Coalition Tactics: Bribery and Control in Parliamentary Elections

Extended Abstract

Hodaya Barr
Bar-Ilan University
Ramat Gan, Israel
odayaben@gmail.com

Eden Hartman
Bar-Ilan University
Ramat Gan, Israel
eden.r.hartman@gmail.com

Yonatan Aumann
Bar-Ilan University
Ramat Gan, Israel
aumann@cs.biu.ac.il

Sarit Kraus
Bar-Ilan University
Ramat Gan, Israel
sarit@cs.biu.ac.il

ABSTRACT

Strategic manipulation of elections is typically studied in the context of promoting individual candidates. In parliamentary elections, however, the focus shifts: voters may care more about the overall governing coalition than the individual parties' seat counts. This paper studies this new problem: manipulating parliamentary elections to promote the collective seat count of a coalition of parties. We focus on proportional representation elections, and consider two variants of the problem; one in which the sole goal is to maximize the total number of seats held by the desired coalition, and the other with a dual objective of promoting both the coalition and the relative power of some favorite party within the coalition.

We examine two types of strategic manipulations: *bribery*, which allows modifying voters' preferences, and *control*, which allows changing the sets of voters and parties. We consider multiple bribery types, presenting polynomial-time algorithms for some, while proving NP-hardness for others. For control, we provide polynomial-time algorithms for control by adding and deleting voters. In contrast, control by adding and deleting parties, we show, is either impossible (i.e., the problem is immune to control) or computationally hard, in particular, W[1]-hard when parameterized by the number of parties that can be added or deleted.

Extended Version: https://arxiv.org/abs/2601.07279

KEYWORDS

Voting; Control; Bribery; Parliamentary Elections

ACM Reference Format:
Hodaya Barr, Eden Hartman, Yonatan Aumann, and Sarit Kraus. 2026. Coalition Tactics: Bribery and Control in Parliamentary Elections: Extended Abstract. In *Proc. of the 25th International Conference on Autonomous Agents and Multiagent Systems (AAMAS 2026), Paphos, Cyprus, May 25 – 29, 2026*, IFAAMAS, 3 pages. https://doi.org/10.65109/GUXI9713

1 INTRODUCTION

Strategic election manipulation by way of bribery and control has been widely studied (see, e.g. [1–22]). This large body of literature focuses on single-winner elections, e.g. presidential elections and elections for individual seats in Congress. In practice, however, many countries around the globe operate under parliamentary systems employing *proportional representation* (of one form or another). In such systems, multiple parties are elected and operate together in the parliament. Moreover, in many, if not most cases, no single party has sufficient power to govern on its own, and the parliament's operation rests on *coalitions* of parties. Any attempt to manipulate multi-party parliamentary elections must take into account such party and coalition dynamics. Indeed, promoting a specific party may be of little significance if it ends up outside the ruling coalition.

As such, existing models of bribery and control are inadequate for parliamentary elections, as they ignore the rich dynamics of parliamentary politics. It is rather interesting that while parliamentary systems are prevalent around the globe, the extensive literature on bribery and control has mostly ignored these systems. This paper takes the first steps toward filling this gap.

Contributions. In this paper, we introduce and study strategic manipulations for promoting *coalitions of parties* in parliamentary elections, focusing on *bribery* — which allows modifying voters' preferences — and *control* — which allows changing the sets of voters and parties. Our first contribution is a formal definition of the model and problems, introducing two variants of the problem. In the first variant, the manipulator's sole goal is to promote an entire coalition of parties. In the second variant, we acknowledge that the manipulator may also be interested in promoting a specific party, and thus define a dual-objective problem — both promoting an entire coalition and promoting a specific preferred party therein. Throughout, we focus on proportional representation elections, wherein each voter casts a single vote for one party.

Having defined the problem(s), we study the complexity of bribery and control in various settings, providing both algorithmic solutions and hardness results. Table 1 summarizes our results.

For bribery, we show that the complexity depends on the cost structure of the bribery. For the 1 and $ cost structures [7] the problem is polynomial-time solvable. For the Swap and Shift cost structures [5] the problem remains polynomial-time solvable if there is no electoral threshold, but becomes NP-hard when such a threshold is introduced.

