'Faulty' votes in PR and SMD systems: Price for the Complexity of Electoral Law. Evidence from Polish local elections[1]

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Abstract: We have hypothesized that the higher turnout in proportional representation (PR) as compared to single-member district (SMD) elections comes with a trade-off. The price is paid in many 'faulty' votes, which we primarily attribute to the higher complexity of voting under PR due to a larger number of choices. The three components of the 'faulty' votes that we identify under PR are (a) spoilt votes, (b) votes for the candidate or party only because it listed as No. 1 on the ballot, and (c) votes for candidates listed as No. 1 on party lists in open list PR elections (the effect does not occur in SMD or with closed lists). We use data from two types of natural experiments from eight local elections in Poland in 2010 and 2014. Those elections used SMD (majority runoff and plurality) and OLPR (open list Jefferson-D'Hondt) systems. The simultaneous use of different electoral systems means that local elections are particularly useful for such comparisons. Our findings corroborate our hypothesis: as a percentage of all eligible voters, in all three cases, PR generates about 3-5% more faulty votes than SMD.

1 Introduction

Following the early work of Duverger (1951), and at least since Rae's (1967) and Lijphart's (1984) seminal books, the political consequences of electoral systems based on proportional representation (PR) have been systematically compared against single-member district (SMD) systems. One of such consequences is turnout. Most scholars agree that PR systems involve noticeably higher participation. We focus our attention on a matter closely related to participation, i.e., the quality of votes. According to the participation argument, PR

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systems encourage voters to participate by offering more choice. Typically, under PR more parties compete than in SMD systems and, in open list PR systems[2], the cafeteria of candidates is much longer. Of course, a richer menu of options involves a cost, i.e., the price is paid in the apparently greater complexity of choice. Even voters who know their own minds in advance must spend more time with the ballot cards to identify their picks. But are such problems meaningful? Do they cause measurable consequences?

This paper investigates a hypothetical trade-off between voter turnout and what we call *faulty* votes. Our "trade-off" hypothesis states that the greater complexity of choices typical of OLPR versus SMD elections causes "cognitive fatigue" of voters and results in more votes that are meaningless or at least problematic.[3] Our goal is to estimate the effects of three categories of faulty votes. They include:

S – spoilt (invalid) votes;

B – ballot positional bonus: the percentage of all votes that were cast on the first party (in the case of OLPR) or candidate (in the case of SMD) on the ballot exclusively because such a competitor was listed first on the ballot;

L – list positional bonus: the percentage of all votes that were cast for the first candidate on a party's list in OLPR exclusively for being listed as #1 within this party's list.

There are two types of spoilt votes. Blank votes are typically interpreted as intended protests or disinterested votes, while mistaken votes are usually interpreted as unintentional (Kouba and Lysek 2016). Those votes are reported directly and there is no need for any estimation. The next two categories of faulty votes, due to what is often called the primacy effect, must be estimated. The ballot bonus comes from parties or candidates receiving additional votes simply because they have been placed on the prominent first position on the

[2] With a closed list PR, voters choose only among party lists, and the seats are allocated according to pre-assigned positions of the candidates, while in the open list PR, voters cast "preferential" votes, i.e., they select a specific candidate or candidates from the list. Both types of lists are popular in legislative, local and other mass elections. In the OLPR variant used in Poland, sometimes called semi-open, voters cast one vote for one candidate, and those with most votes receive the seats that were won by the list.

[3] In Polish local elections, OLPR used the algorithm of Jefferson-D'Hondt divisors, in which party votes are divided by 1, 2, 3, … (positive integers) and the seats are awarded to the parties with their highest resulting numbers. SMD methods included FPTP (first-past-the-post, plurality), and MR (majority top-two runoff), where the candidate wins if s/he has the majority; otherwise, the two leading candidates compete in the plurality election two weeks later. In all cases, tie-breaking rules regulate rare draws.

ballot. This effect may arise when voters vote "randomly" for the first candidate, perhaps associating upper positions with "good" and lower with "bad" traits (Kim et al. 2015) or maybe due to a larger media coverage that top listed candidate receive (van Erkel and Thijssen 2016). We are interested in estimating the total bonus without examining its specific causes. Our second type of bonus, the list bonus, appears only in electoral systems using party lists and allowing for the choice of candidates within lists since there are no such lists in SMD elections. Voters who are responsible for a list bonus automatically choose the candidate listed first on the party list. In order for the three numbers to be comparable with the turnout, we will represent them as a percentage of all eligible voters.

Since our goal is to assess the differences in faulty votes, we will analyze paired estimates of such votes in PR and SMD elections that were held simultaneously among the exact sets of voters. Due to the complexity of estimates and the scarcity of space, we had to minimize the analysis of factors affecting our final numbers and, for instance, omit the analysis of positional bonuses for second, third, last, etc. positions, which are usually estimated as positive and much smaller than first-position bonuses versus middle positions or small and negative (Lutz 2010). For comprehensive overviews of positional bonuses, see Krosnick et al. (2004), Chen et al. (2014), Blom-Hansen et al. (2016).

The paper develops preliminary research from Flis (2016) and the early version of the trade-off hypothesis suggested in Kaminski (2016, p. 55). It begins with the description of faulty votes, our sources of data and main hypotheses. Section 3 contains a comparative analysis of spoilt votes in all pairs of SMD and PR elections that were conducted simultaneously. Section 4 compares the estimated ballot positional bonus in SMD borough mayor and council elections with the estimated ballot positional bonus in OLPR elections to the county councils, also using data from the provincial elections. Section 5 discusses list positional bonus in a system with party lists. In each case, we explain the methodology and how we controlled for potentially relevant variables. The final sections conclude with a discussion of the estimates and policy recommendations.

2 Testable hypotheses and data

We broadly conjecture that faulty votes appear more often when the total number of viable candidates on a ballot is large (in PR systems) versus small (in SMD systems). The reasoning behind our conjecture is simple: The complexity of election choices confuses some voters who become more likely to vote for the first named candidate or party on the ballot paper or the first candidate on the party list. They are also more likely to make a mistake on a ballot or cast a protest blank vote. Asking for choices in PR on two levels - interparty and intraparty – can also lead to confusion as to the number of possible indications. As more candidates usually compete in OLPR elections than in SMD elections, we expect that there will be more faulty votes in OLPR elections.

2.1 Testable hypotheses

Our hypotheses are formulated for the SMD and OLPR elections, and claim that both spoilt votes and randomly cast votes for the first position on the ballot are more frequent in the OLPR system, and that list bonus for competing as No. 1 is positive. Formally, we write (superscripts represent the corresponding election types):

H1 (*More spoilt votes in OLPR*): *Ceteris paribus*, $S^{\mathrm{OLPR}} > S^{\mathrm{SMD}}$;

H2 (*Greater ballot positional bonus in OLPR*): *Ceteris paribus*, $B^{\mathrm{OLPR}} > B^{\mathrm{SMD}}$;

H3 (*Positive list positional bonus in OLPR*): $L^{\mathrm{OLPR}} > 0$.

