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Complexity of vote and paradox of choice for candidates' support. A worldwide analysis of list PR systems with preference voting (1994-2023)

(Version February 2025)

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Abstract

Many democracies, particularly in Europe and Latin America, use list proportional representation with preference voting (LPRPV) to elect their members of parliament. LPRPV systems impose a dual cognitive burden on voters: they must first select a list between multiple parties (ENP) and then decide whether to cast preference votes (PV) for supporting candidates (C) within that list. The complexity of this decision varies greatly across LPRPV systems. Some voters face limited choice as they can cast a single PV with only a few lists and candidates to elect. By contrast, others navigate ballots with dozens of lists and hundreds of candidates in competition, while allowed to cast as many PV as there are seats to be filled. Despite its prevalence in over 30 democracies across the world, the comparative study of how these voting choice parameters influence voter behavior remains critically missing. This contribution addresses this gap by analyzing how the complexity of choice affect support for candidates from 131 elections across 29 countries using LPRPV systems between 1994 and 2023. Overall, our contribution tests three electoral parameters, namely the number of C, the number of PV and the intensity of inter-party competition in the district in terms of ENP. Regarding C, our contribution tests two contradictory views from the literature. The first posits that broader choice sets lead to a vote deconcentration enhancing intra-party competition as voters distribute their PV more widely. The second argues that excessive options overwhelm voters' cognitive capacities, resulting in concentrated voting patterns towards the most visible political figures. This "paradox of choice" observed in SMD systems has not been explored under LPRPV contexts. Our findings reveal that the "paradox of choice" quickly emerges and predominates at election time: higher C always triggers more vote concentration. Furthermore, our results indicate that the only way to reduce the effects of C on intra-party competition is by implementing specific PV modes (i.e. multiple PV rules, including a *panachage* option). Finally, our results tend to confirm that voters develop a two-step decision process (parties as first-order choice and candidate as second-order choice) under LPRPV systems. When voters experience cognitive exhaustion for their party choice (i.e. large choice because of large ENP), voters are more likely to use heuristic cues to concentrate their PV on a few top candidates on the list (e.g. 'primacy effect' of list rank), leading to lower intra-party competition. These insights have significant normative implications, suggesting that electoral engineers can adjust specific combination of C and PV to achieve desired levels of intra-party competition. Because C and District magnitude (DM) are mechanically correlated, defining C under LPRPV systems inevitably induces a trade-off with the proportional nature of the inter-party competition.

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All comments and suggestions are welcome!

Introduction

In electoral democracies, choosing whom to vote for is often a cognitively demanding and costly task (Downs, 1957). Under proportional representation (PR) list systems with preference voting (LPRPV), this cost is amplified. Voters must decide not only on a party list (Beyens et al., 2017; Meffert & Gschwend, 2011), but also whether to support specific candidates (C) by casting one or multiple preference votes (PV). Compared to elections with two candidates in plurality systems, the complexity of electoral choice in LPRPV systems is significantly greater. The difficulty of LPRPV depends on the structure of the electoral offer. For instance, in Slovakia's 2023 national elections for the National Council, voters faced 25 party lists (ENP) competing in a single nationwide district with 150 seats. Within these lists, voters could cast up to 4 PV for 2,728 candidates. By contrast, Central and South American democracies like Chile, Panama, or Suriname often feature small districts with only a few party lists competing for 2 or 3 seats. For example, in Panama's 2019 parliamentary elections, voters in Bocas del Toro's District#1 chose between 17 candidates for 2 seats, casting only a single PV.

We argue that these electoral parameters (C, PV, ENP) directly affect choice complexity and hinder voters' decision-making capacity, influencing voter behavior and electoral outcomes. Despite its widespread use by over 30 countries representing more than half a billion citizens, comparative studies on LPRPV systems remain problematically scarce (Colomer, 2013; M. Shugart, 2005), with one notorious exception (Söderlund, 2019). This article addresses this gap by investigating LPRPV's impact on intra-party competition. Our study examines how these electoral choice shape voter behavior and intra-party competition under LPRPV systems. Using the analogy of a customer forecasting a satisfactory dinner at the restaurant, we expect that the customer (voters) will make a choice depending on (1) the "length of the menu" (number of C on the list), (2) the "number of meals" voters can select (number of PV allowed), and (3) the "challenge of choosing a restaurant" (NEP in the district). Three hypotheses are tested.

First, regarding the "length of the menu" (number of C), we test two competing expectations. Based on Carey & Shugart (1995)'s seminal work, larger district magnitude (DM) incentivize co-partisan competitors to cultivate personal reputation. Higher DM mechanically creates larger number of C within lists (in most countries $C \geq M$[1]). Consequently, a broader choice set for voters fosters greater competition for PV, dispersing voters' support across distinct C and deconcentrating intra-party competition (H1a). On the other hand, based on cognitive psychology (Miller, 1956) and decision theory (Flemming, 1969) , some literature suggests that an abundance of options overwhelm decision-making capacity, leading voters to rely on shortcuts (e.g. gender, party notoriety, list rank, or seniority, see (Däubler & Rudolph, 2020; Järvi et al., 2021; Söderlund et al., 2021; van Erkel & Thijssen, 2016a). This "paradox of choice" has already been identified in single-member district elections (SMDs) (Cunow et al., 2021). We test whether same mechanisms apply under LPRPV systems (H1b)

Second, regarding the "number of meals" (PV), we expect that larger PV allows voters to increase their chances to maximize their satisfaction with the appropriate candidates. Systems with greater number of PV decreases vote concentration (H2). Systems with a single PV (e.g. Brazil, Poland, Croatia) heighten the importance of selecting the most satisfactory candidate. In contrast, systems allowing multiple PV (e.g. Belgium, Slovakia, Czech Republic) enable voters to distribute support, reducing decision-making pressure in case of indecisiveness.

Third, the "challenge of choosing a restaurant" (NEP in the district), we argue that inter-party competition constrains voters' decision-making capacity (H3). Small districts present only a

[1] Various countries have $C \geq M$ because successors are also present on the list in case elected candidates must be replaced during their parliamentary mandate.

handful number of electorally competitive party lists, while larger districts are viable electoral arenas for 'niche' and 'protest' party lists competing against established parties in highly fragmented party systems. High inter-party competition demands significant cognitive investment in choosing a party, leaving fewer resources for candidate selection. Conversely, low party competition allows voters to focus on candidate choice.

This article analyzes 131 elections across 29 countries (1994 to 2023) to test these three hypotheses. Section 2 outlines the theoretical framework and hypotheses, while Section 3 describes the dataset and methodology. Section 4 presents empirical findings from multivariate regression models. Results confirm the importance of inter-party competition and electoral modes of PV (H1 and H3), while highlighting an interactive effect of candidate numbers (partially validating H2b but rejecting H2a). Finally, we discuss the methodological limitations and implications for electoral systems' design and democratic functioning. While electoral personalization is often seen as a way to strengthen voter-representative connections, it also risks empowering a narrow elite, potentially undermining democratic accountability. This study provides new insights into how electoral rules shape intra-party dynamics, with important implications for policy and institutional design.

2. Theory and hypotheses

Since the early 2000s, a growing body of research has developed on LPRPV systems (Christensen et al., 2021; Däubler et al., 2021; Holli & Wass, 2010; Söderlund et al., 2021; Wauters Peter; Erkel Patrick, 2020). In those systems, voters are presented with lists of C, and are allowed to mark PV for one or several of those C. In a few systems, like in Luxembourg and Switzerland, they are even allowed to spread their PV for C across distinct party lists. LPRPV systems are widely used in Europe for the election of national parliaments in 21 countries, as well as across Central and South Americas (Brazil, Chile, Colombia, Ecuador, Panama, Peru, El Salvador, Honduras, and Suriname), and in Asia (Fiji, Indonesia, and Sri Lanka). Furthermore, European elections are based on LPRPV systems in 24 member states (Ireland, Northern Ireland and Malta use STV systems). Even though such LPRPV remain list systems, i.e. political parties keep extensive control over who gets elected (especially in flexible PR systems), personalization of electoral reforms have empowered voters. As a result, voters try and modify the order of the list set up by political parties. Likewise, candidates seek and gain popular support trusting strategic positions at elections (André et al., 2017). In other words, LPRPV are not only about *inter-party* competition, but they also shape *intra-party competition*.