For control, we consider both voter control (adding or deleting voters) and party control (adding or deleting parties). Voter control, we show, is polynomial-time solvable. For party control, we

Proc. of the 25th International Conference on Autonomous Agents and Multiagent Systems (AAMAS 2026), C. Amato, L. Dennis, V. Mascardi, J. Thangarajah (eds.), May 25 – 29, 2026, Paphos, Cyprus. © 2026 International Foundation for Autonomous Agents and Multiagent Systems (www.ifaamas.org). https://doi.org/10.65109/GUXI9713

show that a few variants are immune to manipulation (i.e., no such manipulation can advance the manipulator's goals) and all other variants are provably hard. That being the case, we also consider the parametrized complexity of the problem, where the parameter is the number of parties to add or delete. We show that even under parametrized analysis, the hard variants remain hard, either W[1]-hard or W[2]-hard.

Type			J Objective	J+F Objective
Bribery	1		P (Thm. 3.1*)	P (Thm. 3.1*)
	$		P (Thm. 3.1*)	P (Thm. 3.1)
	Swap	$\tau = 0$	P (Thm. 3.2*)	P (Thm. 3.2)
		$\tau > 0$	NP-hard (Thm. 3.4)	NP-hard (Thm. 3.4*)
	Coalition Shift	$\tau = 0$	P (Thm. 3.2*)	P (Thm. 3.2)
		$\tau > 0$	NP-hard (Thm. 3.3)	NP-hard (Thm. 3.3*)
Voter Control (Deleting & Adding)			P (Thm. 4.1)	P (Thm. 4.1)
Party Control	DCP	$\tau = 0$	Immune (Thm. 5.1)	W[1]-hard (Thm. 5.2)
		$\tau > 0$	W[1]-hard (Thm. 5.3)	W[1]-hard (Thm. 5.3*)
	DOP		W[1]-hard (Thm. 5.4)	W[1]-hard (Thm. 5.4*)
	ACP		W[2]-hard (Thm. 5.5)	W[2]-hard (Thm. 5.5*)
	AOP	$\tau = 0$	Immune (Thm. 5.6)	W[2]-hard (Thm. 5.8)
		$\tau > 0$	W[2]-hard (Thm. 5.7)	W[2]-hard (Thm. 5.7*)

Table 1: Summary of complexity results. In parentheses — the corresponding theorem. An astrict denotes that the result *follows* directly from the theorem.

2 MODEL

A parliamentary election is a triplet $E := (P, V, \succ)$, where $P := \{p_1, \ldots, p_m\}$ is the set of *parties*, $V := \{v_1, \ldots, v_n\}$ is the set of *voters*, and $\succ := (\succ_{v_1}, \ldots, \succ_{v_n})$ are the voters' strict *preference orders* over P. We denote by $\text{Pos}^E(v_i, p)$ the position of party p according to $\succ_{v_i}$, and by $Top^E(v_i)$ the most preferred party according to $\succ_{v_i}$.

Each voter contributes a single vote allotted to voter's most-preferred party participating in the election E. The total number of votes allotted to party p is denoted by $N^E(p)$. The fraction of votes received by party p out of the total number of votes is denoted by $\text{frac}^E(p) := N^E(p)/n$.

Electoral-threshold. To avoid a parliament with small parties, many electoral systems impose a threshold τ, called the *electoral-threshold*, such that only parties with $\text{frac}_p \geq \tau$, get to be represented in parliament. These parties are called *active parties*, and the set thereof is P_A. Votes to active parties are *active votes*.

Lastly, the *fraction of active votes* obtained by party p is:

$$\text{frac}^E_\tau(p) := \begin{cases} \dfrac{N^E(p)}{\sum_{p' \in P_A} N^E(p')} & \text{if } p \in P_A \\ 0 & \text{otherwise} \end{cases}$$

The function $\text{frac}^E_\tau(\cdot)$ is naturally extended to sets, $\text{frac}^E_\tau(A) = \sum_{p \in A} \text{frac}^E_\tau(p)$.

2.1 Manipulation

An external manipulator may modify the original election E into another election $\hat{E} := (\hat{P}, \hat{V}, \hat{\succ})$, where the possible modifications will be detailed in the respective chapters. This manipulator is referred to as the *briber* in the context of bribery, and as the *chair* in the context of control.

