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Voter Turnout with Peer Punishment†

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We introduce a model where social norms of voting participation are strategically chosen by competing political parties and determine voters' turnout. Social norms must be enforced through costly peer monitoring and punishment. When the cost of enforcement of social norms is low, the larger party is always advantaged. Otherwise, in the spirit of Olson (1965), the smaller party may be advantaged. Our model shares features of the ethical voter model and it delivers novel and empirically relevant comparative statics results. (*JEL* D72, Z13)

Woman who ran over husband for not voting pleads guilty.
—*USA Today*, April 21, 2015[1]

In this paper we study voter turnout in two-party elections and investigate the theoretical relation between party size and electoral advantage. We do this in the context of a novel theoretical model that formalizes a well-documented empirical fact: peer pressure plays a key role in enforcing social norms of voting participation.[2] Social norms are typically maintained by various forms of social disapproval and ostracism (Ostrom 1990). While the news article mentioned in the epigraph is clearly an extreme case of punishment, a less traumatic example is represented by Ted Cruz's campaign strategy in the 2016 Iowa Presidential primaries. Voters who

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[1] Nichols, Liz. 2015. https://amp.usatoday.com/amp/26152101 (accessed August 15, 2020).

[2] To take a few of many pieces of evidence, DellaVigna et al. (2017) demonstrates that an important incentive for citizens to vote is to show others that they have voted. Gerber, Green, and Larimer (2008) shows that social pressure from the household or neighbors significantly increases turnout. Amat et al. (forthcoming), using elections data of Spain's Second Republic, shows that turnout was driven by political parties and trade unions' social pressure. The relation between voter participation and peer pressure is also widely discussed in the sociology literature: see Coleman (1988).

were most likely to support Cruz received mailings with information about their own past voting behavior and that of their neighbors.[3]

We model voter participation by viewing a political party as facing a public goods problem: individual voters bear the cost of participation, but the benefit of an electoral victory is shared with all party members. Our core assumption is that each party is able to design a mechanism to overcome this public goods problem by providing incentives to individual voters in the form of social pressure. The optimal solution to this mechanism design problem is to excuse high cost voters from voting. How costly it is to do so depends on how difficult it is to monitor individual voter costs. This difficulty plays a key role in determining the outcome of elections: transparent costs favor a large party. By contrast, we show that difficulty in monitoring voter costs may favor a small party.

In existing turnout models a large party has a natural advantage. Since the marginal cost of turning out an additional voter is increasing in the fraction of party members who turned out, a large party can turn out the same number of voters as a small party at lower cost. While in these models a small party makes a stronger effort than a large party, this is not enough to overcome the natural advantage of the large party. In our model this is likewise the case when voter costs are transparent. When this is not the case, however, some nonvoters must be punished, and for any given number of voters turned out, a small party has fewer nonvoters to punish. This can lead to an overall advantage for the small party.

Our mechanism design approach in which social norms are chosen to maximize a group objective can also be found in Townsend (1994) and in the ethical voter model of Feddersen and Sandroni (2006) and Coate and Conlin (2004).[4] From an empirical perspective, Coleman (1988) and Ostrom (1990) as well as Olson (1965) all provide evidence that, within the limits of available monitoring and punishment, peer pressure mechanisms do a good job of solving public goods problems. Palfrey and Pogorelskiy (2019) provides experimental evidence that communication among voters and in particular communication within parties increases turnout: that is, enables them to attain more advantageous social norms.

Our model delivers a rich set of intuitive comparative statics on equilibrium turnout with respect to the value of the election, its closeness, and to changes in the relative size of the groups. We clarify which results carry over from existing models and which do not. Furthermore, with our model we are able to address questions that could not be asked with existing turnout models. In particular, we examine the consequences of changes in difficulty of monitoring voter costs. We observe, for example, that rule changes that lower turnout costs may also make monitoring more difficult and so have the perverse effect of lowering turnout. This prediction is in line with empirical evidence on the effect of postal voting on turnout in Swiss elections (Funk 2010) and on the effect of the monitoring capacity of parties' local mobilizers

[3] The mailing contained the following statement: "You are receiving this election notice because of low expected voter turnout in your area. Your individual voting history as well as your neighbors' are public record. Their scores are published below, and many of them will see your score as well. Caucus on Monday to improve your score and please encourage your neighbors to caucus as well."

[4] For the relation between our model and the ethical voter model, see Sections III and V.

on turnout buying in Mexico (Larreguy, Marshal, and Querubin 2016).[5] We observe, as well, that in a high stakes election a small increase in party size that gives a party a slight majority will result in a discontinuous upward jump in utility. This suggests that competition over platforms may be fierce indeed.

The paradox of voting significantly motivates the turnout literature, but is a special case of the general problem of why people engage in costly activities that are nearly inconsequential from a material standpoint. A single vote is an example of such costly and nearly inconsequential activities, and so is punishing someone for failing to vote. This paper does not provide an answer to why someone would punish abstention. It merely assumes that punishing others is costless. If punishments are costly, then the question of what is the incentive to vote is just replaced with the question of what is the incentive to punish abstention. We speculate that the ethical voter model, perhaps combined with this model, could be adapted to address both questions, but this is beyond the scope of this paper.

