of electoral system and government composition can cause major disruptions to a nation's politico-economic wellbeing.

Second, the results may have been biased by reverse causality. While the use of PR can increase government party numbers, governments that consist of larger numbers of parties may also decide to switch to PR systems to secure the electoral interests of all coalition partners concerned. This endogeneity might have negatively affected the predicted effect.

Third and last, there is also the problem of post-treatment bias. The confounders on socio-economic heterogeneity may also be mediators, as the use of PR may encourage greater divergence of socio-economic interests and behaviour. The results may thus have suffered somehow from overcontrolling. This paper hence welcomes comments and further studies on the said relations.

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