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Abstract

We tackle the long-standing question of the role of pivotality in voter turnout decisions by testing for the first time whether the occurrence of an election ending in a tie or being decided by a single vote generates information spillovers onto nearby localities' subsequent elections. First, we develop a model of costly instrumental voting in sequential elections, where voters update their beliefs regarding the probability of their vote being decisive upon observing earlier elections' outcomes. Next, by exploiting Italian mayoral elections ending in ties or close outcomes during the past two decades and the quasi-experimental conditions created by the staggered electoral calendar, we find a substantial impact on voter turnout rates of exposure to spillovers from those bizarre electoral outcomes.

JEL classification: D72; H71

Key words: tied elections; voter turnout; information spillover.

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1 Introduction

Whether the chances of casting the decisive ballot in an election play a role in the individual decision to turn out to vote has been a matter of academic research for decades (Riker and Ordeshook, 1968), with some recent contributions raising doubts about the importance of pivotality in electoral participation decisions and challenging the hypothesis of the dependence of turnout rates on beliefs about closeness of elections (Coate et al., 2008; Funk, 2010; Enos and Fowler, 2014; Moskowitz and Schneer, 2019; Gerber et al., 2020). In addition, attempts at ascertaining the role of pivotality tend to be hampered by the fact that predicted closeness of an electoral outcome might induce higher turnout either by directly influencing voters' perceptions of their chances of casting the decisive vote or through more intense party campaigning, media coverage, and social pressure (Schachar and Nalebuff, 1999) - mechanisms are admittedly difficult to separately identify using observational data on real-world elections (Dhillon and Peralta, 2002; Cancela and Geys, 2016).

On the other hand, recent results from quasi-experimental research designs offer a different picture. Morton et al. (2015) exploit a reform of the timing of presidential elections in the small overseas territories to the West of mainland France and estimate that the information spillover caused by exit polls from the mainland, where the electoral result determines in most cases the final overall outcome almost with certainty, would cause a drop in the voter turnout rate in the overseas territories of over ten percentage points. Bursztyn et al. (2018) exploit variation in the existence and dissemination of pre-election polls for high-stakes referenda in Switzerland, and find a significant relationship between ex post referendum closeness and turnout during the period when polls are released and where cantonal newspaper coverage of close elections is greater. Lyytikainen and Tukiainen (2019) test the instrumental voting hypothesis by employing an RDD (regression discontinuity design) on local election data in Finland that exploits population cutoffs determining the size of the council, the latter growing substantially when population crosses each of the thresholds, showing that voter turnout increases with the number of available council seats. Finally, mounting evidence from lab and field experiments suggests that a higher subjective probability of being pivotal raises the likelihood that an individual votes, and that voters learn over time to adjust their beliefs to be more consistent with the historical frequency of pivotality (Gerber and Green, 2000; Levine and Palfrey, 2007; Duffy and Tavits, 2008; Großer, Schram, 2010; Herrera et al., 2014; Agranov et al., 2018; Faravelli et al., 2020).

Admittedly, the chances of casting the vote that breaks a tie in large-scale (parliamentary or presidential) elections are extremely small in general (Mulligan and Hunter, 2003; Gelman et al., 2012). However, episodes where an abstainer could have changed the outcome of an election - exact ties or one-vote-difference outcomes - have periodically occurred in elections involving somewhat smaller electorates, including races for US state governors and seats in state and national legislatures during the past two centuries. For instance, candidates

Alexander Jones in 1868 (10,329-10,328) and Robert Mayo in 1882 (10,505-10,504) gained their seats in the US House of Representatives by a single vote.[1] More recently, George Wiggins won the 1982 State Senator election in New Hampshire by one vote (5,352-5,351), and Anne Ruwet gained a seat in the Connecticut House of Representatives in 2002 by one vote (3,236–3,235). Tied elections have occurred too. In the 1994 race for the Wyoming House of Representatives, Randall Luthi and Larry Call each received 1,941 votes, and the tie was decided by the draw of a ball with Luthi's name out of Wyoming Governor's cowboy hat, while the elections for the Virginia House of Delegates saw the occurrences of ties both in 1971, District 19, and in 2017, District 94, where the two candidates got 11,608 votes each. In the former case, the tie was broken by putting the names of the two candidates in sealed envelopes, with the blindfolded Elections Board chairman picking one from a silver loving cup. In the latter case, the names of the candidates were each placed inside a film canister, and one canister was drawn at random from a ceramic bowl by State Board of Elections chairman on January 4, 2018. If the tie had happened in New Mexico, state law would have called for the election to be decided by a game of chance, such as a single hand of poker. In Peru and the Philippines, a coin is tossed after a tied election, while in the UK candidates draw straws to find a winner in the event of a tie, as after the May 2017 Northumberland County Council tied election. In Switzerland, after two candidates tied at exactly 23,979 votes at the 2011 election for the Federal parliament, the Supreme Court intervened and ruled against the electoral committee's decision of a computer lottery, ordering a manual lottery instead. However, more imaginative ways of settling a tie have appeared:

> *"Crawfordsville, Ind., May 8. — On Monday last occurred the city election at Waynetown, Montgomery County. William Simms and Frank Hollowell tied for the office of treasurer, each gentleman receiving 323 votes. To decide the question as to which one should hold the office, a foot race was held Wednesday between the men. The race was a 200 yard dash, and several thousand people were on the ground betting for the outcome. Simms seemed a sure winner until he tripped and fell when within three yards from the goal. Hollowell fell over him, but crawling over the line won the race amid the howls and cheers of the crowd. Hollowell was duly sworn in."*
>
> *(The Pensacola News, 10 May 1891, Sun, p. 5)*

[1] Congressional Quarterly's Guide to U S Elections, 6th Edition, 2009, Congressional Quarterly Press, Washington.

Indeed, fragmented local government structures coupled with first-past-the-post electoral systems create the most favorable conditions for the realization of close or even tied races, and the Italian local government structure represents an ideal environment in that respect. It comprises over 8,000 municipalities, about half of which have less than 3,000 residents and a third have less than 1,000, and exhibits a number of further attractive features including an important role of municipal governments in providing public services having an impact on people's lives (e.g., housing benefits and income support to the poor, kindergartens, public transportation, and environmental regulation), strong popular attachment to deeply rooted municipal institutions, and voter turnout rates averaging over 75%. Consequently, it constitutes a fascinating set-up to study the role of pivotality in voter turnout decisions.

In fact, Italian municipal elections register the periodic occurrence of ties or one-vote-difference electoral outcomes - over a hundred (42 ties and 67 one-vote-difference outcomes) in the elections that took place between 2001 and 2017. It is the consequences of these rare events that we aim at studying here, focusing on their impact on voter turnout rates in the elections that were held subsequently in the municipalities that, for geographical reasons, were potentially exposed to spillovers from the authorities experiencing those electoral outcomes. In addition, we will investigate whether those unusual electoral outcomes had an impact on the supply side of local politics (number of candidates running for mayor position) and on fiscal policy-making (local income tax) in the neighborhood. Finally, we will explore whether close electoral outcomes (races decided by a handful of votes) had similar consequences on neighboring localities as the less common ties and one-vote-difference outcomes.

In other fields of research that study the impact of rare events on consumers' choices in uncertain environments, such as commercial air crashes, drug poisoning, or faulty automobile recalling (Bosch et al., 1998; Jarrell and Peltzman, 1985), the literature points to a complex and somewhat hard to disentangle set of possible market reactions including switching to rival companies due to "brand-name" effects that bear on firms' tangible assets and spill over to their intangible ones, and market-wise negative spillover effects irrespective of the involved company. We suspect that a similar complexity might arise in the political market as a result of the realization of a rare electoral event. Consequently, in order to clarify the transmission mechanism that can be expected to link the rare election outcome in a locality with voting behavior in surrounding localities and to derive neat empirical predictions on the direction and size of the potential spillover, we first develop a theoretical model based on the pivotal-voter theory with voters' private information regarding their political preferences.

In the model, elections take place sequentially in two localities, making it possible for the outcome of the early election to affect voting behavior in the later election. In particular, upon observing the result of the early election, a share of voters in the other locality (the informed voters) will update their beliefs regarding the distribution of the political preferences in the economy, and will decide whether to turn out to vote accordingly. Interestingly, the model shows that the overall spillover effect of a tie on the rate of turnout in the subsequent election has an ambiguous sign, and can be broken down into three possibly countervailing effects: the 'competition' effect due to the larger pivotal probability of a voter in a closer election (Levine and Palfrey, 2007), the 'underdog' effect arising from the dependence of one's incentives to free ride on the size his fellow members' group (Taylor and Yildirim, 2010; Herrera et al., 2014), and the 'externality' that each voter inflicts on the other voters when deciding to take part in the election by lowering the chances that their votes be pivotal (Börgers, 2004). As a result, the sign of the information spillover on the rate of turnout in neighboring localities ends up being an empirical issue in general. However, careful analysis of the genesis of the three effects discussed above allows our theoretical model to yield the testable prediction that exposure to the information spillover will unambiguously raise voter turnout in elections held in localities that are characterised by a lopsided party support distribution.