Our final testable hypothesis is obviously related to H1-H3, i.e., for $F^{\mathrm{OLPR}} = S^{\mathrm{OLPR}} + B^{\mathrm{OLPR}} + L^{\mathrm{OLPR}}$ and $F^{\mathrm{SMD}} = S^{\mathrm{SMD}} + B^{\mathrm{SMD}}$:

H4 (*More faulty votes in PR*): $F^{\mathrm{OLPR}} > F^{\mathrm{SMD}}$.

We additionally informally conjecture that the aggregated difference in faulty votes is of the same order of magnitude, but with the opposite sign, than the difference (boost) in turnout in PR in relation to SMD, as estimated in the literature.

2.2 Corrections against turnout

To compare the spoilt votes S and positional bonuses B and L with the turnout, we must express them as a percentage of all those entitled to vote, i.e., including voters and eligible non-

voters. For example, if 10% of voters returned spoilt votes ($S = 10\%$) and the turnout was 0.4, then the spoilt votes constitute $10\% \times 0.4 = 4\%$ of all eligible voters. In general, in the case of the first two types of votes, the transformation is straightforward (lowercase letters represent "effective" categories of faulty votes after they are made comparable with the turnout T, which is represented as a proportion of all eligible voters):

(1) $s = TS$; $b = TB$;

In the case of list bonus L, the correction is more complicated. The votes constituting the bonus are estimated as a percentage of all valid votes; we receive the proportion of valid votes when we subtract the proportion of spoilt votes from the turnout. In addition, some voters who vote for the first party listed on the ballot solely because of its position may similarly vote for the first place on this party's list. We do not want to count such voters twice, and we also subtract them from the turnout. Assuming that the interaction between the ballot and list bonuses is negligible (as we argue in Section 5.3), we receive the following formula for conversion:

(2) $l = L \times (T - s/100 - b/100)$;

In formula (2), l represents part of the list bonus from voters who were not included in the ballot bonus. Both $s/100$ and $b/100$ are much smaller than T and the result of the subtraction is positive. By combining formulas (1) and (2), we obtain the following equation defining the faulty votes f as a percentage of all those entitled to vote:

(3) $f = s + b + l = TS + TB + L \times (T - TS/100 - TB/100)$

Formula (3) represents the components of faulty votes f^{OLPR} in the OLPR system. In the SMD system, where there are no party lists, f^{SMD} is the sum of only the first two components.

2.3 Data

We estimate the faulty votes for OLPR that applies the Jefferson-D'Hondt algorithm; SMD elections include MR and FPTP; and (as a proxy for list bonus under OLPR), we analyze BV (bloc vote) elections.[4] In our estimates, we use data from Polish local elections in 2010 and 2014. Local elections offer particularly good conditions for comparing the effects of different

[4] In bloc voting (BV), also called plurality-at-large, the district magnitude is $M > 1$; parties register lists with M candidates; voters cast up to M single votes for different candidates from the same or different lists; M candidates with most votes win seats.

electoral systems, as they often include both PR elections to some boards or councils and majoritarian elections of heads of those bodies (see for instance Ladner and Milner 1999). In our elections, we identified two sets of natural experiments that will help us in our comparisons. Let's start the description of data with the quick tutorial to the Polish local government structure and elections.

The local government in Poland is divided into three tiers. At the highest tier, there are 16 provinces (województwo); the second tier consists of 380 counties (powiat); on the lowest level there are 2,477 boroughs (gmina).[5] The sizes of councils range from 15 to 60. There are 66 special large city county-boroughs, which are also counties. Additional smaller administrative units can be set up in larger boroughs. The chief executives of boroughs[6] are elected directly, while the councilors elect chief executives in non-borough counties (starosta) and provinces (marszałek).

The local elections took place every four years (after 2018: every five years) for all three types of councils and borough leaders (see Table 1). In the 2010 and 2014 elections, SMD (MR or FPTP), BV and OLPR systems were used. Voters coming to a voting booth in 2014 simultaneously received three or four ballots. Most voters voted twice under OLPR, once under FPTP and once under MR systems (elections 2014.1, 2014.2, 2014.3ab and 2014.4 in Table 1). In 66 county-boroughs, there was one MR and two OLPR elections (2014.1, 2014.2 – in this case, the same as 2014.3c, and 2014.4 in Table 1).

TABLE 1 ABOUT HERE

[5] As of election day on November 11, 2014; data from Główny Urząd Statystyczny (Main Statistical Office) (2017).
[6] Administrative names for the heads of local government are: "prezydent" – for a city or town with more than 100,000 inhabitants and for those that had such an office before 1990; "burmistrz" – all other town and mixed town-village boroughs; "wójt" – multi-village boroughs. In Polish literature, all three types are collectively called "włodarz" regardless of the type of borough. From now on we will use one name "mayor."

2.4 Natural experiments

Let us briefly describe the natural experiments and methods that allowed us to estimate our three effects.

Firstly, the pairing of the OLPR and SMD elections has created a comfortable *ceteris paribus* situation for variables that are usually difficult to control in comparisons of electoral laws. Not only the turnout but also the identities of voters were the same. As a consequence, all socio-cultural characteristics of voters in the OLPR and SMD comparisons were controlled for. We used this opportunity to compare spoilt votes for both systems using all eight OLPR and SMD election pairs. The spoilt votes data were obtained from the election results and there was no need for making estimates.

The second natural experiment offered a unique opportunity to calculate the ballot bonus for the first position in the PR election. This bonus is extremely difficult to estimate, because usually if the party is listed as No. 1, it is listed as such in all districts, and the bonus cannot be separated from the party's electoral performance. In 2014, a medium-sized party PSL (*Polskie Stronnictwo Ludowe – Polish People's Party*) was registered in some districts as a party PSL, and in some other districts as a freestanding committee of citizens PSL. The lottery then assigned the PSL a precious No. 1 position on the ballot. However, since the freestanding PSL was legally distinct from the PSL-party, it received a lower position on those ballots where it competed. This coincidence affected the position on the ballot of a major party PiS (*Prawo i Sprawiedliwość – Law and Justice*). PiS found itself in some districts at the top, while in others it took position No. 2 or 3. This natural experiment allowed us to estimate the first-position ballot bonus for PiS. The corresponding ballot bonus in the SMD election was much easier to estimate because those ballots were arranged alphabetically.

The third estimation required the use of indirect methods. The candidates' positions in all OLPR elections were not alphabetical, which means that it was impossible to separate the candidate's popularity from the bonus generated solely by the position on the list. In order to overcome this difficulty, we assessed the bonus in the BV elections, which took place in some boroughs in 2010 and which used alphabetical lists. We treated our estimates as proxies for the list positional bonus in OLPR elections.