I. The Model

A continuum of voters is divided into two parties $k = \{S, L\}$ denoting *Small* and *Large*, respectively. The fraction of the voting population belonging to party k is η_k where $0 < \eta_S < \eta_L$ and $\eta_S + \eta_L = 1$. The two parties compete in an election for a common prize worth V to the party that produces the greatest number of votes and V/η_k to each member of party k. We assume, in other words, that the prize is fungible, such as taxes, subsidies, or government jobs, so that the collective value of the prize to a party does not depend on the size of the party.[6]

Voting is costly and individuals face the same distribution of voting costs independent of party. Each voter privately and independently draws a type y from a uniform distribution on $[0,1]$, which determines a *net participation cost of voting* $c(y)$. This cost of voting is net of social pressure: it consists of the direct cost and inconvenience (costs of time and transportation) minus the direct personal benefits such as fulfilling civic duty or expressive voting. The participation cost of voting c is continuously differentiable, strictly increasing, and satisfies $c(\underline{y}) = 0$ for some $\underline{y} \in [0,1]$. Voters for whom $y < \underline{y}$ have a negative net cost of voting, they are called committed voters and will always vote.

Our main innovation and core assumption is that each party is able to design a mechanism providing incentives to individual voters in the form of social pressure. We model this as an ability to impose penalties that are costly to individual party members. The mechanism has two parts. The first part is a threshold φ_k together with a rule for party members prescribing voting if $y \leq \varphi_k$. That is, all voters with sufficiently low cost of voting are expected to vote. We refer to this as the *social norm* for the party. Notice that φ_k is the probability that a representative party member votes and, since there are a continuum of voters, φ_k is also the turnout rate of the

[5] Our predictions are also consistent with the failure of the 2000 UK policy experiment of setting in-store poll booths to reduce voting costs and hence increase turnout. See Julia Hartley-Brewer, "In-Sore Poll Booths Fail to Lift Voting," *The Guardian,* https://www.theguardian.com/uk/2000/aug/17/juliahartleybrewer.

[6] A party is generally made up of individuals with different interests: we do not attempt to model the internal decision making of the party, but simply note that in practice V represents a composite of those interests. We discuss the assumption that V is independent of the size of the party in Section V.

party. This first part of the mechanism is already present in Feddersen and Sandroni (2006). The second part of the mechanism is novel and is a punishment $P_k \geq 0$ representing social disapproval for failing to comply with the social norm.

The ability to apply punishments is limited by imperfect information. While there is no difficulty in determining whether a party member voted, individual costs of voting are not transparent and the party can only observe a noisy binary signal about whether a nonvoter followed the social norm. In particular, among voters who failed to vote there are two types: high cost voters who were "excused" according to the social norm and low cost voters who were not. If the nonvoting member violated the social norm, that is, $y < \varphi_k$, a negative signal is received with probability $\pi_0 \in [0,1]$ and a positive signal with corresponding probability $1 - \pi_0$. If the nonvoting member did not violate the social norm, that is, $y > \varphi_k$, then a negative signal is received with a lesser probability $\pi_1 \in [0, \pi_0]$. A positive signal should be thought of as "producing a good excuse for not voting" so that a nonvoter who is genuinely excused is more likely to be able to produce a good excuse than one who is not.[7]

The outcome of the election is determined by the fraction of the electorate $b_k = \eta_k \varphi_k$ that each party turns out, and sometimes we will refer to this as the *bid* of party k. The party that turns out more of its members wins. In case of a tie we assume that the large party wins.[8] This is similar to an all-pay auction: the party that "submits the highest bid" wins, but each party pays the cost for their bid. If a party bids only its committed voters it bids $\underline{b}_k \equiv \eta_k \underline{y}$ at zero cost and if it bids all its voters it bids η_k.

We assume that the mechanism is designed, either by benevolent party leaders or by consensus of the party, to maximize the common ex ante utility of party members. Let $\Pi_k(\varphi_k)$ be the probability of winning the election as a function of party turnout. If all group members adhere to the social norm party utility is given by the expected benefit of winning $\Pi_k(\varphi_k)V$ minus the direct cost of participation $\eta_k \int_0^{\varphi_k} c(y)\, dy$ and the cost of punishing "excused" party members $\eta_k \int_{\varphi_k}^1 \pi_1 P_k\, dy$. This latter cost arises precisely because the signal is noisy. The overall utility of the party is therefore $U_k \equiv \Pi_k(\varphi_k)V - \eta_k\left[\int_0^{\varphi_k} c(y)\, dy + \int_{\varphi_k}^1 \pi_1 P_k\, dy\right]$. The two parties simultaneously choose their mechanisms in an effort to maximize party utility. This is a game between mechanisms in the sense of Myerson (1982) or Dutta, Levine, and Modica (2018). An equilibrium consists of probability distributions over mechanisms for both parties such that, given the mechanism of the other party, each party finds its own mechanism optimal.

[7] At the extremes, costs are either public information, so that $\pi_1 = 0$ and $\pi_0 = 1$, or costs are private information and the signal is uninformative, so that $\pi_0 = \pi_1$. Notice that in this latter case the party can provide incentive for voting only by punishing all nonvoters.

[8] If we assume that in case of a tie each party has an equal chance of winning an equilibrium may fail to exist for an uninteresting reason. As we shall see there can be equilibria in which the large party with positive probability bids preemptively, and this is the only case in which the tiebreaking rule matters. The large party bids preemptively when it turns out more voters than there are in the small party. However, it would always benefit from mobilizing slightly fewer voters. Hence, we must allow the large party to bid preemptively by mobilizing the exact number of voters in the small party, meaning if there is a tie it must win. An alternative approach is to follow Simon and Zame (1990) and allow the tiebreaking rule to be endogenous: this leads to the same equilibrium described here.

