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Effects of the Representation System on the Distribution of Votes and Seats in Latin America (1990-2019) *

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Abstract

One of the main consequences of the legal rules that govern electoral systems is that they establish the conditions for the conversion of votes into seats. Based on various public sources of information, this essay constructs indicators on the effects of the rules adopted in the electoral systems of Latin America in the period 1990-2019 in terms of the fragmentation of votes and seats.

The evidence analyzed shows that there is no defined and constant pattern that reflects that the adoption of a proportional representation system results in a different fragmentation than that which occurs when a mixed system is available. The lower fragmentation of the vote than of seats does not turn out to be a product of the presence of partisan alliances. The fragmentation of voting in mixed systems has increased systematically, a situation that does not occur in the case of proportional systems.

Key words: elections, V-Dem, votes, seats, representation, conversion, Latin America.

Introduction

One of the main consequences of the rules that govern electoral systems is to establish the conditions for the conversion of votes into seats.

It is therefore interesting to analyze the empirically discernible effects on the distribution of both basic outcomes of the elections due to the adoption of a certain system of representation in the nations of Latin America.

Based on various public sources of information, this essay constructs indicators on the effects on the distribution of votes and seats of the rules adopted in the electoral systems of Latin America during the period 1990-2019. These three decades are chosen because they are the period in which there is reliable data on both electoral results and modalities of representation systems for the majority of countries in the region.

The essay adopts the conventional IMRaD (Introduction, Methods, Results and Discussion) format, which is a common organizational structure model for original research articles for scientific publications (Sollaci and Pereira, 2004), so it comprises four basic sections: one first part aimed at specifying elements of a theoretical and conceptual nature that are relevant to the topic, which fundamentally takes up the content of a previous essay on the topic (De la Peña, 2005). Subsequently, the sources of information and the methods used for data analysis are specified and characterized. Then we move on to reading the main quantitative results resulting from the exploitation of the chosen sources. Finally, conclusions are reached and lines of research for the near future are proposed.

Theoretical framework

In a conventional definition, it could be said that a political system is “the organizational concretion of a set of stable interactions through which politics is exercised in a context limited by the population” (Molina, 2007). This system is formed primarily by agents and institutions, but also by beliefs, norms, attitudes, values, intentions, and behaviors that are sources of recognition of social representation.

These interactions sustain, but at the same time alter, an order from which a certain distribution of utilities results, leading to decision processes that modify the use of power to obtain objectives defined by the actors. Ultimately, behind every public policy decision there will be winners and losers and, therefore, a distribution of profits between social actors. And it should be remembered that the political system is nothing other than the entity in which political actors come together (Duverger, 1984:33).

For this author, political institutions are the integral parts of a sub-system that is usually called a political regime, understood as the coordinated set of political institutions. In this sense, the analysis of the political system involves not only analyzing the political institutions themselves, but also the relationships between the political regime and the remaining elements of the social system. And the first major division of political regimes that Duverger makes is between democracies and dictatorships.

Democracies are those forms of social organization that attribute ownership of power to society as a whole; They are the forms of organization of the State in which collective decisions are adopted by the population through participation mechanisms, direct or indirect, that confer legitimacy to their representatives. In contrast, dictatorship is a form of government in which power is concentrated in a single individual or reduced collective body, with all powers without limitations or requirements for consensus by the governed.

Beyond the classic horizon of the agora, democracy today usually takes indirect or representative forms, where the will of the people is expressed through those who are recognized as legitimate representatives. And this legitimacy derives from an election process within the universe of residents of some people who will occupy positions of popular representation.

After the Second World War and largely due to its result, not only was the formal and representative democratic system for the formation of governments via elections maintained and consolidated in nations that had opted for this formula before that event, but its Adoption as a mechanism for the formation of governments was expanded in various waves, so today it is a system common to many nations, and it apparently continues to be one of the most, the most legitimate method available for deciding who is in charge of governing a society.

For a democracy today to be considered such, the universality of suffrage is assumed, a condition that has been adapted from a census limit, where only male property owners could elect to one where the right was granted to lawyers, to the extension to all people who have reached a minimum required age, without distinction of gender, educational condition, marital status or ethnic origin, and even allowing the participation of those who have an organic limitation or live outside a defined territorial limit.

In modern democracy there is a fundamental principle for making collective decisions, based on the universality of the aforementioned suffrage: the so-called “majority rule” or the right for the majority position to be adopted when there are various proposals in around a matter of public interest, but with respect for the rights of minorities that allow their survival and enable them to eventually acquire the condition of being a new majority.

Elections are then an instrument to apply this “majority rule.” They are an efficient, clear and transparent exercise that allows the selection of representatives legitimized by the act of participation of the population universe in the decision of those who will be able to make decisions on behalf of the group, seeking through norms accepted by the community that the formation of the Representation responds to this hailed “majority rule.”

Elections, in the liberal scheme of democracy, therefore imply a set of norms that delimit the actions of the elected representation. There is thus, as a background, a constitution that guarantees respect for fundamental human rights such as freedom of expression, association and information, which limit the powers and control the formal functioning of the government.

One of the basic delimitations of the exercise of representatives is the principle of division of powers, by which the powers and functions of the State are divided into different bodies: the executive, responsible for the government; the legislative, in charge of the formation of laws; and the judiciary, responsible for the administration of justice. These bodies make up a

mechanism of checks and balances to which autonomous bodies and more direct deliberative formulas for citizen participation are increasingly being added.

This leads to the configuration of two extreme types of regimes: the presidential one, where the autonomy and unipersonal character of the executive becomes relative powers superior to the ruler than those that are proper to the head of government whose position comes from the decision of the assembly of representatives, typical modality of parliamentarism. In the middle, there are all kinds of logics of counterweights and separation of powers as a form of regulation of powers among themselves, according to each society has decided.

To carry out elections, there must exist that part of public law that constitutes the electoral system or set of principles, rules and legal procedures through which citizens, considered voters, can express their political will in votes, which become either executive power, unipersonal, or in seats of collegiate bodies. In other words: electoral law must include the rules that establish the ways in which elective positions must be assigned and distributed.

This electoral system must establish at least the principle of election, whether by majority, proportional or a mixture of both; the magnitude and limits of the units for the election; the size of the assembly and the formula to calculate the distribution of votes and their conversion into seats, which largely depends on the principle of election; in addition to various administrative matters.

To consider an electoral system as properly democratic, it is necessary that there be regulations that allow electoral competition in periodic processes. These minimum conditions would be necessary to speak of democracy, as Nohlen (1994) recalls.

Thus, electoral competition constitutes only a condition, a characteristic of the political system, which refers to the formal existence of elections with alternatives and without predetermined results. The category of electoral competition is then somewhat bipolar: it exists or it does not exist in a given society. Or, in Giovanni Sartori (1997) terms, it is a structure, a reference to the same rules of the game in a system.

In contrast, competitiveness is a particular state of elections in a given place and at a given time. He talks about the distribution of votes among the competitors who participate in elections according to certain established rules. Competitiveness is an escalation: there can be

more or less competitiveness in a system and in a given election. Or, again from Sartori, it is a certain state of the game that was previously regulated.

For now, it would be necessary to delve deeper only into the aspects that make up the electoral rules of a system: the principle of election, touching at the outset only on the two “extreme types”: the principle of plurality or relative majority, which usually uses a division of the territory of a State in generally single-member district units, where the winner is the one who obtains the greatest number of votes.

Theoretically, this system tends to encourage the formation and preservation of a smaller number of parties and favors the even artificial integration of parliamentary majorities, although it tends to over-represent the major parties in the assembly and under-represent or exclude minor parties.

The other extreme principle is proportional representation, which usually uses a territorial division into large districts or a national unit, deliberately reducing disparities between percentages of votes and seats in assembly, but theoretically creating conditions that encourage fragmentation and inhibit the probability formation of an automatic majority in the legislative body, which usually requires the establishment of alliance mechanisms between parties in the assemblies.

In this way, every electoral system somehow resolves the dilemma between two possible objectives: formation of majorities and proportionality between votes and seats. In this regard, it is important to consider that, as Lijphart (1995) demonstrates, beyond a certain minimum threshold and maintaining the other factors constants, the size of the assembly itself has little influence on competitiveness in the system.

There are systems that opt for intermediate formulas, which seek to achieve a balance between both objectives. Thus, the mystification of the system to form political representation would seek to mediate between the achievement of an ideal proportionality and the maintenance of the capacity for an exit that allows for a majority.