3 Spoilt votes

Spoilt (invalid) votes include blank ballots, usually interpreted as protest or disinterested votes, and incorrectly filled out ballots, interpreted as voter errors. Breux & Couture (2014) demonstrate, using Canadian local elections, that institutional complexity jointly with the borough's social structure, influence spoilt votes. Pachón et al. (2017) also indicate the importance of voting complexity in the OLPR system for the number of spoilt votes.. A recount of spoilt votes after the 2014 Polish local elections showed that the main reason for their large number was voter confusion about the procedure of voting (Gendźwiłł et al., 2016, pp. 55-62).

Elections carried out simultaneously under various electoral laws, as is often the case with local elections, allow a comparative analysis of spoilt votes. The important factor held constant is turnout and the identities of voters who cast their votes simultaneously using different ballot cards under different electoral systems. It is important to remember that the resulting natural experiments are not free from imperfections. First of all, the paired elections usually fill different offices, and the related effects are difficult to separate from electoral systems. Second, external variables can intervene and asymmetrically affect the level of spoilt votes. Although it is virtually impossible to control individual variables such as gender, age or education because of the secrecy of voting, spoilt votes may be broken by the size of the community. A quick look at our data reveals the relevance of this variable.

Figure 1 [SPOILT VOTES] ABOUT HERE

In Figure 1, all boroughs were divided into nine more or less equal subsets (approximately 3.4 million eligible to vote per subset), which included increasingly larger boroughs. All province and county elections used OLPR, and both mayor elections used MR. In boroughs electoral law depended on their size: in 2010, the first four categories used BV, and in 2014, the first six categories used FPTP; the other categories used OLPR (see also Table 1). In both charts, spoilt votes jump when changing from BV or FPTP to OLPR. In all categories, the elections conducted under the OLPR show a greater percentage of spoilt votes.

In order to estimate the difference in the spoilt votes between the OLPR and SMD elections, we compared such votes for all eight SMD and OLPR election pairs that took place in the same year, i.e., in elections in 2010 or 2014. We used exactly the same sets of voters. For example, because both in 2010 and 2014 OLPR was used only in a subset of all boroughs, we compared such elections with the election of mayors with MR in the same set of boroughs (see Table 2).

TABLE 2 [SPOILT VOTES] ABOUT HERE

It's worthwhile taking a few notes. The percentage of spoilt votes in all OLPR-SMD pairs is higher in the OLPR elections, i.e., $s^{\text{OLPR}} > s^{\text{SMD}}$. This means that our hypothesis H1 is corroborated in all eight cases. Nevertheless, the differences within election pairs vary significantly. It is possible that there are more relevant variables that systematically affect spoilt votes. In addition, both the percentage of spoilt votes and the corresponding differences are smaller in 2010 elections than in 2014 elections. This difference may be attributed to the ballot design in all 2014 OLPR elections, i.e., "ballot booklet", not a one-page ballot card. It was shown that the ballot booklet significantly increases the percentage of spoilt votes (Pierzgalski et al. 2018).

4 Ballot (interparty) positional bonus

In an ideal voting world, the position of the candidate or party on the ballot would not affect the result. We know, however, that sometimes competitors can receive from some "lazy", "poorly informed", "less educated" or "ambivalent" voters a bonus for the most prominent first position (Kim 2015). The effects of SMD ballots are so well recognized that the courts refer to them as common knowledge in reversing election outcomes (Alvarez and Hasen 2006).

Intuitively, the positional ballot bonus B is the percentage of valid votes that the candidate or party listed first on the ballot card receives solely because of this position.

4.1 Alphabetical positional bonus with MR

The number of candidates in SMD elections varies from only one to several strong candidates and possibly some additional plankton unknown to the vast majority of voters. While some researchers call the existence of first-position bonuses in such elections "common wisdom" and claim that are usually not very strong or universal (Alvarez and Hasen 2006), in some cases the bonus is estimated as substantial (Grant 2017).

Candidates for borough leaders in 2014.4 MR elections were ordered alphabetically. We assumed that the alphabetic listing was generated in a quasi-random process and was not *a priori* correlated with electoral chances, i.e., that there were no significant effects due to, for example, putting on ballot dummies with alphabet opening names such as *Abacki*. It seems that in the contemporary SMD elections there are no real benefits from listing alphabetically privileged nobodies who would gain the support of a few confused voters. However, see Wilson's early work (1912, p. 593) for entertaining examples of candidates who strategically changed their names in order to head the alphabet.

After excluding 247 single-candidate races, we obtained data on 2229 ballots that varied in length from 2 to 11 candidates, with the average ballot length of 4.54 candidates. We used the following main variables describing candidates for borough leaders:

VOTE is the average percentage of votes for candidates listed as No. 1 on the ballot in the first round of elections;

LENGTH is the ballot length (number of candidates on the ballot);

EXPECTED (percent) is equal to 100/n where n is the corresponding ballot length;

Δ is the dependent variable equal to VOTE – EXPECTED, which represents the difference between actual and expected votes.

Table 3 shows the values of variables and the number of cases for all ballot lengths:

TABLE 3 [Model MR1] ABOUT HERE

Estimated bonuses for candidates No. 1 were small for all ballot lengths with 100+ cases. In the case of three ballot lengths, candidates No. 1 received slightly more votes than expected, while for seven lengths their votes were slightly smaller. In general, the average bonus for all ballot lengths was a tiny –0.51%. This number represents the average loss from being listed as No. 1. Because the p-value is a substantial 0.15, we do not reject the null hypothesis that the positional ballot bonus is equal to zero.

We examined several control variables for Δ, which included LENGTH; POPULATION – the population of the borough standardized with a medium-sized borough Jedlicze, which was normalized at 1; and BOROUGH – a binary variable that assumes 0 for towns and 1 for other boroughs. All seven regressions using our control variables turned out slopes that were insignificant, with p-values for double-sided t-test ranging from 0.343 to 0.9. The amount of the explained variation in Δ was negligible.

The most interesting control variable was LENGTH, which can be interpreted as a proxy for the complexity of the voter's decision problem. Δ was slightly increasing in LENGTH but the increase was insignificant. This suggested that voters were not computationally overloaded and were not more likely to vote for the first named candidate when the candidate list lengthened. This may be due to relatively short ballots, all of which cover 2-11 candidates, and over 98% of them only cover 2-7 candidates.

Interestingly, in the open race (no-incumbent) elections of borough mayors, which account for around 11% of all elections, a small positional bonus was found. Bartnicki (2018) analyzed the winners in the open-race elections in 2006, 2010 and 2014. His four regressions with additional controls identify an average bonus of 2.6%.

Analysis of borough council elections in 2014 under FPTP returned similar conclusions to the elections of the mayors in 2014 (election 2014.3a in Table 1). The main results were as follows: the number of electoral races was 131799; 1733 election cases with only one candidate on the ballot were excluded. The positional ballot bonus was slightly positive at the level of 0.07% (p-value for two-sided mean comparison t test equal to 0.375).

We conclude that the null hypothesis that the estimated positional ballot bonus in the SMD elections for borough mayors and councilors is zero ($B^{SMD} = 0$) was corroborated.

