

Communication Costs, Information Acquisition, and Voting Decisions in Proxy Contests

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This article synthesizes some recent progress in the theories of corporate control and political lobbying to model the proxy campaign as a political campaign. The model yields a number of testable implications, only some of which have been examined in the literature. For example, if the loss from voting for a “bad” dissident exceeds the gain from voting for a “good” dissident, the model predicts that as communication costs fall, the number of proxy fights increases, announcement day returns decrease, and the fraction of dissident wins first increases and then decreases.

- Nov 3, 1989: The California Public Employees' Retirement System (CalPERS) submits a letter to the Securities and Exchange Commission, proposing comprehensive revisions to the proxy rules.
- April 28, 1992: “Proposed amendments to proxy rules to enable shareholders and other persons to exchange views and

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comment on a proxy solicitation undertaken by the issuer, or any other person, without having to prepare a proxy statement or preclear communications with the Commission.”

— Report to the President of the
United States on Regulatory Reform
Initiatives of the Securities and
Exchange Commission (84944,36)

October 15, 1992: “In putting together the final rules, the SEC received nearly 1,200 comment letters - apparently the most in its history on a single subject.”
— The Wall Street Journal

November 19, 1992: “In the first salvo fired under newly liberalized proxy contest rules, a large Centel Corp. stockholder urged other holders to reject a proposed \$3 billion merger with Sprint Corp.”
— The Wall Street Journal

October 6, 1995: “SEC Relaxes Curbs on Use of Computers. . . . At the same time, SEC officials issued a stern warning about the use of the Internet by financial swindlers.”
— The Wall Street Journal

How does the cost of a dissident’s communication with other shareholders affect the efficiency of the proxy contest as a corporate control mechanism?¹ As the above news excerpts reflect, communication costs have fallen during the recent period of rising contest frequency.² While others [see Gilson, Gordon and Pound (1991), Power (1988), and Rosenbaum (1991)] have provided alternative explanations for this recent increase in proxy contest frequency — including the increased use of Rights Plans (poison pills), tougher state antitakeover statutes, the rise of institutional shareholders, and a possible trend away from “episodic confrontations” to more “continuous and tex-

¹ Before the proxy reforms were instituted in 1992, the SEC would not allow more than 10 shareholders to talk among themselves without triggering expensive and cumbersome proxy filings. The rules were so murky that few big shareholders ever held news conferences to discuss their views because they did not know whether they might trigger the proxy rules. At this point, some readers may wonder why doesn’t the First Amendment protect proxy solicitation like any other speech. In *Ohralik v. Ohio State Bar Association*, 436 U.S. 447, 456 (1978), the Supreme Court stated: “Numerous examples could be cited of communications that are regulated without offending the First Amendment, such as . . . corporate proxy statements.”

² Mulherin and Poulsen (1991, p. 142) found that the number of firms filing proxy contests (Schedule 14b) overtook the number of tender offer filings (Schedule 14d1) for the first time in recent years in 1990.

tured monitoring” — my analysis of the influence of declining communication costs on proxy contest initiation and resolution is new to the literature. An important policy issue I address is how costly it should be for shareholders to communicate with each other.

Synthesizing some recent progress in the theories of corporate control and political lobbying, I model the proxy campaign as a political campaign.³ If the costs of such a campaign are too low, Pound’s (1988) concern — “proxy contests involve little resource commitment . . . many contests are simply ‘crank’ control bids that should not be taken seriously” — is warranted. If campaign costs are too high, they deter legitimate reform.

This trade-off is explored in this article by modeling an environment where dissidents of unknown types lobby skeptical shareholders. This lobbying, however, is tempered by the fact that shareholders have access to a costly signal of dissident quality. The cost of such a signal could be interpreted as the time spent analyzing the evidence put forward by the dissident, or as a fee paid to an outside consultant. An interesting tension ensues. If the loss from voting for a “bad” dissident exceeds the gain from voting for a “good” dissident, this article finds that a reduction in barriers to vote solicitation encourages proxy fights but reduces the proportion of dissident wins in the case where barriers are low to begin with. This arises because although the dissident pool is increasing in size, its quality is declining in this region. The results reverse if the loss from voting for a “bad” dissident is less than the gain from voting for a “good” dissident.

This article also addresses the following issues:

Why proxy contest announcements are associated with a stock price appreciation;⁴ how this stock’s price appreciation is determined by firm characteristics;

How the verifiability of the evidence to be presented by the dissident about his proposal (or the intangibility of the firm’s assets) affects

³ Compared to the rather large literature analyzing mergers and tender offers, relatively few articles have provided theories of proxy contests. Manne (1965, p. 114) writes: “Indeed, it is somewhat difficult to describe the necessary conditions under which a proxy fight rather than some other take-over form will be indicated.” Harris and Raviv (1988) were the first to sketch out a theoretical framework. They defined a “successful tender offer” as one where the dissident’s win is guaranteed, an “unsuccessful tender offer” as one where the incumbent’s win is guaranteed, and a “proxy fight” as one where no group’s win is guaranteed. My delineation between the two methods is different: in a tender offer the dissident offers to buy and he “puts his money where his mouth is,” whereas in a proxy contest, he tries to convince shareholders that they should give their votes to him because his proposal is better. This emphasis on the communication process between a dissident of unknown type and a skeptical pivotal shareholder who may acquire additional information separates my analysis from that of Jarrow and Leach (1989, 1991), who focus on communication and coalition formation between dissidents of known types, incumbent management, and fiduciaries in a cooperative game framework.

⁴ This has been documented by DeAngelo and DeAngelo (1989), Dodd and Warner (1983), Ikenberry and Lakonishok (1993), and Mulherin and Poulsen (1992).

the number of proxy fights and the likelihood of a dissident win if there is a proxy fight;

How the size of dissident stock ownership affects the number of proxy fights and the likelihood of a dissident win if there is a proxy fight;⁵

How some managerial defensive measures (like Rights Plans or litigation) affect the number of proxy fights and the likelihood of a dissident win if there is a proxy fight;⁶

How communication costs affect the welfare of the pivotal shareholder; and finally

How the verifiability of the evidence to be presented by the dissident (or the intangibility of the firm's assets) affects the welfare of incumbent management.

