Online Appendix for
Measuring Closeness in Proportional Representation Systems
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Contents

A Extension

Here, we illustrate how to adapt the construction of the party margin to account for party alliances (see Subsection 2.4 of the main text). As in the main text, we consider a district with J parties and n seats. The parties form L disjoint alliances A_l indexed by $l \in \mathcal{A} \equiv \{1, 2, ..., L\}$. An alliance is formed by one or more parties. Therefore, an alliance A_l is a subset of the set of parties. The index $k \in \{1, 2, ..., n\}$ denotes the potential seats of an alliance A_l. Similarly, $\tilde{k}$ captures the potential seats of each of the other alliances indexed by $-l \in \mathcal{A}\backslash\{l\}$. We denote the vote total of a party P_j of an alliance A_l by $votes_{j,l}$.

In the first round, seats are allocated to alliances based on their total number of votes, $votes_l = \sum_{P_j \in A_l} votes_{j,l}$. The construction of the first round margin is equivalent to the construction of the party margin in Subsection 2.1.1 of the main text with alliances replacing parties:

$$first\ round\ margin_{k,l} = votes_l - k \left(\frac{votes_{-l}}{\tilde{k}} \right)_{(n(L-1)-(n-k))}.$$

In the second round, all seats won by alliance A_l are allocated to the parties $P_j \in A_l$. This means that we have to calculate the second round margin for all potential seats i and all potential first round results k as long as $i \leq k$. Again, we construct the second round margin analogously to the party margin in Subsection 2.1.1 of the main text but replace a district's number of seats, n, by the number of seats won by the alliance, k, and the overall number of parties, J, by the alliance A_l's number of parties, $card(A_l)$. For seat i of party P_j of alliance A_l that received k seats in the first round, the second round margin is

$$second\ round\ margin_{i,j,k,l} = votes_{j,l} - i \left(\frac{votes_{-j,l}}{\tilde{i}} \right)_{(n(card(A_l)-1)-(k-i))}.$$

We aggregate the *first round margin* and the *second round margin* to get the party margin in a setting with alliances. The *party margin*$_{ij}$ for a seat i of party P_j

in alliance A_l is defined as:

$$\textit{party margin}_{i,j} = \max_{i \in \{1,\ldots,n\}} \{\min\{\textit{first round margin}_{k,l}, \textit{second round margin}_{i,j,k,l}\}\}.$$

Let us introduce alliances in our example and assume that party P_1 forms the singleton alliance A_1 and parties P_2 and P_3 form another alliance A_2. In the first round, the three D'Hondt ratios for A_1 are 45, 22.5, and 15.0 and for A_2 55, 27.5, and 18.3. Thus, alliance A_1, and therefore party P_1, gains one seat, and alliance A_2 receives two seats. In the second round, the two seats of alliance A_2 are distributed to parties according to their party-specific D'Hondt ratios of 35, 17.5, and 11.7 for party P_2 and 20, 10, and 6.7 for party P_3. Thus, parties P_2 and P_3 each obtain one seat.

As before, we construct the party margin for party P_2. We begin with the first round margin and the first seat, $k = 1$, of alliance A_2. If alliance A_2 lost 40 votes, its highest D'Hondt ratio would be equal to the third highest of alliance A_1 and it would still win exactly one seat. Thus, the first round margin for $k = 1$ of alliance A_2 is 40. Equivalently, the first round margin of alliance A_2 is 10 for $k = 2$ and -80 for $k = 3$.

For the second round margin, we have to consider six $(4 \times 3/2)$ different cases for party P_2 with $i \leq k$. If the alliance won only one seat, the party could lose 15 votes to secure this seat against party P_3. Thus, the second round margin is 15 for $i = 1$ and $k = 1$. If the alliance won two seats, the party would have a chance to get one seat if it lost 25 votes and its highest D'Hondt ratio was equal to the second highest D'Hondt ratio of its ally. This implies a second round vote margin of 25 for $i = 1$ and $k = 2$. The remaining four cases are -5 for $i = 2$ and $k = 2$, 28.3 for $i = 1$ and $k = 3$, 15 for $i = 2$ and $k = 3$, and -25 for $i = 3$ and $k = 3$. The following table summarizes the vote margins from the two rounds.