In spite of constituting the real world examples of the unlikely event of a single vote being decisive, the consequences of the realization of tied elections have not been studied systematically before either by political scientists or economists, with the exception of Enos and Fowler (2014) and Hyytinen et al. (2018). Enos and Fowler (2014) test the hypothesis of the role of pivotality in turnout decisions by conducting a field experiment in the aftermath of the November 2010 tied election in District 6 for the Massachusetts State House. Since the Democratic and the Republican candidate each received 6,587 votes, a special election for assigning the seat was scheduled for the following May 2011, making it possible to experimentally manipulate voters' knowledge of closeness of the coming election by placing phone calls to registered voters to remind them about the special election. In particular, only a random subset of them was reminded about the exact tie in the previous election and the unusually high chance that their vote in the special election could be pivotal. The results of their field experiment provide evidence that the pivotal treatment had a large and significant effect on regular voters' but no effect on infrequent voters' turnout. On the other hand, Hyytinen et al. (2018) exploit the large number of ties that are registered in Finnish elections for municipal councils and are resolved by a lottery to compare the estimates of the personal incumbency advantage that arise in those ideal experimental conditions (previous electoral outcome determined via random seat assignment due to exact ties in vote counts) to conventional regression discontinuity design estimates obtained in a non-experimental fashion using local polynomial inference around the thresholds. However, neither of those contributions models or studies the potential information spillover of a tied election on voter turnout rates in other localities. The only previous paper we are aware of that investigates the geographic propagation of electoral shocks is Baskaran and Hessami (2018), who study the spillover effect of the election of a female mayor in a locality on the electoral performance of female candidates in contiguous municipalities, finding that exposure to a female mayor through local media market integration tends to reduce voter gender bias.

In this paper, we test for information spillovers from tight races on neighboring municipalities holding elections in the subsequent years by taking advantage of the features of the Italian local electoral system, in particular the vital requirement that localities vote according to a staggered schedule. The main results of our analysis can be summarized as follows. First, the turnout rate in the municipalities that are first-order (border-sharing) neighbors of localities experiencing a tie or a one-vote-difference outcome and that vote in the subsequent year is estimated to be higher by between two and three percentage points than in authorities that are not exposed to the information spillover. The turnout effect on first-order neighbors remains positive and significant (about one percentage point of additional turnout) two years after the tied election, but it tends to vanish over time: no effect is found if the elections are held more than two years apart. As for geographic distance, second-order neighbors (neighbors' neighbors) tend to experience some positive effect on the rate of turnout if they hold an election during the year immediately following the close election in the neighborhood, but the effect becomes nil in the subsequent years. In line with the model's specific prediction, the turnout impact of the information spillover is estimated to be larger the more uneven is the distribution of party preferences in the electorate of the receiving locality.

Second, when considering a number of alternative channels that might potentially be responsible for the transmission of the effects of electoral shocks between neighboring localities, we find that the supply side of the political market, i.e., the number of mayoral candidates, is not affected by whether a close outcome occurred in the neighborhood in the preceding years. However, we find some evidence that incumbents that are exposed to close electoral outcomes in the neighborhood in the years before they are up for re-election tend to set lower local income tax rates in the proximity of the election, compatibly with the hypothesis that income tax manoeuvring is used as a vote-buying strategy when the electoral race is perceived as increasingly uncertain. Finally, there is no evidence of significant information spillovers from the close but less salient elections that end up being decided by a handful of votes.

The rest of the paper is structured as follows. Section **2** presents a theoretical model of voting based on Taylor and Yildirim (2010) that allows for an information spillover between sequential elections. Section **3** illustrates the panel dataset of Italian municipalities, while section **4** introduces the econometric model and discusses the estimation results. Section **5** conducts a number of tests of potential alternative channels of interaction among localities, and section **6** concludes.

2 A theoretical model of elections and information spillovers

This section presents a theoretical model based on the pivotal-voter theory developed by Ledyard (1984) and Palfrey and Rosenthal (1983, 1985), which assumes that voters rationally anticipate the probability of their votes being pivotal and cast their votes if the expected benefit of voting outweighs the cost of voting. Although it is widely believed that pivotal-voter models tend to underestimate the turnout rates in large electorates, they can still offer reasonable predictions in small-scale elections. Börgers (2004) proposes a model of a small electorate with *ex ante* symmetric citizens where each voter has his personal political preference which is private information, and shows that voluntary majority voting may lead to a too high turnout rate from the social viewpoint due to the fact that each voter ignores the negative pivotal externality he inflicts on the other voters when deciding to vote. Taylor and Yildirim (2010) generalize Börgers (2004) by allowing for asymmetric political preferences, and highlight an "underdog effect" in small-scale elections in that the minority group has a higher turnout rate than the majority group does.

To formalize the idea of information spillovers between different elections, we extend the model of Taylor and Yildirim (2010) to one with two elections that take place sequentially. There are two localities in an economy, indexed by $j = 1, 2$, each containing n_j voters. An election is held in locality j at time $t = 1, 2$, with two candidates running for the election. Candidates belong either to party L or to party R, that can be broadly interpreted as left-wing and right-wing parties. Voters are of type $\theta = L, R$, i.e., either prefer party L or party R. The type θ is private information to each voter; however, before the election at period t takes place, there is a common knowledge that a voter is of type $\theta = L$ with probability $\lambda \in (0, 1)$ and of type $\theta = R$ with probability $1 - \lambda$.

Following Enos and Fowler (2014), we distinguish two situations: one where the voters in the later election are aware of the electoral outcome in the early election, referred to as the "informed voters," and one where they are unaware of the outcome, referred to as the "uninformed voters." When observing the outcome in the previous election, the informed voters will update their belief regarding the distribution of the political preferences in this economy.[2] In this case, there is an information spillover of the early election that will affect the voting behavior in the later election. By contrast, the uninformed voters still use their prior belief.[3]

In each election, voters simultaneously decide whether to vote for their preferred party or to abstain. The winner is the candidate who gets a majority of votes, and ties are solved by a fair coin toss. A voter receives

[2] Degan (2007) also considers a dynamic spatial model where voters make decisions in two consecutive elections and investigates the impact of information on electoral outcomes. Unlike this paper, she assumes that voters can be either informed or uninformed about the valence of candidates, and that all voters turn out to vote.

[3] This can be considered an application of the "availability heuristic" proposed by Tversky and Kahneman (1973), or a tendency to rely on past occurrences that can be remembered immediately to estimate the probability of an event. Since we focus on the spill-overs among localities rather than voters, we assume for simplicity that all voters in a locality are either all informed or uninformed about the outcome in the previous election.

a payoff normalized to 1 if his preferred candidate wins, and 0 if the other one is elected. Moreover, voting incurs a cost $c \in [0, \bar{c}]$, which is also private information to each voter. However, it is common knowledge that c is randomly drawn from a differentiable distribution $F_j(c)$ with $\frac{\mathrm{d}F_j}{\mathrm{d}c} > 0$. For simplicity, we assume that F_1 and F_2 are independent and $F_1 = F_2 = F$.

We focus on the type-symmetric Bayesian Nash equilibrium, where all voters of the same type adopt the same equilibrium strategy. A voter will cast his vote if the expected benefit of voting is greater than the cost of voting. It can be easily shown that a voter of types (θ, c) will use the following strategy in equilibrium: he votes if and only if $c \leq c^*_\theta$, where c^*_θ is some critical cost level for type θ. The sequence of events can be summarized as follows. (1) Each voter in locality 1 observes his types of (θ, c). (2) Voters in locality 1 decide whether to vote or not. Then the electoral outcome is realized. (3) After the outcome in locality 1 is revealed, the informed voters in locality 2 update their belief regarding the share of voters who prefer party L from λ to λ', while the uninformed voters still use the prior belief λ. (4) Each voter in locality 2 observes his types (θ, c). (5) Voters in locality 2 decide whether to vote or not. Then the electoral outcome is realized.

Analyze the electoral equilibrium in locality 1 first. In order to decide whether to vote or not, a voter needs to compute the probability of his vote being "pivotal," in that his vote either creates or breaks a tie, in both cases making a difference to the outcome. Given the probability $\Pi_{1\theta}$ that voter θ is pivotal in locality 1's election (detailed in Appendix A), the expected benefit of voting is $\frac{1}{2}\Pi_{1\theta}$, because the difference in payoff between his preferred candidate and the other one is 1, and a tie is broken by a fair coin toss. Therefore, a voter will cast his vote if:

$$\tfrac{1}{2}\Pi_{1\theta}(\tau_{1L}, \tau_{1R}) \geq c. \tag{1}$$

Since $c \geq 0$, there exists some $\tau_{1L} > 0$ and $\tau_{1R} > 0$ such that $\frac{1}{2}\Pi_{1\theta}(\tau_{1L}, \tau_{1R}) = c^*_\theta > 0$ in equilibrium. Therefore, a voter will cast his vote if and only if $c \leq c^*_\theta$, and so the equilibrium turnout rate will satisfy $\tau^*_{1\theta} = F(c^*_\theta)$. It follows that, in the type-symmetric Bayesian Nash equilibrium, $(\tau^*_{1L}, \tau^*_{1R})$ will satisfy:

$$\tau^*_{1L} = F\left(\tfrac{1}{2}\Pi_{1L}(\tau^*_{1L}, \tau^*_{1R})\right) \quad \text{and} \quad \tau^*_{1R} = F\left(\tfrac{1}{2}\Pi_{1R}(\tau^*_{1L}, \tau^*_{1R})\right).$$

This leads to the following result:

Lemma 1 (Taylor and Yildirim, 2010)**.** *In the type-symmetric Bayesian Nash equilibrium,* $\tau^*_{1L} < \tau^*_{1R}$ *and* $\lambda\tau^*_{1L} > (1-\lambda)\tau^*_{1R}$ *if and only if* $\lambda > \frac{1}{2}$.

That is, the supporters of the *ex ante* underdog candidate are more likely to turn out to vote relative to the supporters of the *ex ante* leading candidate. This is because the pivotal probability is larger for a voter in the minority group: if $\lambda > \frac{1}{2}$, so that candidate L has larger support, a vote for candidate R

narrows the expected lead of candidate L, while a vote for candidate L widens it. As a result, supporters of candidate R have a higher incentive to vote. However, the higher turnout rate cannot make up for the initial disadvantage, so the expected winning probability for the *ex ante* leading candidate is still higher than for the underdog candidate.