4.2 Lottery-generated positional bonus under OLPR

When the electoral law is PR, the election menu is extended by an order of magnitude. In the OLPR system, voters choose the party as well as the name from its list. If the district magnitude is low M = 5 (the minimum number of candidates for the list in the PR borough elections) and the number of competing parties is also equal to the low five, the total number of candidates on the ballot is 25. In provincial elections, with over 16 candidates for one seat, the average number of candidates just on the ballot was about 120. In addition, with OLPR, voters may be able to choose a local candidate on each list. Even if they choose the first party without paying attention to its identity, the second choice of a local candidate may provide them with a psychological alibi that they voted conscientiously.

The positional bonus in PR elections is more difficult to identify than in SMD elections because there are no alphabetically organized ballots that differ over districts. In all districts, a virtually unchanged set of parties competes, and larger parties compete in practically all districts. The party positions on the ballots, the same in all districts, are allocated by lottery after all competitors are registered. The lucky party drawing No. 1 keeps this position in all districts. Therefore, it is not possible to precisely distinguish between the bonus and "normal" votes for party No. 1.

The estimation of the ballot bonus in the county election in 2014 (Election #2 in Table 1) was possible due to the exceptional coincidence that produced a suitable natural experiment. A medium party PSL drew the first position on ballots in all districts in which it competed. The lottery was held after all parties registered their lists of candidates. However, in about 1/3 of districts, PSL didn't register their list to compete as a party but formed a freestanding committee. Because the PSL-party and PSL-freestanding were different legal entities, the PSL-freestanding didn't enjoy the top position in the districts in which it was registered and was given a more distant spot. In such districts, the competitor with No. 2 was moved up to the first position. However, the No. 2 spot was assigned to a tiny citizens' committee Direct Democracy that competed only in one county where PSL was actually listed first; in all districts with PSL-freestanding the second position on the ballot was empty. Thus, the final beneficiary was a big party PiS that drew No. 3. Finally PiS competed as No. 3 in one district; No. 2 against PSL-party; No. 1 against PSL-freestanding; and in eight counties it didn't compete at all (see Figure 2).

FIGURE 2 ABOUT HERE

If a party received extra votes for being No. 1 in some counties, then its electoral result in such counties should be higher. We have estimated such a hypothetical bonus for PiS. Since our alternative choice, PSL competed partially as the PSL-party and partially as PSL-freestanding, we wouldn't be able to separate the bonus from a possibly disturbing effect of having two slightly different PSLs. The potential impact of different PSLs on other parties' score, such as PiS, should be diluted and negligible.[7]

All variables listed below record the percentage of votes among all votes cast, including spoilt votes. The dependent variable is:

1. County/PiS_14: support at the borough level for PiS in county elections in 2014;

The explanatory variables are:

2. Province/PiS_14: support at the borough level for PiS in provincial elections in 2014;

3. NO-PSL: no PSL-party on county ballots in 2014.

In all provincial elections (Election #1 in Table 1), PiS received the number 3, because PSL competed in this election in all districts as a party. Our key explanatory variable, the dummy variable NO-PSL took the value 1 when PSL competed as freestanding (and PiS was assigned No. 1) and 0 when PSL competed as a party. Out of all 314 Polish counties, we excluded eight cases in which PiS didn't compete in counties and 66 counties-boroughs that have a different government structure than ordinary counties. In other counties, both PiS and PSL competed. We analyzed data at the borough level with 2338 boroughs.

TABLE 4 ABOUT HERE

[7] A quick look at the data confirms the significant ballot bonus for PSL: it received an extremely large for this party 21.42%, well above pre-election polls.

The first regression estimates the positional bonus with provincial elections as a control. The fourth column shows a non-standardized impact of NO-PSL. In 2014, moving PiS up to No. 1 resulted in 8.52% more votes in a borough. The result is highly significant.

It can be speculated that the effect may be due to the fact that NO-PSL is somehow connected to boroughs with more support for PiS, regardless of whether PSL ranks first or not. We ran three more regressions with similarly defined sets of dependent and explanatory variables and similarly defined sets of boroughs to test the reliability of our findings (see Table 4). In the previous election of 2010, we were looking for the impact of NO-PSL on the PiS result; PiS was listed fifth and PSL second. We also examined the impact of NO-PSL on the medium-sized party SLD (*Sojusz Lewicy Demokratycznej – Alliance of Democratic Left*), which was listed as No. 1 in 2010 and No. 6 in 2014. In all three cases, since PSL never occupied the top position, we didn't expect any impact of NO-PSL on PiS or SLD results.

In fact, our second regression shows that NO-PSL had no impact on the PiS result when PSL was not listed first in the previous election in 2010. Note that the 2010 and 2014 constants and the betas for provincial results in the two regressions involving PiS are very close.

The regressions involving SLD generate analogous conclusions to the second PiS regression. The removal of PSL from No. 1 didn't move SLD to the top spot, and the impact of NO-PSL on SLD in 2014 was small and statistically insignificant. Similarly, in the 2010 elections, when SLD occupied the top spot, moving PSL from a non-top to another non-top position had no statistically significant impact on the SLD results. Like the previous models, both SLD models have similar betas and constants.[8]

Our second model examined the ballot bonus separately for two NO-PSL values. The aim was to check whether different levels of PiS support in provinces affect the bonus.

FIGURE 3 ABOUT HERE

[8] An additional, more detailed analysis confirmed that NO-PSL did not have a statistically significant impact on the results of all other parties in the 2014 and 2010 elections.

The two regression lines are nearly parallel. The distance between the lines at different values of PiS support in the provinces represents the estimate of the positional bonus. This estimated bonus ranges from 8.92 (PiS support in the province = 0) to 7.42 (PiS support in the province is equal to a maximum of 65); at the level of 26.89, which is the actual average support for PiS in the provincial elections, the effect is estimated at 8.38, which is close to our previous estimate at 8.52. We also note that a similar analysis of PiS results in the 2010 election showed two almost identical regression lines.

To estimate the positional ballot bonus, we will use the average of our two numbers $B^{\text{OLPR}} = 8.45$. As the turnout in the 2014.2 county election was 47.4%, the application of the formula (1) returns $b^{\text{OLPR}} = 4.00$ effective ballot bonus. Because $b^{\text{OLPR}} - b^{\text{SMD}} = 4 - 0 = 4$, our H2 is corroborated.

5 List (intraparty) positional bonus

A voter in OLPR elections faces two choices. After selecting a party, s/he must choose a specific candidate from the party list. Some voters choose their party and then select the first candidate on the list, whoever they are. This is a fairly common and strong effect in electoral systems that use lists of candidates (see Lutz 2010 in the Swiss elections; Faas and Schoen 2006 in Bavaria; Raciborski 1997 and Marcinkiewicz 2014 in Poland; van Erkel and Thijssen 2016 in Belgium; Blom-Hansen et al. 2016 in Denmark). What's more, some voters are increasingly less willing to vote for candidates from lower positions, although the last position may record a slight increase (Marcinkiewicz 2014) or decline (Lutz 2010). The effect is absent from SMD elections (no lists of candidates) or from closed list PR elections (no choice of candidate within lists allowed).