In short, I derive a number of testable implications, only some of which have been examined in the literature. The overall results support the conjecture of Mulherin and Poulsen (1991) who argue that proxy rules should not be devised with a "one size fits all" approach, but should respect cross-sectional differences among firms. The contribution of this article is to develop a model to isolate and examine the effect of some of these cross-sectional variables.

Section 1 develops the model. A dissident shareholder decides on whether to spend a certain amount of money and solicit the votes of a pivotal shareholder. However, a second unbiased opinion is always available to the skeptical shareholder. This opinion is costly, and the higher the accuracy of this second opinion, the higher is its cost. Section 2 identifies three classes of equilibria. The information acquisition and voting strategies of the pivotal shareholder and the communicating strategy of the dissident are explicitly characterized. In Section 3, I perform the comparative statics that give many of the results of this article. Section 4 collects all the testable implications, discusses the limitations of the model, lays out directions for future research and concludes. All proofs are in the Appendix.

1. The Model

A proxy campaign is an exercise in strategic information transmission, the economics of which were analyzed in a seminal article by Crawford and Sobel (1982). There is a burgeoning literature analyzing lobbying by self-interested parties — Austen-Smith and Wright

⁵ Pound (1988) finds that the probability of a dissident win increased with his shareholdings, but Thomas and Martin (1994) document an insignificant relationship.

⁶ Thomas and Martin (1994) find that the presence of Rights Plans actually increases the likelihood of a dissident win.

(1992), Becker (1983), Milgrom and Roberts (1986), and Potters and Van Winden (1992) — and this article adapts the Potters and Van Winden (1992) model to a corporate control context.

There exists a dissident who, at time $t = 1$, either decides to engage in a proxy solicitation or to remain inactive. Dissidents can be either of two types: the “good” dissident whose proposal, if it wins and is incorporated, increases firm value from its existing level, and the “bad” dissident whose proposal, if it wins and is incorporated, decreases firm value from its existing level. The value of the firm under incumbent management is normalized to zero.

The dissident type is chosen by nature at time $t = 0$. The prior probability that a dissident is good is denoted by p . The lower the p , the higher are the chances that a bad dissident would become active. This assumption is a stylized way of capturing the idea that a proxy contest — a corporate control contest characterized by dissidents and management lobbying for a shareholder’s vote — is certain to encourage dissidents of different types to try their luck.⁷

Passive dissidents have no payoff. The payoff of active dissidents is as follows. If C is the cost incurred to solicit a proxy, losing dissidents bear that cost; x is the net gain (net of C) of a good dissident if he wins; y is the net gain (net of C) of a bad dissident if he wins; and $x \geq y > 0$.

There exists a pivotal shareholder, who owns s_p of the firm’s shares. His vote decides the winner. The value of his shares remain at zero if incumbent management wins, it increases by m if a good dissident wins, and it decreases by n if a bad dissident wins; m and n are positive. The assumption of a pivotal shareholder is an artifact that was first used by Shleifer and Vishny (1986) to break the Grossman and Hart (1980) free-rider problem. Besides vastly simplifying the analysis, it permits one to focus on the communication between the dissident and the skeptical shareholder, which is the main theme of this article.⁸

⁷ The minimum share ownership needed to submit a proposal for a proxy vote today is \$1000. The possibility of very risky proposals from dissidents, hence, is a valid concern. The initial 1935 SEC proxy rules were designed to minimize this. Pound (1991) quotes from Section 14 of the act: “. . . designed to assure that the security holders whose proxy or consent is solicited will be afforded adequate information as to the action proposed to be taken, and as to the source of the solicitation and the interest of the solicitor.” Rosenbaum (1991), arguing the case for management, writes: “Absent SEC oversight, proxy materials readily could degenerate into exaggeration and emotional appeals that confuse rather than inform shareholder-voters.” Proxy rules were severely tightened in 1956 partly because of the concerns that were generated by two well-publicized contests: *Robert Young v. New York Central Railroad* (1954) and *Louis Wolfson v. Montgomery Ward* (1955). These contents were characterized by multimillion dollar coast-to-coast campaigns that involved radio and television interviews, speeches, and full-page advertisements. The American Institute of Management denounced them as “adventurers who do not hesitate to promise the impossible.”

⁸ The pivotal shareholder could be conceived of as a block of shareholders that vote in the same way. This assumption is not unreasonable. There is already some evidence that institutional shareholders have started coordinating with each other. The United Shareholders Association

Various interpretations could be given to the variables m , n , x , and y . One interpretation is that every agent is risk neutral; the good dissident increases firm value, the bad dissident decreases firm value, but this decrease is offset by his private benefit of control. Another interpretation is that the pivotal shareholder is risk averse; the good dissident increases firm value, the bad dissident decreases firm value because his proposal is risky, but this decrease is offset by his private benefit of control or the bad dissident does not believe that his proposal has risk.⁹ It is important to note that all we need for the analysis is that both types have an incentive to solicit proxies (x and y are positive), and that the pivotal shareholder prefers some dissidents (m is positive) and does not prefer some other dissidents (n is positive). Note also that s_d , the number of shares held by each dissident, is assumed to be the same for both types of dissidents. This assumption allows the analysis to abstract from issues related to signaling through stockholding, and permits the focus to be exclusively on the proxy solicitation process as a credible communication mechanism.

I now interpret the communication cost C . The 1992 SEC rules on proxy reform focused on those parts of the costs that regulation itself affected: the “disinterested” persons exemption (previously SEC filing was required if more than 10 shareholders were to be contacted by someone, even if that person was not himself soliciting proxies) and delays caused by extensive preliminary filing requirements. Then there are costs that management can impose on the dissident: delaying access to shareholder lists, shortening the time available for proxy solicitation, scheduling the proxy vote in a special meeting rather than in the regular annual meeting, and setting an inconvenient “record date” (the “record date” is the date the voters are registered). Finally, there are costs which are structural: costs increase if ownership is more diffused and/or more shares are held in a street name.