Consider now the election held in locality 2. After the numbers of votes for both parties in locality 1 are revealed, the informed voters update their belief regarding the population share of each party and decide whether they want to cast their vote or not. Suppose that n_{1L} and n_{1R} are the numbers of voters who vote for the candidates from party L and party R in period 1, respectively, and let the posterior belief regarding the population share for party L, denoted by λ', be:

$$\lambda' = \frac{n_{1L} + \lambda(n_1 - n_{1L} - n_{1R})}{n_1}. \tag{2}$$

The numerator of (2) represents the expected number of supporters of the L party, where the informed voters in locality 2 still use the prior belief λ to be the share of the L-type supporters among those who did not turn out to vote in period 1. Without loss of generality, assume that $\lambda > 1/2$, i.e., the candidate from party L is the *ex ante* leading party. In the comparative statics analysis that follows, we consider the situation where $|\lambda' - \lambda|$ is relatively small and it is still believed that party L remains the leading party after the first election. In this case, we can obtain a predictable pattern on voters' turnout rates by focusing on some special cases as described in the following proposition:

Proposition 1. *In the case of informed voters, suppose that $\lambda > 1/2$ and $|\lambda' - \lambda|$ is relatively small. Then in a close election where λ is close to $1/2$, $\tau^*_{2L} > \tau^*_{1L}$ and $\tau^*_{2R} < \tau^*_{1R}$ if $\lambda' < \lambda$. By contrast, in a lopsided election where λ is close to 1, $\tau^*_{2L} > \tau^*_{1L}$ and $\tau^*_{2R} > \tau^*_{1R}$ if $\lambda' < \lambda$.*

Proof. Appendix A.

To understand this result, we can split the overall impact of a change in λ on the probability of being pivotal (equations (7) and (8) in Appendix A) into three effects: the competition effect, the underdog effect, and the externality effect of voting. The competition effect is negative: when the election is expected to be closer ($\lambda' < \lambda$), the pivotal probability for a voter is larger and so is the rate of turnout. Mathematically, the competition effect is captured by the change in the probability of a tie event caused by the belief update, keeping the voters' abstention probability fixed (the first two terms of (7) and (8) in Appendix A). The effect is maximal at $\lambda = 1$ and minimal at $\lambda = \frac{1}{2}$, given that, when the election is already very close, the effect of additional closedness on the pivotal probability is tiny.

The second is the underdog effect and is captured by the third term in (7) and (8). For the leading party, this term is negative, meaning that, when the election becomes closer, the pivotal probability for its supporters becomes larger because the disadvantage of the underdog party is narrowed, with a positive effect on the turnout rate of the leading party. On the contrary, this term is positive for a supporter of the underdog party, which means that, when the election becomes closer, the pivotal probability for its supporters will be smaller, with a negative impact on the turnout rate of the underdog party. Unlike the competition effect, (7) and (8) show that the underdog effect is negligible in in a lopsided competition ($\lambda \to 1$).

Finally, the externality effect of voting captures the change in the probability of voters' abstention when λ changes. As argued by Börgers (2004), there is a negative externality arising from voting, in that a vote will make it less likely that other voters are pivotal. If a voter anticipates that it is more likely that the other voters will abstain from voting, the pivotal probability of his vote increases. Since $\tau^*_{1R} > \tau^*_{1L}$ by Lemma 1, the probability that a voter abstains decreases as the election becomes closer, thus lowering each voter's pivotal probability and incentive to turn out to vote.[4] This term too approaches zero as $\lambda \to 1$, letting the competition effect dominate in a lopsided election.

Proposition 1 allows us to draw an interesting implication with regard to the effect of the realization of a tie in the early election on the rate of turnout in the subsequent one. Since $\lambda > 1/2$, a tie in the early election will cause a downward updating in the belief regarding the population share for party L, $\lambda' < \lambda$, leading to the following prediction:

Corollary 1. *In the presence of an even distribution of preferences between party R and party L (*λ *close to* 1/2*) in locality 2, a tie occurring in the early election in locality 1 will induce a higher (lower) turnout rate of supporters of the leading (underdog) party in the later election. By contrast, in the presence of a lopsided distribution of preferences between party R and party L (*λ *close to* 1*) in locality 2, a tie occurring in the early election in locality 1 will induce higher turnout rates of supporters of both parties in the later election.*

Corollary 1 provides a testable hypothesis: the impact of a tie on total turnout in the later election will be stronger where there is a lopsided distribution of preferences. In this case, the turnout rates are predicted to unambiguously increase for all supporters. On the contrary, since in a close election the underdog effects go in opposite directions for the two parties, they tend to cancel out so that the overall turnout impact is weaker.

In order to see the belief adjustment mechanism at work, we provide a numerical example with various values of n_1 and λ, and compute the equilibrium turnout rates for each party. Since the expected benefit of voting is $\frac{1}{2}\Pi_{1\theta}$, we let the voting cost be uniformly distributed on $[0, \bar{c} = 0.5]$. The results of the numerical exercise are summarized in table 1.

[4] Recall that the probability of abstention by a voter in the first period is $1 - \lambda\tau^*_{1L} - (1-\lambda)\tau^*_{1R}$.

Table 1 The equilibrium turnout rates with various sizes and beliefs

	n_1= 101			n_1= 1,001			n_1= 5,001		
λ	τ^*_{1L}	τ^*_{1R}	τ^*_1	τ^*_{1L}	τ^*_{1R}	τ^*_1	τ^*_{1L}	τ^*_{1R}	τ^*_1
0.5	0.1840	0.1840	0.1840	0.0859	0.0859	0.0859	0.0503	0.0503	0.0503
0.51	0.1826	0.1851	0.1838	0.0849	0.0861	0.0855	0.0492	0.0499	0.0495
0.55	0.1736	0.1855	0.1790	0.0743	0.0794	0.0766	0.0367	0.0393	0.0379
0.6	0.1567	0.1791	0.1657	0.0564	0.0645	0.0596	0.0228	0.0261	0.0241
0.7	0.1179	0.1558	0.1293	0.0315	0.0481	0.0365	0.0104	0.0138	0.0114
0.8	0.0848	0.1334	0.0945	0.0188	0.0297	0.0210	0.0056	0.0089	0.0063
0.9	0.0589	0.1195	0.0650	0.0114	0.0234	0.0126	0.0032	0.0066	0.0035
1	0.0334	0.1489	0.0334	0.0052	0.0328	0.0052	0.0013	0.0101	0.0013

Notes: Figures obtained based on the assumption that c is uniformly distributed on [0, 0.5]. Moreover, τ^*_1 is the total turnout rate, where $\tau^*_1 = \lambda\tau^*_{1L} + (1-\lambda)\tau^*_{1R}$.

The figures in table 1 first show how the 'size effect' discussed by Levine and Palfrey (2007) operates: as the electorate becomes larger, the rates of turnout for both parties' supporters decrease because the pivotal probabilities become smaller. Second, and more importantly for our purposes, table 1 largely confirms the predictions in Proposition 1 and Corollary 1 concerning the role of the distribution of party support in locality 2 in explaining the size of the impact on voter turnout of the information spillover caused by the election result in locality 1. In the presence of an even distribution of support between party R and party L (λ around 0.51 to 0.55) and with relatively small electorates ($n_1 = 101; 1,001$), the underdog effect appears to dominate voters' responses to the information spillover from a tied election: as the own election is itself expected to be even closer ($\lambda \to 0.5$), the rate of turnout of the supporters of the leading party τ^*_{1L} increases, while that of the supporters of the underdog party τ^*_{1R} decreases, with only a modest effect on the overall rate of voter turnout. On the other hand, when starting from a lopsided distribution of support for the two parties (say $\lambda \geq 0.6$), table 1 shows an overwhelming competition effect: the turnout rates of the supporters of both parties decisively increase when the expected vote shares of the two parties get closer, with an impressive boost on the overall rate of voter turnout.

3 Institutional framework and dataset

We perform the empirical analysis on a panel dataset of Italian municipal elections spanning through almost twenty years (2001 to 2017). While the total number of Italian municipalities exceeds 8,000, we focus on the around 7,000 localities that are situated in the fifteen "state law" continental Italy's regions and belong to either of 83 administrative provinces. We thus exclude the five regions (the two islands *Sardegna* and *Sicilia*, and the three small alpine regions *Valle d'Aosta*, *Trentino-Alto-Adige,* and *Friuli-Venezia-Giulia*) that are entitled to larger autonomy and establish own limits and rules on the municipal governments that are located within their boundaries ("home rule").

The municipal level of government is characterized by considerable fragmentation, with average population size of around 7,500 inhabitants and more than half the localities having less than 3,000 residents. Irrespective of their size, though, all municipal authorities are statutorily responsible for the provision of public services in two main areas.[5] The first area concerns environment-related services, and includes local public transportation systems, road maintenance and cleaning, waste collection and management, water and sewer services, parks and green spaces, environmental monitoring, regulation and protection, urban planning and zoning (including the location of new productive plants), and management of industrial, agricultural and touristic infrastructures located within the municipal boundaries. The second area concerns personal social services including social care to the elderly and disabled, organization and management of pre-school services (kindergartens), cultural services (libraries, museums, sports), and local police.