Positional effects with party lists are well recognized, but difficult to estimate, because positions on OLPR lists are rarely randomly or alphabetically ordered. The rare exception is Finland, where the order of candidates is arranged by lottery (Ministry of Justice 2018). Typically, party leadership, or party primary, arranges lists of candidates with stronger and/or senior "electoral locomotives" occupying higher positions. Therefore, voting on the list created by the leadership conflates positional effects with the strength of the candidate (see van Erkel and Thijssen 2016 for a creative attempt to "distill" such effects; see also Blom-Hansen et al.

(2016) for ingenious use of columns on the ballot, which generated partial as-if-random allocation of candidates.). Similar problems appear in Polish local 2014 elections.

Despite methodological problems with identifying the bonus, there are strong indications that Polish voters handsomely reward the first candidates regardless of their identity. In an opinion poll of 2011, 77% of voters did not pay attention to the order of candidates on the list; 10% usually voted for a highly positioned candidate, but not necessarily No. 1; 6% usually voted for candidate No. 1; 7% were undecided (CBOS 2011, pp. 5-6). We have used a proxy for estimating list positional bonus under OLPR using a different list-based system that was applied in Poland in 2010.

5.1 List positional bonus under BV

The only electoral system used in Poland with district magnitudes greater than one and the alphabetical list of candidates was bloc voting (BV). It was used in all elections to the Senate from 1989 to 2007 and in some borough council elections in 2006 and 2010, but not in 2014.

We used 2010 borough council elections with BV as a proxy for list positional effects under OLPR. A total of 18887 seats were filled by BV. The district magnitudes ranged from two to five seats (two: 3931; three: 1689; four: 872; five: 494). On average, 10.5 candidates competed for one seat. Most of the candidates came from one-candidate lists and we excluded them from the analysis. The average length of the list with 2+ candidates was 2.67. In addition, some of the lists we analyzed contained fewer candidates than the district magnitude (Table 5).

TABLE 5 ABOUT HERE

Candidates ranked first on the list received an average of 7.3% more votes than the average for the remaining positions. This bonus decreases slightly in absolute terms with the list's length. In relative terms, No. 1 candidates received 17%, 21%, 26% and 30% more votes than the average for other positions for list lengths 2, 3, 4 and 5, respectively.

Using equation (2), we can calibrate the list bonus as a percentage of all eligible voters. The parameters are as follows: turnout (46.6%); total actual spoilt votes ($5.4\% \times 0.466 \approx 2.5\%$);

the estimated ballot bonus (8.45%×0.466 ≈ 3.94%). The calibrated list bonus is estimated as 7.3%×(0.466 – 0.025 – 0.0394) = 7.3%×0.4016 ≈ 2.93%. Remembering that we used list-based BV as a proxy for list-based OLPR, a low p-value for this result corroborates our hypothesis H3 that $l^{\mathrm{OLPR}} > 0$.

6 Summary of results

We identified three types of 'faulty' votes, i.e., spoilt votes that were blank or incorrect; votes related only to the most prominent first position of a party or candidate on the ballot; and votes cast for the first candidate on the party list in the OLPR elections solely because of this position. We estimated these effects thanks to the natural experiments that we identified in the local elections in Poland in 2010 and 2014 (see Table 6).

TABLE 6 ABOUT HERE

Our estimates of faulty votes return a surprisingly large number: 12.27% more of eligible voters cast a faulty vote under OLPR than SMD systems. When faulty votes are calculated as the percentage of all who voted, the difference between both types of elections is staggering: a full one-quarter of voters more cast a faulty vote under OLPR! Since we used data from simultaneous SMD and PR elections to estimate the effects, the turnouts were identical. Both spoilt votes and the ballot bonus are much larger in the case of PR than SMD systems; the list positional bonus appears only in OLPR systems.

Of course, we do not claim that ours are universal estimates. Various institutional and socio-cultural factors or ballot format may affect the size and maybe even the direction of the effect. Below, we will briefly discuss such factors that cannot be controlled statistically with our data.

If we had to guess the gap in spoilt votes between typical "standalone" PR and SMD elections, it would probably be smaller than our estimates. In our case, four simultaneous

elections imposed significant computational burdens on voters. What's more, the lists of candidates were so long that some ballots were printed as "ballot booklets," which made the selection even more complex and troublesome. The average percentage difference in effective spoilt votes between PR and SMD in the 2010 elections (that used ballot sheets) recorded in Table 2 was only 2.94. The relevant average in the 2014 elections (with ballot booklet) was as high as 5.94.

The effect of the "ballot booklet" may be also partially or even mostly responsible for increasing the size of the ballot positional bonus. The first party was printed on the first page of the book, which made its location even more prominent. We do not know how strong the positional ballot bonus would be with a regular ballot. We know only that, combined with the booklet ballot format, the effect became very strong. This part of our research is difficult to replicate because exchanging first-position parties in some districts created a very rare natural experiment. At the very least, this part of our results adds another warning about bad ballot design, which is more likely in the PR than SMD because of the greater complexity of choices (Geys and Heyndels 2003).

The list positional bonus is equal to a relatively high 7.30 (2.93 effective). There is no reason to believe that this effect was affected by the ballot booklet format. However, one can argue that these votes are not completely faulty, because they followed the conscious choice of the party leadership that possibly placed its "best" candidate at the top (van Erkel and Thijssen 2016). This is a valid point. However, those voters who follow their party blindly and generate such a bonus do not use the option offered by OLPR to vote for a particular candidate. In this sense, their vote is flawed, or incomplete, because they could simply vote for their party. Moreover, awareness of such a bonus is important for the relationship between party authorities and individual candidates. It means that competition within the list, which is a key promise of the OLPR, is not fair (Flis 2014, pp. 294-296).

6.1 Interactions between ballot bonus and list bonus voters

We are interested in the specific type of interaction among the three subsets of faulty voters. Namely, we do not want to count such voters twice if they belong to more than one subset. Since the first set of voters casting invalid votes is disjoint with the other two sets, the

only potentially problematic interaction can take place between the two types of "bonus" voters, i.e., those who vote for the first party on the ballot or the first candidate on the party list.

If there were a significant interaction between the ballot and list bonus voters, our formula (2) representing the correction for list bonus would have to be modified. In the worst-case scenario, the same voters would vote for the first party on the ballot and then for the first candidate on this party's list. This would result in double counting such voters.

We checked whether there is interaction between the PiS list bonus voters and the PiS ballot bonus voters. If there were interaction, we would see different proportions of the list bonus votes voters in districts where PiS competed as No. 1 and non-No. 1. As a control variable, we used the number of votes for the first PiS candidate in the 2010 election. The differences turned out to be small with a two-sided p-value (t-test) of 0.711. This corroborates the null hypothesis that among the ballot bonus voters, the list bonus voters constitute the same proportion as among the other voters.