The interest of intra-party competition under LPRPV has had previous scholarly attention (Arter, 2013; Dodeigne & Pilet, 2021; Villodres, 2003; Wauters, 2023; Wildgen, 1985). Those studies have, first, tried to map the degree of intra-party competition across countries. They have especially connected the topic of intra-party competition with the literature on the personalization of politics (Balmas et al., 2012), identifying three main patterns of intra-party competition: "centralized personalization" (high concentration of intra-party competition dominated by a single leader), "decentralized personalization" (deconcentrated intra-party competition with PV spread across many C), and "oligarchized personalization" (with a few "oligarch" candidates attracting most PV, see Dodeigne & Pilet (2021). This literature has also tried to examine the factors explaining the concentration of PV within lists. Most of these factors relate to characteristics of candidates (their profiles, their positions on the list, and their campaigning styles) (Maddens & Put, 2013; Marien et al., 2017; Söderlund et al., 2021; van Erkel & Thijssen, 2016) ; as well as factors at lists and parties-level (list length, list composition, party ideology, established versus entrepreneur parties) (Dodeigne & Pilet, 2021; Wauters et al., 2016).

Despite some in-depth single-country studies that enhance our understanding of LPRPV (e.g. Popescu and Chiru 2020), a systematic comparative analysis of the effects of C, PV and ENP on intra-party competition remains critically absent (Colomer, 2013; M. Shugart, 2005, but see Söderlund 2019). Our article addresses this gap by examining how the complexity of voters' choice sets influences intra-party competition. Does a larger electoral choice set (in terms of C, PV and

ENP) deconcentrate intra-party competition? For example, Slovak voters face thousands of candidates competing for 150 seats disputed by 25 party lists, whereas some Panamanian voters in small districts hardly face a limited choice 17 candidates competing for 2 seats. Voter choice is also shaped by PV rules: some voters may cast only one PV, while others can support multiple candidates within or across lists (without or with *panachage*). These variations affect the intra-party competition differently. A wider choice set typically leads to vote deconcentration, while a restricted choice set concentrates competition around fewer C. We examine three dimensions of the voters' choice set in LPRPV systems, testing three hypotheses regarding PV, C and ENP.

First, drawing on the analogy of a restaurant menu, the "number of meals" a client can select corresponds to the number of PV allowed per voter. LPRPV systems vary widely: some allow a single PV, while others permit multiple PV, even across lists (e.g. *panachage* in Switzerland and Luxembourg) [2]. Previous research (Dodeigne & Pilet, 2021) demonstrates that systems allowing extensive PV use (e.g. Belgium) encourage voters to distribute their support across a wider set of C, resulting in more intense and deconcentrated competition. Conversely, in systems limiting voters to a single PV (e.g. Netherlands), competition tends to concentrate around prominent figures such as incumbents, party leaders, and other high-visibility politicians. This pattern is supported by studies showing that media exposure and political prominence attract more PV (Bräuninger et al., 2012; Górecki & Marsh, 2012; Maddens & Put, 2013; Thijssen, 2013; van Erkel & Thijssen, 2016b; van Holsteyn & Andeweg, 2010).

H1: The greater the number of PV, the stronger the vote deconcentration.

Second, we assess the effect of the complexity "long of the menu". In LPRPV systems, this refers to the variation in the number of C on party lists. Typically, the length of lists in terms of C mechanically correlates with the district magnitude (DM), as parties usually nominate a number of C equal to or exceeding the DM. In some cases, the number of C surpasses DM due to successors being listed to replace elected candidates during their mandate (Bormann and Golder 2013)[3]. Overall, voters across the world face very different choice sets, from very short lists (C=2 or 3 as in Panama and Chile) to extensive ones (C=20, 50, or even 150 as in Netherlands and Slovakia). The impact of choice of C scope under LPRPV remains largely unexplored, though insights can be drawn from studies on plurality systems. Two contrasting expectations emerge in the literature. On the one hand, scholars argued that extensive candidate options enhance voter satisfaction by increasing the likelihood of finding candidates who align with their policy, ideological, or sociodemographic preferences (Cox, 1997; Powell, 2000). Thus, larger choice sets of C would lead voters to spread their PV across many candidates, resulting in greater vote deconcentration.

H2a: The greater the number of C, the stronger the vote deconcentration

On the other hand, psychological and decision theory research (Flemming, 1969; Iyengar & Lepper, 2000; Miller, 1956) have long demonstrated that excessive choice negatively impacts decision-making processes. This is the so-called "paradox of choice" (Schwartz 2004). Facing large choice set, actors tend to rely on heuristic cues to reduce their options range to a limited set of options. Returning to the restaurant analogy, indecisive customers tend to opt for familiar options ("I'll have the burger"), rely on cognitive cues like endorsements ("I'll take the chef's signature dish"), or settle for the first satisfactory option ("I'm fine with today's special"). Similar heuristic cues are used by voters when casting their ballots. Using experimental research design, Cunow and colleagues

[2] Research has focused extensively on how the weight of PV impacts seat allocation, particularly distinguishing between open PR systems (where candidates rely entirely on PV for election) and semi-open/flexible list systems (where party rank order strongly influences outcomes). This dimension is well documented (Carey & Shugart, 1995; Passarelli, 2020; Renwick & Pilet, 2016): it shows that greater openness amplifies PV influence, fostering intra-party vote deconcentration (Emanuele et al., 2023). However, other aspects of LPRPV influence intra-party competition, notably the complexity of voters' choice sets.

[3] For consistency, we use C instead of DM, noting their strong correlation and convergent results

(2021) found that more ballot options overwhelm voters, prompting them to focus on a few familiar candidates while disregarding others with less information. Their conclusion, "less is more," suggests that with a higher number of C, voters tend to invest less resources in information-gathering behaviour. When facing large information with large C, voters tend to rely on cognitive shortcuts such as list rank, media visibility, gender, or incumbency when supporting candidates (Christensen et al., 2021; Däubler & Rudolph, 2020; Helimäki et al., 2024; Iyengar & Kamenica, 2010; Lau & Redlawsk, 2001; Mcdermott, 1998; Ortega & Oñate, 2024; M. S. Shugart et al., 2005; Simon, 1991; van Erkel & Thijssen, 2016a). These cognitive shortcuts are known to reinforce success of the same restricted number of incumbent politicians highly ranked on the lists. This reliance on heuristics underscores how an extensive choice set can inadvertently narrow voter behavior and intensify intra-party vote concentration. This hypothesis also finds support from the finding that aligns in (Dodeigne & Pilet, 2024) 's study of Belgian local elections using LPRP system. Their analysis of 50,000 real ballots showed that the average number of PV cast decreases as C increases. While not entirely linear, smaller districts (with fewer C) saw voters casting 4–5 PV on average, compared to 2–3 PV in larger districts. Therefore, we posit that:

H2b: The greater the number of C, the stronger the vote concentration

Finally, a third dimension of the choice set under LPRPV is the number of party lists on the ballot. As Van Holsteyn and Andeweg (van Holsteyn & Andeweg, 2010) argued, preference voting is often a second-order decision: voters first choose a party list and then select C within that list. Returning to the restaurant analogy, clients first choose the "type of restaurant" (e.g. Indian, Italian, or local) before even considering the menu (C) and number of meals (PV). When many highly rated restaurants are available, clients may experience choice fatigue before even deciding on their meal. Similarly, voters faced with many party lists may exhaust their cognitive resources, leaving less effort for evaluating candidates within the selected list – especially if that list contains many C. For example, in Slovakia's 2023 parliamentary elections, voters first had to choose from 25 party lists and then decide among 150 candidates within their chosen list. Moreover, when fewer viable parties exist, their ideological cohesion tends to decrease, leading voters to prioritize candidate evaluation due to more diverse ideological views within the same list (Isotalo Veikko et al., 2023). These considerations leads to posit that:

H3: The greater the inter-party competition (ENP), the stronger the vote concentration for intra-party competition

3. Research design: a longitudinal and worldwide comparative design

3.1. Data collection: the *IntraPartyComp* project

Despite earlier call for the need for comparative approach (already mentioned by Shugart in 2005, and reiterated by Colomer in 2011), limited access to electoral archives prevented the development of a cross-sectional dataset. The *IntraPartyComp* project introduces the first comprehensive database that allows to describe the level of electoral intra-party competition across and within countries and over time. First, the research design is cross-sectional, covering currently 29 democracies using LPRPV for national and European elections (see Table 1)[4]. This worldwide dataset permits to test in a systematic way our hypotheses assessing how intra-party competition is shaped by electoral choice set (PV, C and ENP). The large-N comparative approach allows us to isolate effects across countries, and beyond political and cultural specificities over the world. For H1 (effects of PV), we cover four configurations of PV across 29 countries: electoral systems where voters can only cast one single PV, countries where they can cast a limited number of PV, countries

[4] Although we are currently facing important challenges in terms of data accessibility and availability, we seek to include the following six countries: Iceland (Europe), Indonesia & Sri Lanka (Asia), Lebanon (Middle East), Ecuador and Honduras (Latin America)

where PV = C, countries where PV=C plus a *panachage* option across lists is allowed. Second, for H2a and H2b (effects of C), our dataset includes countries where lists range from as little as 2-5 C (e.g. most lists in Panama and Chili, and some small districts in Belgium), to as many as 120-150 C (e.g. countries using state-wide districts such as the Netherlands, Lithuania and Slovakia). Finally, the large variance of inter-party competition across and within countries allows us to test the effect of across electoral contexts for H3 (effects of ENP).

Table 1. Country and electoral systems covered by the *IntraPartyComp* dataset (1994-2023)

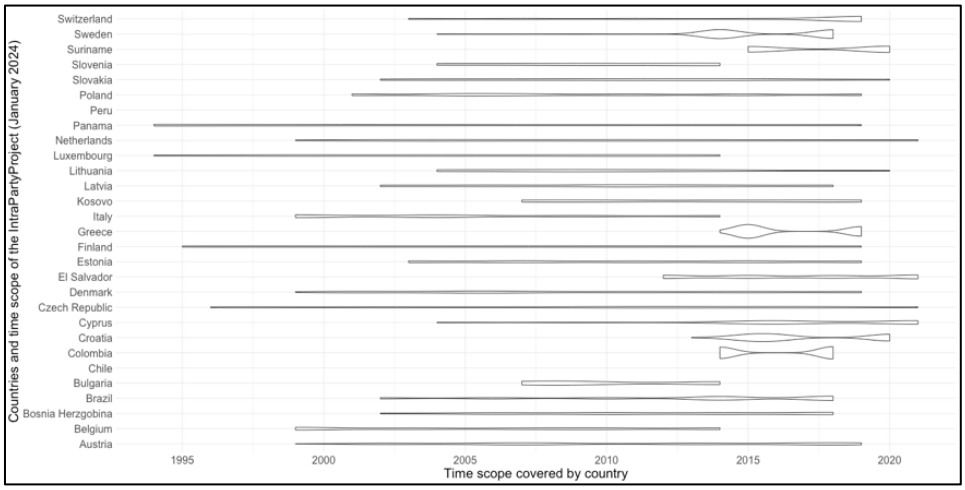
Countries	**Nb. of elections**	**Nb. of candidates**	**Geographical world coverage**	**Electoral systems**	**Preference Votes (PV)**
Brazil*	5	32.302	South America	Open	Single PV
Chile*	1	960	South America	Open	Single PV
Colombia*	2	2.714	South America	Open (> 2003)	Single PV
El Salvador*	4	2.416	Central America	Free	As many PV
Panama*	6	3.501	Central America	Mixed / Open	Single PV
Peru*	3	6200	Central America	Open	Single PV
Suriname*	2	984	Central America	Flexible	Single PV
Austria	6	37.090	Western Europe	Flexible	Limited PV
Belgium	5	9.627	Western Europe	Flexible	As many PV
Luxembourg	4	2.341	Western Europe	Free	As many PV
Netherlands	7	8.072	Western Europe	Flexible	Single PV
Switzerland*	5	17.905	Western Europe	Free	As many PV
Czech Republic	7	37.621	Eastern Europe	Flexible	Limited PV
Poland	6	44.358	Eastern Europe	Open	Single PV
Slovakia	6	6.122	Eastern Europe	Flexible	Limited PV
Bulgaria	3	374	Eastern Europe	Flexible (> 2013)	Single PV
Latvia	6	8.860	Eastern Europe	Open	As many PV
Lithuania	5	6.356	Eastern Europe	Mixed / Open	Limited PV
Sweden	2	15.402	Northern Europe	Flexible	Single PV
Denmark	10	6.221	Northern Europe	Open	Single PV
Estonia	5	6.486	Northern Europe	Flexible	Single PV
Finland	9	15.038	Northern Europe	Open	Single PV
Bosnia-Herzegovina	5	3.139	Southeastern Europe	Open	As many PV
Croatia	3	7.401	Southeastern Europe	Flexible (> 2015)	Single PV
Kosovo*	5	5.592	Southeastern Europe	Open	Limited PV
Slovenia	3	2.968	Southeastern Europe	Flexible	Single PV
Cyprus	5	1.213	Southern Europe	Open	Limited PV
Greece	2	9.523	Southern Europe	Open	Limited PV
Italy**	4	4.485	Southern Europe	Open	Limited PV
29 countries	**131**	**310.514**	**547.332.930 inhabitants**		

Note: * National elections only; ** European elections only. All other countries cover both national and European elections. *Remark*: some of these countries are only covered for parliamentary parties while others include all candidacies according to data availability. For the sake of parsimony, only lists with parliamentary representation are tested below.

Second, the research design is cross-temporal encompassing three decades of electoral results (since the 1994 elections in Panama and Luxembourg, until the most recent 2023 elections in Estonia). This allows us to test our main hypotheses across a large set of elections, controlling for the potential effects of the "personalization thesis" over time – albeit disputed in the scholarship as there is no clear indication of a reinforcement of individual candidates in the electoral process over time. As display on Figure 1, the time scope greatly varies across political systems, though. Our dataset includes countries that present an extensive time-scope coverage, while other countries hardly cover a few elections (because of limited elections organized under LPRPV and data availability). Hence, intra-party competition is measured since the mid-1990s in a few countries (e.g. Panama, Finland, and Czech Republic), whereas other countries present only a couple of elections since the mid-2010s (e.g. Colombia and Suriname). This is a methodological limitation to take into consideration for the external validity of our results.

Data collection for national elections was based on official electoral information online as well as electoral archives (publicly available or obtained on request via official authorities). For European elections, we used the COMEPELDA project dataset (Däubler et al., 2021). Yet, European elections arguably differ from national elections in terms of inter-party and intra-party competition – especially its second-order nature while it is more centralized (Dodeigne & Pilet, 2021). Still, European elections offer a unique opportunity to test the effect of electoral rules on intra-party competition under the same supranational elections.

Figure 1. Time scope, by country covered in the IntraPartyComp project



3.2. Descriptive statistics of the level of electoral (de-)centralization

We now present the measurement of our dependent variable. In line with recent research (Arter 2013, Passarelli 2020, Arter 2021, Dodeigne & Pilet 2021)[5], we use the Gini scores estimating the dispersion of preference votes between co-partisan candidates within the same lists. It is measured as follows:

$$G = 1 - \sum_{i=1}^{n} (X_i - X_{i-1})(Y_i + Y_{i-1})$$

Where

X_i: The cumulative share of the number of candidates present on the list
Y_i: The cumulative share of the candidates' proportion of preference votes on the list

[5] Other measurements have also been used in the scholarship and have their own merits (Arter, 2013; Dodeigne & Pilet 2021).