Although in the extreme the ideal would be to compare the distribution of votes and seats and the reducing effects on the fragmentation between simple majority and proportionality systems, the reality of the electoral systems of Latin America, the study space chosen for this analysis, does not allow, since election schemes based on the principle of plurality are practically

eliminated from this region (the exception is the recent adoption by Bolivia of this system). This is why an analysis must be chosen that compares data corresponding to systems with the principle of proportionality against mixed systems.

This allows us to formulate a basic hypothesis for this analysis: what is expected, at least from a theoretical point of view, is that mixed representation systems do not achieve proportionality like that achieved by those who adopt this as a pure principle. Thus, it would be expected that when converting votes into seats, proportional representation systems would have a smaller reductive effect on the number of parties in the assemblies than plurality systems or even mixed ones, and that this would also be stable over time.

Moving on to the issue of how to approach the analysis of the phenomenon that is the subject of this essay, party systems are usually characterized in different ways, based on the number of their components, the degree of polarization between them and the direction that the party actually has competition, among many other elements.

In the field of political science, this reality leads to facing various aspects to understand the electoral phenomenon. Then, a first issue is that elections are a formula to allow the members of a political community to express their preference between various options to, based on said preferences, define a distribution of seats in the representative bodies. That is: the votes essentially serve to decide who will occupy the positions of representatives of the community.

Thus, every election has two outputs: numbers of votes cast for the competing options and numbers of seats won by these options in the popular representation. However, both quantities do not have to reflect identical proportions. That is to say: the proportion of votes for a competitor is not always reflected in a similar proportion of seats in an assembly. In the extreme, this does not occur when elected for a single position.

When it comes to collegiate bodies, of the various competitors under a motto, some enter and others do not. And it is possible to count how many parts actually make up the organ. Thus, from the point of view of the number of components of the party system, three groups are usually differentiated: one-party, two-party and multi-party systems.

The characterization of party systems according to their number of components has taken two aspects that are not necessarily coincident, but should tend toward convergence:

qualitative mechanisms for defining party systems, as was done by authors such as Sartori; and proposals that seek the quantification of the “effective” components of a system.

However, the conversion methods studied by political science are only theoretical approaches to the phenomenon, a product of the so-called "mechanical conversion effects", since in reality elections occur in which the participant who obtains the most votes does not turn out to be the one who obtains the largest number of seats, as a result of inequalities in the regional distributions of votes per contender, deformations in the integration of the units into which the territory is divided for election purposes and other phenomena that mechanically promote or result in deviations from proportionality expected.

As Taagepera and Shugart (1989) rightly point out, electoral studies can provide a Rosetta stone for other fields of Politic science. Thus, starting from easily definable and measurable quantities, we can arrive at more complex notions, with a precise meaning.

For decades, this potential for mathematical treatment of the electoral field has led to the postulation and use of aggregate indicators that account for electoral events.

The indices would then be a procedure that seeks to “make the abstract concrete,” according to Tarriba (2014:9), who emphasizes the fact that in the field of social sciences there are difficulties in directly measuring these concepts, which tend to be of the interaction of very diverse variables, but that their usefulness is clear in allowing "to evaluate, compare and monitor complex phenomena and processes over time", being tools with high communicative power as they can describe "in a single figure (...) a relative position or a trend." These limitations are overcome in the electoral field, where there are unitary outputs that allow simple, clear and unambiguous treatment of the data for the construction of indices.

This is how the vote and seat data have been able to be collapsed into simple indicators that attempt to account for the observed distributions or differences in a single piece of data. Among the great diversity of these indicators, the indices of vote concentration or fragmentation stand out for a given election, such as those used in this analysis.

Sources and methods

A reliable, comprehensive and relatively up-to-date source for international comparative analysis of electoral results in terms of votes and seats is the party database produced and made publicly available by the *Varieties of Democracy* (V-Dem) project, which includes data on elections since 1900 for parties that achieved more than five percent of the vote (Pemstein *et al.*, 2021). This project is carried out by a permanent body whose headquarters are located at the V-Dem Institute of the Department of Political Science of the University of Gothenburg.

Starting in recent years, V-Dem has complemented its data offering with a database on political parties and electoral results (Lindberg *et al.*, 2022a), with its respective codebook (Lindberg *et al.*, 2022b) and coding units (Lindberg *et al.*, 2022c). This database includes data on parties that nominated candidates for office in each nation's lower houses and that achieved seats or at least five percent of the vote in a given election since at least 1900.

In parallel, the Observatory of Political Reforms in Latin America has made available to the public a catalog on *Electoral Reforms in Latin America, 1977-2019* (Freidenberg *et al.*, 2021), which allows us to know and record the existing representation system in each country at a given time, which is essential for the purposes of the intended analysis.

Based on selected variables, a database was generated that could be considered a derivative of the V-Party database, with eleven fields and 668 records, which was called ERPAL-VD and whose unit is the party in a given election. The fields in this database are: the corresponding election, the country (with the code assigned by the Correlates of War or COW project), the year of the election, the corresponding decade, the representation system adopted (taken from Freidenberg, 2021), the specific party (with a unique numerical identifier for each party according to Party Facts by Döring and Regel, 2019), the condition of having been part or not of an electoral alliance that concentrated the vote, the proportion of votes obtained and the proportion of seats in the Lower House achieved and the voting and seat squares.

Likewise, a second base was built, whose unit is the election, with ten fields and 136 records, called ERPAL-VS. The fields in this database are: the corresponding election, the country (with the COW code), the year of the election, the corresponding decade, the

representation system adopted (Freidenberg *et al.*, 2021), the condition of having existed or not electoral alliances that have concentrated the vote, the vote fragmentation index, the seat fragmentation index, the quotient of both fragmentations and the estimated reductive effect. Both databases are integrated into a single data group with permanent and free public access (De la Peña, 2022).

To conduct the data interpretation exercise, various statistical tools are used. First, regressions are carried out. In general, regression analysis is a process used to estimate relationships between variables that helps understand how the value of the dependent variable varies by changing the value of an independent variable, while keeping the value of the remaining variables fixed. In general, these models allow us to estimate the percentage of the variability of the dependent variable that can be explained by applying the regression equation and knowing the coefficient of determination (R^2). In this essay, two types of regressions are used, as appropriate:

One is the linear regression, a form of analysis that estimates coefficients by fitting a straight line or surface that minimizes discrepancies between predicted and actual output values, the simple form of which is used in this text is

$$y = \beta_0 + \beta_1 x_1 + \varepsilon$$

The other type of regression used is logistic, an analysis used to predict the result of a variable based on other independent or predictor variables, with an output domain of the function limited to the interval $[0,1]$, by calculating of regression coefficients (β) of the independent variables, to calculate the marginal contribution on the probability of occurrence of the dependent variable or “odds ratio” (L), which corresponds to the risk of having the effect evaluated for a certain value with respect to the value decreased by one unit. A positive value of β for an independent variable means that said variable has a certain probability of having a positive effect on the dependent variable, while a negative value means a negative effect. The simple equation for these calculations, which is the one used in this essay, is

$$P_L = \frac{1}{1 + e^{-(\beta_0 + \beta_1 x_{1,i} + \varepsilon)}}$$

These models use maximum likelihood to estimate the goodness of fit and have a measure of the statistical significance of the calculations they make helps to differentiate results that are a product of chance from those that can be said to really impact the phenomenon (Kleinbaum and Klein, 2010).

Additionally, Kolmogorov-Smirnov normality tests are used, which compare the observed cumulative distribution function of a variable with a specific theoretical distribution, using the Lilliefors correction to estimate the p value and establish asymptotic significance in a bilateral test.

Now, for analysis purposes, we start from the recovery of the data on voting and seats reported by the V-Dem project, from which indicators on competitiveness in the elections under study are generated. These indices, corresponding to the original proposal of Herfindahl (1950) market concentration meter, are described below.

Let v_i be the proportion of the reported vote that corresponds to the i -th party and s_i be the proportion of the total seats that correspond to the i -th party, an index of vote fragmentation (H_v) can be defined, or its conversely, the effective number of electoral parties or N_v (Laakso and Taagepera, 1979), as

$$H_v = \frac{1}{N_v} = \sum_{i=1}^m v_i^2$$

And an index of seat fragmentation (H_s), or its inverse, the effective number of legislative parties or N_s (Laakso and Taagepera, 1979), as

$$H_s = \frac{1}{N_s} = \sum_{i=1}^m s_i^2$$

The calculation of these indices must take into account the fact that a small part, but greater than zero, of the distribution of both votes and seats, is not reported as obtained by any of the parties considered in the database.