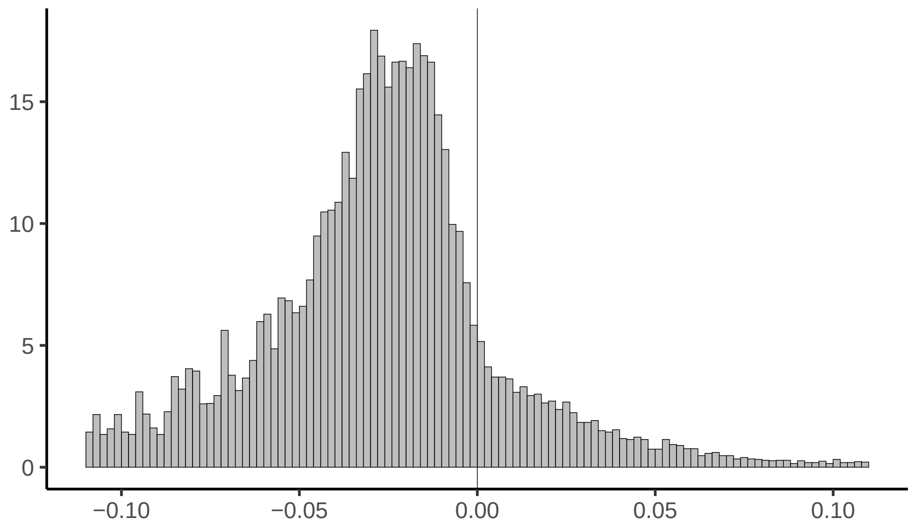
Table A.1: Party vote margins for party P_2

		Margins	
i	k	First round	Second round
1	1	40.0	15.0
1	2	10.0	25.0
1	3	−80.0	28.3
2	2	10.0	−5.0
2	3	−80.0	15.0
3	3	−80.0	−25.0

We aggregate these margins to get the party margin in a setting with alliances. We start with the aggregation for the first seat, $i = 1$, of party P_2. The first three rows in Table A.1 depict cases for which party P_2 receives one seat. In the first step, we determine whether the first or the second round margin is binding by taking the minimum for each row. For example, the alliance A_2 could lose 40 votes and would still get one seat ($k = 1$), but party P_2 could only lose 15 votes to win this seat ($i = 1$). Thus, the binding margin is 15 votes. The binding margins for $i = 1$ and $k = 2$ is 10 and for $i = 1$ and $k = 3$ is -80. The maximum of these binding margins is the one for $i = 1$ and $k = 1$ of 15. This implies that party P_2 could lose up to 15 votes and therefore, the party margin for the first seat, $i = 1$, of party P_2 is 15. Similarly, the party margin is -5 for $i = 2$ and -80 for $i = 3$.

B Additional tables and figures

Figure B.1: Distribution of the assignment variable for Switzerland



Note: This figure depicts the density (y-axis) in equally-sized bins of width 0.002 (0.2 percentage points) of the assignment variable (x-axis) for around three times the optimal bandwidth based on the standard settings with first-order polynomial and a triangular kernel.