Gini scores produce a *relative* measurement (from 0 to 1) in which a score of 0 describes a situation of perfect equality in the distribution of preference votes (i.e. decentralized personalized elections), while a score of 1 represents a situation of perfect inequality (i.e. central personalized elections, where all preference votes are captured by a single candidate). For the comparative research of the IntraPartyComp project, the Gini scores present three key properties: (1) *scale independence* (the Gini coefficient provides relative scores between 0 and 1 percent for each list, irrespective of the electoral weight of the lists); (2) *population independence* (the Gini coefficient can be estimated irrespective of the number of candidates present on electoral lists); (3) *transfer principle* (when preferential votes switch from a very popular candidate to a least successful candidate between two elections, the Gini coefficient automatically reflects the greatest electoral equality between candidates, i.e. decentralized personalization). Yet, the Gini score presents a small-sample bias: when the number of observations (n) is low (i.e. lists with a small number of candidates), the Gini coefficient does not strictly vary between 0 and 1 (it varies between 0 and (n-1)/n). While most electoral lists are large enough not to be affected by this bias, it is sufficient to affect our analyses. We rely instead upon the "Adjusted Gini score" (Deltas, 2003; Söderlund, 2019). The adjusted Gini score is estimated as follows

$$G_{\text{adjusted}} = \frac{n}{n-1} \cdot G$$

Where G is the Gini score while *n* is the list size in terms of C

Table 1 presents the descriptive statistics about the distribution of our dependent variable (adjusted Gini scores), as well as our three covariates of interest regarding the number of PV (H1), the number of C (H2a & H2b) and the number of ENP (H3). First, regarding the adjusted Gini scores, we observe a mean score of 0.5 (with a sd. of 0.2 and a median value of 0.6). Yet, there are a few outliers as vote concentration on list are normally distributed slightly right skewed as indicated in Table 1. Some systems present highly centralized intra-party competition such as Netherlands (0.90) and Slovakia (0.79)(see also figure A1 in Appendix). By contrast, other countries such as Switzerland (0.20), Luxembourg (0.28) present the lowest Adjusted Gini scores. This indicates a very intense intra-party competition with decentralized elections. In between these two groups of countries, we find many political systems with Gini scores in the 0.40-0.60 interval (e.g. Belgium 0.42, Chili 0.50, Kosovo 0.51, Finland 0.56). Furthermore, we observe that intra-party competition can be associated with a clear national pattern (that is to say, limited within-country variance). Hence, the Netherlands present a standard deviation of 0.07 (with a mean Adjusted Gini score of 0.90), namely a strong centrality of personalized elections across – irrespective of party lists, electoral districts and over time. In most political systems, a substantial variance of intra-party competition seems to be located within the country (with large differences across electoral districts, and the number of co-partisan candidates in competition)[6].

Second, regarding the impact of the number of PV that voters are allowed to cast (H1), we classify preference voting into four groups, namely electoral systems in which (1) voters can cast a single preference vote ("Single PV"); (2) voters can cast a limited number of preference votes ("Limited PV"); (3) voters can cast as many preference votes as C ("As many PV"); (4) voters can cast as many preference votes as C with a *panachage option* ("As many VP +P"). Because most countries use the principle of single PV (14 amongst our 29 countries), Table 1 indicates that a large majority of the observations from our dataset are coved by single PV (59,1%), other systems use "limited PV" and as "As many PV" (respectively 20.8% and 11.2%) while only Switzerland and Luxembourg use "As many PV with *panachage*" (8.8% of all observations).

[6] This is identifiable with the flat density curves on Figure 1 (e.g. Brazil has a std of 0.18, with a mean score of 0.59).

Table 1. Descriptive statistics of the dependent variables and main covariates of interest (PV, C and ENP)

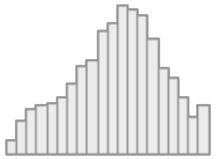
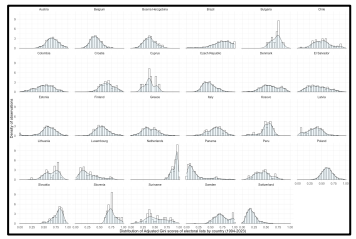
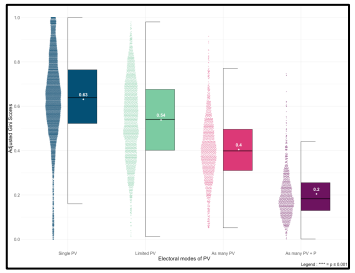
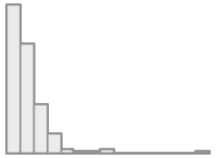
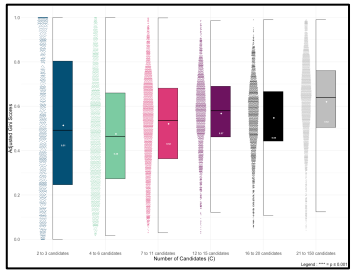
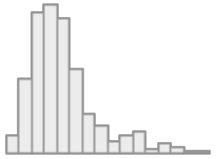
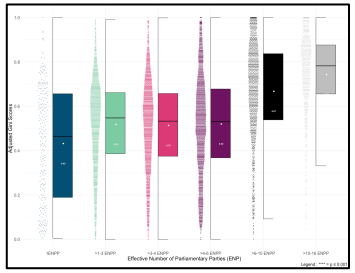
Main variables	Descriptive statistics	Distribution graphs	Co-variation graphs
Adjusted Gini scores (*DV*)	Mean (sd) : 0.5 (0.2) min ≤ med ≤ max: 0 ≤ 0.6 ≤ 1		
Number of PV (*H1*)	1. Single PV (59.1%) 2. Limited PV (20.8%) 3. As many PV (11.2%) 4. As many PV + P (8.9%)		
Number of C (*H2a & H2b*)	Mean (sd) : 16.5 (16.9) min ≤ med ≤ max: 2 ≤ 12 ≤ 150		
Effective Number of Parties (*H3*)	Mean (sd) : 4.6 (2.6) min ≤ med ≤ max: 0 ≤ 4 ≤ 16		

Table 1 furthermore presents the distribution of Adjusted Gini score for those four categories of PV. Table 1 indicates that the concentration of PV clearly shrinks when voters are allowed to cast more PV (meaning that PV is used to spread electoral support across multiple candidates, suggesting confirmation of H1). The differences across modes of PV are statistically significant ($p<0.001$). Hence, "Single PV" clearly favors the highest electoral centralization (the mean of the Adjusted Gini score by list is 0.63)[7]. By contrast, decentralized elections are found in electoral systems where the number of PV allowed is the largest (electoral decentralization is three times bigger under "As many PV+ P" than under "Single PV"). Nonetheless, a large variance is present within each mode of PV. This is due to the variety of countries covered in our dataset, but also the diversity of configurations on our other core independent variables.

Third, number of Candidates, Table 1 indicates that lists often include a limited number of candidates (the median value C being 12 candidates), with minimal values as little 2 to 3 C as commonly observed for several lists in Panama elections. Yet, there is a large variance across countries, with a few outliers that cause a right-skewed distributions because of countries using state-wide electoral districts (120 candidates in Lithuania and 150 candidates in both Slovakia and Lithuania). Table 1 tends to support the hypothesis of paradox of choice (H2) as the concentration of votes increases as there are more candidates on the (from 0.51 to 0.62, although not entirely in the linear way).