As for local elections, all Italian municipalities have direct election of the mayor every fifth year in a single or dual ballot depending on resident population size, with larger localities (>15,000 inhabitants) holding a run-off stage among the two most voted candidates if none of them gets more than 50% of the votes in the first stage. The list supporting the most voted mayor candidate enjoys a seat majority premium, in the sense that at least $\frac{2}{3}$ of the council seats ($\frac{3}{5}$ of the seats if resident population>15,000 inhabitants) are assigned to the councillor candidates (frequently grouped in one or more political parties or lists) supporting the mayor that is elected. The rest of the council seats are assigned on a proportional representation basis (D'Hondt method). Voters express a vote for a mayor candidate as well as for a councillor candidate if they wish. Voting is a "civic duty" (article 48 of the Italian Constitution) and no sanctions exist for abstainers.

Elections take place according to a staggered schedule that is reported in table 2 for the years 2001 to 2017. The fact that Italian municipalities currently vote in different years is the result of the shorter actual lengths of terms of office in a number of municipalities due to mayors' resignation, impediment, death, or mandated early termination acts by the Ministry of the Interior that cumulated over the decades since restoration of democracy in the late 1940s (Lo Prete and Revelli, 2021). As a result, the current staggered timing of elections can be taken as exogenous.

During the 2001 to 2017 period there were more than 20,000 mayoral elections. The number of mayor candidates varies from a single candidate running unopposed (about 6% of the elections) to as many as 19 candidates. Most elections (over 70% of them) have 2 to 3 candidates.

[5] The sole exception is the possibility (or obligation in some instances) for small-sized municipalities to set up an intermunicipal cooperation agreement or formal institution for the provision of public services that require a minimum scale of production.

Table 2 Schedule of municipal elections

year	
2001	1,033
2002	659
2003	289
2004	4,095
2005	322
2006	1,071
2007	686
2008	387
2009	3,919
2010	356
2011	1,110
2012	678
2013	489
2014	3,680
2015	410
2016	1,090
2017	663

Notes: Source: Ministero dell'Interno, Governo Italiano (www.interno.gov.it).

Table B.1 in Appendix B reports the 42 cases of elections ending in a tie during the same period (municipality's name, region, and number of votes earned by each of the two most voted mayor candidates). When a tie happens, an extra electoral round needs to be called after two weeks. Ties periodically arise even in pretty large electorates, in the order of the thousands of registered voters. The largest tie saw two candidates get exactly 1,653 votes. Table B.2 in Appendix B reports instead the results of the 67 elections that were decided by a single vote, that is elections where an abstainer could have changed the outcome of the race if only he had chosen to turn out. In a few instances, one-vote-difference outcomes occurred in large localities counting several thousands of registered voters.

4 Empirical analysis

4.1 The internal impact of a tie

First, given that the Italian electoral law requires a tied election to be settled by calling a second ballot between the evenly voted mayoral candidates two weeks after the first ballot, it would be tempting to try to exploit those supplementary elections and observe the behavior of voters in those unusual circumstances. Indeed, any evidence that should arise from such investigation should be taken as no more than suggestive due to the small number of observations and the lack of an obvious control group. However, the coexistence of two electoral systems, namely single-round elections for smaller municipalities and two-round elections for larger ones, makes an exploratory exercise in this sense possible. In particular, in order to evaluate the impact on the decision to turn out to vote of the increased perception of pivotality that should follow a tied election, we might compare voter turnout in the ballotage following the tied election to the rate of turnout in run-off elections that are held in larger authorities (population exceeding 15,000) that vote according to a two-round electoral system and are statutorily required to have a second round whenever a candidate does not get at least 50% of the votes in the first round. Both when the supplementary election is held because of a tie and in ordinary two-round elections, the ballotage takes place on the second Sunday following the first round.

There were 898 ordinary run-off elections during the 2001-2017 period. The average first-round vote share of the most voted candidate in those jurisdictions is slightly below 40%, and the average vote share gap relative to the most voted opponent is about ten percentage points. This suggests that, even if a winner did not emerge in the first round, those elections should not be perceived as particularly close. To remove differences between the localities that experience ties (that tend to be small[6]) and those voting according to the two-round electoral system (hosting a population of at least 15,000), we regress the *change* in turnout in percentage points between the two electoral rounds Δy_{jt} on a vector of year indicators h_t ($t = 2001, ..., 2017$) and on a dummy variable $D(\text{tie})$ equaling 1 if the second round election in locality j had to be called because of a tie in the first round:

$$\Delta y_{jt} = \theta D(\text{tie}) + h_t + u_{jt} \tag{3}$$

The least squares estimate of the θ coefficient from equation (3) takes a large and highly significant value of around 12.3 (standard error ≈ 0.8). This means that the rate of turnout in the second round is over 12 percentage points higher if the extra round was called because of an exact tie in the first round than if the second round occurred because no candidate got more than 50% of the votes in the first round. The θ coefficient is estimated to be of almost exactly the same size and significance if the treated sample of municipalities with tied first round elections is matched with subsamples of municipalities from the control group with similarly sized electorates. In particular, when matched with the 384 localities holding a second round of elections and having an electorate of less than 20,000 voters, the localities holding a ballotage after a tie experience a higher rate of turnout of 11.8 percentage points (standard error ≈ 0.8) relative to the control group. These results provide suggestive prima facie evidence that the rare event of a tied election has an effect on electoral participation in subsequent races held in the same locality experiencing the tie. The next section moves on to test the model's hypothesis that tied elections have an influence onto voting behavior in neighboring localities too.

[6] The average electorate size of the 42 localities that had a tie is about 1,600.

4.2 Information spillovers

We test here the hypothesis that ties and one-vote-difference outcomes have an impact on voter turnout in subsequent elections taking place in neighboring localities. We use a plain geographic definition of neighborhood and rely on a standard border-sharing criterion, in the sense that two localities are considered first-order neighbors if they share a border, and are considered second-order neighbors if they do not share a border, but have a common first-order neighbor. Overall, about 1,500 elections in our sample were held within five years of the occurrence of a tie or a one-vote-difference outcome in their first-order or second-order neighborhoods.

The results of estimation of an equation that allows for information spillovers from close electoral outcomes in the neighborhood are reported in tables 3 and 4. First, table 3 reports the results of estimation of equation (4) below, where the dependent variable y_{it} is the rate of voter turnout that is registered in municipality i at an election held at time t, and j indexes the locality where the rare electoral outcome occurs:[7]

$$y_{it} = \rho_{1l} n_1(i,j) D(\text{tie}_{j,t-l}) + \rho_{2l} n_2(i,j) D(\text{tie}_{j,t-l}) + m_i + g_t + \varepsilon_{it} \tag{4}$$

$n_1(i,j)$ and $n_2(i,j)$ contain the binary spatial information on the location of authorities holding elections relative to the authorities where ties occurred, with $n_1(i,j) = 1$ ($n_2(i,j) = 1$) if i is a first-order (second-order) neighbor of j, 0 otherwise. $D(\text{tie}_{j,t-l}) = 1$ if a tie occurred in locality j at an election held during the time interval $(t, t-l)$, with l taking values $l = 1, ..., 5$ in different specifications of equation (4).[8] ρ_{1l} and ρ_{2l} are the parameters of interest, m_i and g_t are municipality and year fixed effects, and ε_{it} is the error term. In order to allow for the possibility of spatial autocorrelation in the residuals due to omitted variables or shocks to turnout having a geographic pattern, standard errors are clustered by each of the 83 provinces municipalities belong to.

The results in table 3 show that the turnout rate in the authorities that are first-order neighbors of localities experiencing a tie and hold elections in the subsequent year (parameter ρ_{11}) is higher by between two and three percentage points than in further away localities, with the estimated effect declining but still remaining sizeable and statistically significant in the next year ($\rho_{12} \approx 1$). The spillover vanishes over time, though, in the sense that no effect is found if the elections are held more than two years apart. The lower panel of table 3 shows evidence of a spillover effect of a non-negligible size on second-order neighbors holding elections right in the subsequent year too ($\rho_{21} \approx 0.9$), but the estimate falls short of statistical significance at conventional levels. The estimate of the spillover effect turns nil in the following years. The results are

[7] For authorities voting according to a two-round electoral system, the rate of turnout in the first round is considered.

[8] We group ties and one-vote-difference outcomes in a single binary variable that we refer to as 'ties' for convenience from now on. Section **5** extends the analysis to the elections that are decided by a small number (2-5) of votes.

robust when we include a number of controls (table 4), namely the size of the electorate (in thousands of eligible voters), the number of mayoral candidates, and the win margin of the mayor, defined as the difference in votes between the elected mayor and its most voted opponent as a percentage of the total votes cast for those two candidates.

Table 3 Spillovers: turnout

	years from tie to election in neighborhood				
	1 year	2 years	3 years	4 years	5 years
	dependent variable: turnout rate				
	first-order neighbors				
D(tie)	2.544^{***}	0.926^{**}	0.388	0.430	0.381
	(0.614)	(0.407)	(0.301)	(0.286)	(0.241)
	first-order & second-order neighbors				
D(tie) (1^{st}-order)	2.495^{***}	0.927^{**}	0.390	0.434	0.383
	(0.614)	(0.407)	(0.301)	(0.287)	(0.242)
D(tie) (2^{nd}-order)	0.895	-0.116	0.111	0.182	0.101
	(0.674)	(0.305)	(0.215)	(0.211)	(0.174)
obs.	20,937				

Notes: D(tie) = dummy variable equal to 1 if an authority is a neighbor of a locality where the election ended in a tie or was decided by one vote. Standard errors clustered by province (83 clusters). ***: p-value < 0.01; **: p-value < 0.05; *: p-value < 0.10.