II. The Optimal Punishment

In choosing a mechanism $\{\varphi_k, P_k\}$ the party must ensure that party members are willing to comply with the social norm. That is, the maximization of U_k is subject to incentive constraints. In particular the members who are "expected" to vote, that is, $y \leq \varphi_k$ must be willing to do so. As voters are infinitesimal, they receive no direct benefit from the public good so if they vote they simply bear the net cost $c(y)$. If they choose not to vote they avoid the cost, but instead face an expected cost of punishment equal to the probability of being "caught without a good excuse" times the punishment $\pi_0 P_k$. Hence the incentive constraints are that for $y \leq \varphi_k$ we have $c(y) \leq \pi_0 P_k$. In addition, the punishment cannot be set so high that voters who are not expected to vote are tempted to do so. That is, there are additional incentive constraints for these voters that the cost of voting should be greater than the expected punishment, that is, for $y > \varphi_k$ we have $c(y) \geq \pi_1 P_k$.

A mechanism that maximizes utility must minimize the monitoring cost given by $\int_{\varphi_k}^1 \pi_1 P_k\, dy$ for any social norm φ_k. This means that P_k should be chosen as small as possible provided that incentive constraints are not violated. Clearly, it cannot be optimal for the party to choose $\varphi_k < \underline{y}$. If instead $\varphi_k = \underline{y}$ and just committed voters are asked to vote, incentive compatibility is not an issue and P_k should be taken equal to 0. It is only when $\varphi_k > \underline{y}$ that incentives must be provided to members who find voting costly. As $c(y)$ is increasing we see that if the incentive constraint is satisfied by the marginal voter $y = \varphi_k$ then it is satisfied for all $y \leq \varphi_k$. Hence the relevant constraint is $c(\varphi_k) \leq \pi_0 P_k$ and the punishment P_k is minimized when $P_k = c(\varphi_k)/\pi_0$. Notice that when this punishment is chosen the incentive constraints for $y > \varphi_k$ do not bind. If we define the monitoring difficulty of voting as $\theta = \pi_1/\pi_0 \in [0,1]$ then an optimal mechanism has least monitoring cost equal to $\int_{\varphi_k}^1 \pi_1 P_k\, dy = \theta(1-\varphi_k)c(\varphi_k) \equiv M(\varphi_k)$ which we refer to for simplicity as the *monitoring cost*.

Recall that in addition to the monitoring cost there is the direct cost of participation. This has two parts: $\int_0^{\underline{y}} c(y)\, dy$ that is a negative constant representing a benefit that we may ignore and $\int_{\underline{y}}^{\varphi_k} c(y)\, dy \equiv T(\varphi_k)$, which we refer to as the *turnout cost* and represents the added cost of turning out voters beyond those who are committed. Hence, for $\varphi_k \geq \underline{y}$ we define the total expected cost of turning out voters to be the sum of the turnout and monitoring cost $C(\varphi_k) = T(\varphi_k) + M(\varphi_k)$ which is increasing in φ_k. For $\varphi_k < \underline{y}$ it is convenient to define $M(\varphi_k) = 0$ since in any case it is never optimal to choose $\varphi_k < \underline{y}$. With these conventions party utility can be rewritten as

$$U_k \equiv \Pi_k(\varphi_k)V - \eta_k C(\varphi_k) - \eta_k \int_0^{\underline{y}} c(y)\, dy$$

$$= \Pi_k(\varphi_k)V - \eta_k\left[\int_{\underline{y}}^{\varphi_k} c(y)\, dy + \theta(1-\varphi_k)c(\varphi_k)\right] - \eta_k \int_0^{\underline{y}} c(y)\, dy.$$

III. Main Results

What is gained by adding monitoring to an otherwise standard group-turnout model? A large group has a natural advantage since, for a given social norm, it can turn more voters out. In particular, to turn out a fraction b of the electorate, the large party can choose a smaller social norm $\varphi_L = b/\eta_L$ than the small party $\varphi_S = b/\eta_S$. Hence, focusing only on turnout costs, the large party has a cost advantage in turning out voters since the marginal cost of turnout $T'(\varphi) = c(\varphi)$ is increasing. By contrast, the large party faces a disadvantage in monitoring cost since it will need to monitor and punish a greater proportion of nonvoters. To determine the combined effect of turnout and monitoring costs consider the total expected cost of mobilizing a fraction b of the electorate, which equals

$$\eta_k C(b/\eta_k) = b\frac{C(b/\eta_k)}{(b/\eta_k)} = bAC(b/\eta_k),$$

where $AC(\varphi_k)$ denotes the average cost. We see immediately that the party with the lower average cost will have a cost advantage. If $AC(\varphi_k)$ is declining in φ this will be the small party while if $AC(\varphi_k)$ is increasing it will be the large party. Alternatively, we can think in terms of the concavity of the expected cost function $C(\varphi_k)$. If $C(\varphi_k)$ is convex, then $AC(\varphi_k)$ is increasing and the large party has an advantage. If it is concave, then $AC(\varphi_k)$ is declining and the small party has an advantage.