Finally, our third core independent variable is the nature of inter-party competition. Since we only want to consider relevant parties, we use the indicator of Effective number of Parliamentary Parties (ENP). Table 1 informs that the competition in electoral districts encompass –on average – 4.6 effective parties with limited variation (the median score is 4.0 effective parties per district, while standard deviation does not exceed 2.6). Table 1 tends to confirm H3 which posits that candidates are second-order choices which are predominated by the first-order party choice, resulting in greater vote deconcentration when ENP increases (from 0.43 to 0.74), especially in extreme intra-party competition when ENP exceed 6 parties (last two categories on the vignette from Table 1).

[7] We furthermore distinguished "optional" and "mandatory" PV, but differences are hardly noticeable (0.01).

Table 2. Multilevel Beta regression upon the degree of intra-party competition (Gini Scores)

	Model 1 Country factors		**Model 2 District factors**		**Model 3 Party factors**		**Model 4 Full model (interaction)**		**Model 5 Full model (without outliers)**	
Predictors	*Est.*	*std. Err.*	*Est.*	*std. Err.*	*Est.*	*std. Err.*	*Est.*	*std. Err.*	*Est.*	*std. Err.*
Intercept	3.08	2.67	**5.04** *	2.70	2.86	2.68	**6.14** **	2.71	2.00	2.21
ElectionYear	-0.00	0.00	**-0.00** *	0.00	-0.00	0.00	**-0.00** **	0.00	-0.00	0.00
Elections Level (ref. national)	**-0.24** **	0.08	**-0.38** ***	0.08	**-0.30** ***	0.08	**-0.31** ***	0.08	**-0.36** ***	0.08
Electoral syst. (ref. Flexible)	-0.11	0.21					**-0.39** **	0.17	**-0.42** **	0.19
ENP			**0.02** ***	0.01			**0.02** ***	0.01	**0.05** ***	0.01
Nb. of Candidates (C)			**0.01** ***	0.00			**0.01** ***	0.00	**0.02** ***	0.00
Party magnitude (M)					-0.00	0.00	**-0.02** ***	0.00	**-0.02** ***	0.00
Electoral modes (ref.=Single PV)										
Limited PV	**-0.44** **	0.22					**-0.50** **	0.19	**-0.44** **	0.21
As many PV	**-0.90** **	0.33					**-0.70** **	0.28	**-0.67** **	0.32
As many PV + P	**-1.45** ***	0.35					**-1.26** ***	0.31	**-1.21** ***	0.35
*Interaction C * Electoral modes of PV*										
C * Limited PV							**0.00** *	0.00	0.00	0.00
C * As many PV							-0.01	0.00	**-0.01** **	0.00
C * As many PV + P							-0.01	0.01	**-0.01** **	0.01
Random Effects										
σ^2	0.37		0.37		0.37		0.37		0.24	
τ_{00} Country	0.33		0.45		0.55		0.22		0.30	
τ_{00} District	0.07		0.06		0.07		0.06		0.07	
τ_{00} Party	0.09		0.09		0.09		0.09		0.13	
ICC	0.57		0.62		0.66		0.50		0.68	
N Country	29		29		29		29		29	
N District	558		558		558		558		558	
N Party	530		530		530		530		528	
Observations (N lists)	10.629		10.629		10.629		10.629		10.100	
Efron R^2	0.678		0.680		0.679		0.681		0.812	
Marginal R^2 / Conditional R^2	0.207 / 0.662		0.037 / 0.634		0.007 / 0.662		0.270 / 0.635		0.298 / 0.773	

*Legend: * p<0.1 ** p<0.05 *** p<0.001*

4. Empirical findings

We now test the effects of our hypotheses in multivariate regression models while considering other control variables. The additional control the tier of government at which the election takes place (national and European elections), Elections Year, the openness of electoral systems (flexible versus opens systems), and party magnitude (P). Openness of electoral systems is based on Renwick & Pilet (2016) with a distinction between "open" list systems (including free *panachage* systems) and "flexible" list systems (see Table 1 for classification by country). It has been shown to influence intra-party competition (Dodeigne & Pilet, 2021). Finally, party magnitude (P) equals the number of seats obtained by a party list in each electoral district. Considering the hierarchical structure and cross-classified data configuration of our dataset (i.e. electoral lists are presented by political parties across multiple electoral districts in different countries), we estimate regression models with random intercepts. Because of the bounded limits of the adjusted Gini scores (from 0 to 1), we adjusted generalized linear mixed models using beta distribution[8]:

$$Logit\ (Adjusted\ Gin\ Scores_{ijk}) = \alpha Parties_{ijk} + \tau Districts_{jk} + \delta Countries_{k} + \alpha_i + \tau_j + \delta_k$$

-*Parties* $_{ijk}$ includes vectors of Party factors (*Party Magnitude* $_{ijk}$)
-*Districts* $_{jk}$ includes vectors of District factors (*Number of C* $_{jk}$, *ENP* $_{jk}$)
-*Countries* $_{k}$ includes vectors of Country factors (*Elections level* $_{k}$, *Elections Year* $_{k}$, *Electoral systems* $_{k}$, *PV Modes* $_{k}$)
-$\alpha + \tau + \delta$ are the vectors of the coefficients associated to*Parties* $_{ijk}$, *Districts* $_{jk}$, *Countries* $_{k}$
-$\alpha_i + \tau_j + \delta_k$ are respectively intercepts for the levels of parties, districts and countries.

In total, the regression models cover 10.638 electoral lists with parliamentary representation (the main unit of observations) nested across 530 political parties (level I) in competition in 558 electoral districts (Level II) across 29 countries (Level III)[9]. Finally, we remind the reader that the adjusted Gini scores can theoretically take any values between 0 and 1 on, while a beta distribution implies that 0 and 1 are strictly non-inclusive values (i.e. 0 < Adjusted Gini scores <1). Empirically, none of the electoral lists achieve a score of 1, but 9 lists obtained a score of 0 (0.08% of all our observations are thus excluded from our analysis). Overall, Table 2 presents our models based on 10.629 observations. Regarding diagnosis, our models confirm that the goodness-of-fit is unmistakably better when considering the hierarchical structure of electoral competition. Besides, Table 2 shows that the Intraclass Correlation Coefficient (ICC) oscillates between 50 and 68 percent across models – ICC indicates the proportion of the total variance of the random effect. This implies that most of this cross-sectional variance is located at the country-level (τ_{00} Country is the largest) and more marginally at the party and district levels (τ_{00} District and τ_{00} Party are about four to six times lower, depending on the model).

Furthermore, we observe that most diagnoses of goodness-of-fit were satisfactory (low VIF scores indicating no multicollinearity, while the predicted adjusted Gini scores converge with the real observed scores of our dataset). Yet, residuals were not entirely normally distributed for some extreme values. Our Model 5 removes, therefore, 509 outliers that cause strong discrepancy in our analysis of residuals. Diagnoses were subsequently much more satisfactory. In this respect, Model 5 presents the highest Efron's R^2 (0.81) as well as conditional R^2 (0.30) and marginal R^2 (0.78). Model 4 (same as Model 5, but with outliers inclusive) presents a lower R^2 (precisely due to outliers), but this model is the most explanatory in terms of cross-sectional variance (lowest τ_{00} Country and lowest ICC across models). By contrast, Model 5 is the most explanatory across lists