If the dissident decides to solicit at time $t = 1$, then at time $t = 2$, the incumbent management is assumed to take the fight to a shareholder's

(USA), representing 65,000 large shareholders, has become a significant force in the corporate control debate. On February 3, 1993, the *New York Times* reported that a group called New Foundations had been formed to facilitate communications. Note also that, unlike a tender offer, the other atomistic shareholders do not have to make a decision as to whether to offer their shares now at the bid price or hold on in expectation of a larger payoff later. Their only decision is with regard to their vote. As they consider the outcome of the contest to be independent of their individual vote, they are indifferent. We assume that enough of them vote with the pivotal shareholder to get him a majority.

⁹ See Harris and Raviv (1993) for a formalization of this “agreeing to disagree” notion. A good illustration is provided by the disagreement between Kirk Kerkorian and Chrysler Corporation in 1995. Mr. Kerkorian wanted Chrysler to pay out most of its cash hoarding. The management of Chrysler disagreed, citing the need to have a comfortable cushion to hedge the next economic downturn.

vote.¹⁰ The proxy contest unfolds. At this point the pivotal shareholder may choose to seek a second opinion. Though unprejudiced, this signal is not perfect. More accurate signals cost more. As noted before, this cost could be interpreted as the time spent analyzing the evidence put forward, or it could be interpreted as the fee paid to an outside consultant if one is hired. The pivotal shareholder, therefore, has to decide on how much to spend on investigation, or alternatively, he has to decide on the accuracy of this signal. Let β be the probability that second opinion says “good dissident” given that it is actually a “good” dissident, or the probability that second opinion says “bad dissident” given that it is actually a “bad” dissident. Hence β is a metric for the accuracy of the signal. If $\beta = 1$, the signal is perfect; if $\beta = 0.5$, the signal is worthless.

The following parametric form for the cost function is posited: $-K[\ln\{2(1 - \beta)\} + 2\beta - 1]$, where $\beta \in [0.5, 1]$ and $K \in (0, \infty)$. This parametric representation of the cost function has some intuitive appeal. Not only is cost increasing with accuracy β , but it is increasing at an increasing rate. The cost of obtaining a perfect signal ($\beta = 1$) is infinite, and the cost of obtaining a worthless signal ($\beta = 0.5$) is zero. Further, the marginal cost at $\beta = 0.5$ is zero. So the choice of $\beta = 0.5$ is equivalent to a decision of not buying the signal. Further, K can be interpreted as a metric for the verifiability of the evidence that is presented (or a measure of the tangibility of the firm’s assets). The higher K is, the lower is the verifiability of the evidence that is presented (or the lower is the tangibility of the firm’s assets).

At time $t = 3$, the pivotal shareholder decides on how to vote. At time $t = 4$, he votes, the party that gets his vote is declared the winner, and payoffs are consumed.

It is useful to establish some notation at this point. The endogenous choice variables in the analysis, to distinguish them from the exogenous model parameters that have been described above, are denoted by Greek symbols. They are

At time $t = 1$,

α_g = probability that a good dissident decides to engage
in a proxy contest.

¹⁰ See Chapter 21, “Management’s Right to Use Corporate Funds,” in Aranow and Einhorn (1968) to understand the overwhelming advantage incumbent management has over the dissident in communicating to shareholders. Besides the reimbursement of the usual expenses, management has been allowed to deduct the costs of professional proxy solicitors, public relations experts, legal counsel, and corporate employee time. Dissidents, on the other hand, have been known to recover some of their costs only if they win and only if a majority of shareholders ratify their expenses. Losing dissidents have never recovered anything.

α_b = probability that a bad dissident decides to engage in a proxy contest.

At time $t = 2$,

β = the accuracy of the signal the pivotal shareholder buys if his vote is solicited ($\beta = 0.5$ is equivalent to not buying a signal).

At time $t = 3$,

ψ_g = probability that the shareholder decides to vote for the dissident after getting a signal that says "dissident is good."

ψ_b = probability that the shareholder decides to vote for the dissident after getting a signal that says "dissident is bad."

ψ = probability that the shareholder decides to vote for the dissident if he chooses not to buy a signal ($\beta = 0.5$).

2. Equilibria

The formal search for candidate equilibria is detailed in the first part of the Appendix. The solution algorithm is as follows. First, I characterize the optimal voting strategies of the pivotal shareholder at time $t = 3$. Second, I characterize the optimal information acquisition and voting strategies of the pivotal shareholder at time $t = 2$. Third, given the above strategies of the pivotal shareholder, the best response of the two dissident types at time $t = 1$ is characterized. I conclude by detailing the Nash equilibria that survive.

Among the class of candidate equilibria that involve the buying of a signal, it can be asserted that a separating equilibrium cannot exist. The reason is that if only the good dissident undertakes proxy fights, there is no need for the pivotal shareholder to buy a costly signal. Among the class of candidate equilibria that involve no buying of a signal, it can also be asserted that a separating equilibrium cannot exist. The reason is that if only the good dissident is presumed to undertake proxy fights, the pivotal shareholder will always vote for the dissident, and if that is the case, the bad dissident will deviate. Separating equilibria, hence, are ruled out. This is true for all search cost functions.

An exploration for candidate pooling equilibrium identifies two such equilibria.

Proposition 1. *One of two pooling equilibria may exist in certain parameter regions. In the first pooling equilibria, both types of dissidents always solicit proxies, the pivotal shareholder never buys a signal, and he always votes for the dissident. In the second pooling equilibria, both types of dissidents always solicit proxies, the pivotal shareholder buys a signal of a particular accuracy, and he votes for the dissident only if the signal says “good dissident.”*

Corollary 1 in the Appendix shows that the allowable parameter regions for these two equilibria have no intersection. This implies that these two equilibria cannot coexist. The intuition underlying this result is as follows. In the first pooling equilibrium, there are two necessary conditions for existence. The first necessary condition is that the unconditional expected gain from voting for the good dissident outweighs the unconditional expected loss from voting for the bad dissident, so that the net gain achieved by unconditionally voting for the dissident is positive. The second necessary condition is that K is bounded below so that the gain obtained from signal buying is less than the above net gain. In the second pooling equilibrium, there are also two necessary conditions. The first necessary condition is that if the net gain achieved by unconditionally voting for the dissident is positive, then K is bounded above so that the gain obtained from signal buying is more than the above net gain. This explains why there is no intersection in the allowable parameter regions for the two equilibria. If, on the other hand, the net gain achieved by unconditionally voting for the dissident is nonpositive, then K is bounded above so that the gain obtained from signal buying is positive. So K is bounded above in the second pooling equilibrium. The second necessary condition for this equilibrium is that y , the bad dissident's gain, is bounded below, so that he has an incentive to solicit a proxy in spite of the probability of losing.