When monitoring is perfect, i.e., $\theta = 0$, we are in the existing world of the ethical voter model. In this case, $AC(\varphi_k)$ is increasing and the large party always has an advantage. By contrast, if $\theta > 0$, the monitoring cost $M(\varphi_k) = \theta(1 - \varphi_k)c(\varphi_k)$ is nonnegative, takes on strictly positive values, yet at the endpoints is equal to 0. In particular, when only committed voters vote, no monitoring is needed, while on the other hand if everyone votes there is nobody to punish.[9] Because the monitoring cost cannot be convex, it might be the case that average costs are decreasing giving the small party a cost advantage.

A. *Equilibrium*

In order to characterize the equilibrium, we should first determine the highest fraction of the electorate $\bar{b}_k$ a party is willing to turn out. At this upper bound, either the party reached full turnout or the utility from winning the election is equal to 0. That is, if $\eta_k C(1) < V$ then the party is willing to turn out all its voters and $\bar{b}_k = \eta_k$. If instead $\eta_k C(1) \geq V$, then $\bar{b}_k$ is the unique solution to $\eta_k C(\bar{b}_k/\eta_k) = V$. We refer to $\bar{b}_k$ as the *willingness to bid*.

We say that the party with the smaller willingness to bid is *disadvantaged*, denoted by the subscript d, and the party with the higher value is *advantaged*, denoted by $-d$. Except where explicitly stated we also assume that the small party is willing to turn out at least the number of committed voters of the large party, that is, $\bar{b}_S > \eta_L \underline{y}$.[10] In the next theorem we characterize payoffs in the unique equilibrium.

[9] Notice that this property of monitoring cost is robust to the details of the particular monitoring process.

[10] When $\bar{b}_S < \eta_L \underline{y}$ there is a unique equilibrium in which each party turns out only committed voters. This is the only case in which there is an equilibrium in pure strategies.

THEOREM 1: *There is a unique equilibrium. In this equilibrium neither party uses a pure strategy, the utility of the disadvantaged party is* 0 *and the utility of the advantaged party is* $V - \eta_{-d} C(\overline{b}_d / \eta_{-d})$.

While a complete proof of all of our theorems, including a characterization of the equilibrium strategies, can be found in the online Appendix, the intuition for the result is fairly straightforward and follows from basic properties of auction theory. In a second price auction the disadvantaged party loses the auction and gets 0 while the advantaged party gets the difference between the value of the prize and the cost of matching the bid of the disadvantaged party. We know that this result continues to hold for the all-pay auction, although the equilibrium strategies are mixed rather than pure. We can now move to one of the main results of our paper: what determines party advantage.

B. *Which Party Is Advantaged?*

Intuitively, the large party having a large number of committed voters is naturally advantaged. On the other hand, we also know that increasing average costs of turning out supporters favors the small party. The expected cost function $C(\varphi)$, however, is not a fundamental of our model: it depends on the distribution of costs in the population and on the monitoring difficulty θ. We aim here to establish how these economic fundamentals interact to determine party advantage. Specifically, we will establish that, regardless of the distribution of costs, for the small party to be advantaged three conditions must be satisfied: (i) monitoring costs must be high; (ii) the small party must not be "too small"; (iii) the value of winning the election must be of intermediate size.

THEOREM 2: *For any individual cost function* $c(y)$ *with corresponding committed voters* $\underline{y}$ *there exist four constants* $\underline{\theta}^S < 1$, $\underline{\eta}_S < 1/2$, *and* $\overline{V} > \underline{V}^S > 0$ *such that if all the conditions* $\theta > \underline{\theta}^S$, $\eta_S \geq \underline{\eta}_S$, *and* $\underline{V}^S < V < \overline{V}$ *hold the small party is advantaged. Conversely if* $\underline{y} > 0$ *for any values of the other parameters there exist three constants* $\underline{\theta}^L > 0$, $\overline{\eta}_S > 0$, *and* $\underline{V}^L > 0$ *such that if any of the conditions* $\theta < \underline{\theta}^L$, $\eta_S < \overline{\eta}_S$, $V < \underline{V}^L$, *or* $V > \overline{V}$ *are satisfied then the large group is advantaged.*

Notice that the reason for the intermediate value of the prize is very intuitive: if the prize is small, parties turnout will be low and committed voters will play a disproportionate role favoring the large party. If the value of the prize is high, parties will be willing to turn out many voters and the large party has more voters. It is only in the intermediate case that the small party may be advantaged.[11] Notice that the theorem has the following implication: if monitoring costs are high, the two parties are relatively close in size and willing to turn out most but not all of their voters, then it is

[11] The theorem provides sufficient conditions for party advantage and does not cover all parameter configurations. Indeed, there are intermediate cases in which the identity of the advantaged party depends on the shape of the cost function $c(y)$.

the small and not the large party that is advantaged. Furthermore, if any one of these conditions fails sufficiently badly the large party is advantaged. In particular if $\theta = 0$, that is, monitoring is perfect and we are in the existing world of the ethical voter model with a common prize for each group, the smaller party can never be advantaged.[12]

C. *Who Wins?*

Advantage is defined in terms of willingness to turn out supporters. From Theorem 1 we know that this is the same as a utility advantage: the advantaged party receives a positive utility and the disadvantaged party receives no utility. Does it translate also into an advantage in terms of winning the election? To what extent does the advantaged party turn out more voters and have a better chance of winning? As turnout is stochastic for both parties, a natural measure is first-order stochastic dominance (FOSD). If the equilibrium bidding function of one party FOSD that of the other then it has a higher chance of winning the election and in a strong sense it turns out more voters.