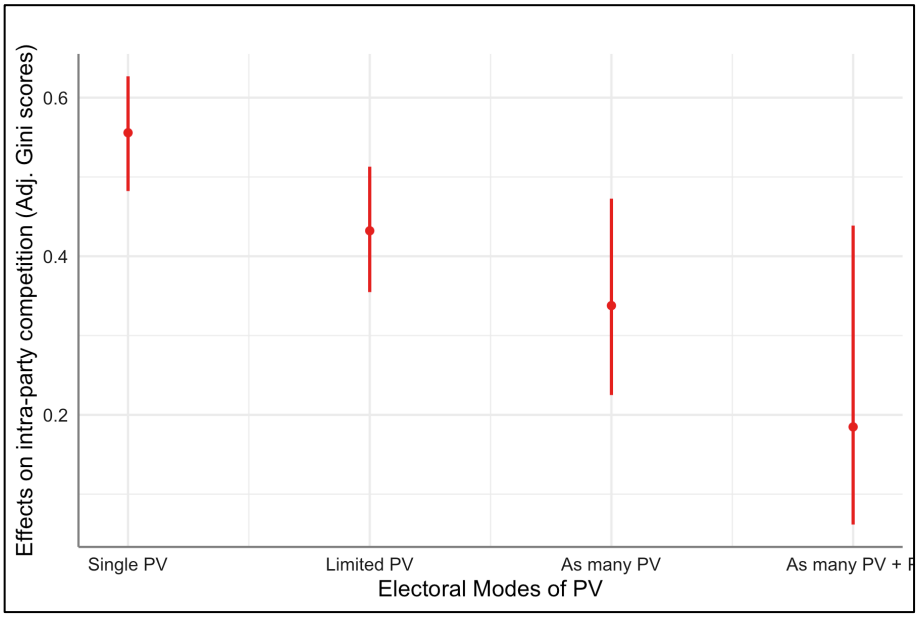
[8] Results of Maximum likelihood linear models are, however, extremely convergent. Our models are based on *glmmTMB* package developed by Brooks ME, Kristensen K, van Benthem KJ, Magnusson A, Berg CW, Nielsen A, Skaug HJ, Maechler M, Bolker BM (2017). "glmmTMB Balances Speed and Flexibility Among Packages for Zero-inflated Generalized Linear Mixed Modeling." The R Journal, 9(2), 378–400. doi:10.32614/RJ-2017-066.

[9] We also considered the longitudinal structure of our dataset, by controlling for autocorrelation of repeated measures of the Adjusted Gini scores over multiple elections (1994-2023). We, however, do not detect any noticeable effect of time on electoral personalization. For the sake of parsmimony, we thus do not include autocorrelation over time.

(residual variance σ^2 is the lowest with 0.22), but it is the least satisfactory to explain differences across countries (highest ICC with 0.68). Overall, Model 5 has yet the highest performance index (combination of AIC weighted, BIC weighted, RMSE, R^2). For the sake of parsimony, we focus on the results of Model 5 keeping in mind that most variables are significant with consistent effect size across models anyway.

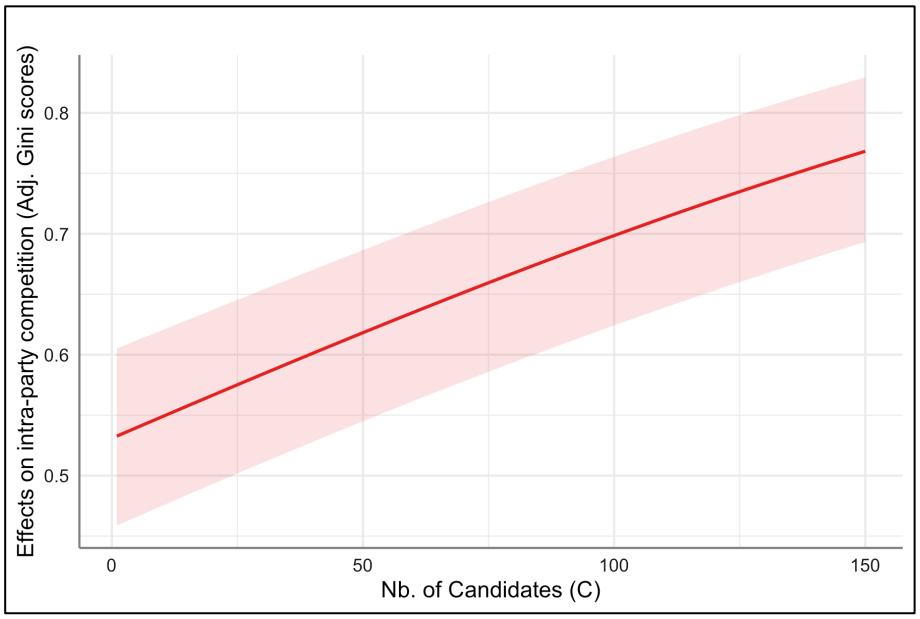
We now turn to the discussion of our hypotheses. We start with our first hypothesis about the effect of modes of PV. H1 posits that being allowed to cast more PV would lead to more intra-party competition. Our results that when voters have the opportunity to cast multiple PV for a wider set of candidates, they tend to expand their support on a wider set of suitable choices and they do not limit their choices to a few prominent candidates. As illustrated on Figure 4, there is a clear deconcentration of PV in systems allowing to cast multiple PV (i.e. lower adjusted Gini scores). All other things being equal, the predicted adjusted Gini scores is the lowest for "As many PV +P" (0.32), which is twice smaller than predicted scores for "Single PV" (0.66). Furthermore, we observe linear effect of electoral systems as "Limited PV" present a lower score (0.59) than "Single PV" but a higher score than "As many PV" (0.46).

Figure 4. Marginal effects of Electoral Modes of PV (predicted effect from Model 5)



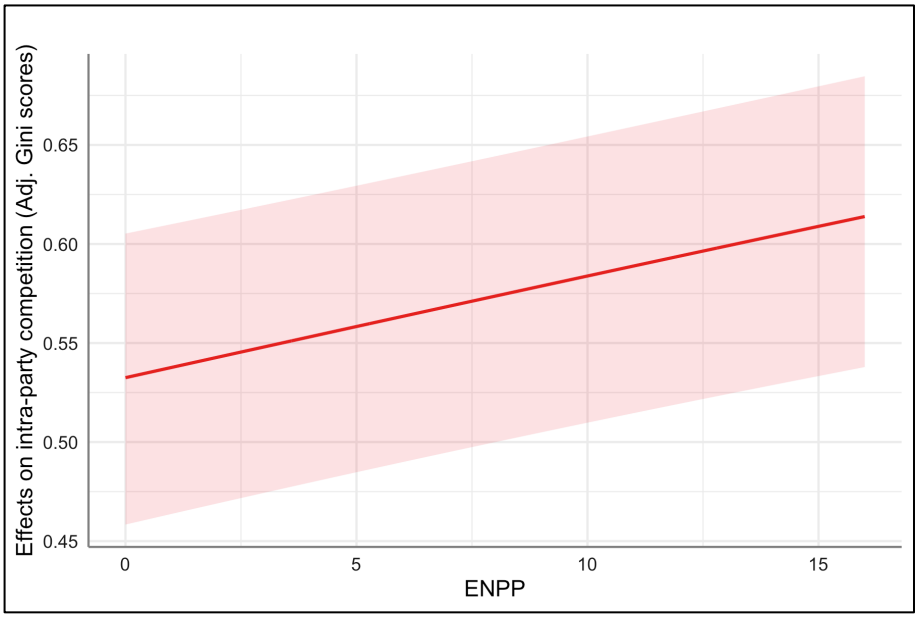
Second, moving to H2 related to the number of C on the ballot, our results confirm the decisive explanatory power of list length in terms of number of candidates. This variable is by far the strongest explanatory factor of the variance observed for vote concentration (i.e. largest Chisq score with 123.2). When candidate choice is about 12 candidates (our mean value), the adjsusted Gini scores is 0.55. The latter increases by almost 50 percent to reach about 0.75 in the largest district with longest number of C (e.g. 120 candidates Lithuania, and 150 in Slovakia and the Netherlands). Therefore, our findings thus reject H2a ("maximizing utility") and instead confirm H2b ("paradox of choice"). H2a posited that the higher the number C, the more voters spread their preference votes across many C, leading to more intra-party competition (lower adjusted Gini scores). Figure 5 shows that H2a must be rejected as we find the exact opposite effect. There is a positive relationship between C and the adjusted Gini scores, finding supporting for the "paradox of choice" (H2b).