All of those control variables have the expected sign, and in most cases are precisely estimated. Larger electorates and wider win margins tend to be associated with lower rates of turnout, in line with the comparative static effects of the rational choice theory of voter turnout (Levine and Palfrey, 2007), while a higher number of candidates is associated with higher turnout.[9] It is interesting to notice that the spillover effect turns significant again five years after the occurrence of the tie, when the localities that voted at the same time as when the tie occurred and are first-order neighbors of the locality that experienced the tie are back to the polls.

Finally, we test the model's hypothesis that the impact of the informational shock on turnout depends on the degree of lopsidedness of party affiliation in the locality that receives the spill-over (Corollary 1). We experiment with a number of win margin thresholds - average percentage vote difference between the two most voted candidates across the elections observed during the whole period of observation - to proxy the distribution of political consensus (30%, 40%, 50%, 60%, 70%), and estimate equation (4) both on the two distinct subsamples (low and high win margin authorities, according to the various thresholds) and on the

[9] We should not stress these results too much, though, because, with the exception of the size of the electorate in the short run, the other two controls (number of candidates and win margin) can be suspect of endogeneity or reverse causality.

full sample by means of an interaction term (information spill-over dummy multiplied by the lopsidedness proxy dummy).

Table 4 Spillovers: turnout, with controls

	years from tie to election in neighborhood				
	1 year	2 years	3 years	4 years	5 years
			turnout		
			first-order neighbors		
D(tie)	2.319***	0.901***	0.339	0.377	0.496**
	(0.462)	(0.385)	(0.286)	(0.260)	(0.233)
electorate	-0.076	-0.075	-0.076	-0.075	-0.075
	(0.072)	(0.071)	(0.072)	(0.072)	(0.071)
candidates	0.320***	0.322***	0.321***	0.321***	0.321***
	(0.044)	(0.044)	(0.044)	(0.044)	(0.044)
vote margin	-0.071***	-0.071***	-0.071***	-0.071***	-0.071***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
			first-order & second-order neighbors		
D(tie) (1^{st}-order)	2.299***	0.904***	0.339	0.378	0.496**
	(0.465)	(0.386)	(0.288)	(0.262)	(0.235)
D(tie) (2^{nd}-order)	0.354	-0.280	-0.014	0.075	0.021
	(0.526)	(0.247)	(0.178)	(0.168)	(0.163)
electorate	-0.076	-0.075	-0.075	-0.075	-0.075
	(0.072)	(0.072)	(0.072)	(0.072)	(0.072)
candidates	0.320***	0.321***	0.321***	0.321***	0.321***
	(0.044)	(0.044)	(0.044)	(0.044)	(0.044)
vote margin	-0.071***	-0.071***	-0.071***	-0.071***	-0.071***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
obs.			20,937		

Notes: D(tie) = dummy variable equal to 1 if an authority is a neighbor of a locality where the election ended in a tie or was decided by one vote. Standard errors clustered by province (83 clusters). ***: p-value < 0.01; **: p-value < 0.05; *: p-value < 0.10.

Table 5 reports the results for the elections that were held in the neighborhood in the year following the tied elections and for first order neighbors only (ρ_{11}). The results reported in table 5 are in line with the model's empirical prediction that the impact of the information spill-over on turnout is larger on jurisdictions that have a more lopsided distribution of preferences in the electorate. When focusing on the elections with a more and more uneven distribution of votes between the two main candidates, the impact of a tied election in the neighborhood increases up to an impact on voter turnout of about ten percentage points. The estimated differential impact between the two sub-samples goes up to between six and seven percentage turnout points when the threshold exceeds 50% of the vote gap, and is highly statistically significant.

Table 5 Spillovers: turnout, lopsidedness

	30%	40%	50%	60%	70%
D(tie)	2.631***	2.224***	2.273***	2.180***	2.309***
	(0.521)	(0.560)	(0.665)	(0.640)	(0.649)
D(tie)×D(lop)	-0.214	1.674	2.618	7.037***	6.660***
	(1.225)	(1.674)	(2.225)	(1.741)	(2.513)
			D(lop)=0		
D(tie)	2.413***	2.112***	2.217***	2.152***	2.299***
	(0.502)	(0.557)	(0.588)	(0.645)	(0.649)
obs.	13,065	15,964	18,247	19,530	20,145
			D(lop)=1		
D(tie)	2.538**	3.861**	4.432***	9.451***	10.012***
	(1.057)	(1.638)	(1.623)	(2.177)	(1.608)
obs.	7,872	4,973	2,690	1,407	792

Notes: D(tie) = dummy variable equal to 1 if an authority is a neighbor of a locality where the election ended in a tie or was decided by one vote, and held an election in the subsequent year; D(lop) = dummy variable equal to 1 if the mean vote difference between the two most voted candidates in the elections having taken place in a locality during the period of observation exceeds the predetermined threshold in line 1. Standard errors clustered by province (83 clusters). ***: p-value $<$ 0.01; **: p-value < 0.05; *: p-value < 0.10.

5 Alternative mechanisms

Finally, we test in this section whether alternative mechanisms might explain the observed spillover effect from tied elections on turnout rates in neighboring localities. The mechanism that is built in the theoretical model of section **2** can be seen as a direct one: the occurrence of a tie induces people living in the neighborhood to update their beliefs about the distribution of preferences between the main parties and, as a result, about the chances of casting the decisive vote in their own municipality. Under the circumstances discussed in section **2**, such cross-locality information spillover might make people living in those communities more likely to vote in subsequent elections. As we documented, the spillover effect turns out to be stronger the closer in space and time is the election in i following the tied election in j.

However, one could think of indirect mechanisms linking the political outcome in a locality to the political process in neighboring localities that can in turn take two distinct forms. First, the tie in locality j might have an effect on the supply side of the political market and induce a larger number of citizens to run as mayor candidates in locality i. This would occur in so far as potential candidates perceive the incumbent in locality i to be weaker and the coming election to be a closer one, where an opponent might have higher than usual chances to win. In turn, the larger number of candidates in locality i should be expected to stimulate turnout. Second, and relatedly, the tie in locality j might make the incumbent government in nearby locality i anticipate that the next race will be more uncertain, that his vote share will be lower, and that a larger number of people will vote in the next election than it was the case in the previous one. This could induce the incumbent to try to 'buy' votes to foster its chances of re-election. One way of doing so is by manoeuvring local taxes and expenditures before the elections to produce a short-term boost in popularity. We will test this hypothesis by using the local income tax rate (a surtax that municipalities can impose on the same tax base as the national personal income tax, and whose tax rate they set annually between 0 and 1%) as the key dependent variable, and verify in particular if holding elections after a tie in a neighboring jurisdiction has the effect of inducing a decrease in the local income tax rate as a vote-buying strategy.

We first test whether a tie in a given jurisdiction has an effect on the number of mayor candidates in neighboring authorities in subsequent elections, so we estimate equation (4) with the number of candidates as the dependent variable. The results in table 6 show that the number of mayoral candidates is not affected by the fact that a close outcome occurred in the neighborhood in any of the preceding years. As far as local tax policy determination is concerned, we use the local income tax rate as the dependent variable in equation (4). Local income tax rate data are available for the years 2001-2015. Table 7 shows some evidence that incumbents that are exposed to close outcomes in the neighborhood (first-order neighbors only, with no effect on second-order ones) and that hold elections during the next one to three years tend to set lower local income tax rates, compatibly with the hypothesis that a tie having occurred in the neighborhood raises uncertainty about own electoral outcomes, and tends to stimulate vote-buying fiscal policies on the part of incumbents.

Table 6 Spillovers: mayor candidates

	years from tie to election in neighborhood				
	1 year	2 years	3 years	4 years	5 years
	dependent variable: number of mayor candidates				
	first-order neighbors				
D(tie)	0.121	-0.027	-0.005	0.022	-0.004
	(0.163)	(0.083)	(0.069)	(0.057)	(0.047)
	first-order & second-order neighbors				
D(tie) (1^{st}-order)	0.116	-0.027	-0.005	0.022	-0.004
	(0.164)	(0.083)	(0.069)	(0.058)	(0.048)
D(tie) (2^{nd}-order)	0.095	-0.006	0.017	0.001	-0.015
	(0.115)	(0.068)	(0.058)	(0.060)	(0.045)
obs.	20,937				

Notes: D(tie) = dummy variable equal to 1 if an authority is a neighbor of a locality where the election ended in a tie or was decided by one vote. Standard errors clustered by province (83 clusters). ***: p-value < 0.01; **: p-value < 0.05; *: p-value < 0.10.

Table 7 Spillovers: income tax rate

	years from tie to election in neighborhood				
	1 year	2 years	3 years	4 years	5 years
	income tax rate				
	first-order neighbors				
D(tie)	-0.054***	-0.028**	-0.024*	-0.015	-0.016
	(0.021)	(0.014)	(0.013)	(0.013)	(0.010)
income tax rate					
	first-order & second-order neighbors				
D(tie) (1^{st}-order)	-0.053***	-0.028**	-0.024*	-0.015	-0.016
	(0.021)	(0.014)	(0.013)	(0.013)	(0.010)
D(tie) (2^{nd}-order)	-0.024*	-0.009	-0.011	-0.007	-0.008
	(0.014)	(0.010)	(0.008)	(0.008)	(0.007)
obs.	18,449				

Notes: D(tie) = dummy variable equal to 1 if an authority is a neighbor of a locality where the election ended in a tie or was decided by one vote. Standard errors clustered by province (83 clusters). ***: p-value < 0.01; **: p-value < 0.05; *: p-value < 0.10.