Party advantage, as we shall see, is not enough to guarantee FOSD. Hence we introduce the notion of *strong advantage*. Convexity of $C(\varphi)$ is a simple sufficient condition for large party advantage and it is natural to view this as a strong advantage. On the other hand, in the presence of committed voters $C(\varphi)$ cannot be concave, so for the small party we introduce the weaker notion of incremental concavity, that $C(\varphi)$ be concave for $\varphi \geq \underline{y}$. We define strong advantage for the small party as the combination of small party advantage (that is a larger willingness to turn out supporters) and incremental concavity.[13] Equipped with this definition we have the following result.

THEOREM 3: *The equilibrium bidding function of a strongly advantaged party FOSD that of the disadvantaged party.*

To relate strong party advantage with the distribution of costs in the population and the monitoring difficulty θ, we denote by $G(c)$ the CDF of costs for an individual so that the net participation cost of voting can be expressed as $c(\varphi) = G^{-1}(\varphi)$, $\varphi = G(c)$ and the support is $[c(0), c(1)]$. We denote the density of $G(c)$ by $g(c)$, and we assume it is continuously differentiable, strictly positive, and has a single "top" in the sense that it is either single peaked or it is a limiting case such as the uniform where the density is flat at the top. The key determinant of strong advantage is how many relatively low cost and relatively high cost voters there are. In order to show this formally we introduce two measures based on the density of relatively low cost voters $\underline{\gamma}$ and of relatively high cost voters $\overline{\gamma}$. First define

$$\mu(c) = \frac{\left(g(c)\right)^2}{2\left(g(c)\right)^2 + \left(1 - G(c)\right)g'(c)},$$

[12] In the case of a common per capita prize for each group, as in Feddersen and Sandroni (2006), the large group is always advantaged regardless of monitoring costs. We discuss this point and different assumptions about a common prize in Section V.

[13] We discuss the case of incrementally concave costs and an advantaged large party in the online Appendix. Indeed, with incrementally concave costs and an advantaged large party, it might be the case that the small disadvantaged party turns out more members in expectation and has a higher probability of winning than the large advantaged party.

then $\underline{\gamma} = \min_{c \geq 0} \mu(c)$ and $\overline{\gamma} = \max\{0, 1 - \max_{c \geq 0} \mu(c)\}$. In the online Appendix we prove the following result.

PROPOSITION 1: *The measures $\underline{\gamma}$ and $\overline{\gamma}$ satisfy $0 \leq \underline{\gamma}, \overline{\gamma} \leq 1/2$. If $g(c)$ is weakly decreasing then $\underline{\gamma} = 1/2$. If $g(c)$ is weakly increasing then $\overline{\gamma} = 1/2$. If the density $g(c)$ shifts to the right then $\overline{\gamma}$ is constant and $\underline{\gamma}$ decreases; if the density shifts to the right holding fixed $c(1)$ then $\overline{\gamma}$ increases. Furthermore, increasing dispersion by a change of scale around the mode increases both $\underline{\gamma}$ and $\overline{\gamma}$.*

The proposition asserts that if there are many relatively low cost voters then $\underline{\gamma}$ is large and if there are many relatively high cost voters then $\overline{\gamma}$ is large. If there are many of both type then both may be large: in particular for the uniform $\underline{\gamma} = \overline{\gamma} = 1/2$. Intuitively we expect that having many relatively low cost voters, that is high $\underline{\gamma}$, is similar to having many committed voters and so it should favor the large party. The next theorem makes this precise and also shows that, conversely, having many relatively high cost voters, that is high $\overline{\gamma}$ favors the small party.

THEOREM 4: *The large party is strongly advantaged if and only if $\theta < \underline{\gamma}$. Cost is incrementally concave (a necessary condition for small party strong advantage) if and only if $\theta > 1 - \overline{\gamma}$.*

In particular a necessary condition for the large party to be strongly advantaged is $\theta < 1/2$ and similarly $\theta > 1/2$ is necessary for the small party to be strongly advantaged. These conditions are also sufficient in the uniform case. More broadly for a downward sloping density $\theta < 1/2$ is sufficient for the large party to be strongly advantaged and for a upward sloping density $\theta > 1/2$ is necessary for the small party to be strongly advantaged.[14] When there is a single peak in the interior, increasing dispersion by raising both $\underline{\gamma}$ and $\overline{\gamma}$ favors whichever party has the monitoring cost advantage. That is, if $\theta < 1/2$ it favors the large party and if $\theta > 1/2$ it favors the small party.

D. *Discussion*

While our results are based on the neutral assumption that costs are the same for both parties this is not essential. With differential costs the all-pay auction is still equivalent to the second price auction and anything that lowers a party's costs are to their advantage.[15] In particular, small party advantage rests not on high monitoring costs, but on high monitoring costs for the large party: if the small party has lower monitoring costs this is also to its advantage. So, for example, a rural minority may have an advantage because urban voters have high monitoring costs although the rural voters have low monitoring costs.

Examples of a smaller group prevailing over a larger one are not uncommon, but, since our theory predicts a positive probability of the disadvantaged party winning,

[14] Recall that additional conditions are required for small party advantage: the small party should not be too small and the prize must be of intermediate value.