Notice that in these equilibria, both types of dissidents always solicit proxies, and hence the proxy communication process is completely uninformative. Casual empiricism does not square with this prediction. DeAngelo (1988) exhaustively details the communication during a typical proxy campaign, and it does not seem that shareholders are totally skeptical. Further, the first pooling equilibrium predicts that dissidents always win, a prediction that is not borne out by the data.¹¹

¹¹ Theorem 1.1 in the Appendix shows that, for certain parameter regions, a third type of pooling equilibrium can also exist. Here no proxy solicitation takes place at all. If we make the assumption that $x > y$, this equilibrium is ruled out by applying Banks and Sobel's (1987) Universal Divinity refinement criteria. If there is an out-of-equilibrium deviation, it is likely to come from the good

This brings the analysis to the third equilibrium that is identified.

Proposition 2. *A semipooling equilibrium may exist for certain parameter regions. Here the good dissident always solicits, the bad dissident sometimes solicits, the pivotal shareholder buys a signal of a particular accuracy, and he votes for the dissident only if the signal says "good dissident."*

We need two restrictions to hold for this equilibrium to survive. These restrictions can be interpreted as bounds on K [Corollary 2(iii) in the Appendix]. Define p' as the conditional probability that a dissident is good given that a proxy solicitation has taken place. Then

$$p' = p\alpha_g / [p\alpha_g + (1 - p)\alpha_b]. \quad (1)$$

As $\alpha_g^* = 1$ and $\alpha_b^* < 1$ in this equilibrium, $p' > p$. The expected revenue of the pivotal shareholder at time $t = 2$ is going to be

$$p'\beta m - (1 - p')(1 - \beta)n \quad (2)$$

and so the marginal revenue with respect to β is

$$p'm + (1 - p')n. \quad (3)$$

This implies that a marginal increase in β (the signal accuracy) increases marginal revenue from two sources: the expected increase caused by voting for the good dissident [the first term in Equation (3)] and the expected increase caused by *not* voting for the bad dissident [the second term in Equation (3)]. This implies that if $m > n$, the marginal revenue increases in p' , and if $m < n$, the marginal revenue decreases in p' .¹² This is intuitive because in the first case the pivotal shareholder is concerned more with the loss that he will incur by not voting for the good dissident, whereas in the second case the pivotal shareholder is concerned more with the loss that he will incur by voting for the bad dissident.

The marginal cost of signal buying is

$$K(2\beta - 1)/(1 - \beta) \quad (4)$$

and, since $\beta^* = y/(C + y)$ in equilibrium (Theorem 3.3 in the Appendix), the marginal cost is

$$K(y/C - 1). \quad (5)$$

type. Concentrate posterior beliefs on him, and vote for him. All dissidents will deviate.

¹² This equilibrium does not exist if $m = n$. The pooling equilibria, however, may exist for this knife-edge case.

Since the marginal revenue [Equation (3)] is bounded above and below, it follows that the marginal cost [Equation (5)] should also be bounded above and below in equilibrium. So K is bounded above and below. Intuitively, if K is too high, the pivotal shareholder deviates to no search/vote for dissident [if Equation (2) is positive] or no search/vote for management [if Equation (2) is negative]. If K is too low, β goes to infinity.

Alternatively, the restrictions could be interpreted as bounds on m or n . We present two numerical examples below to illustrate this:

Example 1 ($m > n$). $p = 0.05$, $K = 2$, $C = 0.1$, $y = 0.2$. If $n = 1$, this equilibrium exists for $m \in (6.29, 21)$.

Example 2 ($m < n$). $p = 0.05$, $K = 2$, $C = 0.1$, $y = 0.2$. If $m = 1$, this equilibrium exists for $n \in (6.29, \infty)$.

Notice that the marginal cost, Equation (5), does not change in the above examples. So marginal benefit, Equation (3), is unchanged in equilibrium. Therefore, in the first example, as m increases, p' decreases. However, p' cannot decrease below p . As m decreases, p' increases. However, p' cannot be too large, otherwise the pivotal shareholder would find it more beneficial to deviate to no search/vote always for the dissident. In the second example, as n decreases, p' decreases. However, p' cannot be too small, otherwise the pivotal shareholder would find it more beneficial to deviate to no search/vote always for the management; n does not have an upper bound. These examples also illustrate that there exists a wide range of values of m and n for which this equilibrium survives.

The bad dissident in this equilibrium, one observes, sometimes solicits a proxy. This fundamentally affects the credibility of the proxy process, with its consequent effect on the signal purchase decision and shareholder welfare. Further, the probability that a bad dissident solicits a proxy is dependent on firm-specific factors of interest. The next section focuses on these firm-specific factors and analyzes their effect on all the three classes of equilibria.

3. A Cross-Sectional Analysis of Proxy Contests

The purpose of this section is to develop testable implications of the three classes of equilibria that were detailed in the previous section. The focus is on variables that have been scrutinized in the empirical literature on proxy contests: the number of proxy contests per year, the fraction of dissident wins per year, the abnormal returns associated with announcements of proxy contests, and the effect of certain managerial defensive measures. Certain normative issues that might

be of interest — the welfare of the pivotal shareholder and the welfare of the incumbent management — are also analyzed in this section.

3.1 The probability of a proxy contest

A proxy contest occurs if there exists a good dissident (probability = p) and he decides to fight (probability = α_g) or there exists a bad dissident (probability = $1 - p$) and he decides to fight (probability = α_b). Hence the probability of a proxy contest (denote it by θ) is

$$\theta = p\alpha_g + (1 - p)\alpha_b. \quad (6)$$

As $\alpha_g = 1$ and $\alpha_b \leq 1$ in all the three equilibria, we substitute the value of α_b from Equation (1) into Equation (6) to obtain

$$\theta = p/p'. \quad (7)$$

Substituting the equilibrium value of p' in Equation (7) for each of the three equilibria, and taking the relevant partial derivative of θ (see the Appendix) the following comparative statics are obtained.