Therefore, the equations must include an additional term that accounts for this part, corresponding to the difference between the total votes or seats and the reported part, where for the votes we have to

$$v_r = 1 - \sum_{i=1}^m v_i^2$$

And for the seats

$$s_r = 1 - \sum_{i=1}^m s_i^2$$

To estimate the weight in the fragmentation or concentration of this remnant, the average of its observed value and its square must be taken (Taagepera, 1997), which leads to correcting the previous formulas as

$$H_v = \frac{1}{N_v} \cong \sum_{i=1}^m v_i^2 + \left[\frac{(1 - \sum_{i=1}^m v_i^2) + (1 - \sum_{i=1}^m v_i^2)^2}{2} \right]$$

And likewise

$$H_s = \frac{1}{N_s} \cong \sum_{i=1}^m s_i^2 + \left[\frac{(1 - \sum_{i=1}^m s_i^2) + (1 - \sum_{i=1}^m s_i^2)^2}{2} \right]$$

What will be the values adopted for this analysis.

Unlike this exercise, it is not feasible to make, from the data on the distribution of votes and seats by party provided by V-Dem, a moderately reliable estimate of the disproportionality in this distribution according to conventional indices.

In this regard, one of the most used statistics for this calculation is the Loosemore-Hanby *D* index (1971), whose complement is known as the Rose index, which calculates the absolute difference between the votes cast and the seats, obtained by the formula:

$$D = \frac{\sum_{i=1}^m |v_i - s_i|}{2}$$

And the other is the least squares method proposed by Gallagher (1991), which is noted here as G , and which is perhaps the most used today, since it allows establish a relative weight to the differences based on their magnitude based on

$$G = \sqrt{\frac{\sum_{i=1}^m (v_i - s_i)^2}{2}}$$

However, both estimators assume the availability of voting and seating data for a complete or almost complete list of components that form pairs in a biunivocal manner, which is not feasible given that the reports of V-Dem (and the distributions that occur in reality) entail the aggregation of the vote for parties that obtain their support jointly due to having been part of an alliance.

Neither the exclusion of cases in which particular voting data is not reported for a given party member of an alliance nor the duplication of the vote count for each component of an alliance, nor any other clear and generalizable procedure allows establishing the desired pairing and, consequently, carry out the calculation of the referred indices.

That is why we resort to constructing an index that accounts for the difference between the distribution of votes and seats based on another logic. It is clear that all the components of each side of the conversion of votes to seats are reported, but that this is done based on the divisions formally established on each occasion: as contenders in the election at first and then as eventually differentiated components in the assemblies.

And as seen previously, it is possible from knowing the distributions of each side, treated independently, to know the fragmentation or its counterpart, the concentration, whether of the votes or the seats.

Then, it is possible to relate both extremes of this process, by calculating a quotient between fragmentations or concentrations (C_N), called as fragmentation ratio, as

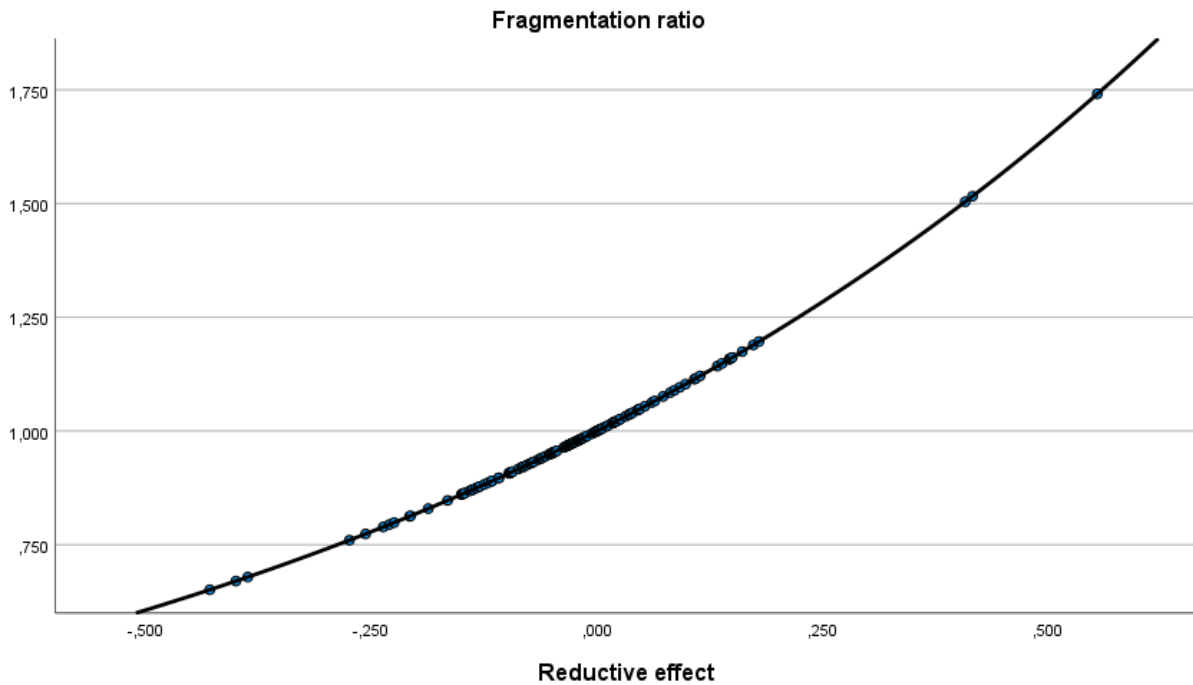
$$c_N = \frac{H_v}{H_s} = \frac{N_s}{N_v}$$

And, to give it more clarity and meaning, modify it to its natural logarithm (r_N), or reductive effect, as

$$r_N = \ln(c_N) = \ln\left(\frac{H_v}{H_s}\right) = \ln\left(\frac{N_s}{N_v}\right)$$

As can be seen in Figure 1, the reductive effect (r_N) would then simply be the conversion of the quotient between fragmentations (c_N), by extracting the natural logarithm, an exercise that yields a value of 0.368 in a logistic regression.

Figure 1. Relationship between reductive effect and fragmentation ratio



SOURCE: Based on Lindberg *et al.* (2022a) and Freidenberg *et al.* (2021)

Results of the study

This analysis is based on the recovery of data on 668 units of analysis (party-election) from eighteen Latin American countries that have competed in one of the 136 elections held in the period 1990-2019 for which data on voting and/or voting have been reported or on seats achieved for the lower chambers of those countries and that have been achieved under rules of either proportional representation or mixed.

The number of elections considered for this study would reflect that on average there are 4.5 elections for the Lower House that are held annually in the region, which results in an average cycle of four years between elections.

Table 1. Number of elections according to representation system by country

	Representation System		
	Both	Mixed	Proportional
Argentina	12		12
Bolivia	5		5
Brasil	8		8
Chile	1		1
Colombia	9		9
Costa Rica	8		8
Dominicana	7		7
Ecuador	12		12
El Salvador	10		10
Guatemala	9		9
Honduras	7		7
México	10	10	
Nicaragua	6		6
Panamá	5	5	
Paraguay	7		7
Perú	8		8
Uruguay	6		6
Venezuela	6	6	
Total	136	21	115

SOURCE: Based on Freidenberg *et al.* (2021)

Twenty-one of these elections, in only three countries, have been subject to rules for the distribution of seats that imply the existence of a mixed system, while 115 elections in fifteen nations have been subject to rules of proportional representation (Table 1).

In the case of one country (Bolivia), there have been modifications to the rules of electoral competition that have led to the transition from a proportional system to one majority type. In another (Chile) until recently they moved to a proportional system, after having had a peculiar binomial system.

On both occasions, the data related to the aforementioned peculiar systems, the Bolivian majority system and the Chilean binominal system, have been excluded from the analysis, as they are the subject of case studies rather than a comparative analysis such as the one intended here and go far beyond the scope and extension of this essay. However, both countries are considered with regard to their elections under the principle of proportional representation.