Table B.1: Results and balance tests for Switzerland

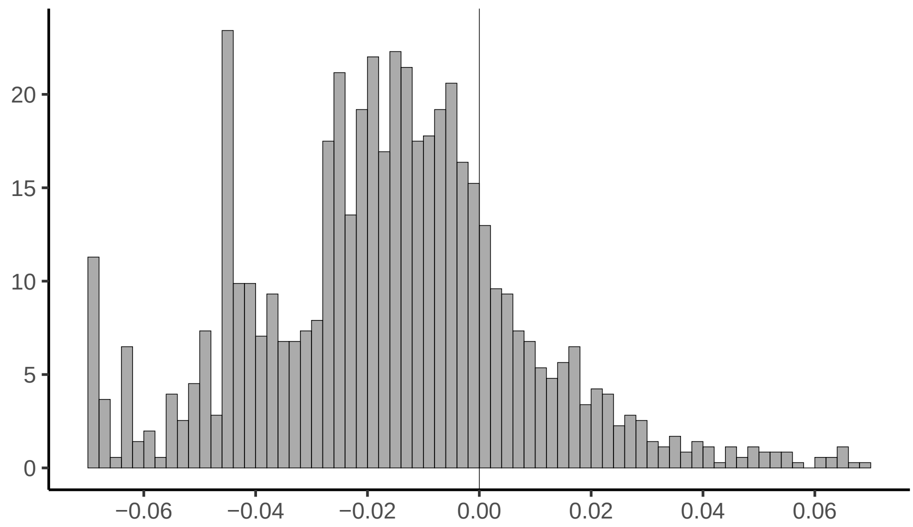
	(1)	(2)	(3)	(4)
Panel (A): Main results				
Elected in t+1	0.357	0.287	0.364	0.289
	(0.029)	(0.040)	(0.027)	(0.038)
Panel (B): Covariate balance				
Vote margin in t-1	0.000	-0.005	-0.002	-0.002
	(0.005)	(0.008)	(0.005)	(0.007)
Age	1.310	1.505	1.143	1.650
	(0.637)	(0.882)	(0.609)	(0.829)
Sex	-0.034	-0.011	-0.035	-0.021
	(0.021)	(0.030)	(0.021)	(0.028)
Year	4.071	-1.158	4.980	-0.582
	(1.722)	(2.367)	(1.663)	(2.215)
Number of seats in canton	-0.483	0.692	-0.124	0.873
	(0.766)	(1.018)	(0.742)	(0.964)
Aargau	0.015	0.006	0.008	0.016
	(0.016)	(0.021)	(0.015)	(0.020)
Appenzell Innerrhoden	0.000	0.000	0.000	0.000
	-	-	-	-
Appenzell Ausserrhoden	0.000	0.001	0.001	-0.000
	(0.003)	(0.005)	(0.003)	(0.005)
Bern	-0.040	-0.005	-0.056	0.002
	(0.029)	(0.039)	(0.029)	(0.037)
Basel Landschaft	0.000	0.004	0.000	-0.001
	(0.008)	(0.011)	(0.007)	(0.010)
Basel Stadt	0.007	-0.000	0.002	0.006
	(0.011)	(0.016)	(0.010)	(0.015)

Fribourg	0.000	-0.008	-0.001	-0.009
	(0.008)	(0.010)	(0.008)	(0.010)
Geneva	-0.002	-0.001	-0.004	0.005
	(0.019)	(0.026)	(0.018)	(0.024)
Glarus	0.000	0.000	-0.000	0.000
	(0.000)	-	(0.001)	(0.000)
Graubünden	0.001	-0.002	0.005	-0.005
	(0.004)	(0.004)	(0.005)	(0.005)
Jura	0.001	-0.000	0.002	-0.000
	(0.004)	(0.007)	(0.004)	(0.006)
Lucerne	-0.001	0.004	-0.002	0.004
	(0.011)	(0.013)	(0.011)	(0.013)
Neuchâtel	-0.001	-0.002	0.002	-0.002
	(0.006)	(0.006)	(0.006)	(0.007)
Nidwalden	0.000	0.000	-0.000	0.000
	-	-	(0.000)	-
Obwalden	0.001	0.000	0.001	0.000
	(0.002)	(0.002)	(0.002)	(0.002)
St. Gallen	0.001	-0.009	-0.002	-0.015
	(0.015)	(0.021)	(0.014)	(0.020)
Schaffhausen	0.002	0.002	0.002	0.001
	(0.003)	(0.003)	(0.003)	(0.003)
Solothurn	0.001	-0.007	0.001	-0.006
	(0.011)	(0.016)	(0.011)	(0.014)
Schwyz	0.001	0.002	0.001	0.000
	(0.005)	(0.008)	(0.005)	(0.007)
Thurgau	0.002	0.000	0.004	-0.001
	(0.006)	(0.010)	(0.007)	(0.009)
Ticino	0.016	0.016	0.010	0.021
	(0.012)	(0.017)	(0.011)	(0.015)

Uri	-0.000	0.000	-0.000	0.000
	(0.000)	-	(0.001)	(0.001)
Vaud	-0.033	-0.043	-0.036	-0.064
	(0.029)	(0.038)	(0.028)	(0.036)
Valais	0.008	0.001	0.005	0.004
	(0.010)	(0.015)	(0.010)	(0.014)
Zug	0.002	-0.000	0.002	0.000
	(0.004)	(0.006)	(0.004)	(0.005)
Zurich	0.019	0.044	0.056	0.045
	(0.030)	(0.040)	(0.029)	(0.038)
Social democrats (SP)	-0.011	-0.001	-0.023	0.001
	(0.039)	(0.054)	(0.038)	(0.050)
Christian democrats (CVP)	0.035	0.052	0.014	0.049
	(0.035)	(0.050)	(0.033)	(0.046)
Liberals (FDP)	0.018	0.012	0.041	-0.014
	(0.039)	(0.053)	(0.037)	(0.049)
National convervatives (SVP)	-0.010	0.003	-0.036	-0.012
	(0.040)	(0.051)	(0.038)	(0.049)
Panel (C): Covariate rejection rates				
5% level	5.7%	0%	5.7%	2.9%
10% level	5.7%	2.9%	14.3%	5.7%
Bandwidth	0.036	0.018	0.073	0.036
Left obs	12,947	5,717	19,158	12,970
Right obs	2,649	1,651	3,436	2,651