Proposition 3. (i) *In the semipooling equilibrium, if $n > m$, the probability of a proxy contest is decreasing in communication costs, decreasing in the verifiability of evidence presented, and increasing in the bad dissident's gain from winning. The results reverse if $m > n$.* (ii) *In the pooling equilibria, the dissidents always solicit proxies.*

Pound (1991) finds that the number of proxy fights declined dramatically after 1956, the year extensive and wide-ranging disclosure requirements were imposed by the SEC. Our model suggests the following interpretation of this result: more often than not, the loss from voting for a bad dissident outweighed the gain from voting for a good dissident in this sample period. This would mean that any reduction in the disincentives for a bad dissident to waging a proxy contest — like lowering the costs of communicating with shareholders, or decreasing the verifiability of the evidence that is presented (or the tangibility of the firm's assets), or increasing his gain from winning — increases the likelihood that bad dissidents would enter the fray. So the number of proxy fights increases. It is important to realize here that the implications are reversed if the loss from voting for a bad dissident is less than the gain from voting for a good dissident.

Another point worth noting is that the effect of dissident shareholding depends on our interpretation of the bad dissident's motivation. If the bad dissident solicits proxies because his private benefits of control outweigh the loss he incurs because he reduces unit share value, then y decreases as s_d increases. So increased dissident shareholdings will decrease proxy fights in the case $n > m$. However, if the reduc-

tion in unit share value caused by risky proposals does not affect the bad dissident (either because he is risk neutral and is indifferent toward his risky proposal, or because he is risk averse and does not consider his proposal to be risky), y increases with s_d . So increased dissident shareholdings will increase proxy fights in the case $n > m$. These effects reverse for the case $n < m$.

The above discussion hints at the crucial link between the quality of the dissident pool and the disincentives that discourage proxy solicitation. This is now analyzed.

3.2 The probability of a dissident win if there is a proxy contest

Denote by γ the probability of a dissident win. In the first pooling equilibrium, dissidents always win. In the other equilibria, a dissident wins only if he decides to solicit a proxy and the signal says “good dissident.” So $\gamma = p\beta\alpha_g + (1 - p)(1 - \beta)\alpha_b$ in these cases.

A popular metric in some empirical articles on proxies [Pound (1988) and Thomas and Martin (1994)] is the likelihood of a dissident win given that a proxy contest takes place. Denote this by λ . So $\lambda = \gamma/\theta$.

Substituting equilibrium values for each of the three equilibria, and taking the relevant partial derivative of λ (see the Appendix) we get the next result.

Proposition 4. (i) *In the semipooling equilibrium, if $n > m$, the probability of a dissident win if there is a proxy contest is increasing in the verifiability of evidence presented, and is an inverted U-shaped function of communication costs and the bad dissident’s gain from winning. The results reverse if $m > n$.* (ii) *In the first pooling equilibria, the probability of a dissident win if there is a proxy contest is independent of the above variables.* (iii) *In the second pooling equilibria, if $p > 0.5$, the probability of a dissident win if there is a proxy contest is increasing in the verifiability of evidence presented. The effect reverses if $p < 0.5$. The other variables have no effect.*

In the semipooling equilibrium, if $n > m$, it is reasonable to expect that as verifiability of the evidence to be presented (or tangibility of assets) increases, it would be increasingly difficult for bad dissidents to engage in proxy contests. That is why the quality of the dissident pool improves, and more dissidents win. But what explains the inverse U-shaped effect of the other variables? The intuition behind this result is as follows. If the costs of communicating are low to begin with, then a further decrease in costs, though it enlarges the pool of active dissidents, increases the fraction of bad dissidents in the enlarged

pool. So the probability of a dissident win if there is a proxy contest decreases. In other words, if the costs of communicating are low to begin with, making them any lower is counterproductive.

Note that if $m > n$, the results are reversed. Specifically, λ is U-shaped with respect to y or C in this case. Note also that in the pooling equilibria, the only firm-specific variable that affects dissident wins is K . Interestingly, as verifiability increases, dissidents win more often only if p is greater than half (they win less often if p is less than half); p has no effect on λ in the semipooling equilibrium.

Duvall and Austin (1965), in one of the first empirical examinations of proxy contests, documented that during the period 1956 to 1960, firms whose returns were much lower than industry averages were contested with greater success. Since the poor performance of such firms is apparent (K is low), our model's prediction of a high λ — assuming $n > m$ — is consistent with these findings. Pound (1988) found that the chances of a dissident win increased with his shareholdings, but Thomas and Martin (1994) found this relationship to be insignificant. It is possible that Thomas and Martin (1994) analyzed a dataset where the effect of s_d was not monotonic (as predicted by Proposition 4).¹³

3.3 Abnormal stock return at the announcement of a proxy contest

We can view the other shareholders as agents with small stockholdings who take the outcome of the proxy contest to be independent of their individual voting decisions. They bear no signal purchase cost. This simplifies the evaluation of the abnormal stock return at the announcement of a proxy contest.

We know that if there is no proxy contest, then the value of a share remains at zero. If there is a proxy contest and if there is search, then the price change for each share [from Equation (2)] is

$$\Delta W \equiv [mp'\beta - (1 - p')(1 - \beta)n]/s_s. \quad (8)$$

Substituting equilibrium values for each of the three equilibria in Equation (8), and taking the relevant partial derivative of ΔW — see the Appendix — the following comparative statics are obtained.¹⁴

¹³ Note that as s_d increases, y decreases (increases) for the private benefits of control interpretation (for the other interpretations given in this article).

¹⁴ Equation (8) is the price reaction to a *completely unanticipated* contest. This particular analysis is done because of the one-shot nature of this game. In a dynamic setting, the value under incumbent management cannot be assumed to be exogenous (as our model has assumed). This value would have to incorporate expectations about future proxy contests. The price reaction to anticipated contests would, therefore, be different.