Figure 5. Marginal effects of the number of C on vote concentration



Finally, we confirm our third hypothesis H3, which posits that more relevant parties on the ballot (i.e. higher ENP) reduce intra-party competition. The explanation is that voters have already devoted a lot of efforts to decide which party list to vote for, which exhaust their cognitive resources when they subsequently have to consider a large range of C for casting their PV. Figure 6 shows that, all other things being equal, our results confirm that vote deconcentration is more likely to be observed when ENP is the lowest. By contrast, when ENP increased, voters use heuristic alternative cues and opt to support only a few prominent candidates. This results in more vote concentration as shown by the increase in adjusted Gini Scores. Yet, we cautiously underline that the effects remain ultimately moderate as the predicted scores between the lowest ENP (1) and largest ENP (16) varies by less than 0.10 (respectively, 0.63 and 0.72)

Figure 6. Marginal effects of ENP (predicted effect from Model 5)

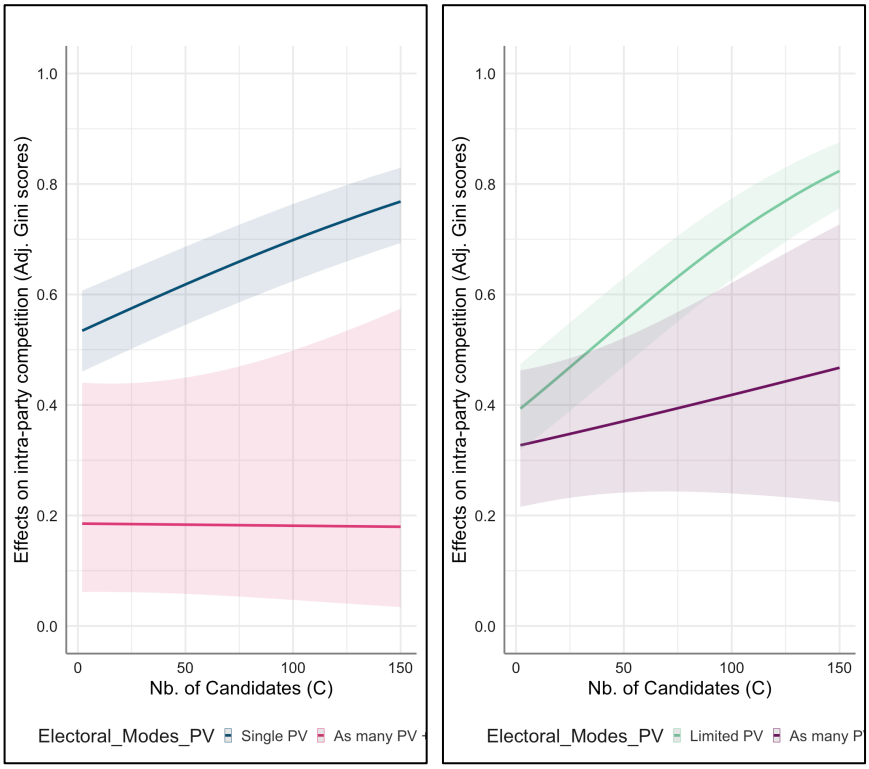


Finally, our models control for the enhancing effect of the complexity of choice when voters face an extensive choice decision both in terms of number C and number of PV. Figure 7 display that interactive relationship between PV and C. Our results indicate that in most PV systems (i.e. "Single PV", "As many PV" and "Panachage"), any variations of the number of C on the lists have hardly (or limited) effects on vote deconcentration. In particular, the adjusted Gini scores vary little by C and always within large confidence intervals for "As many PV" and "Panachage" systems. It is as if "As many PV" and "Panachage" has been inducing a general electoral behaviour always leading to a large vote deconcentration, irrespective of the list size. Likewise, "Single PV" always produce high vote deconcentration – even when the number of C is very small or moderate.

By contrast, "Limited PV" system present a singular pattern as voters tend to use their PV options very differently, depending on the type of candidates running on the lists. On the one hand, when the C choice is limited (i.e. voters face limited information costs to cast their PV), voters tend to support a wider set of candidates leading to vote deconcentration. For the shortest lists of candidates, the adjusted Gini scores for "Limited PV" (0.50) largely converge with "As many PV" systems (0.44). On the other hand, when the C choice is limited (i.e. large information costs), the predicted adjusted Gini scores dramatically increase as shown by steep curve on Figure 7. This suggests a neat effect of the paradox of choice. As C increases, the "adjusted Gini scores" converge with the vote concentration pattern observed in "Single PV": when C reaches 100, adjusted Gini scores reaches 0.80 in "Limited PV" as in "Single PV".

Overall, these results suggest that "Limited PV" mix the features of two electoral worlds. In fact, "Limited PV" system is the intermediary system between "Single PV" and "As Many PV (+P)" systems. While "Single PV" induce a world of vote concentration, "As Many PV" systems create a world of vote deconcentration. In this respect, "Limited PV" displays the features of both worlds, depending on the intervening effect of C. When candidate information is manageable (low C), "Limited PV" systems reflect the deconcentration world of "As Many PV (+P)". When information costs are high (large C), electoral behaviours in "Limited PV" are similar to "Single PV" systems.

Figure 7. Marginal effects of interactions between C mode of PV on vote concentration



Discussion and conclusion

Half a billion citizens live under LPRPV electoral systems across more than 30 democracies worldwide. These voters face the dual challenge of selecting a party list and supporting one or multiple co-partisan candidates within that list. The complexity of this task varies significantly across countries and districts. Using the analogy of dining at a restaurant, voters must first choose a restaurant (the party list) from a varying number of good places in town. Once decided, voters can face a short or a large menu (number of candidates). Finally, customers may choose a single dish ("Single PV") or multiple meals ("As many PV" + *panachage* option). This contribution argues that such variations in voters' choice sets influence electoral behaviour for candidates support. And these patterns directly shape intra-party competition. Previous studies have examined how voters behave when the number of C on the ballot increases, but these have focused on SMD systems, where voters choose both a candidate and a party simultaneously. Cunow and colleagues (2021) demonstrated that even a modest increase in C – from 3 to 6 – can overwhelm voters, leading them to concentrate their PV on fewer candidates using cognitive shortcuts like higher list ranks. However, there has been little research on how LPRPV parameters – number of PV, C, and ENP – impact voter decision-making and intra-party – competition.

This contribution fills that gap using a novel dataset covering 29 democracies from 1994 to 2023. Our analysis yields three key findings. First, regarding PV modes (H1), our results confirm the strong linear relationship between the number of PV voters can cast and vote concentration (ajudsted Gini Scores). Similar to a costumer ordering multiple dishes, when voters can cast multiple PV, they distribute their support across several C, resulting in vote deconcentration. Second, in line rational choice theory, we predicted that larger number of C would increase voters' ability to find suitable options (maximization of utility), resulting in large vote deconcentration. Our findings reject this hypothesis (H2a). Instead, this is the competitive hypothesis of "paradox of choice" that is observed (H2b): as C increases, voters' decision-making capacity saturates, which make them rely on on heuristic cues favoring vote concentration around a few highly ranked and visible candidates. This results are in line with Cunow and colleagues (2021)'s own observation of a strong paradox of choice in SMDs (even with as little to 4-5 candidates in competition). Finally, we hypothesized that voters prioritize selecting a party list, expending their cognitive resources on this first-order choice. As part of a two-step decision funnel, our results confirm that when the number of relevant parties competing in the district is high (large ENP), voters are less likely to consider a wide range of C. Instead, they rely on cognitive shortcuts, favoring visible, high-ranking candidates leading to vote concentration (H3). Overall, our findings emphasize the critical role of complexity of choice and paradox of choice in shaping intra-party competition.