5.1 Sensitivity tests

Finally, we provide the results of a number of further tests on different specifications and subsamples in order to verify the robustness of the evidence reported above. All these additional results are relegated to Appendix C. First, one might think that, due to the operation of the "size effect," the rate of turnout in smaller localities should be more likely to be affected by information spillovers from electoral outcomes in the neighborhood than in larger cities. To see if this is the case, tables C.1-C.3 in Appendix C report the results of estimation of equation (4) on subsamples of authorities of smaller population to verify if the spillover effect tends to be driven by localities with more influenceable smaller electorates that happen to be close to where tied elections occur. In fact, Tables C.1-C.3 show that the estimate of the size of the spillover effect on turnout increases somewhat when we restrict our attention to smaller localities - electorates below 5,000, 2,500, and 1,000 voters respectively - though the estimates tend to be less and less precise as the sample shrinks.

Next, as a falsification test table C.4 allows the rate of voter turnout at a municipal election to be affected by the contemporaneous or future occurrences of close elections in the neighborhood (first-order and second-order neighbors). The results reassuringly confirm that the rates of turnout registered at the elections taking place in a neighborhood have no systematic relationship with the occurrence of ties or one-vote-difference episodes occurred in contemporaneous or subsequent municipal elections from the same neighborhood.

Last, we test whether the elections that are decided by a tiny number of votes (2 to 5 votes) have a similar effect on voter turnout rates in neighboring localities holding elections within the next five years as the more eccentric electoral outcomes that we have analysed up to this point. Indeed it could be argued that such electoral results convey roughly the same informational content in terms of polarization of party consensus as a tie or a one-vote-difference outcome does, and should therefore be expected to have similar consequences. On the other hand, they might not be salient enough to attract media and popular attention, thus having milder or no effect at all in the vicinity. A casual Google search for news on Italian mayoral elections decided by a single vote returns, amongst the first hits, a number of such cases from the May 2019 electoral round as emphatically reported by the local press, e.g.: "*Castelveccana: eletto per un solo voto in più*" (www.varesenews.it, online newspaper of the Varese province); "*Clamoroso a Follonica! Il sindaco vince per un voto*" (www.ilgiunco.net, dayly newspaper of Maremma, province of Grosseto); "*Vince per un voto e si conferma sindaco*" (www.isnews.it, online news for the Molise region). Sporadically, even national news providers (www.lanazione.it; www.ansa.it) appear to have reported on those uncommon electoral outcomes. Interestingly, though, similar searches for Italian mayoral elections decided by a handful of votes return no news in that regard.

The results reported in table C.5 are compatible with the hypothesis that only the oddest electoral outcomes attract as much attention as to produce an information spillover on the neighborhood. In the localities that are close to the 248 municipalities whose elections were decided by two to five votes, turnout rates were not significantly higher in either of the waves of elections occurring within the subsequent five years.

6 Conclusions

This paper has investigated whether the unusual occurrence of local electoral outcomes where a single abstainer's vote could have been decisive has an impact on voting behavior in subsequent elections in the neighborhood. In particular, this paper has focused on the information spillovers of stark real-world examples of pivotality in Italian municipal elections on the demand and the supply sides of the political process in nearby localities.

To clarify the mechanism linking tight electoral outcomes to voting behavior in the neighborhood, we have first built a theoretical model of costly instrumental voting in sequential elections with private information, where voters update their beliefs regarding the distribution of political preferences between two parties and the probability of their vote being pivotal upon observing the outcomes of earlier elections, and decide whether to turn out to vote according to those beliefs. The model shows that the overall impact of the information spillover on the rate of voter turnout in the subsequent election has an ambiguous sign because three possibly offsetting effects - a 'competition' effect, an 'underdog' effect, and an 'externality' effect -

are at work. However, the model also delivers the testable prediction that exposure to the informational spill-over will unambiguously raise voter turnout in lopsided elections.

Empirically, we have exploited the over one-hundred elections ending in ties or in one-vote-difference outcomes that were observed in the Italian municipalities in the past two decades and relied on the fact that the local electoral schedule is staggered to test the potential information spillover on nearby municipalities' turnout rates. Our main result is that the turnout rate in the municipalities that are first-order neighbors of localities experiencing a close outcome and that vote in the subsequent year is higher by between two and three percentage points than in locallities that are not exposed. The effect remains positive and significant (about one percentage point of additional turnout) two years after the tied election, but no effect is found if the elections are held more than two years apart. As for second-order neighbors, they tend to experience some positive effect on the rate of turnout if they hold an election during the year immediately following the close election in the neighborhood, but the effect becomes nil in the subsequent years. Finally, in line with the model's specific prediction, the impact of the informational spill-over on voter turnout is estimated to be larger the more uneven is the distribution of party preferences in the electorate of the receiving locality.

When testing further hypotheses on potential mechanisms linking the political processes of close-by localities, we find no impact on the supply side of the political market: the number of mayoral candidates is not affected by whether a close outcome occurred in the neighborhood in the preceding years. Conversely, there emerges some suggestive evidence that incumbents that are exposed to close outcomes in the neighborhood in the years before their re-election tend to use the local income tax rate to foster their popularity as the electoral race turns increasingly uncertain. Finally, episodes of races being decided by two to five votes are not estimated to generate significant spillovers on turnout rates in the vicinity, suggesting that only the oddest electoral outcomes are salient enough to generate an informational impact on the neighborhood.

References

[1] Agranov, M., Goeree, J., Romero, J., Yariv, L., What makes voters turn out: The effects of polls and beliefs, Journal of the European Economic Association 16 (2018) 825-856.

[2] Baskaran, T., Hessami, Z., Does the election of a female leader clear the way for more women in politics? American Economic Journal: Economic Policy 10 (2018) 95-121.

[3] Börgers, T., Costly voting, American Economic Review 94 (2004) 57-66.

[4] Bosch, J-C., Eckard, E., Singhal, V., The competitive impact of air crashes: Stock market evidence, Journal of Law & Economics 41 (1998) 503-519.

[5] Bursztyn, L., Cantoni, D., Funk, P., Yuchtman, N., Polls, the press, and political participation: The effects of anticipated election closeness, NBER Working Paper No. 23490 (2018).

[6] Cancela, J., Geys, B., Explaining voter turnout: A meta-analysis of national and subnational elections, Electoral Studies 42 (2016) 264-275.

[7] Coate, S., Conlin, M., Moro, A., The performance of pivotal-voter models in small-scale elections: Evidence from Texas liquor referenda, Journal of Public Economics 92 (2008) 582-596.

[8] Degan, A., Candidate valence: Evidence from consecutive presidential elections, International Economic Review 48 (2007) 457-482.

[9] Dhillon, A., Peralta, S., Economic theories of voter turnout, Economic Journal 112 (2002) 332-352.

[10] Duffy, J., Tavits, M., Beliefs and voting decisions: A test of the pivotal voter model, American Journal of Political Science 52 (2008) 603-618.

[11] Enos, R., Fowler, A., Pivotality and turnout: Evidence from a field experiment in the aftermath of a tied election, Political Science Research and Methods 2 (2014) 309-319.

[12] Faravelli, M., Kalayci, K., Pimienta, C., Costly voting: A large-scale real effort experiment, Experimental Economics 23 (2020) 468-492.

[13] Funk, P., Social incentives and voter turnout: Evidence from the Swiss mail ballot system, Journal of the European Economic Association 8 (2010) 1077-1103.

[14] Gelman, A., Silver, N., Edlin, A., What is the probability that your vote will make a difference? Economic Inquiry 50 (2012) 321-326.

[15] Gerber, A., Green, D., The effects of canvassing, telephone calls, and direct mail on voter turnout: A field experiment, American Political Science Review 94 (2000) 653-663.

[16] Gerber, A., Hoffman, M., Morgan, J., Raymond, C., One in a million: Field experiments on perceived closeness of the election and voter turnout, American Economic Journal: Applied Economics 12 (2020) 287-325.

[17] Großer, J., Schram, A., Public opinion polls, voter turnout, and welfare: An experimental study, American Journal of Political Science 54 (2010) 700-717.

[18] Herrera, H., Morelli, M., Palfrey, T., Turnout and power sharing, Economic Journal 124 (2014) F131-F162.

[19] Hyytinen, A., Merilainen, J., Saarimaa, T., Toivanen, O., Tukiainen, J., When does regression discontinuity design work? Evidence from random election outcomes, Quantitative Economics 9 (2018) 1019-1051.

[20] Jarrell, G., Peltzman, S., The impact of product recalls on the wealth of sellers, Journal of Political Economy 93 (1985) 512-536.

[21] Kahneman, D., Tversky, A., Availability: A heuristic for judging frequency and probability, Cognitive Psychology 5 (1973) 207-232.

[22] Ledyard, J., The pure theory of large two-candidate elections, Public Choice 44 (1984) 7-41.

[23] Levine, D., Palfrey, T., The paradox of voter participation? A laboratory study, American Political Science Review 101 (2007) 143-158.

[24] Lo Prete, A., Revelli, F., Voter turnout and city performance: Evidence from Italian municipalities, Journal of Law, Economics, and Organization 37 (2021) 168-197.

[25] Lyytikainen, T., Tukiainen, J., Are voters rational? European Journal of Political Economy 59 (2019) 230-242.

[26] Morton, R., Muller, D., Page, L., Torgler, B., Exit polls, turnout, and bandwagon voting: Evidence from a natural experiment, European Economic Review 77 (2015) 65-81.

[27] Moskowitz, D., Schneer, B., Reevaluating competition and turnout in U.S. House elections, Quarterly Journal of Political Science 14 (2019) 191-223.

[28] Mulligan, C., Hunter, C., The empirical frequency of a pivotal vote, Public Choice 116 (2003) 31-54.