Table 2. Elections and parties according to representation system, decade and country

		Elections		Parties		Parties / elections	Electoral alliance	Report	
		N	%	N	%			Votes	Seats
América Latina (1990-2019)		136	100.0%	668	100.0%	4.9	11.2%	86.1%	91.9%
System	Mixed	21	15.4%	106	15.9%	5.0	15.1%	88.3%	92.0%
	Proportional	115	84.6%	562	84.1%	4.9	10.5%	85.7%	91.9%
Decade	1990-1999	52	38.2%	237	35.5%	4.6	5.5%	87.2%	92.6%
	2000-2009	44	32.4%	204	30.5%	4.6	7.4%	85.6%	91.7%
	2010-2019	42	30.9%	232	34.7%	5.5	20.7%	81.3%	86.8%
Country	Argentina	12	8.8%	56	8.4%	4.7	55.4%	77.0%	84.9%
	Bolivia	5	3.7%	20	3.0%	4.0	5.0%	87.1%	95.1%
	Brasil	8	5.9%	72	10.8%	9.0	0.0%	80.8%	84.5%
	Chile	1	0.7%	10	1.5%	10.0	50.0%	82.4%	93.1%
	Colombia	9	6.6%	36	5.4%	4.0	0.0%	76.1%	81.9%
	Costa Rica	8	5.9%	31	4.6%	3.9	0.0%	83.4%	94.1%
	Dominicana	7	5.1%	23	3.4%	3.3	0.0%	92.1%	98.9%
	Ecuador	12	8.8%	91	13.6%	7.6	3.3%	86.5%	90.7%
	El Salvador	10	7.4%	43	6.4%	4.3	0.0%	92.6%	95.7%
	Guatemala	9	6.6%	56	8.4%	6.2	3.6%	80.0%	93.1%
	Honduras	7	5.1%	19	2.8%	2.7	0.0%	92.7%	94.7%
	México	10	7.4%	46	6.9%	4.6	15.2%	90.1%	95.8%
	Nicaragua	6	4.4%	17	2.5%	2.8	5.9%	94.2%	95.6%
	Panamá	5	3.7%	28	4.2%	5.6	0.0%	87.6%	91.1%
	Paraguay	7	5.1%	25	3.7%	3.6	28.0%	88.4%	93.9%
Perú	8	5.9%	43	6.4%	5.4	20.9%	84.7%	94.5%	
Uruguay	6	4.4%	20	3.0%	3.3	0.0%	96.4%	97.8%	
Venezuela	6	4.4%	32	4.8%	5.3	28.1%	85.8%	86.3%	

SOURCE: Based on Lindberg *et al.* (2022a) and Freidenberg *et al.* (2021).

In the case of another nation, Haiti, the lack of reports on voting by the source used as a basis prevents its inclusion in the study universe. And in the case of Cuba, the lack of elections

organized under criteria of partisan contest prevents its consideration as part of the space under observation.

There is little difference between the distribution of elections and that of parties included in this analysis, depending on the representation system to which they correspond, the decade in which the elections were held or the country (Table 2).

And although only one in nine parties that has participated in an election in the period and for which data is reported has done so in alliance, the proportion has risen significantly in the recent decade (2010-2019).

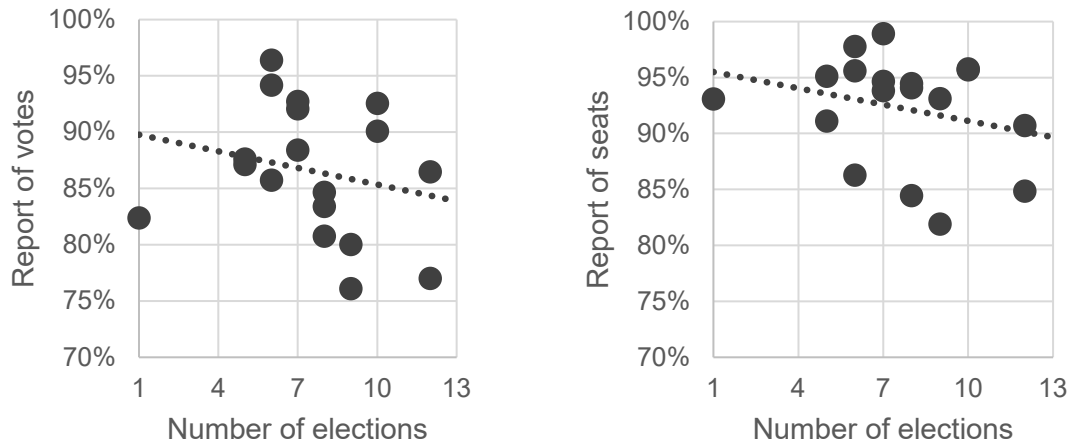
Likewise, alliances are not allowed by all electoral systems: eight countries do not report alliances and four more only occasionally, with six other countries where alliances have occurred on a more regular basis, notably Argentina, where more than half of the parties have contested by forming temporary electoral alliances.

However, the variations in the proportions of voting and seats that were reported as corresponding to the parties considered do seem relevant, especially due to their impact on the unreported remainder that represents a high variability in the proportions of this segment, which may have an impact on the calculations made of the effective number of electoral and legislative parties and, therefore, the estimated reductive effect for the different units of analysis and their aggregates.

The reporting of 87 percent of the vote and 92 percent of seats in the 136 elections considered in this study is not homogeneous. Apparently, the recovery of this data has tended to be lower as the date of the elections gets closer, which could be reflecting either problems in the construction of the database that serves as a source, or the increase unobserved of the participation of parties in elections that do not reach the threshold of five percent of the vote or do not obtain seats in the lower chambers of their countries.

Furthermore, there is a propensity for a greater proportion of voting and seating data to be available in those nations that have held fewer elections within the two representation systems considered in this analysis (Figure 2), although this is greatly affected by the cases in which smaller proportions of votes and seats have been recovered and reported.

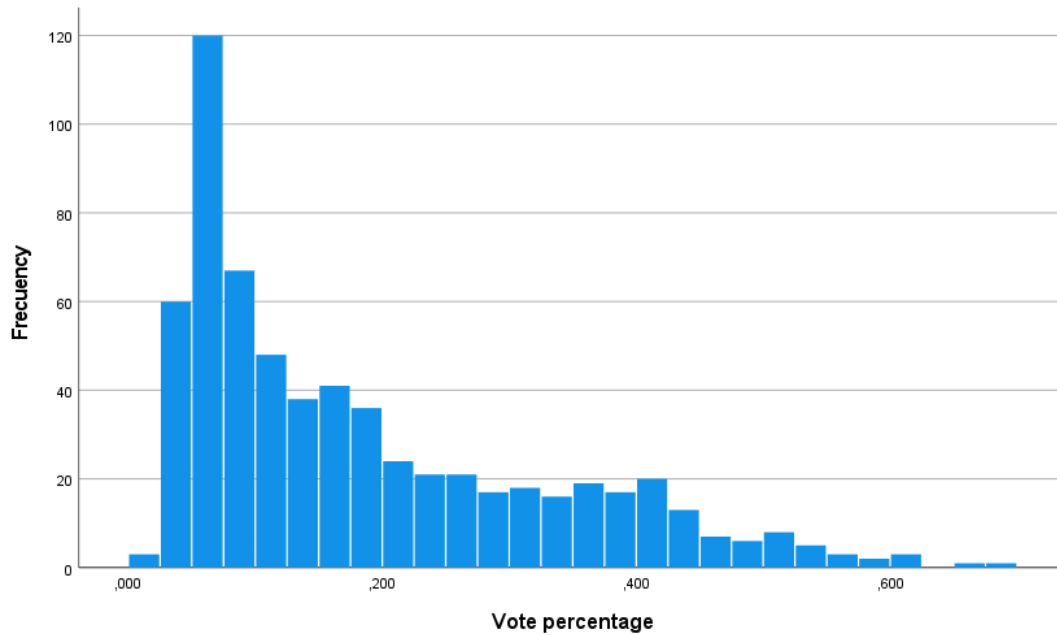
Figure 2. Voting and seats reported according to number of elections



SOURCE: Based on Lindberg *et al.* (2022a) and Freidenberg *et al.* (2021).