Proposition 5. *The announcement of a proxy contest is associated with a stock price increase in all the equilibria. (i) In the semipooling equilibrium, if $n > m$, this appreciation is positively correlated with the verifiability of evidence presented, positively correlated with the cost of communication, and negatively correlated with the bad dissident's gain from winning. The results reverse if $m > n$. (ii) In the first pooling equilibria, the stock price jump at announcement is independent of the above variables. (iii) In the second pooling equilibria, the stock price jump at announcement is positively correlated with the verifiability of evidence presented. It is independent of the other variables.*

Note that the expected profits of the pivotal shareholder, after netting out the signal costs for search, should be nonnegative for him to participate. Hence it follows that the expected profits of the other shareholders who do not have any signal costs are positive. That is why their share prices appreciate at the announcement of a proxy contest. In other words, they “free ride.” DeAngelo and DeAngelo (1988), Dodd and Warner (1983), Ikenberry and Lakonishok (1993), and Mulherin and Poulsen (1992) have found that, on average, there is a positive abnormal return at the announcement. Proposition 5 suggests that it would be worthwhile examining the effects of certain firm-specific variables (like the tangibility of the firm's assets) on this positive abnormal return.

I now turn to examine the effects of certain managerial defensive measures.

3.4 The effect of certain managerial defensive measures

Over half of America's largest corporations have adopted Rights Plans or Poison Pills [Thomas and Martin (1994)]. This involves the issuance of share purchase rights as a pro rata dividend. Upon the occurrence of a triggering event — like the acquisition of a certain percentage of the company's stock by a dissident — the rights are convertible into the common stock of the target company (“flip-in” pill) and, on a second-step merger, they become exercisable for stock of the acquiror (“flip-over” pill). Since this measure involves a reduction of the dissident's wealth in the event of a win, it means that y decreases.

Another defensive measure is litigation. Many times dissidents have to sue to obtain the shareholder lists [e.g., *AFL-CIO's Food and Allied Service Trades Department v. Wal-Mart Stores Inc.* (1992)] or they get sued if they request one [e.g., *Sears, Roebuck and Co. v. Robert A. G. Monks* (1991)]. From the perspective of this model, it means that C increases. Therefore the following result is obtained from Propositions 3 and 4.

Proposition 6. *Defensive measures like Rights Plans, which reduce*

the gain the dissident obtains if he wins, or litigation, which just increases the dissident's costs of proxy solicitation, have the following effects. (i) In the semipooling equilibrium, if $n > m$, the probability of a proxy contest decreases. If there is a proxy contest, the probability of a dissident win actually increases if the costs of communication are lower than C^* (the expression for C^* is given in the Appendix). The results reverse if $m > n$.¹⁵ (ii) There is no effect on the two pooling equilibria.

Using a logit regression, Thomas and Martin (1994) find that in the period 1985 to 1991 the incidence of Rights Plans actually increased the probability of a dissident's win. Their conjectured hypothesis for this surprising result was a signaling hypothesis: since only firms with "inefficient" managers adopt Rights Plans, one should expect more dissident wins in such firms. This model suggests an alternative hypothesis. If the costs of communicating to shareholders are relatively low and the loss from voting for a bad dissident outweighs the gain from voting for a good dissident, managerial defensive measures can actually improve the quality of the dissident pool. This means that more dissidents will win.

3.5 Some normative aspects

We now turn to some normative aspects. From the pivotal shareholder's point of view, his expected gain if there is search [multiply Equation (8) by s_s and add signal cost] is

$$\Delta W(P) \equiv [p'\beta m - (1 - p')(1 - \beta)n] + K[\ln\{2(1 - \beta)\} + 2\beta - 1]. \quad (9)$$

After substituting for the equilibrium values in Equation (9), and taking the relevant partial derivative of $\Delta W(P)$ (see the Appendix) I obtain the next result.

Proposition 7. (i) In the semipooling equilibrium, if $n > m$, the expected gain of the pivotal shareholder is increasing in the verifiability of evidence presented, increasing in the cost of communication, and decreasing in the bad dissident's gain from winning. The results reverse if $m > n$. (ii) In the first pooling equilibria, the expected gain of the pivotal shareholder is independent of the above variables. (iii) In the second pooling equilibria, the expected gain of the pivotal shareholder is positively correlated with the verifiability of evidence presented. It does not depend on the other variables.

¹⁵ A defensive measure is actually a transfer of wealth from the dissident to the pivotal shareholder in the event of a dissident win. This means that y decreases, and m and n increase. As there is some leakage in this transfer (large legal expenses), it is unreasonable to assume that $y + m$ and $y + n$ are unchanged. It is for this reason that the above comparative statics are done only with respect to y .

This is an interesting result because it tells us that if the loss from voting for a bad dissident outweighs the gain from voting for a good dissident, the pivotal shareholder would actually want the costs of communication to increase.

I now turn to take the point of view of incumbent management. For the sake of tractability, incumbent management was assumed to be passive. Specifically, it was assumed that incumbent management took no strategic action (like accepting side payments) during the proxy contest. If one posits a simple incumbent management objective here — he wants to maximize the ex ante probability that he remains in control — it would be interesting to analyze how much information incumbent management would like to be disclosed during a proxy contest. In other words, what would management like K — which is a measure of the verifiability of the evidence presented and, in this model, not a control variable for incumbent management — to be?

An incumbent remains in control if there is no dissident proxy or if there is a dissident proxy, the dissident does not win. In the first pooling equilibrium, this probability is zero. In the other equilibria, it is

$$Z \equiv p(1 - \alpha_g) + (1 - p)(1 - \alpha_b) + p\alpha_g(1 - \beta) + (1 - p)\alpha_b\beta. \quad (10)$$

The objective of incumbent management is to maximize Z in Equation (10). After substituting for the equilibrium values in Equation (10), and taking the relevant partial derivative of Z (see the Appendix) I obtain the next result.

Proposition 8. *(i) In the semipooling equilibrium, if $n > m$, incumbent management would want to increase the verifiability of evidence presented. This result reverses if $m > n$. (ii) In the first pooling equilibria, incumbent management is indifferent to the verifiability of evidence presented. (iii) In the second pooling equilibrium, if $p < 0.5$, incumbent management would want to increase the verifiability of evidence presented. This result reverses if $p > 0.5$.*

This means that incumbent management would want shareholders to more easily verify evidence only if the loss from voting for a bad dissident outweighs the gain from voting for a good dissident (in the semipooling equilibrium) or if there are more bad dissidents than good dissidents (from the second pooling equilibrium). If on the other hand, good dissidents dominate, incumbent management would like pivotal shareholders to have access to costlier audit technologies.