Note: The table reports estimates for the election probability in $t+1$, the assignment variable in $t-1$, and for several candidate characteristics in t, whereby t indexes elections. The estimates for the parties relate to the four parties represented in the Federal Council; we combine the national conservatives (SVP) with its recent splinter party (BDP). We present bias-corrected and robust point estimates and standard errors (Calonico, Cattaneo, and Titiunik 2014a; b). Standard errors account for candidate-level clustering (Calonico et al. 2017). For some small cantons and the narrow bandwidths, it is not feasible to calculate standard errors; we denote these cases with "-". We use separate linear models on each side of the threshold in columns (1) and (2) and quadratic models in columns (3) and (4). For the regressions, we use a triangular kernel. In each column, we use the same bandwidth for all variables. In columns (1) and (3), we employ the optimal bandwidth for the election probability in $t+1$ (Calonico et al. 2017) in columns (2) and (4), we use half this bandwidth. We use identical bandwidths for the point estimate and the bias correction. The two bottom rows refer to the observations within the bandwidth; these numbers are lower for the lagged assignment variable and the four party variables. The lagged assignment variable is missing for a candidate's first year in the data and we lack harmonized party information before 1971.

Figure B.2: Distribution of the assignment variable for Honduras



Note: This figures depicts the density (y-axis) in equally-sized bins of width 0.002 (0.2 percentage points) of the assignment variable (x-axis) for around three times the optimal bandwidth based on the standard settings with first-order polynomial and a triangular kernel.

Table B.2: Results and balance tests for Honduras

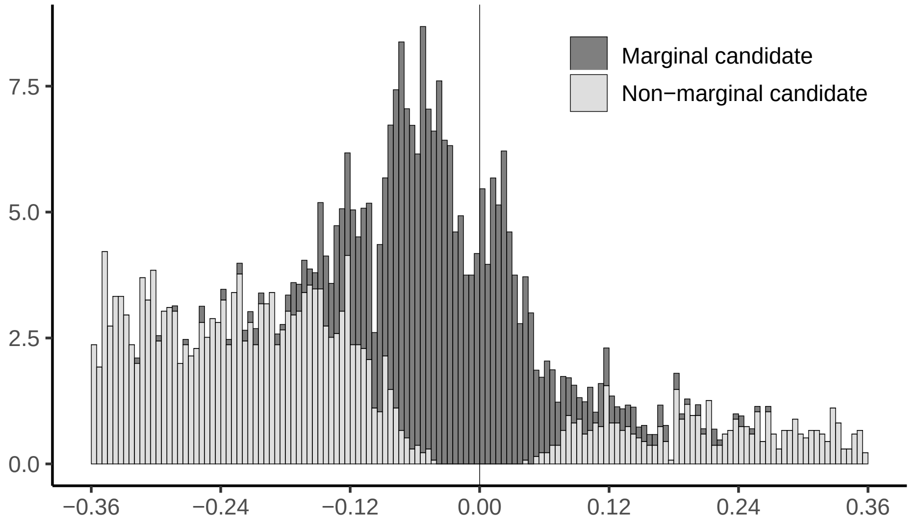
	(1)	(2)	(3)	(4)
Panel (A): Main results				
Elected in t+1	-0.018	0.008	-0.020	0.023
	(0.079)	(0.110)	(0.082)	(0.111)
Panel (B): Covariate balance				
Vote margin in t-1	0.008	0.015	0.008	0.016
	(0.013)	(0.015)	(0.014)	(0.015)
Sex	-0.093	-0.182	-0.124	-0.176
	(0.115)	(0.155)	(0.118)	(0.157)
Year	-0.109	0.080	-0.056	0.086
	(0.505)	(0.671)	(0.519)	(0.675)
Number of seats in department	0.960	1.172	0.637	1.315
	(1.919)	(2.658)	(1.963)	(2.669)
Atlántida	0.038	-0.018	0.066	-0.043
	(0.062)	(0.048)	(0.064)	(0.051)
Choluteca	-0.036	0.008	-0.047	0.015
	(0.017)	(0.014)	(0.020)	(0.021)
Colón	0.002	-0.014	0.001	-0.008
	(0.034)	(0.034)	(0.035)	(0.037)
Comayagua	0.020	-0.032	0.022	-0.030
	(0.032)	(0.019)	(0.033)	(0.024)
Copán	-0.009	-0.007	-0.014	-0.010
	(0.026)	(0.015)	(0.027)	(0.018)
Cortés	0.015	-0.032	0.003	-0.008
	(0.113)	(0.160)	(0.115)	(0.159)
El Paraíso	0.017	-0.005	0.041	0.005
	(0.050)	(0.083)	(0.051)	(0.082)