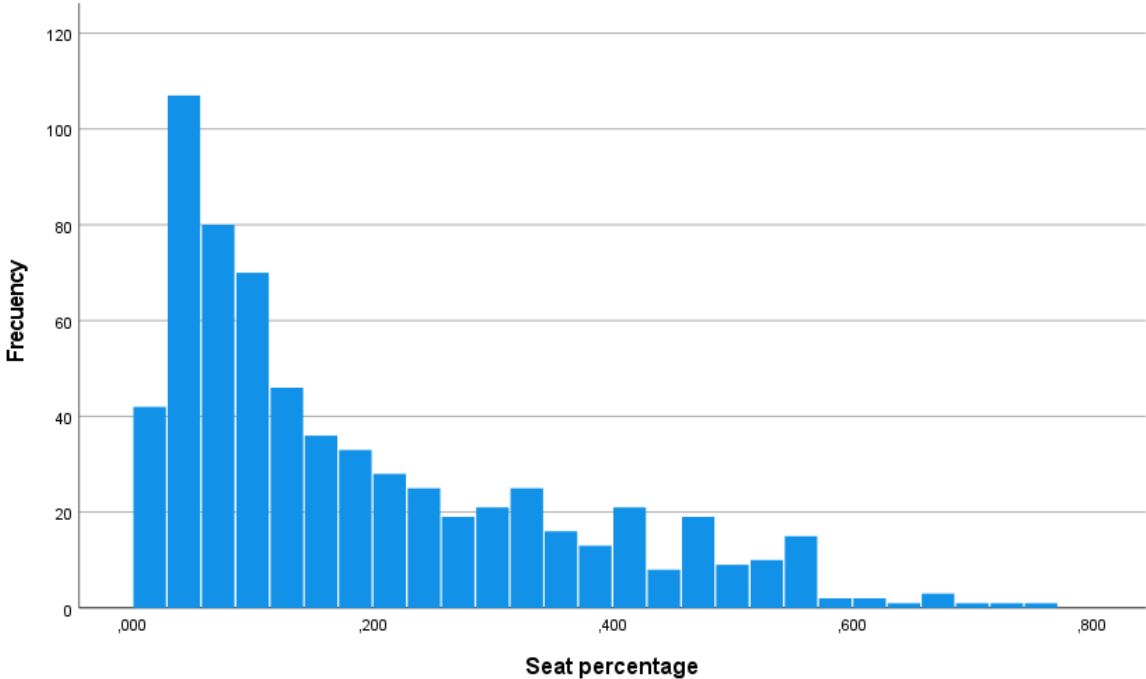
The majority of voting reports and seats achieved by a political party corresponds to the lower limit established for inclusion in the V-Dem database, which shows that the cases in which parties have been incorporated into the base for having achieved seats without exceeding the voting threshold claimed for their report, or vice versa, is reduced (Figures 3a and 3b).

Figure 3a. Frequencies of parties according to vote percentage



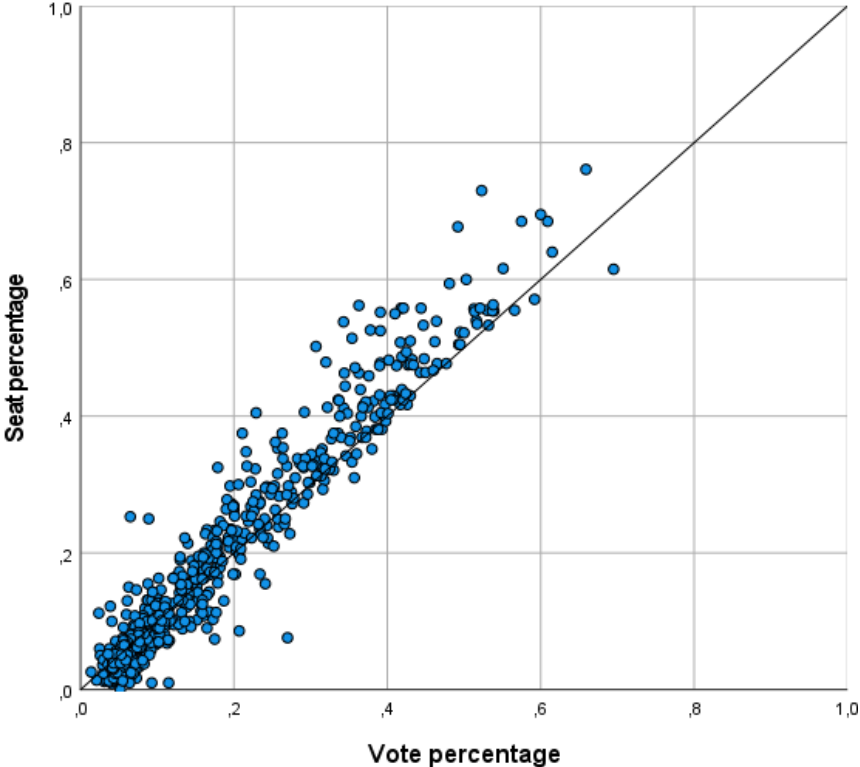
SOURCE: Based on Lindberg *et al.* (2022a).

Figure 3b. Frequencies of parties according to seat percentage



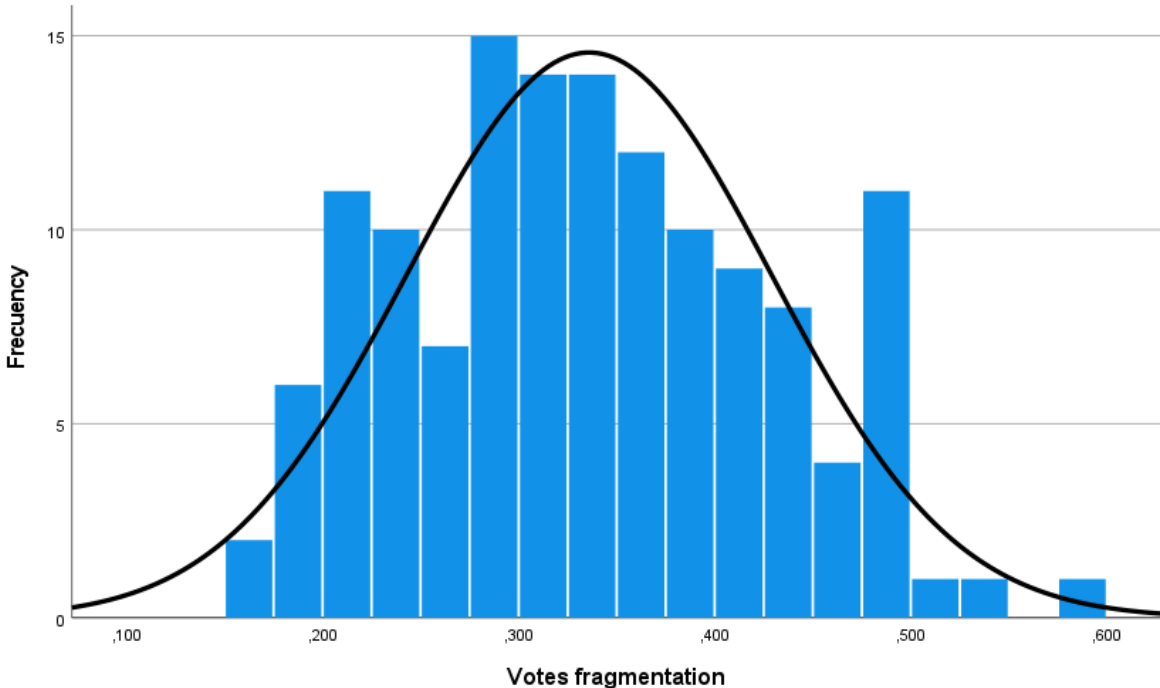
SOURCE: Based on Lindberg *et al.* (2022a).