[29] Palfrey, T., Rosenthal, H., A strategic calculus of voting, Public Choice 41 (1983) 7-53.

[30] Palfrey, T., Rosenthal, H., Voter participation and strategic uncertainty, American Political Science Review 79 (1985) 62-78.

[31] Riker, W., Ordeshook, P., A theory of the calculus of voting, American Political Science Review 62 (1968) 25-42.

[32] Schachar, R., Nalebuff, B., Follow the leader: Theory and evidence on political participation, American Economic Review 89 (1999) 525-547.

[33] Taylor, C., Yildirim, H., A unified analysis of rational voting with private values and group-specific costs, Games and Economic Behavior 70 (2010) 457-471.

Appendix A

Pivotal probabilities

According to Taylor and Yildirim (2010), the pivotal probability for an L-type voter is:

$$\begin{aligned}
&\Pi_{1L}(\tau_{1L},\tau_{1R}) \\
=&\sum_{k=0}^{\lfloor\frac{n_1-1}{2}\rfloor}\tbinom{n_1-1}{k,k,n_1-1-2k}(\lambda\tau_{1L})^k\left[(1-\lambda)\tau_{1R}\right]^k\left[1-\lambda\tau_{1L}-(1-\lambda)\tau_{1R}\right]^{n_1-1-2k} \\
+&\sum_{k=0}^{\lfloor\frac{n_1-1}{2}\rfloor}\tbinom{n_1-1}{k,k+1,n_1-2-2k}(\lambda\tau_{1L})^k[(1-\lambda)\tau_{1R}]^{k+1}[1-\lambda\tau_{1L}-(1-\lambda)\tau_{1R}]^{n_1-2-2k},
\end{aligned}\tag{5}$$

where $\lfloor\cdot\rfloor$ is the integer part of a number, and $\tau_{1\theta}$ is the *ex ante* probability that a voter of type θ turns out and casts his vote. The first term after the equality in (5) represents the event where there is a tie, and the second term represents the event where the L-type candidate would lose by one vote without his vote.

Similarly, the pivotal probability for an R-type voter is:

$$\begin{aligned}
&\Pi_{1R}(\tau_{1L},\tau_{1R}) \\
=&\sum_{k=0}^{\lfloor\frac{n_1-1}{2}\rfloor}\tbinom{n_1-1}{k,k,n_1-1-2k}(\lambda\tau_{1L})^k\left[(1-\lambda)\tau_{1R}\right]^k\left[1-\lambda\tau_{1L}-(1-\lambda)\tau_{1R}\right]^{n_1-1-2k} \\
+&\sum_{k=0}^{\lfloor\frac{n_1-1}{2}\rfloor}\tbinom{n_1-1}{k,k+1,n_1-2-2k}(\lambda\tau_{1L})^{k+1}[(1-\lambda)\tau_{1R}]^{k}[1-\lambda\tau_{1L}-(1-\lambda)\tau_{1R}]^{n_1-2-2k}.
\end{aligned}\tag{6}$$

Proof of Proposition 1

Proof. By taking the derivatives of the pivotal probabilities in (5) and (6) with respect to λ, and fixing at the equilibrium $(\tau_{1L}^*,\tau_{1R}^*)$, we have:

$$\begin{aligned}
&\frac{\partial\Pi_{1L}(\tau_{1L}^*,\tau_{1R}^*)}{\partial\lambda}= \\
&\sum_{k=0}^{\lfloor\frac{n_1-1}{2}\rfloor}\binom{n_1-1}{k,k,n_1-2-2k}\lambda^{k-1}(\tau_{1L}^*)^k(1-\lambda)^{k-1}(\tau_{1R}^*)^k\left[1-\lambda\tau_{1L}^*-(1-\lambda)\tau_{1R}^*\right]^{n_1-2-2k} \\
&\times\Bigg\{\underset{(-)}{\frac{k(1-2\lambda)\left[1-\lambda\tau_{1L}^*-(1-\lambda)\tau_{1R}^*\right]}{(n_1-1-2k)}}+\underset{(-)}{\frac{k(1-2\lambda)(1-\lambda)\tau_{1R}^*}{(k+1)}}-\underset{(-)}{\frac{\lambda(1-\lambda)\tau_{1R}^*}{(k+1)}} \\
&\quad+\lambda(1-\lambda)(\tau_{1R}^*-\tau_{1L}^*)\underset{(+)}{\left[1+\frac{(n_1-2-2k)(1-\lambda)\tau_{1R}^*}{(k+1)\left[1-\lambda\tau_{1L}^*-(1-\lambda)\tau_{1R}^*\right]}\right]}\Bigg\},
\end{aligned}\tag{7}$$

and $\frac{\partial \Pi_{1R}(\tau^*_{1L},\tau^*_{1R})}{\partial \lambda} =$

$$\sum_{k=0}^{\lfloor \frac{n_1-1}{2} \rfloor} \binom{n_1-1}{k,k,n_1-2-2k} \lambda^{k-1}(\tau^*_{1L})^k(1-\lambda)^{k-1}(\tau^*_{1R})^k \left[1-\lambda\tau^*_{1L}-(1-\lambda)\tau^*_{1R}\right]^{n_1-2-2k}$$

$$\times \Bigg\{ \underset{(-)}{\frac{k(1-2\lambda)\left[1-\lambda\tau^*_{1L}-(1-\lambda)\tau^*_{1R}\right]}{(n_1-1-2k)}} + \underset{(-)}{\frac{k(1-2\lambda)\lambda\tau^*_{1L}}{(k+1)}} + \underset{(+)}{\frac{\lambda(1-\lambda)\tau^*_{1L}}{(k+1)}}$$

$$+ \lambda(1-\lambda)(\tau^*_{1R}-\tau^*_{1L}) \underset{(+)}{\left[1+\frac{(n_1-2-2k)\lambda\tau^*_{1L}}{(k+1)\left[1-\lambda\tau^*_{1L}-(1-\lambda)\tau^*_{1R}\right]}\right]} \Bigg\}. \tag{8}$$

There are no definite signs in general. We then focus on some special cases to see the effect of λ. Consider a very close election where $\lambda \to 1/2$. In this case, we have $\tau^*_{1R} \to \tau^*_{1L}$, according to Börgers (2004), who deals with the symmetric case $\lambda = 1/2$. Therefore, the terms in the braces in (7) and (8) approach to zero except the third one. Therefore,

$$\frac{\partial \Pi_{1L}(\tau^*_{1L},\tau^*_{1R})}{\partial \lambda}|_{\lambda \to 1/2} < 0 \quad \text{and} \quad \frac{\partial \Pi_{1R}(\tau^*_{1L},\tau^*_{1R})}{\partial \lambda}|_{\lambda \to 1/2} > 0.$$

Consider a new λ' which is close to λ and $\lambda' < \lambda$. Then under this λ', since $\frac{\mathrm{d}F}{\mathrm{d}c} > 0$, we know

$$\tau^*_{1L} < F\left(\frac{1}{2}\Pi_{1L}(\tau^*_{1L},\tau^*_{1R})\right) \quad \text{and} \quad \tau^*_{1R} > F\left(\frac{1}{2}\Pi_{1R}(\tau^*_{1L},\tau^*_{1R})\right). \tag{9}$$

Thus, in order to maintain the equality, the new equilibrium $(\tau^*_{2L},\tau^*_{2R})$ under λ' must be the case where

$$\tau^*_{2L} > \tau^*_{1L} \quad \text{and} \quad \tau^*_{2R} < \tau^*_{1R}. \tag{10}$$

That is, when a very close election becomes even closer, the pivotal probability for a supporter of the leading (underdog) candidate will be larger (smaller), so that it is more (less) likely for that voter to turn out and vote in the later election.

Another extreme case is $\lambda \to 1$, where the election is dominated by the leading party. Similar to the previous case, we have

$$\frac{\partial \Pi_{1L}(\tau^*_{1L},\tau^*_{1R})}{\partial \lambda}|_{\lambda \to 1} < 0 \quad \text{and} \quad \frac{\partial \Pi_{1R}(\tau^*_{1L},\tau^*_{1R})}{\partial \lambda}|_{\lambda \to 1} < 0.$$

Consider a new λ' which is close to λ and $\lambda' < \lambda$. Then under this λ',

$$\tau^*_{1L} < F\left(\frac{1}{2}\Pi_{1L}(\tau^*_{1L},\tau^*_{1R})\right) \quad \text{and} \quad \tau^*_{1R} < F\left(\frac{1}{2}\Pi_{1R}(\tau^*_{1L},\tau^*_{1R})\right). \tag{11}$$

Thus, in order to maintain the equality, the new equilibrium $(\tau_{2L}^*, \tau_{2R}^*)$ under λ' is such that

$$\tau_{2L}^* > \tau_{1L}^* \quad \text{and} \quad \tau_{2R}^* > \tau_{1R}^*. \tag{12}$$

That is, when the election becomes less lopsided, the pivotal probability for a supporter of either party increases, so that it is more likely for a voter to vote. Thus, the total turnout rate increases. $\square$