While our empirical results show robust and highly consistent results, our analysis has yet some key methodological limitations. The reliance on aggregate electoral data – rather than individual-level voter behavior – prevents a direct test of the cognitive mechanisms that is at the core of this contribution. For instance, we infer that higher ENP undermine voters' decision-making capacity (exhausting their cognitive for subsequent candidate choice). Yet, it may be that such causal mechanism would be true for some voters, but not for others (especially the most politically interested and sophisticated voters). Even though this kind of profile of voters is not the most prevalent in modern democracies, we must acknowledge that for these voters, the structure of inter-party competition would matter less. An alternative research strategy would be to rely on individual-level data on PV choices across multiple countries and elections. This kind of data is scarce, though. Future research could address this gap by incorporating questions into comparative electoral surveys to evaluate the number of PV that voters cast.

Despite these limitations, our results offer valuable insights for both scholars and policymakers. Our findings contribute to ongoing debates about the "best" electoral system for representative democracies (Bowler et al., 2005). LPRPV pursue two main electoral goals regarding the distribution of power in democratic systems. As a PR list system, it seeks to promote a proportional distribution of power (seats) between political parties (i.e. inter-party competition, (Carey & Hix, 2011; M. Shugart & Wattenberg, 2003); while as a preference voting system, it empowers voters'

influence in the distribution of seats between co-partisans within the party list (i.e. intra-party competition, (Mitchell, 2000; Römmele et al., 2005). Our study highlights the inevitable tensions between these goals. Larger DM increase inter-party competition but concentrate intra-party competition, because Larger DM is mechanically associated with higher number of C. And Larger C trigger the "paradox of choice" by which voters' activate heuristic cues favoring prominent candidates. Conversely, smaller DM broadens intra-party competition (because a lower number of C favours votes deconcentration), but smaller DM also undermine the proportional nature of elections regarding the seats distribution between party lists. In very small districts (<4 seats), some could even question the proportional nature of PR systems.

In this respect, we conclude that there is a inevitabe trade-off in electoral engineering. Our results provide decisive guidelines for electoral decision-makers in balancing their goals. For those actors who would like to maintain a certain level of intra-party competition (e.g. the goal is preventing the emergence of a few too dominant candidates within a party), different solutions are possible. A first one is to opt for a system that allows to cast "As many PV" (including with a *panachage* option). This PV mode guarantees high intra-party competition and is rather non-sensitive to the length of the list (C) and the number of relevant parties (ENP). Another option is to choose a system with a limited number of PV to be cast coupled with short electoral lists in terms of C. When there are too many C, "Limited PV" systems lead instead to low intra-party competition. However, since C is often related to district magnitude, such electoral engineers must keep in mind that "Limited PV" with low DM would also often mean limited inter-party competition. Turning to electoral engineers seeking to limit intra-party competition (e.g. the goal is to reduce risks of factionalization within a party), there are different configurations available. The most straightforward is to opt for a "Single PV" system, which limits intra-party competition – almost irrespective of C and ENP (and therefore would work both under low and large DM). Another option is to go for "Limited PV", but only when combined with large DM and large number of candidates on the lists.

Finally, we want to underline that these trade-offs also affect voter satisfaction and perceptions of democracy. Studies suggest that preference voting fosters satisfaction by empowering voters (Farrell & Mcallister, 2006). Such systems are often implemented as a remedy against the growing public discontent with political parties as key players in democracies (Renwick & Pilet, 2016). However, complex LPRPV rules can be counterproductive and undermine this empowerment, reinforcing the dominance of party elites and concentrating votes on a few leaders (van Erkel & Thijssen, 2016b). While some LPRPV systems aim to distribute power more equitably amongst candidates within party lists, our findings suggest that some configurations exacerbate existing inequalities, limiting voter influence on candidates' election to office. In conclusion, this discussion clearly confirms that the diversity of LPRPV systems are much more than a technical arrangement: they decisively impact the nature of access to power *between* and *within* parties in representative democracies. We can only restate the pressing advice of prominent scholars in the field of electoral systems (Colomer, 2013; M. Shugart, 2005) who loudly call for more comparative research on such systems that are among the most commonly used in democracies across the world. We still know too little about those systems and how they affect the nature of elections for candidates, parties and voters.

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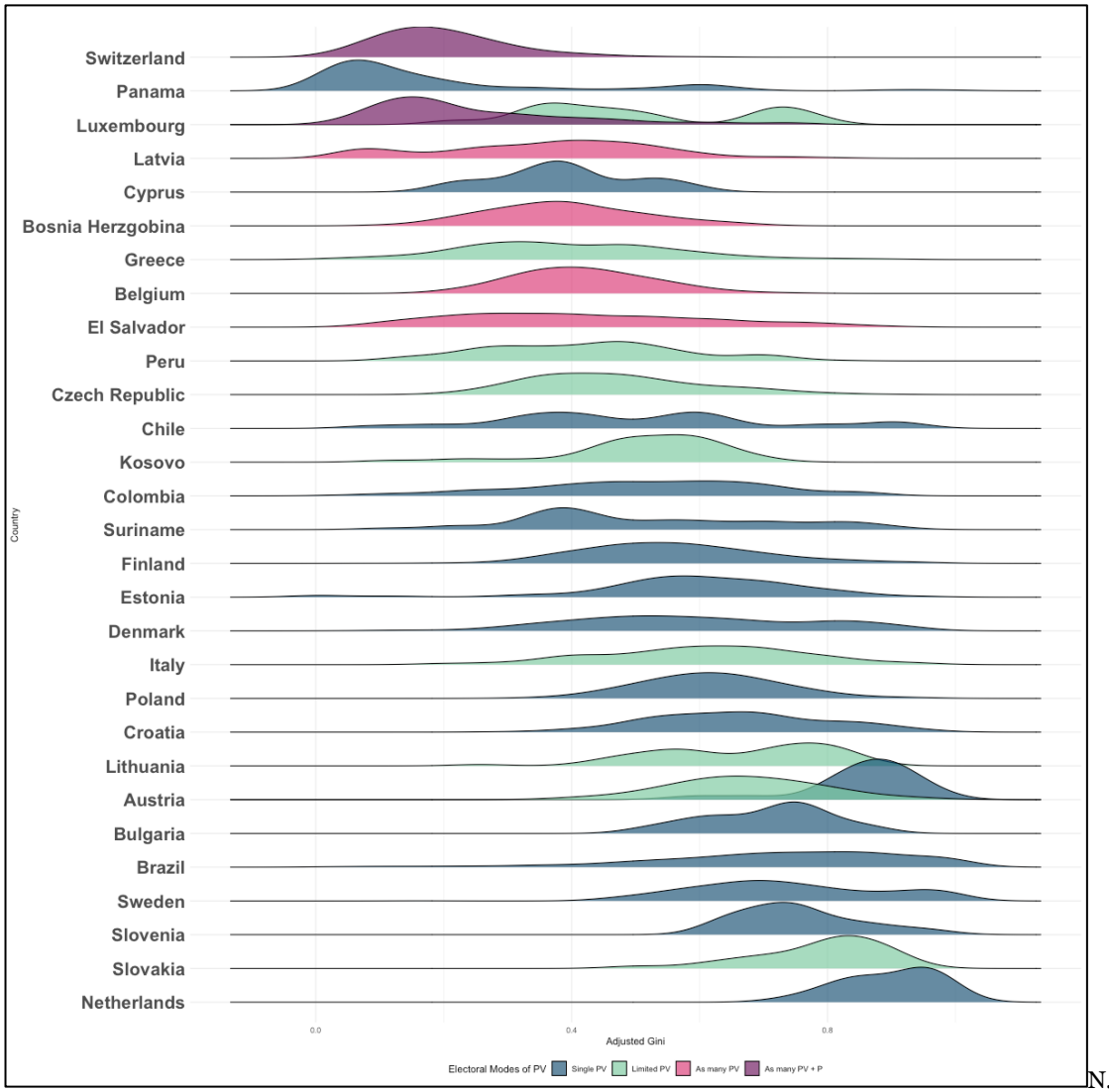
Appendix

Figure A1. Distribution of Adjusted Gini scores of electoral lists, by ascending country mean scores and electoral PV (1994-2023)



N.B. Luxembourg and Austria present two distributions with two electoral modes of PV because of distinct rules at national and European elections.