Figure 4. Dispersion of the vote percentage according to seat percentage



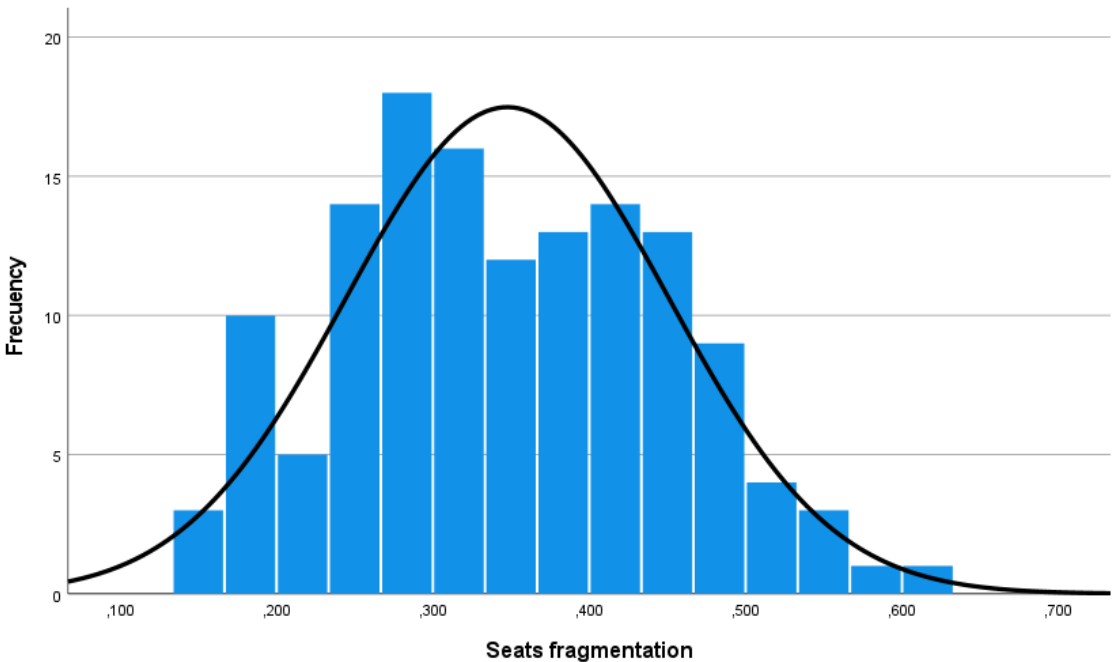
SOURCE: Based on Lindberg *et al.* (2022a).

Figure 5a. Frequency distribution according to voting fragmentation



SOURCE: Based on Lindberg *et al.* (2022a).

Figure 5b. Frequency distribution according to seat fragmentation

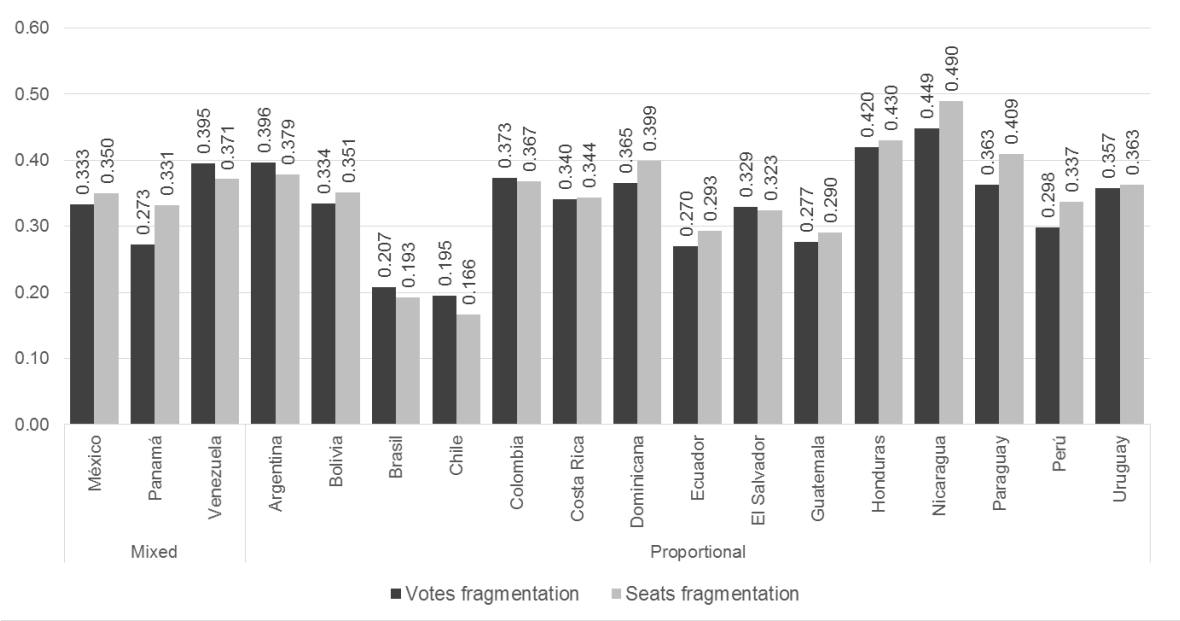


SOURCE: Based on Lindberg *et al.* (2022a).

The distributions of the fragmentations of votes and seats produce normal curves, which take values of at least 0.2 in the Lillieforts bilateral asymptotic significance tests, which reach 0.429 for the votes and 0.250 for the seats when carrying out simulations Monte Carlo's type.

It is very clear that there are countries in which the levels of fragmentation are lower, highlighting the case of Brazil (in addition to Chile, with only one election observed). In contrast, Honduras and Nicaragua show higher levels of fragmentation than other countries (Figure 6).

Figure 6. Fragmentation of votes and seats according to representation system

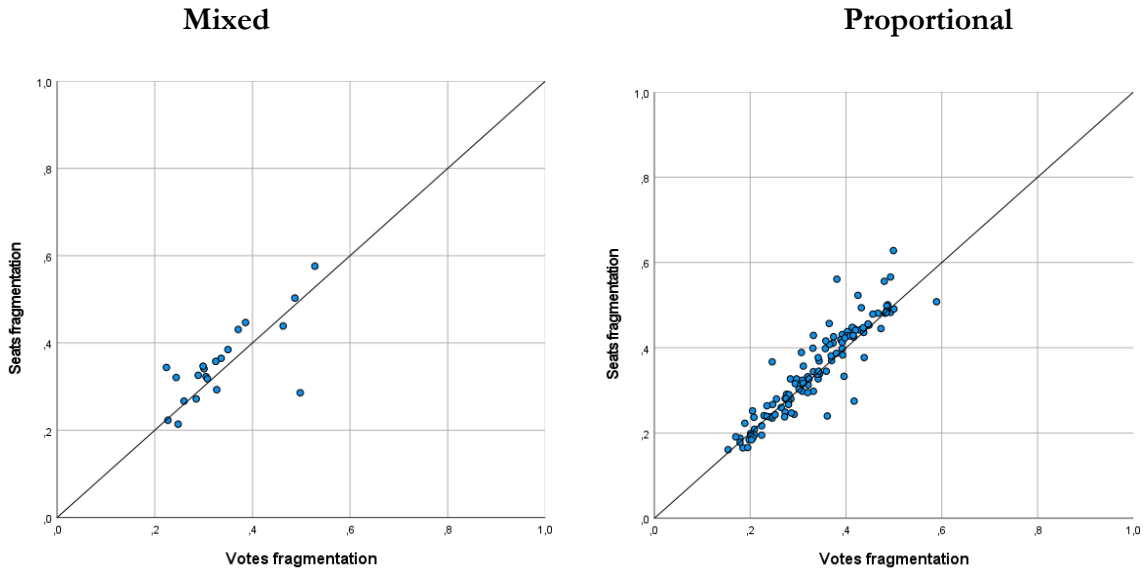


SOURCE: Based on Lindberg *et al.* (2022a) and Freidenberg *et al.* (2021).

The determination of the level of fragmentation of seats in assemblies is stronger when it comes to proportional representation systems than when they are mixed. In proportional systems, the corresponding coefficient is 0.845 with a slope of 1.038, with a surprising approximation between the levels of fragmentation observed in the votes and those recorded in the distribution of seats.

Meanwhile, in mixed systems the determination is 0.552 with a less pronounced slope, 0.734 (Figure 7). Thus, although with few observations, it can be said that for this subset of systems, as the fragmentation of votes increases, the number of seats increases, but in a lower relative proportion, so that more plurality is found in the assemblies than what they produce the votes directly.

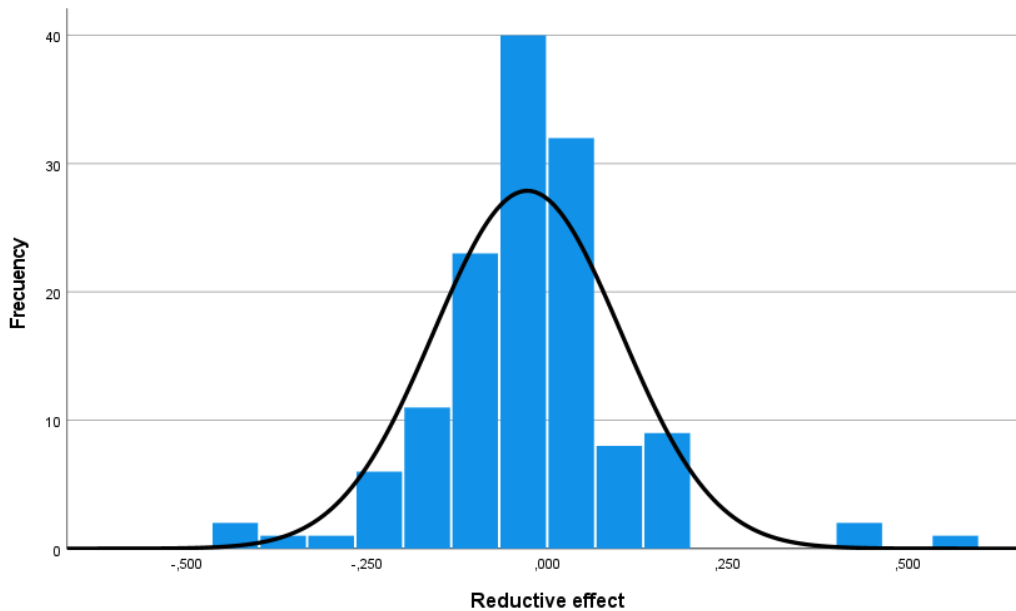
Figure 7. Fragmentation of votes and seats according to representation system



SOURCE: Based on Lindberg *et al.* (2022a) and Freidenberg *et al.* (2021).