7 Conclusion

Electoral systems were studied both as independent variables and as consequences of social and political factors (see, among others, Lijphart and Grofman 1984, Boix 1999, Colomer 2005, Kaminski 2006, Benoit 2007). Treating electoral laws as independent – fixed – parameters of the political system created the field of "political consequences of electoral laws." There is a broad consensus among scholars that one of the most important consequences is that PR usually facilitates greater turnout than SMD-based systems. Among the studies of this "PR boost" effect, Blais and Carty (1990, pp. 174-5) examined 509 elections in mostly European democracies and, after controlling for several institutional variables, found that PR increased turnout by 5% compared to majority-based systems and 7% compared to plurality systems. Ladner and Milner, in a natural experiment setting of different electoral laws applied in Swiss cantonal municipalities, estimated the PR boost between –1% and 13%, depending on the size of the community (Ladner and Milner 1999, p. 245). Kartal (2015) conducted laboratory experiments in two groups of subjects and found the PR boost between positive 4.2% (small minority group) and negative –8.6% (large minority group). Lijphart estimated the PR-boost at 9-12% (1997, p. 7). The average estimate of a PR boost based on the above numbers is about 5%.

We hypothesize that PR boost comes with a trade-off in popular OLPR systems. With choice comes complexity that lowers the quality of votes. Although technically increasing turnout, faulty votes don't really form conscientious choices. All categories of faulty votes summed together for PR after recalibration and subtraction of faulty votes in SMDs constitute a "PR blow" – a negative PR effect in relation to SMD. Even if we halve our estimate of the total "PR blow" of 12.27%, it has a similar magnitude as the estimated PR boost, but works in the opposite direction. Our findings are consistent with the results of such experimental studies as Kim et al. (2015), who report that the specific factors that increase the propensity to choose the first candidate among voters include poor information, ambivalence, weak cognitive skills and unwillingness to put effort into their choice.

When the faulty votes are considered in relation to all who voted, and not all those entitled to vote, our percentage estimates will increase significantly to about twice the previous number, i.e., around 25%. Even if we cautiously take into account that this number is extremely high, corrections for a substantial number of faulty votes coming with PR must seriously affect the comparisons of SMD and PR systems. For instance, in an influential book, Powell (2000) argues that PR systems have a clear advantage over SMD systems in translating electorate preferences into policy decisions. However, for example, according to his proportionality measure of the representation, which estimates the percentage of voters represented, PR systems average 96.1 and SMD average 85 (Powell 2000, p. 96). Although it is not immediately obvious how to adjust Powell's results using estimates of faulty votes, it is clear that – considering the difference is 11.1 – such a correction can significantly reduce this difference, or even reverse the relationship.

Our results offer a few simple policy recommendations that would make the OLPR elections more meaningful or at least that would dissipate the undesirable bonuses among parties. Of course, one should choose the ballot format with the utmost caution, and the side effects of particularly exotic designs should be tested with the survey or focus data. Using smaller districts, limiting the length of candidate lists (no longer than the district magnitude), or limiting the number of simultaneous elections would reduce the complexity of voting. Obviously, this would slightly restrict voter choices but the result should be visible in a smaller number of blank and erroneous votes.

The ballot bonus is not difficult to engineer down. Instead of one nationwide lottery to place a party on the ballot, separate lotteries or quasi-random procedures for districts or at least sub-national regions can be organized. The goal would be to dissipate a possibly inevitable bonus among various parties. In the United States, random rotation of candidate names is used in many states (e.g. Darcy 1986; Chen et al. 2014; Krosnick et al. 2004). For example, since 1975, elections in California use a two-step procedure that seriously limits the ballot bonus. First, a "randomized alphabet" is drawn and applied to the order of candidates on the ballot in one district. For the next district, the first letter falls to the last position and so on (Padilla 2018). The procedure doesn't nullify the bonus but dissipates it significantly.

Simplifying voting should reduce the list bonus as well. It is worthy of noting that Finland uses a lottery for ordering candidates (Ministry of Justice 2018). The authors see no other clear way to further reduce the list bonus without violating the parties' rights to compile their lists of candidates.

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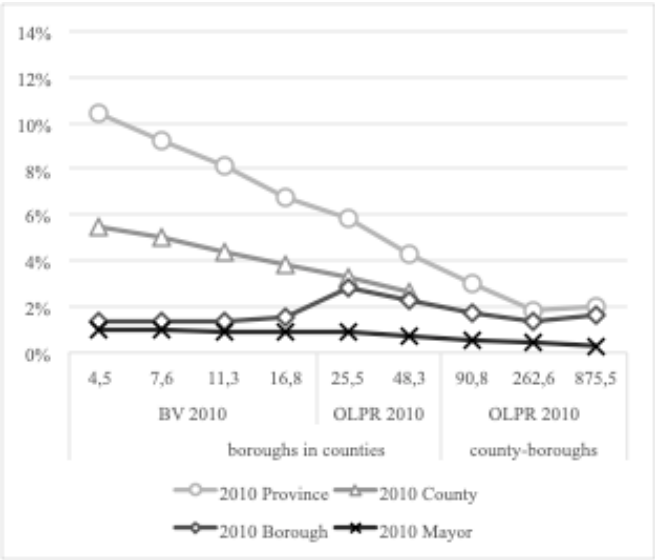
Tables and Figures

Figure 1: Spoilt votes in nine categories of increasingly larger boroughs in the elections in 2010 and 2014

Note: Spoilt votes are shown as percentages of those entitled to vote. The terms under the x-axis correspond to electoral laws that were used in borough council elections in 2010 and 2014 in boroughs of various sizes. All nine subsets include similar numbers of eligible voters (about 3.4 million per subset). County and borough elections for the three last subsets are merged.



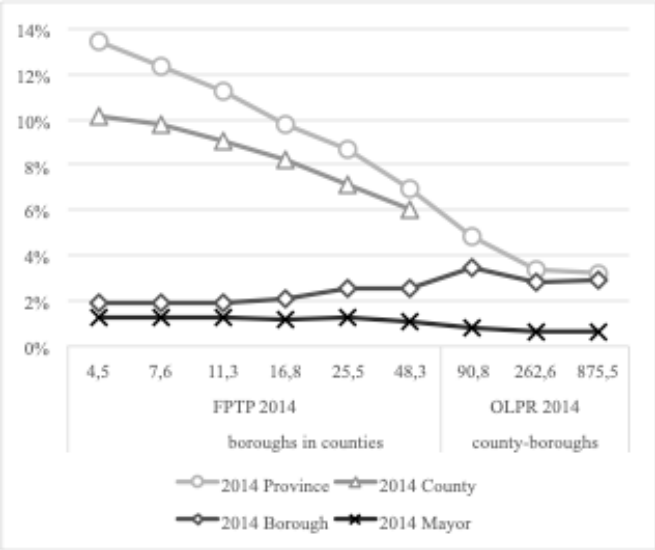


Figure 2: The territorial distribution of the positions of PiS on the ballot

Note: 1. PiS competing as No. 1(without PSL-party)