[15] Our earlier working paper, which is available upon request, analyzes this case.

we cannot draw conclusions about advantage by examining the results of a single election. One case where we have data on many similar elections is that of teacher unions capturing school boards. These have been studied by Moe (2005, 2006) which indicates that these elections are often the only ballot issue and that the unions, the small party, are consistently successful at defeating the parents, the large party. Since the stakes are control over budgetary resources, the common prize model is not unreasonable and turnout is low indicating that civic duty is probably not an important reason for voting. Although other explanations are possible, it seems likely that the fact that the interested voters in the large party (the parents) are a scattered fraction of the overall population makes monitoring difficult. That is, these elections seem likely to satisfy our conditions for small party advantage.

There is also a strategic lesson here for small parties. Consider a fixed cost per voter of turning out: for example, the cost of busing voters to the polls or a voter ID law. An increase in the fixed cost shifts the distribution of voting costs to the right, raising $\underline{\gamma}$ and leaving $\bar{\gamma}$ unchanged. It also decreases the number of committed voters $\underline{y}$. The former decreases the chances of large party strong advantage, and the latter increases the chances of small party advantage: that is, higher fixed costs for both parties favor the small party.

It is natural to try to raise costs for the other party. What this analysis shows is that it is enough for the small party to raise the fixed costs of voting, that is, make it more difficult and unpleasant, for everyone. For this to work, however, two other things must be true: the stakes must be sufficiently low and monitoring costs sufficiently high.[16] On the other hand, if the stakes become large enough this policy can fail catastrophically: a small change from $V < \overline{V}$ to $V > \overline{V}$ will abruptly shift party advantage from the small to the large.

IV. Comparative Statics

We will now investigate the effects on turnout and closeness of elections, of the value of election, and of the efficiency of the monitoring technology.

A. *The Value of Elections*

If $V > \eta_L C(\eta_S/\eta_L)$ the large party is willing to outnumber the entire small party: in this case we say the election is a *high value election.* This is a natural model when the stakes are high such as elections for national leader or important referenda such as Brexit. We will say that the small party *concedes the election* if it turns out only its committed voters. Furthermore, we say that the large party *preempts the election* if it turns out the most voters feasible for the small party, that is η_S. The next result shows that while both parties are willing to turn out all their voters, this will not occur in equilibrium.

[16] We argue in Section IVB that over time monitoring costs have probably increased. If so it would pay small parties to try to increase participation costs, and this may explain why the small party in the United States, the Republican party, has increasingly engaged in efforts to raise costs through voter ID laws and the like.

THEOREM 5: *In a high value election the probabilities that the small party concedes and the large party preempts the election increase in V, and approach* 1 *in the limit. As V increases, the bid distribution of the small party declines in FOSD and the bid distribution of the large party increases in FOSD. The expected vote differential increases in V while the expected turnout cost remains constant.*

We refer to the fact that mobilization of the small party is decreasing and its probability of concession increasing in V as the *discouragement effect*, which is standard in all pay auctions. Since the large party is willing and able to outnumber the small party, the small party becomes discouraged and, as the stakes increase, turns out fewer and fewer voters. Notice that the expected turnout cost of the small party declines and the expected turnout cost of the large party increases, but the two effects exactly offset each other.

In the high value election we can see clearly that there is a discontinuity in the surplus when the parties are of near equal size. As $\eta_L \rightarrow 1/2$ the surplus of the large party approaches $V - (1/2)C(1)$, that is, in the limit it does not approach 0. Hence, a small change in party size shifting a small party into a large party causes the surplus of that party to jump from 0 to a strictly positive value and conversely. Moreover, neither the probability of concession nor the probability of the large party taking the election approach 0 and for large V both are close to 1. In other words, a small change in the party size causes a party that was conceding with positive probability to stop conceding and instead preempt the election with positive probability. The discontinuity is important if we step back from the model and consider a broader setting in which parties choose platforms in an effort to compete for members prior to the election: we see that a small shift in the relative sizes of the parties can have disproportionate consequences, suggesting that the competition over platforms may be a fierce one.

It is interesting to contrast a *low value election* in which $V < \eta_S C(\eta_L \underline{y}/\eta_S)$ and only committed voters turn out with a high value election. As Theorem 5 shows, in a high value election both parties turn out more than their committed voters with positive probability and the large party does so with probability 1 and indeed has positive probability of turning out as many voters as there are in the small party. Hence, turnout is substantially higher in a high value than in a low value election. This is consistent with suggestive evidence of higher participation in national than in local elections, and with empirical evidence showing that electoral participation will be higher in elections where stakes are high.[17]

B. *Monitoring Difficulty in High Value Elections*

Here we focus on the important case of a high value election. Our intuition is that increasing monitoring difficulty θ should decrease turnout. The following theorem shows that if the small party is neither too large nor too small this is true and that in addition elections are closer.

[17] See, Andersen, Fiva, and Natvik (2014).

THEOREM 6: *In a high value election, an increase in monitoring difficulty θ decreases the turnout of the advantaged (large) party in terms of FOSD. Furthermore, there exists $0 < \underline{\eta} < \overline{\eta} \leq 1/2$ such that for $\underline{\eta} < \eta_S < \overline{\eta}$ the expected turnout of the disadvantaged (small) party decreases in monitoring difficulty in terms of FOSD while the expected vote differential also decreases.*

There is some direct data on the effect of monitoring inefficiency on turnout cost: Larreguy, Marshal, and Querubin (2016) found that increased monitoring inefficiency of local mobilizers decreases turnout buying for two parties of similar size as Theorem 6 suggests. That increased monitoring difficulty decreases turnout may also help to explain why measures designed to increase turnout by lowering participation costs may actually have the perverse effect of decreasing turnout because they also raise monitoring costs. Voting at a polling place is a relatively visible and easy to monitor activity. Voting by post, internet, or indeed in the supermarket is not so much so. Hence, lowering the inconvenience of voting by allowing it to take place away from the polling place is an example of a reform that may have the perverse effect of reducing turnout. There is evidence that this is indeed the case: Funk (2010) shows this was the case when postal voting was introduced in Switzerland, and the 2000 UK policy experiment of setting in-store poll booths also failed to increase turnout.