Appendix B

Table B.1 Ties

municipality	region	year	votes	municipality	region	year	votes
Valmala	Piemonte	2004	28	Cellere	Lazio	2014	372
Acceglio	Piemonte	2006	47	Quingentole	Lombardia	2004	378
Oldenico	Veneto	2014	92	Roseto V.	Puglia	2010	434
Margno	Lombardia	2009	96	Cazzano di T.	Veneto	2004	450
Colleretto C.	Piemonte	2014	97	Montorfano	Lombardia	2013	465
Cortanze	Piemonte	2006	101	Rignano G.	Puglia	2012	531
Aisone	Piemonte	2009	101	Cerchiara C.	Calabria	2009	593
Serravalle L.	Piemonte	2004	121	Revine Lago	Veneto	2014	613
Piazzatorre	Lombardia	2004	132	Scanno	Abruzzo	2003	625
Roatto	Piemonte	2001	139	Ortucchio	Abruzzo	2016	636
Vizzola Ticino	Lombardia	2004	163	Calvagese R.	Lombardia	2002	706
Cerano d'Intelvi	Lombardia	2004	170	Orsara di P.	Puglia	2002	877
Fraine	Abruzzo	2011	194	S. Angelo A.	Campania	2005	878
Borbona	Lazio	2004	196	Ardenno	Lombardia	2016	922
S. Giovanni in G.	Molise	2009	241	Menaggio	Lombardia	2014	953
Corrido	Lombardia	2004	251	S. Benedetto M.	Abruzzo	2008	968
Proserpio	Lombardia	2014	294	Narzole	Piemonte	2016	997
Miglierina	Calabria	2004	298	Casina	Emilia R.	2016	1,164
Spadola	Calabria	2007	300	Cannobio	Piemonte	2004	1,227
Terravecchia	Calabria	2008	314	Arcene	Lombardia	2009	1,492
Civita d'Antino	Abruzzo	2016	351	Monte San Vito	Marche	2009	1,653

Table B.2 Elections decided by one vote

municipality	region	year	votes	municipality	region	year	votes
Briga Alta	Piemonte	2006	22-21	Cleto	Calabria	2009	366-365
Igliano	Piemonte	2004	30-29	Campiglia	Veneto	2004	371-370
Spriana	Lombardia	2004	37-36	Camburzano	Piemonte	2004	391-390
Castelverrino	Molise	2004	49-48	Guardistallo	Toscana	2014	391-390
Canevino	Lombardia	2009	49-48	Lauriano	Piemonte	2001	443-442
Sueglio	Lombardia	2011	55-54	Lanzo d'Intelvi	Lombardia	2005	447-446
Calascio	Abruzzo	2011	61-60	Torre Nocelle	Campania	2013	496-495
Crissolo	Piemonte	2016	72-71	San Donato	Molise	2011	519-518
Testico	Liguria	2011	78-77	Premosello	Piemonte	2011	530-529
Valvestino	Lombardia	2014	82-81	Verzino	Calabria	2004	544-543
Levice	Piemonte	2004	89-88	Valbrembo	Lombardia	2004	552-551
Collegiove	Lazio	2009	106-105	San Mango	Campania	2012	577-576
Cornalba	Lombardia	2006	112-111	Castelpagano	Campania	2001	626-625
Vallinfreda	Lazio	2011	122-121	Campoli App.	Lazio	2002	638-637
Gambasca	Piemonte	2009	136-135	Castiglione	Toscana	2012	647-646
S. Giacomo F.	Lombardia	2015	139-138	Angolo terme	Lombardia	2009	667-666
Pozzaglia S.	Lazio	2014	151-150	Gaglianico	Piemonte	2014	675-674
Osiglia	Liguria	2014	155-154	Mergozzo	Piemonte	2004	678-677
Pettoranello	Molise	2009	173-172	Moricone	Lazio	2014	690-689
Acquaviva	Molise	2005	175-174	Grotteria	Calabria	2012	752-751
Castel C.	Abruzzo	2015	191-190	Berzo inferiore	Lombardia	2003	760-759
Salisano	Lazio	2017	181-180	Castel S.Elia	Lazio	2007	841-840
Prasco	Piemonte	2004	195-194	Ronco Freddo	Emilia R.	2004	888-887
Salle	Abruzzo	2004	196-195	Gissi	Abruzzo	2014	921-920
Vesime	Piemonte	2017	196-195	Occhiepo	Piemonte	2009	986-985
Angrogna	Piemonte	2007	252-251	Spirano	Lombardia	2004	987-986
Mello	Lombardia	2001	253-252	Corte Franca	Lombardia	2011	1311-1310
Cortino	Abruzzo	2016	259-258	Travacò	Lombardia	2014	1385-1384
Casal C.	Piemonte	2016	266-265	Grottaferrata	Lazio	2017	1930-1929
Zaccanopoli	Calabria	2004	281-280	Montecompatri	Lazio	2003	2047-2046
Gaiba	Veneto	2009	284-283	Curti	Campania	2014	2251-2250
Fabbrica C.	Piemonte	2004	292-291	Meda	Lombardia	2012	3867-3866
Breme	Lombardia	2006	307-306	Monselice	Veneto	2004	4251-4250
Palermiti	Calabria	2010	355-354				

Appendix C

Table C.1 Spillovers: turnout (electorate<5,000)

	years from tie to election in neighborhood				
	1 year	2 years	3 years	4 years	5 years
	dependent variable: rate of turnout				
	first-order neighbors				
D(tie)	2.657***	0.804*	0.270	0.366	0.315
	(0.669)	(0.455)	(0.360)	(0.342)	(0.273)
	first-order & second-order neighbors				
D(tie) (1^{st}-order)	2.610***	0.806*	0.272	0.372	0.316
	(0.669)	(0.454)	(0.363)	(0.343)	(0.274)
D(tie) (2^{nd}-order)	0.904	-0.095	0.102	0.232	0.119
	(0.865)	(0.405)	(0.288)	(0.272)	(0.213)
obs.	15,491				

Notes: D(tie) = dummy variable equal to 1 if an authority is a neighbor of a locality where the election ended in a tie or was decided by one vote. Standard errors clustered by province (83 clusters). ***: p-value < 0.01; **: p-value < 0.05; *: p-value < 0.10.

Table C.2 Spillovers: turnout (electorate<2,500)

	years from tie to election in neighborhood				
	1 year	2 years	3 years	4 years	5 years
	dependent variable: rate of turnout				
	first-order neighbors				
D(tie)	3.138***	1.120**	0.508	0.535	0.397
	(0.784)	(0.562)	(0.422)	(0.364)	(0.272)
	first-order & second-order neighbors				
D(tie) (1^{st}-order)	3.107***	1.128**	0.508	0.538	0.397
	(0.787)	(0.560)	(0.424)	(0.365)	(0.273)
D(tie) (2^{nd}-order)	0.426	-0.272	0.060	0.193	0.068
	(1.026)	(0.561)	(0.358)	(0.339)	(0.262)
obs.	11,193				

Notes: D(tie) = dummy variable equal to 1 if an authority is a neighbor of a locality where the election ended in a tie or was decided by one vote. Standard errors clustered by province (83 clusters). ***: p-value < 0.01; **: p-value < 0.05; *: p-value < 0.10.

Table C.3 Spillovers: turnout (electorate<1,000)

	years from tie to election in neighborhood				
	1 year	2 years	3 years	4 years	5 years
	dependent variable: rate of turnout				
	first-order neighbors				
D(tie)	3.781*	0.603	0.710	0.577	0.427
	(2.192)	(0.824)	(0.761)	(0.641)	(0.456)
	first-order & second-order neighbors				
D(tie) (1^{st}-order)	3.765*	0.581	0.719	0.611	0.422
	(2.173)	(0.839)	(0.787)	(0.663)	(0.455)
D(tie) (2^{nd}-order)	-0.286	-0.450	0.122	0.442	0.149
	(1.673)	(0.991)	(0.668)	(0.601)	(0.468)
obs.			5,203		

Notes: D(tie) = dummy variable equal to 1 if an authority is a neighbor of a locality where the election ended in a tie or was decided by one vote. Standard errors clustered by province (83 clusters). ***: p-value < 0.01; **: p-value < 0.05; *: p-value < 0.10.

Table C.4 Spillovers: turnout leads

	years from tie to election in neighborhood				
	0 years	-1 year	-2 years	-3 years	-4 years
	dependent variable: rate of turnout				
	first-order neighbors				
D(tie)	0.596	0.466	-0.517	0.179	0.001
	(0.420)	(0.699)	(0.591)	(0.736)	(0.677)
	first-order & second-order neighbors				
D(tie) (1^{st}-order)	0.597	0.479	-0.517	0.179	0.028
	(0.419)	(0.695)	(0.591)	(0.738)	(0.671)
D(tie) (2^{nd}-order)	0.045	-0.952*	-0.132	0.116	-0.530
	(0.200)	(0.538)	(0.363)	(0.570)	(0.636)
obs.	20,937				

Notes: D(tie) = dummy variable equal to 1 if an authority is a neighbor of a locality where the election ended in a tie or was decided by one vote. Standard errors clustered by province (83 clusters). ***: p-value $<$ 0.01; **: p-value $<$ 0.05; *: p-value $<$ 0.10.

Table C.5 Spillovers from close outcomes

	years from tie to election in neighborhood				
	1 year	2 years	3 years	4 years	5 years
	dependent variable: rate of turnout				
	first-order neighbors				
D(close)	0.498	0.150	-0.027	-0.019	0.191
	(0.560)	(0.309)	(0.278)	(0.262)	(0.186)
	first-order neighbors				
D(tie)	2.550***	0.927**	0.387	0.430	0.387
	(0.612)	(0.406)	(0.301)	(0.286)	(0.242)
D(close)	0.515	0.152	-0.027	-0.018	0.197
	(0.547)	(0.307)	(0.277)	(0.261)	(0.190)
obs.	20,937				

Notes: D(close) = dummy variable equal to 1 if an authority is a neighbor of a locality where the election was decided by 2 to 5 votes. D(tie) = dummy variable equal to 1 if an authority is a neighbor of a locality where the election ended in a tie or was decided by one vote. Standard errors clustered by province (83 clusters). ***: p-value < 0.01; **: p-value < 0.05; *: p-value < 0.10.