4. Conclusion

In this section, I first attempt to do a meta-analysis of all the three equilibria. To achieve this, assume that in a cross-sectional sample of firms all the three equilibria might be found. If that is the case, the following generalizations follow.

If the loss from voting for a bad dissident outweighs the gain from voting for a good dissident:

For the semipooling equilibrium, any attempts to ease the proxy solicitation process is counterproductive. It reduces the expected wealth gain of both the pivotal shareholder as well as the other atomistic shareholders. In the other equilibria, proxy costs have no welfare impact. This implies that, on average, the above comparative statics will hold in the cross-section.

For two of the three equilibria, the expected wealth gain of both the pivotal shareholder as well as the other atomistic shareholders is positively related with the verifiability of the evidence presented (or the tangibility of the firm's assets). Therefore, on average, these results will hold in the cross-section.

For the semipooling equilibrium, the probability of a proxy fight increases as the cost of communicating with shareholders decreases, as the verifiability of the evidence to be presented (or the tangibility of the firm's assets) decreases, and as the costs due to managerial defensive measures like Rights Plans decreases. In the other equilibria, there is no impact of these variables on the probability of a proxy fight. This implies that, on average, these results will hold in the cross-section.

For the semipooling equilibrium, if there is a proxy fight, the probability of a dissident win increases as the verifiability of the evidence to be presented (or the tangibility of the firm's assets) increases. The effect of the other variables is not monotonic. If the costs of communicating with shareholders are low, then the probability of a dissident win, if there is a proxy contest, increases as the cost of communicating with shareholders increases, and as the costs due to managerial defensive measures like Rights Plans increases. If the costs of communicating with shareholders are high, these directions are reversed. The only variable that has an impact in the pooling equilibria is the verifiability of the evidence to be presented (or the tangibility of the firm's assets). The impact occurs only in one of the pooling equilibria; there the probability of a dissident win is positively related with verifiability if $p > 0.5$. This implies that, on average, the comparative statics with respect to communication costs will hold in the cross-section. However, no definite prediction can be made about the observed empirical relationship between proportion of dissident wins and the tangibility of the firm's assets.

In all the three equilibria, the announcement of a proxy contest is associated with a stock price appreciation, and this appreciation is positively correlated with the verifiability of the evidence presented (tangibility of the firm's assets). For the semipooling equilibrium, this appreciation is also positively correlated with the costs of communicating with shareholders. This implies that, on average, the above comparative statics will hold in the cross-section.

Since the existing empirical evidence is broadly compatible with some of the above results, it is likely that the assumption that bad dissidents harm more than good dissidents benefit, holds generally in the data. It should be pointed out, however, that for very badly managed firms — where bad dissidents harm less than good dissidents benefit — the above results reverse for the semipooling equilibrium.

Several avenues for future research on the proxy process open up. First, one would want to analyze the choice between a proxy contest and a tender offer.¹⁶ Second, one might consider weakening the assumption of a pivotal shareholder, and directly analyze strategic coordination among large shareholders. A third avenue for future research is to drop the assumption that managers always take the proxy fight to a shareholder's vote. That is not quite true in practice. In Thomas and Martin's (1994) sample, approximately 20% of proxy contests were "settled." This means that the introduction of another stage in the game, a stage where the manager decides to "settle" with a dissident or he decides to take the fight to the shareholders, would be fruitful. We would then have to be explicit about the manager's pay-offs at each state, and this would lead us to say something meaningful about appropriate managerial incentives.

Appendix

Proof of Propositions 1 and 2.

Optimal voting strategies of the pivotal shareholder at $t = 3$. First define some convenient notation:

Probability that dissident is "good" given that a proxy fight has ensued = $\{p\alpha_g\}/\{p\alpha_g + (1 - p)\alpha_b\} \equiv p'$. Probability that dissident

¹⁶ A study conducted by the Investor Responsibility Research Center indirectly supported a hypothesis that dissidents with higher levels of ownership prefer the tender offer; its sample of proxy contests was biased toward small levels of dissident ownership (80% of the contests were waged by dissidents holding less than 20% of the company's stock). Pound (1988) found that the chances of a dissident win increased if the contest was for partial control rather than full control; the contests for full control were likelier to be tender offers. DeAngelo and DeAngelo (1989) find that the typical dissident is resource constrained. Sridharan and Reinganum (1991) find that targets of proxy contests are poorer performers, more highly leveraged [as predicted by Harris and Raviv (1988)], and more likely to be management-controlled than the corresponding targets of hostile tender offers. Finally, Mulherin and Poulsen (1992) find that proxy contests and tender offers became increasingly intertwined in the 1980s.

is “good” given that a proxy fight has ensued and signal says “good dissident” = $\{p'\beta\}/\{p'\beta + (1 - p')(1 - \beta)\} \equiv p_g(\beta)$.

Probability that dissident is “good” given that a proxy fight has ensued and signal says “bad dissident” = $\{p'(1 - \beta)\}/\{p'(1 - \beta) + (1 - p')\beta\} \equiv p_b(\beta)$.

Noting that at $t = 3$, the signal costs expended at $t = 2$ are sunk costs, the expected net gains of the pivotal shareholder at the voting stage is zero if incumbent management wins, $mp_g(\beta) - n(1 - p_g(\beta))$ if the signal is “good dissident,” and $mp_b(\beta) - n(1 - p_b(\beta))$ if the signal is “bad dissident.”