Another application concerns the idea that in Western Europe, over the period since World War II, the social ties underlying the party system have broken down. One possible interpretation of this is that monitoring has become more inefficient. For example, in the old days labor union members in the United Kingdom socialized in pubs and old money socialized in clubs, with the resulting strong social ties keeping monitoring costs low for the Labor and Conservative party, respectively.[18] For a considerable period after World War II, Western Europe was dominated by large mildly left-wing parties of various flavors of labor or Christian Democrats. Theorem 6 supports the idea that there is a connection between the breakdown in social ties, meaning less efficient monitoring, and the decline in these parties as measured by declining turnout and more competitive elections.[19]

V. Related Literature and Discussion of the Model

In our model there is no room for pivotality of the individual voter to play a role. Although they do well in the laboratory for small elections (see, for example, Levine and Palfrey 2007), pivotal voters models such as Palfrey and Rosenthal (1985) have difficulty in explaining turnout in mass elections.[20] Consequently attention has turned to follow-the-leader models such as Shachar and Nalebuff (1999)

[18] This is consistent with the concept of "mass parties" in the political science literature: see, for example, the discussion of the literature in Katz and Mair (1995).

[19] Gray and Caul (2000) relates postwar turnout decrease with the decline of mobilizing actors such as labor parties and trade unions, and Knack (1992) connects the decline of American voter turnout with a weakened enforcement of social norms.

[20] Coate, Conlin, and Moro (2008) shows that in a sample of Texas liquor referenda, elections are much less close than what would be predicted by the pivotal voter model, and Coate and Conlin (2004) shows that a model of ethical voters better fits that data than the model of pivotal voters. Not surprisingly, the probability of being pivotal in large elections is very low as documented by Mulligan and Hunter (2003) and Shachar and Nalebuff (1999).

or models of ethical voters such as Feddersen and Sandroni (2006) and Coate and Conlin (2004).[21] While Shachar and Nalebuff (1999) focuses on the costs to the leaders, we follow the ethical voter literature in focusing on the costs to the followers. Our model can be interpreted as an ethical voter model in which, in addition to voting out of a sense of civic duty, voters also engage in peer pressure out of a sense of civic duty. As a result, when in the mechanism design problem monitoring cost is 0, the solution is the same as that in the ethical voter model.

In the remainder of this section we examine three key elements of our model: symmetry of the fundamentals, the absence of exogenous uncertainty, and the fact that costs are bounded.

A. *Symmetry of the Fundamentals*

As a benchmark we have assumed symmetry in voting costs between the two parties and in that they compete for a common prize worth the same to each party. This is a useful benchmark model: voters in both parties face identical ex ante participation costs and a common prize is efficiency neutral. Naturally if one side has a cost advantage or values the prize more highly than the other party it will be more able and willing to turn out voters and this will give it an electoral advantage.

A common prize makes sense when the outcome of the election are taxes, subsidies, and other transfer payments. By contrast, if civil rights and law changes are at stake it may make sense to assume that the benefit of winning is the same for all members of a party. It is less certain in this case that the benefit should be the same for both parties.

In the literature, assumptions about a common prize vary. Shachar and Nalebuff (1999) and Herrera, Morelli, and Nunnari (2016), which are interested in the same turnout issues we are, assume a common prize. Coate and Conlin (2004) assumes that the per capita value of the prize is independent of the size of the party, but may differ between the two parties: this is appropriate in their setting of liquor referenda. Feddersen and Sandroni (2006) assumes the per capita value of the prize is the same for everyone. Finally, Palfrey and Rosenthal (1985) and Levine and Palfrey (2007) also assume the per capita value of the prize is the same for everyone, but study a pivotal voter model in which the aggregate size of the prize to the party is of less importance.

The case of a common per capita prize makes a useful contrast to that of a common prize: this provides an additional advantage to a large party which has more members to enjoy the per capita value. Indeed, it provides enough advantage to the large party that it is advantaged in our model regardless of monitoring costs.[22] In all likelihood reality lies in between a common prize and a per capita prize: typically elections involve a mix of issues, some involving taxes and transfers,

[21] Herrera, Morelli, and Nunnari (2016) examines all three models. Ali and Lin (2013) extends the Feddersen and Sandroni (2006) model by introducing "pragmatic" voters alongside ethical voters. A pragmatic voter votes only because she wishes others to think of her as being ethical. Morris and Shadmehr (2017) studies a model where voters with heterogeneous beliefs are encouraged to participate by a party that provides incentives. In their model, incentives have an opposite effect on optimistic and pessimistic voters, while our incentives encourage all voters.