Figure 8 shows the frequency distribution of the reductive effect between fragmentations for the case of elections in Latin America during the period 1990-2019 under the mixed and proportional representation systems.

Figure 8. Frequency distribution according to reductive effect



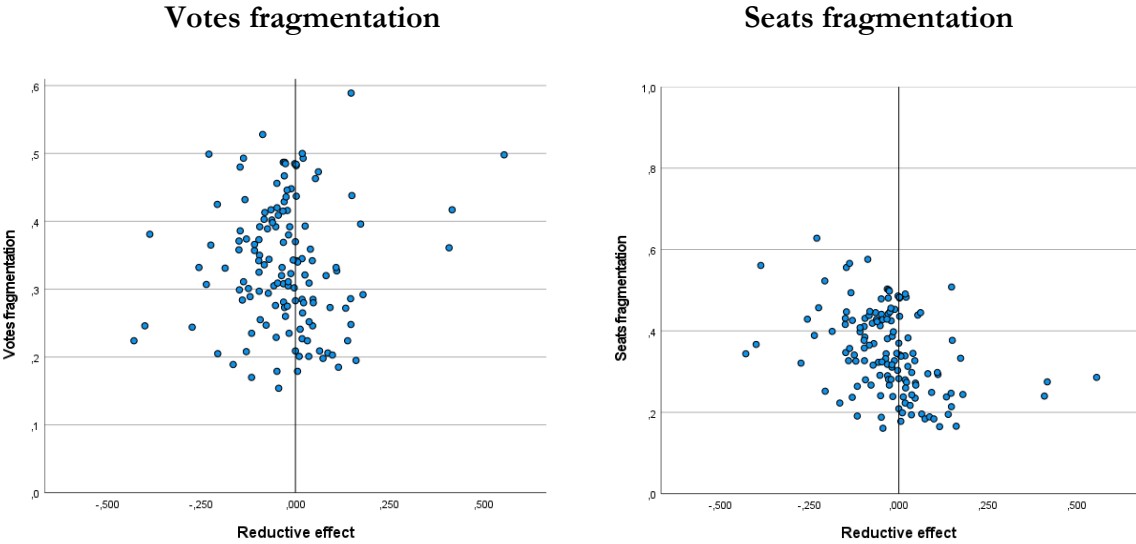
SOURCE: Based on Lindberg *et al.* (2022a) and Freidenberg *et al.* (2021).

The asymptotic significance of the corrected Lilliefors test would show that, despite the possible appearance, the reduction in fragmentation does not follow a properly normal behavior, which is reflected in the concentration in values below zero but above the mean of the distribution itself. The average of the reductive effect is -0.028, with an asymmetry of 0.645 and a kurtosis of 4.63, which would show an excess compared to normal.

It is worth mentioning that the reductive effect continues to be negative, that is, there is greater fragmentation in the composition of the national assemblies than in the distribution of votes, even in the segment of elections in which electoral alliances were not registered, with the average being -0.032 of the reductive effect when there was no alliance and -0.012 when there was; Therefore, the explanation for the negative direction of the reductive effect would not be found in the occurrence of alliances to compete in the elections, but in other factors.

The relationship between the reductive effect and the fragmentation of the vote shows that this has a low explanatory capacity for the reductive effect, with a coefficient of determination of 0.003 and a slope of just 0.037 (Figure 9).

Figure 9. Reductive effect according to votes and seats fragmentation



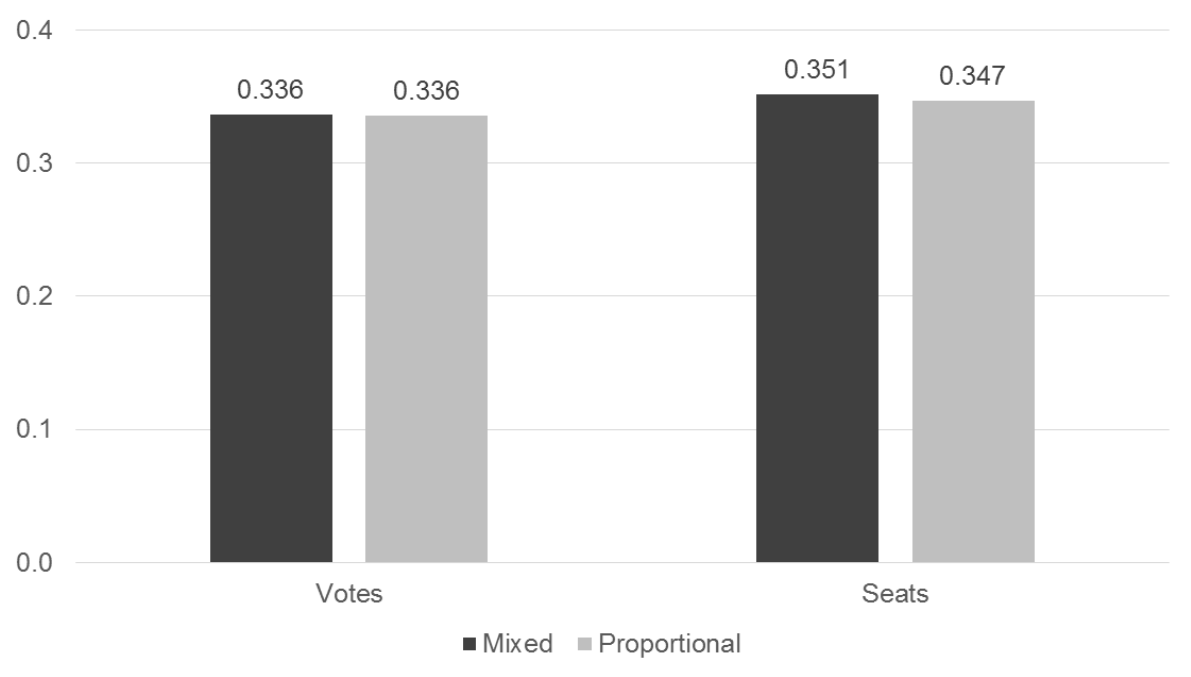
SOURCE: Based on Lindberg *et al.* (2022a) and Freidenberg *et al.* (2021).

In contrast, fragmentation in the distribution of seats shows to have greater explanatory capacity in the variations in the reductive effect, with a coefficient of determination of 0.148 and

with a negative slope, of -0.306, which indicates that the greater the reductive effect, the less fragmentation of the distribution of seats, as would be expected (Figure 9b).

When the levels of fragmentation of votes and seats are compared according to the system of representation in place (Figure 10), it is discovered that there is no difference in the estimated fragmentation of the vote according to the system that has been adopted, which would also be the case of seats, although there is a slight difference with greater fragmentation in mixed systems than in those of proportional representation, but within margins that are not statistically significant.