We assume there is a set C of parties (actually running in E or not), which we call the *coalition*. The manipulator aims to increase the fraction of active votes of the coalition, and possibly also those of some *favored party* therein. Specifically, the manipulator aims to construct a modified election instance $\hat{E} = (\hat{P}, \hat{V}, \hat{\succ})$ satisfying one or both of the following objectives:

Definition 1 (Joint Objective). *Given* coalition target-fraction $\varphi \in (0, 1]$*, the objective is that the fraction of active votes received by the coalition parties is at least* φ*:*

$$\text{frac}^{\hat{E}}_\tau(C) \geq \varphi \qquad \text{(OBJ-J)}$$

Definition 2 (Favored-Party Objective). *For a* favored-party, $p_1 \in C$*, and a* target-favored-party-ratio $\rho \in [0, 1]$*, the objective is that the fraction of active votes received by* p_1*, relative to the votes of the coalition, is at least* ρ*:*

$$\text{frac}^{\hat{E}}_\tau(p_1) \geq \rho \cdot \text{frac}^{\hat{E}}_\tau(C) \qquad \text{(OBJ-F)}$$

We separately consider two settings: where the manipulator aims to satisfy both objectives, a setting we denote by **J+F**, and the setting where the manipulator aims to satisfy only the Joint objective, a case we denote by **J**. Clearly, **J** is a special case of **J+F** (by setting $\rho = 0$). Thus, any hardness result for the former applies also for the latter, and any polynomial-time algorithm for the latter applies to the former as well.

3 FUTURE WORK

We introduced and studied bribery and control in parliamentary elections, when the goal is to promote an entire coalition of parties. This work lays the foundation for a wide range of open questions.

Manipulation Types. Broadening the scope of strategic manipulations in parliamentary elections is especially compelling — particularly the study of practices observed in real-world settings, such as control via party splits and mergers, modification of the electoral threshold, and destructive manipulations.

Coalition Dynamics. In practice, political dynamics are richer and more complex than assumed in this paper. It would also be interesting to extend our approach to settings where the manipulator's goal accounts for these dynamics — e.g., promoting one of several coalitions or ensuring the preferred party is part of *some* winning coalition — is an interesting direction for future work.

Multiple Manipulators. An interesting direction is to consider settings with *several* manipulators, each with its own distinct objective. In this case, *strategic* considerations come into play, motivating the study of the resulting dynamics and their equilibrium.

ACKNOWLEDGMENTS

This research is partly supported by the Israel Science Foundation grants 2544/24, 3007/24 and 2697/22.

REFERENCES

[1] John J Bartholdi III, Craig A Tovey, and Michael A Trick. 1992. How hard is it to control an election? *Mathematical and Computer Modelling* 16, 8-9 (1992), 27–40.

[2] Nadja Betzler and Johannes Uhlmann. 2009. Parameterized complexity of candidate control in elections and related digraph problems. *Theoretical Computer Science* 410, 52 (2009), 5425–5442.

[3] Eric Brelsford, Piotr Faliszewski, Edith Hemaspaandra, Henning Schnoor, and Ilka Schnoor. 2008. Approximability of Manipulating Elections. In *Proceedings of the Twenty-Third AAAI Conference on Artificial Intelligence, AAAI 2008, Chicago, Illinois, USA, July 13-17, 2008*, Dieter Fox and Carla P. Gomes (Eds.). AAAI Press, 44–49. http://www.aaai.org/Library/AAAI/2008/aaai08-007.php

[4] Edith Elkind, Piotr Faliszewski, Sushmita Gupta, and Sanjukta Roy. 2020. Algorithms for Swap and Shift Bribery in Structured Elections. In *Proceedings of the 19th International Conference on Autonomous Agents and MultiAgent Systems* (Auckland, New Zealand) *(AAMAS '20)*. International Foundation for Autonomous Agents and Multiagent Systems, Richland, SC, 366–374.

[5] Edith Elkind, Piotr Faliszewski, and Arkadii Slinko. 2009. Swap bribery. In *Algorithmic Game Theory: Second International Symposium, SAGT 2009, Paphos, Cyprus, October 18-20, 2009. Proceedings 2*. Springer, 299–310.

[6] Piotr Faliszewski. 2008. Nonuniform bribery. In *7th International Joint Conference on Autonomous Agents and Multiagent Systems (AAMAS 2008), Estoril, Portugal, May 12-16, 2008, Volume 3*, Lin Padgham, David C. Parkes, Jörg P. Müller, and Simon Parsons (Eds.). IFAAMAS, 1569–1572. https://dl.acm.org/citation.cfm?id=1402927

[7] Piotr Faliszewski, Edith Hemaspaandra, and Lane A. Hemaspaandra. 2006. The complexity of bribery in elections. In *Proceedings of the 21st National Conference on Artificial Intelligence - Volume 1* (Boston, Massachusetts) *(AAAI'06)*. AAAI Press, 641–646.