2. PiS competing as No. 2 or No. 3 (PSL listed as No. 1)

3. PiS is not competing

4. County-boroughs

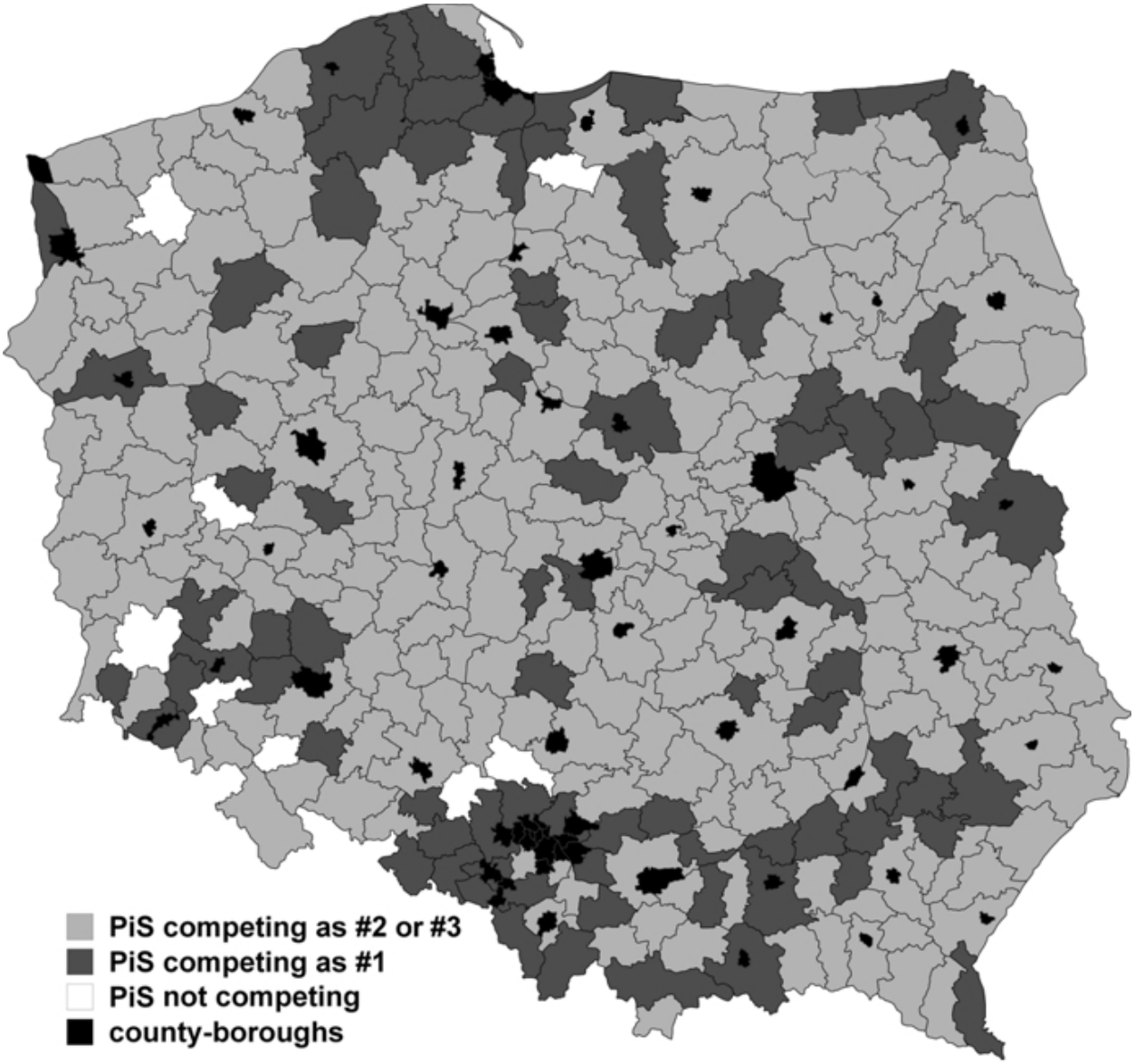


Figure 3 (Model PR2): Votes for PiS in the 2014 elections in counties by votes for PiS in provinces for NO-PSL = 1 and NO-PSL = 0.

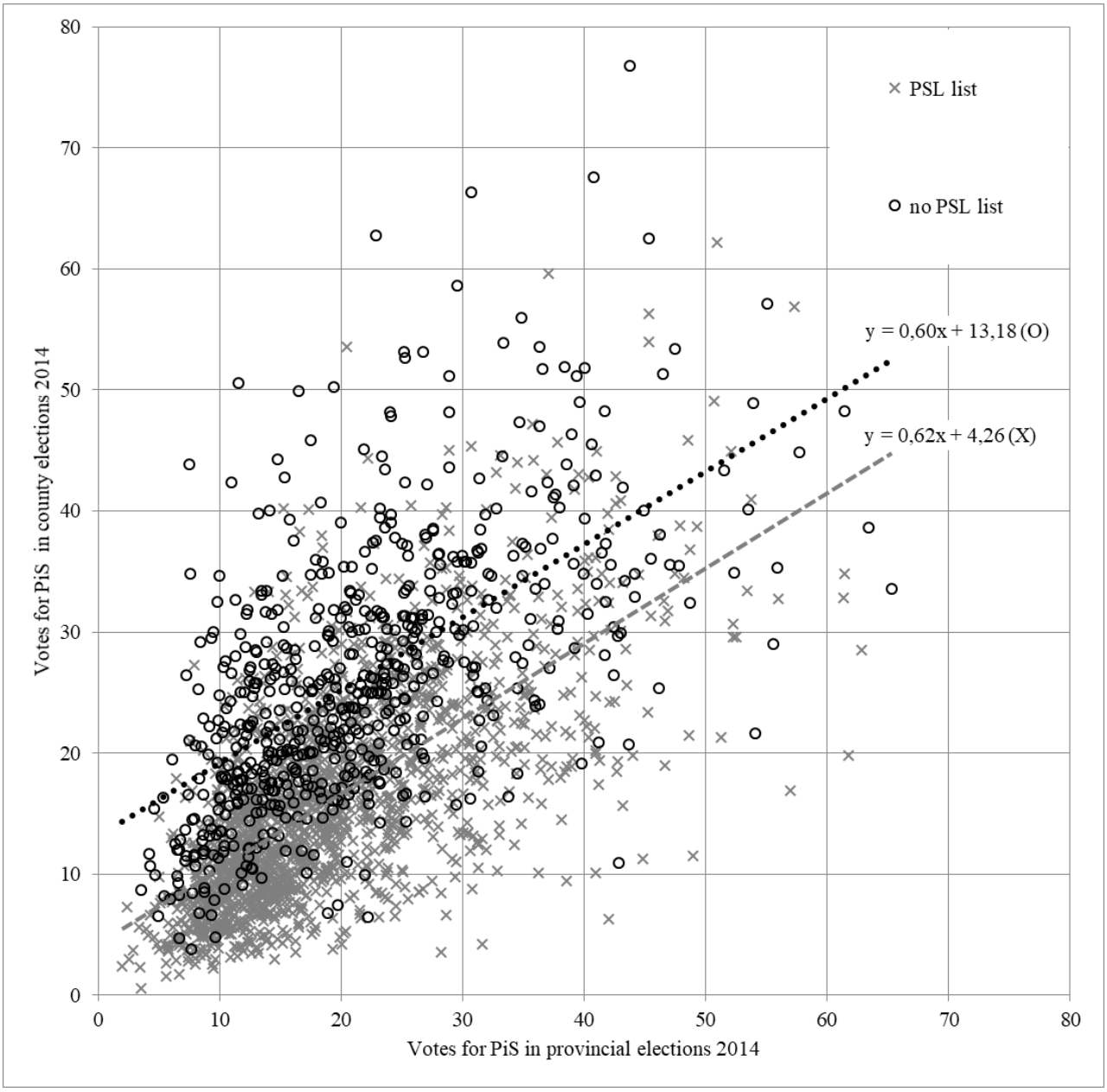


Table 1: The structure of local government and the main parameters of the elections in 2010 and 2014 (on the day of elections, November 11, 2014).