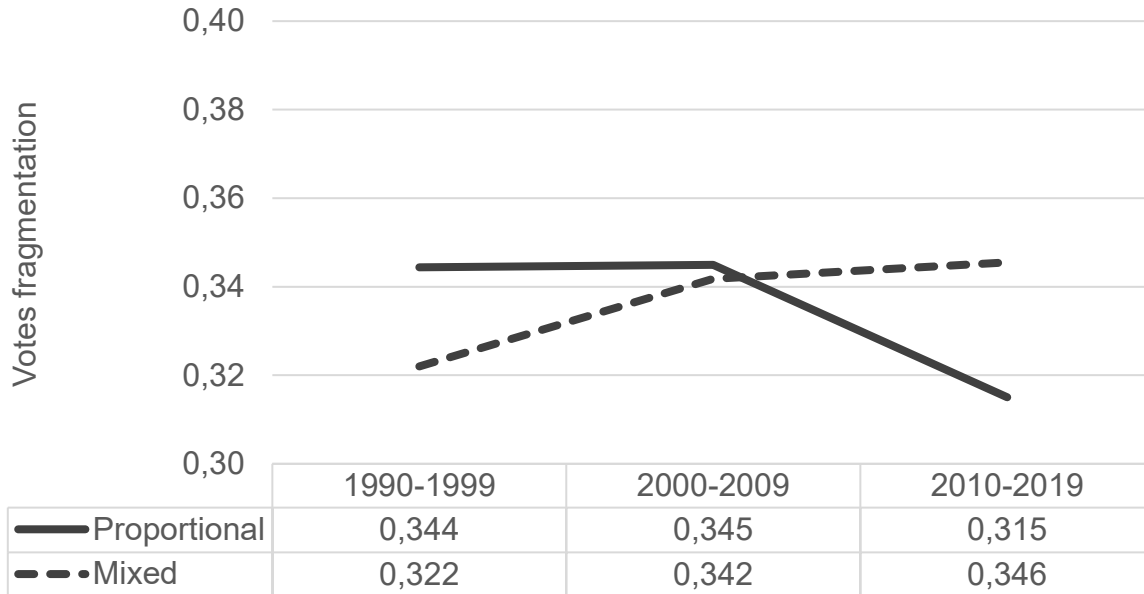
Figure 10. Fragmentation of votes and seats according to representation system



SOURCE: Based on Lindberg *et al.* (2022a) and Freidenberg *et al.* (2021).

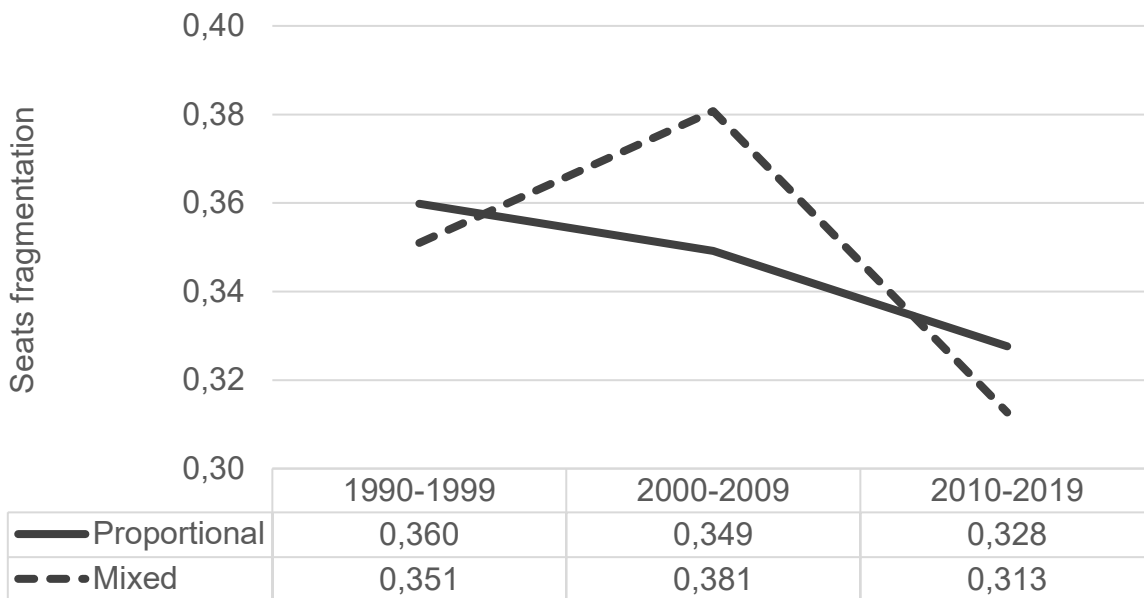
The aggregate data conceals a temporal change that is relevant to explain and that is presented in Figures 11a and 11b: while in systems of proportional representation there has been a clear trend towards a decrease in fragmentation in both votes and seats, in systems mixed has been presented an increase in the fragmentation of the vote over time and an equivocal movement regarding the fragmentation of the distribution of seats.

Figure 11a. Fragmentation of voting according to representation system



SOURCE: Based on Lindberg *et al.* (2022a) and Freidenberg *et al.* (2021).

Figure 11b. Fragmentation of seats according to representation system

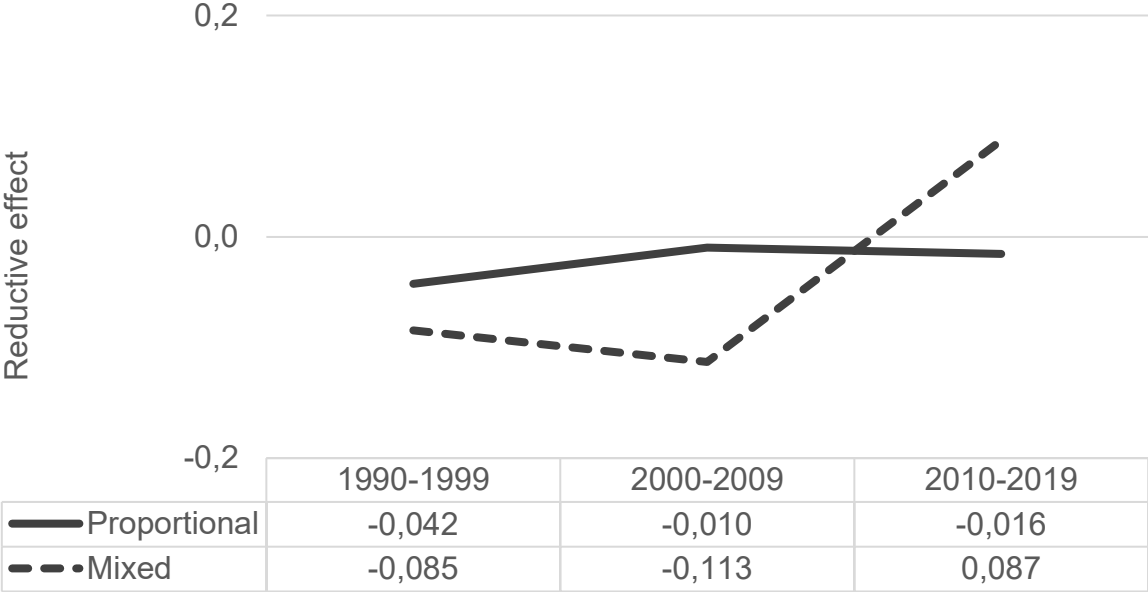


SOURCE: Based on Lindberg *et al.* (2022a) and Freidenberg *et al.* (2021).

The above affects the fact, shown in Figure 12, that while in proportional representation systems the reductive effect has been relatively constant, in mixed representation systems the relationship between fragmentation shows a greater increase in the case of the votes than in the

seats, with the fragmentation of the vote becoming greater than that of the seats in the decade from 2010-2019.

Figure 12. Reductive effect according to representation system per decade



SOURCE: Based on Lindberg *et al.* (2022a) and Freidenberg *et al.* (2021).

Discussion

The main conclusion of this research is that there is no defined and constant pattern that shows that in Latin America during the decades from 1990 to 2019, the adoption of a system of proportional representation results in a level of fragmentation clearly different from that which occurs when it has a mixed system. Ergo, in terms of pluralization of political competition, the existence of a system of one type or another is elective.

The presence of a lower fragmentation of the vote than that of seats in Latin America during the period under study is not a product of the presence of alliances concentrating the votes by various parties that later appear differentiated in the assemblies, but of other factors that should be investigated.

What seems true is that the fragmentation resulting from the voters at the polls is only a part of the fragmentation that occurs in the assemblies, perhaps the most important, but not its entirety, so we must explore what other factors indicate on it.

Then, the parties, by differentiating themselves into different parliamentary fractions, will give way to a greater plurality than that expressed at the time of voting and by decision of the voters and this differentiation procedure will become more acute as the fragmentation in the vote becomes mayor.

In the three-decade period observed, the fragmentation of voting in mixed systems has increased systematically, a situation that does not occur in the case of proportional systems. This may be due to factors related to the chosen representation system or to conditions specific to the countries included in either system of seat distribution based on votes, which should be the subject of a subsequent analysis.

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