[22] If $V_k = \eta_k v$ the objective function is equivalent to $\Pi_k(b_k, F_{-k})v - C(b_k/\eta_k)$. Since for a given bid b the smaller party must turn out more voters $b/\eta_S > b/\eta_L$ and expected costs are increasing, it follows that the cost of a bid is always lower for the large party, hence it is advantaged.

other involving rights. Esteban and Ray (2011) considers a model with both types of prizes to describe the surge of ethnic conflicts and Esteban, Mayoral, and Ray (2012) brings their theoretical predictions to the data showing that both types of prizes are important.[23]

B. *Endogenous versus Exogenous Uncertainty*

There are different assumptions used in the literature about the way in which voting determines the outcome of an election. Palfrey and Rosenthal (1985) assumes as we do that the parties are of fixed size and the party with the most votes wins. Other models introduce aggregate shocks and assume that these are sufficiently large to guarantee the existence of a pure strategy equilibrium. In our model, voter turnout is also random but this is endogenous due to the use of mixed strategies by the parties. This is reflected in the reality of elections as in the case of GOTV (Get Out the Vote) efforts. Our view is that these efforts are an important part of establishing the social norm for the particular election, and indeed, GOTV efforts are variable and strategic. Furthermore, political parties have strong incentives not to advertise their GOTV effort, and in fact to keep it secret.[24] Clearly, there is little reason to do that unless indeed GOTV effort is random. Hence, the mere fact that it is secret provides evidence that, consciously or not, political parties engage in randomization when choosing social norms for particular elections.

In general and in Shachar and Nalebuff (1999) and Coate and Conlin (2004), exogenous random turnout leads to a model in which the probability of winning depends not only on bids but also on the size of the two parties. Herrera, Morelli, and Nunnari (2016) uses a more standard contest resolution function in which the probability of winning depends only on the bids and this is also the case in the specific application of Feddersen and Sandroni (2006).

Despite this wide variety of assumptions on conflict resolution the existing literature assumes that monitoring costs are absent and conclude that the large party is advantaged. They all study pure strategy equilibria. As each paper makes special assumptions we give a general result in the online Appendix for a common prize, convex common costs, and a standard contest resolution function where the probability of winning depends only on the bids: pure strategy equilibrium advantages the large party which turns out more voters and a gets greater utility than the small party. This is the same result we find for our mixed equilibrium.[25]

[23] In the online Appendix we show that our results about small group advantage are robust in the sense that they hold for any nontrivial mix of a common and per capita prize. It is only in the extreme case of a pure per capita prize that the large group is advantaged regardless of monitoring cost. The theory of group size has been explored also in settings where the benefit of an electoral victory itself provides incentives due to private attributes. See, for example, Esteban and Ray (2001) and Nitzan and Ueda (2011).

[24] Accounts in the popular press document both the surprise over the strength of the GOTV and the secrecy surrounding it. For example: "The power of [Obama's GOTV] stunned Mr. Romney's aides on election night, as they saw voters they never even knew existed turn out … " (Nagourney et al. 2012); or "[Romney's] campaign came up with a super-secret, super-duper vote monitoring system […] to plan voter turnout tactics on Election Day" (York 2012). Note that the secrecy at issue is not over whether people voted: we assume that the act of voting is observable. Rather the secrecy is over the social norm that is enforced on election day.

[25] There is an analogous result for concave costs, but it is of lesser interest since pure strategy equilibria are not so likely to exist in that case.

C. *Bounded Costs*

We have assumed that costs are bounded by $c(1)$. A consequence of this is that, if the prize V is sufficiently large, a party that could insure victory by doing so would turn out all of its voters. Moreover, while we show in the online Appendix that the equilibrium probability that either party turns out all of its voters is 0 in a high value election, there is a small probability that the turnout of the small party is close to 100 percent. Empirically, this has little meaning since measured turnout is as a fraction of the voting age population not, as in the model, as a fraction of people actively contemplating voting. Nevertheless, it might be judged unreasonable that a party would turn out nearly all of its voters: in reality, we would expect that some voters would have such high costs that it would not be worth turning them out regardless of how high the stakes might be. It turns out that this does not matter very much. In the online Appendix, we show that while the equilibrium is more difficult to compute with unbounded costs the equilibrium strategies and utilities are close to those with bounded costs even when V is very large.

VI. Conclusion

We have examined a model that captures the importance of social norms and peer pressure in voter turnout. The resulting theory does not discard the major existing theories: the ethical voter model corresponds to the special case in which monitoring costs are zero and, when the electorate is small, pivotality can be incorporated into the incentive constraints for individual voters. The theory also makes a rich new set of predictions, relating, for example, monitoring cost to turnout. One key prediction concerns the case in which monitoring cost is large and committed voters few: in this case, unlike in ethical voting and follow-the-leader theories, the small group may be advantaged.[26] This may explain why there are many referenda where special interests do well: for example, the type of commercial gambling permitted on Indian reservations, school budgets, the working environment for prison guards, and so forth.

Our model applies more generally to a situation where two groups compete by turning out members. It has the potential to organize in a common framework a variety of puzzles in the literature on voting, lobbying, and conflict. Why are small groups much more effective at lobbying or bribery as in as in Hillman and Riley (1989), Acemoglu and Robinson (2001), or Levine and Modica (2017)? What is the nature of small and large party advantage with a broader range of contest success functions? What does the theory tell us about which contest success functions most successfully trade off getting the prize to the right party while minimizing the cost of electoral competition? Opening the black box of the party to understand the mechanism design that overcomes the free-rider problem as we have done can help identifying key elements common to all of these issues.

[26] We should mention that minority advantage is also present in Casella and Turban (2014) albeit for an entirely different reason: the authors study a model in which votes can be bought and sold in market.

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