Type of office	Number	Seats (Total)	Dis mag 2010	Electoral law 2010	Electoral law 2014
1. Province council	16	30-51 (555)	5-15	OLPR	OLPR
2. County council	314*	15-29 (6276)	3-10	OLPR	OLPR
3. Borough council (all types)	2,477	15-60 (37842)	1-8	OLPR or BV	OLPR or FPTP
(a) <20,000	2139	15 (32085)	1-5	BV	FPTP
(b) ≥20,000	272	18-24 (4063)	5-8	OLPR	FPTP
(c) county-boroughs	66	18-60 (1694)	5-8	OLPR	OLPR
4. Borough mayor	2477	1 (2477)	1	MR	MR

Note: "Number" = the total number of councils of this type; "Seats" = seat interval for the council's size (in parenthesis: total seats in all councils); "Dis mag" = seat interval for district magnitude in 2010; MR = majority top-two runoff; BV – bloc voting; FPTP – first-past-the-post; OLPR = open-list proportional representation with Jefferson-D'Hondt; "<20,000" = boroughs with population lower than 20,000; "≥20,000" = boroughs with population at least 20,000 excluding county-boroughs; "county-boroughs" – large boroughs that also have the status of county. We will refer to particular elections using their year and "Type of office" characteristics (e.g., 2010.3c = county-boroughs elections of 2010).

* Excluding 66 county-boroughs that were included in the 3c category.

Source: Główny Urząd Statystyczny (2018), Kodeks Wyborczy (2018).

Table 2: Spoilt votes in eight paired elections in 2010 and 2014 using SMD and OLPR

Year	OLPR elections	Spoilt votes S^{OLPR}	SMD elections	Spoilt votes S^{SMD}	S^{OLPR}–S^{SMD}
	1	5.72	4	0.75	4.97
	2	3.22	4	0.75	2.47
2010	3bc	1.95	4bc	0.56	1.39
	1ab	10.40	3ab	2.16	8.24
	2ab	8.40	3ab	2.16	6.24
	1	8.25	4	1.04	7.21
	2	6.68	4	1.04	5.64
2014	3c	3.05	4c	0.70	2.35

Note: Spoilt votes as percentages of those entitled to vote. Election numbers represent elections described in Table 1.

Table 3 (Model MR1): Votes for No. 1 listed candidates and related data by ballot length in elections of mayors in 2014 using MR (percentage).

LENGTH	Number	VOTE	EXPECTED	Δ
2	666	49.06	50.00	–0.94
3	653	32.31	33.33	–1.02
4	439	25.28	25.00	0.28
5	253	20.70	20.00	0.70
6	123	17.11	16.67	0.44
7	53	12.45	14.29	–1.84
8	25	10.52	12.50	–1.98
9	13	7.97	11.10	–3.13
10	2	2.80	10.00	–7.20
11	2	6.24	9.10	–2.86
Total:	n = 2229		BONUS:	–0.51

Note: Own calculations based on official election data from Państwowa Komisja Wyborcza (2019). "Number" is the number of ballots with the corresponding length; VOTE is the mean vote for candidates listed as #1 by different ballot lengths; EXPECTED is the expected percentage of votes for a given ballot length; Δ = VOTE – EXPECTED; BONUS is the estimated bonus for being listed as a #1 candidate across all ballot lengths.

For H_0: BONUS = 0 & H_a: BONUS ≠ 0, t = -1.4385; two-sided p-value = Pr(|T| > |t|) = 0.1504.

Table 4 (Model PR1): Estimates of ballot bonus B for PiS and SLD when there is no PSL-party (percent of all votes cast).

		Province results	NO-PSL		
County results	Constant	$ß_1$	B	$ß_2$	R^2
PiS_14	4.38	0.59 (0.00)	8.52	0.36 (0.00)	0.52
PiS_10	4.31	0.68 (0.00)	-0.20	-0.01 (0.57)	0.44
SLD_14	5.15	0.38 (0.00)	-0.23	-0.01 (0.55)	0.15
SLD_10	7.11	0.39 (0.00)	0.24	0.01 (0.64)	0.15

Source: own calculations based on the official election data from Państwowa Komisja Wyborcza (2019).

Table 5 (Model BV1): Support for candidates for various positions on party lists and related data in elections to borough councils in 2010 using BV (percentage of votes for the list).

Length	Number	#1	#2	#3	#4	#5	Bonus
2	11797	54.0	46.0	-	-	-	8.0
3	5033	37.8	32.2	30.0	-	-	6.7
4	2391	29.5	24.8	23.3	22.4	-	6
5	1295	24.5	20.4	19.0	18.0	18.0	5.7
Total:	n = 20516				Estimated list bonus:		7.3

Note: Own calculations based on official election data from Państwowa Komisja Wyborcza (2019). "Number" is the number of party lists with the corresponding length; #1-#5 is the candidate position on the list; "Bonus" is equal to the difference between the mean vote for the first position and the mean for remaining positions; "Estimated list bonus" is the average "Bonus" weighted by numbers of lists.

For H_0: BONUS = 0 & H_a: BONUS ≠ 0, for means-comparison t-test two-sided p-value = Pr(|T| > |t|) = 0.0000 (for four tests for data from all four list lengths).

Table 6: Percentages of faulty votes in local elections in Poland in 2010 and 2014 by electoral system.

Faulty votes	OL-PR/BV	OL-PR/BV (effective)	SMD (effective)	Δ
Spoilt blank or mistaken	4.69-26.2[s]	1.95-10.40[t]	0.56-2.16[u]	5.34[w]
Ballot positional bonus	8.45[v]	4.00	0[x]	4.00
List positional bonus	7.3[y]	2.93	0[z]	2.93
			Total difference:	12.27

Note: Δ = effective OLPR/BV – effective SMD; [s, t, u]Ranges for eight paired elections; [w]Median for eight paired elections; [v]Mean from Models PR1 and PR2; [x]Model MR1; [y]Model BV1; [z]Effect not present in SMD elections.