[8] Piotr Faliszewski, Edith Hemaspaandra, and Lane A Hemaspaandra. 2009. How hard is bribery in elections? *Journal of artificial intelligence research* 35 (2009), 485–532.

[9] Piotr Faliszewski, Yannick Reisch, Jörg Rothe, and Lena Schend. 2015. Complexity of manipulation, bribery, and campaign management in Bucklin and fallback voting. *Autonomous Agents and Multi-Agent Systems* 29 (2015), 1091–1124.

[10] Piotr Faliszewski and Jörg Rothe. 2016. Control and Bribery in Voting. In *Handbook of Computational Social Choice*, Felix Brandt, Vincent Conitzer, Ulle Endriss, Jérôme Lang, and Ariel D. Procaccia (Eds.). Cambridge University Press, 146–168. https://doi.org/10.1017/CBO9781107446984.008

[11] Orgad Keller, Avinatan Hassidim, and Noam Hazon. 2018. Approximating Bribery in Scoring Rules. In *Proceedings of the Thirty-Second AAAI Conference on Artificial Intelligence, (AAAI-18), the 30th innovative Applications of Artificial Intelligence (IAAI-18), and the 8th AAAI Symposium on Educational Advances in Artificial Intelligence (EAAI-18), New Orleans, Louisiana, USA, February 2-7, 2018*, Sheila A. McIlraith and Kilian Q. Weinberger (Eds.). AAAI Press, 1121–1129. https://doi.org/10.1609/AAAI.V32I1.11476

[12] Hong Liu, Haodi Feng, Daming Zhu, and Junfeng Luan. 2009. Parameterized computational complexity of control problems in voting systems. *Theoretical Computer Science* 410, 27-29 (2009), 2746–2753.

[13] Cynthia Maushagen, Marc Neveling, Jörg Rothe, and Ann-Kathrin Selker. 2022. Complexity of shift bribery for iterative voting rules. *Annals of Mathematics and Artificial Intelligence* 90, 10 (2022), 1017–1054.

[14] Cynthia Maushagen and Jörg Rothe. 2020. The last voting rule is home: Complexity of control by partition of candidates or voters in maximin elections. In *ECAI 2020*. IOS Press, 163–170.

[15] Curtis Glen Menton and Preetjot Singh. 2013. Control complexity of Schulze voting. In *Twenty-Third International Joint Conference on Artificial Intelligence*.

[16] David Parkes and Lirong Xia. 2012. A complexity-of-strategic-behavior comparison between Schulze's rule and ranked pairs. In *Proceedings of the AAAI Conference on Artificial Intelligence*, Vol. 26. 1429–1435.

[17] Ariel D Procaccia, Jeffrey S Rosenschein, and Aviv Zohar. 2007. Multi-Winner Elections: Complexity of Manipulation, Control and Winner-Determination. In *IJCAI*, Vol. 7. 1476–1481.

[18] Tomasz Put and Piotr Faliszewski. 2016. The Complexity of Voter Control and Shift Bribery Under Parliament Choosing Rules. *Trans. Comput. Collect. Intell.* 23 (2016), 29–50. https://doi.org/10.1007/978-3-662-52886-0_3

[19] Sigal Sina, Noam Hazon, Avinatan Hassidim, and Sarit Kraus. 2015. Adapting the social network to affect elections. In *Proceedings of the 2015 international conference on autonomous agents and multiagent systems*. Citeseer, 705–713.

[20] Liangde Tao, Lin Chen, Lei Xu, Weidong Shi, Ahmed Sunny, and Md Mahabub Uz Zaman. 2022. How Hard is Bribery in Elections with Randomly Selected Voters. In *Proceedings of the 21st International Conference on Autonomous Agents and Multiagent Systems*.

[21] Yongjie Yang. 2019. Complexity of Manipulating and Controlling Approval-Based Multiwinner Voting. In *Proceedings of the Twenty-Eighth International Joint Conference on Artificial Intelligence, IJCAI-19*. International Joint Conferences on Artificial Intelligence Organization, 637–643. https://doi.org/10.24963/ijcai.2019/90

[22] Aizhong Zhou and Jiong Guo. 2020. Parameterized complexity of shift bribery in iterative elections. In *Proceedings of the 19th International Conference on Autonomous Agents and Multiagent Systems*. 1665–1673.