Francisco Morazán	0.068	0.093	0.065	0.084
	(0.108)	(0.153)	(0.111)	(0.153)
Gracias a Dios	0.000	0.000	0.001	0.000
	-	-	(0.005)	-
Intibucá	0.002	-0.008	0.004	-0.011
	(0.028)	(0.021)	(0.029)	(0.022)
Islas de la Bahía	0.000	0.000	0.000	0.000
	-	-	-	-
La Paz	-0.002	0.003	-0.003	0.005
	(0.057)	(0.080)	(0.058)	(0.079)
Lempira	0.006	-0.006	0.022	-0.015
	(0.024)	(0.012)	(0.025)	(0.017)
Ocotepeque	0.008	0.004	0.007	0.006
	(0.048)	(0.079)	(0.049)	(0.078)
Olancho	-0.015	-0.018	-0.012	-0.014
	(0.015)	(0.021)	(0.019)	(0.027)
Santa Bárbara	-0.036	-0.002	-0.044	0.004
	(0.056)	(0.060)	(0.058)	(0.062)
Valle	-0.004	0.002	-0.007	0.002
	(0.009)	(0.004)	(0.011)	(0.006)
Yoro	-0.077	0.032	-0.105	0.018
	(0.101)	(0.139)	(0.104)	(0.139)
National conservatives (PN)	0.008	-0.051	0.011	-0.015
	(0.110)	(0.158)	(0.113)	(0.158)
Social liberals (PL)	0.046	-0.087	0.054	-0.100
	(0.109)	(0.145)	(0.112)	(0.146)
Social democrats (Libre)	-0.008	0.039	-0.001	0.019
	(0.111)	(0.140)	(0.113)	(0.141)

Panel (C): Covariate rejection rates				
5%	4%	0%	4%	0%
10%	4%	4%	4%	0%
Bandwidth	0.020	0.010	0.035	0.017
Left obs	454	181	614	379
Right obs	160	104	209	148

Note: The table reports estimates for the election probability in $t + 1$, the assignment variable in $t - 1$, and for several candidate characteristics in t, whereby t indexes elections. In contrast to the Swiss case, we do not have information on the candidates' age. The estimates for parties focus on the three largest parties. We present bias-corrected and robust point estimates and standard errors (Calonico, Cattaneo, and Titiunik 2014a; b). Standard errors account for candidate-level clustering (Calonico et al. 2017). For some small departments, it is not feasible to calculate standard errors; we denote these cases with "-". We use separate linear models on each side of the threshold in columns (1) and (2) and quadratic models in columns (3) and (4). For the regressions, we use a triangular kernel. In each column, we use the same bandwidth for all variables. In columns (1) and (3), we employ the optimal bandwidth for the election probability in $t+1$ (Calonico et al. 2017) in columns (2) and (4), we use half this bandwidth. We use identical bandwidths for the point estimate and the bias correction. The two bottom rows refer to the observations within the bandwidth; these numbers are lower for the lagged assignment variable.

Figure B.3: Distribution of the assignment variable for Norway



Note: This figure depicts the density (y-axis) in equally-sized bins of width 0.005 (0.5 percentage point) of the assignment variable (x-axis) for around three times the optimal bandwidth based on the standard settings with first-order polynomial and a triangular kernel. The dark-shaded part represents the marginal candidates, the light-shaded part non-marginal candidates.

References

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