If there has been no signal buying at time $t = 2$ (i.e., $\beta = 0.5$), $p' = p_g = p_b$. So the optimal voting decision in this case is

$$\psi^* = \begin{cases} 1 & \text{if } mp' > n(1 - p') \\ [0, 1] & \text{if } mp' = n(1 - p') \\ 0 & \text{if } mp' < n(1 - p'). \end{cases} \quad (\text{A1})$$

If there has been signal buying at time $t = 2$ (i.e., $\beta > 0.5$), $p_g > p' > p_b$. The optimal voting decision when signal says “good dissident” is

$$\psi_g^*(\beta) = \begin{cases} 1 & \text{if } mp_g(\beta) > n(1 - p_g(\beta)), \\ & \text{i.e., } \beta > n(1 - p')/(mp' + n(1 - p')) \\ [0, 1] & \text{if } mp_g(\beta) = n(1 - p_g(\beta)), \\ & \text{i.e., } \beta = n(1 - p')/(mp' + n(1 - p')) \\ 0 & \text{if } mp_g(\beta) < n(1 - p_g(\beta)), \\ & \text{i.e., } \beta < n(1 - p')/(mp' + n(1 - p')) \end{cases} \quad (\text{A2})$$

and the optimal voting decision when signal says “bad dissident” is

$$\psi_b^*(\beta) = \begin{cases} 1 & \text{if } mp_b(\beta) > n(1 - p_b(\beta)), \\ & \text{i.e., } \beta > mp'/(mp' + n(1 - p')) \\ [0, 1] & \text{if } mp_b(\beta) = n(1 - p_b(\beta)), \\ & \text{i.e., } \beta = mp'/(mp' + n(1 - p')) \\ 0 & \text{if } mp_b(\beta) < n(1 - p_b(\beta)), \\ & \text{i.e., } \beta < mp'/(mp' + n(1 - p')) \end{cases} \quad (\text{A3})$$

Optimal information acquisition and voting strategies of the pivotal shareholder at $t = 2$.

The expected net gain of the pivotal shareholder at $t = 2$, denoted by π_s , is his expected revenue minus his information acquisition cost (if any). Note that when $\beta = 0.5$, we have $p' = p_g(\beta) = p_b(\beta)$ and $\psi^* = \psi_g^*(\beta) = \psi_b^*(\beta)$. This allows us to express his expected revenue as

$$R_s = [p'\beta + (1 - p')(1 - \beta)][mp_g(\beta) - n(1 - p_g(\beta))]\psi_g^*(\beta)$$

$$\begin{aligned}
 &+ 0[1 - \psi_g^*(\beta)] \\
 &+ [p'(1 - \beta) + (1 - p')\beta][mp_b(\beta) - n(1 - p_b(\beta))]\psi_b^*(\beta) \\
 &+ 0[1 - \psi_b^*(\beta)].
 \end{aligned}$$

Given the expressions for $p_g(\beta)$ and $p_b(\beta)$, this simplifies to

$$\begin{aligned}
 R_s &= [mp'\beta - n(1 - p')(1 - \beta)]\psi_g^*(\beta) \\
 &+ [mp'(1 - \beta) - n(1 - p')\beta]\psi_b^*(\beta).
 \end{aligned} \tag{A4}$$

The information acquisition cost is

$$C(\beta) = -K[\ln\{2(1 - \beta)\} + 2\beta - 1] \tag{A5}$$

where $K \in (0, \infty)$ and $\beta \in [0.5, 1]$.

Lemma 1 (Properties of the function $C(\beta)$). (i) C and its first derivative w.r.t. β are zero at $\beta = 0.5$, (ii) C is increasing and convex in β .

Proof. The first derivative of C with respect to β is $K(1 - \beta)^{-1} - 2K$. This is equal to zero at $\beta = 0.5$, and it is greater than zero when $\beta > 0.5$. The second derivative of C with respect to β is $K(1 - \beta)^{-2}$. This is greater than zero always. ■

Now define $g(\beta)$ as

$$g(\beta) \equiv [mp'\beta - n(1 - p')(1 - \beta)] + K[\ln\{2(1 - \beta)\} + 2\beta - 1]. \tag{A6}$$

Lemma 2 (Properties of the function $g(\beta)$). (i) $g(\beta)$ has a global maximum with respect to β , (ii) this global maximum is $g^* \equiv mp' + K \ln\{2K/[2K + mp' + n(1 - p')]\}$, (iii) g^* decreases in K , (iv) g^* is bounded below.

Proof. The first-order condition of $g(\beta)$ in Equation (A6) with respect to β is

$$mp' + n(1 - p') = K(2\beta^* - 1)/(1 - \beta^*) \tag{A7}$$

which implies that

$$\beta^* = [K + mp' + n(1 - p')]/[2K + mp' + n(1 - p')]. \tag{A8}$$

Note that Equation (A8) implies that $\beta^* \in (0.5, 1)$. The second-order condition is

$$-K/(1 - \beta)^2 < 0.$$

So this is a well-posed maximization problem. Substituting the value of β^* from Equation (A8) in Equation (A6), the maximum value of

$g(\beta)$ with respect to β is

$$\begin{aligned} g^* &= mp' + K \ln 2(1 - \beta^*) \\ &= mp' + K \ln\{[2K]/[2K + mp' + n(1 - p')]\}. \end{aligned} \quad (\text{A9})$$

The partial derivative of g^* with respect to K is $1 - [2K]/[2K + mp' + n(1 - p')] + \ln\{[2K]/[2K + mp' + n(1 - p')]\}$.

This is less than zero as $1 - t + \ln t$ is negative for $t \in (0, 1)$.

Finally, it is easy to show that $K \ln\{2(1 - \beta^*)\} \geq 0.5K(1 - 2\beta^*)/(1 - \beta^*)$ for $\beta^* \in [0.5, 1]$.

This implies that in the domain $\beta^* \in [0.5, 1]$,

$$\begin{aligned} g^* &= mp' + K \ln\{2(1 - \beta^*)\} \geq mp' + 0.5K(1 - 2\beta^*)/(1 - \beta^*) \\ &= mp' - 0.5(mp' + n(1 - p')) \text{ from Equation (A7)} \\ &= 0.5(mp' - n(1 - p')). \end{aligned} \quad (\text{A10})$$

The inequality is strict for $\beta^* > 0.5$. ■

Now partition the (m, n, p') parameter space, and use Equations (A1)–(A5) to construct the following table of expected net gains of the pivotal shareholder at $t = 2$ (see Table 1).

Lemma 3 (Suboptimality of Strategy I). *If $g^* > mp' - n(1 - p') > 0$, strategy I is not an optimal strategy.*

Proof. Take two variables a and b , such that $a > b > 0$. Then $\ln((a + b)/2b) > (a - b)/(a + b)$. To see why, notice that both sides equal zero when $a=b$. The partial derivative of the LHS with respect to a is $1/(a + b) > 0$ and this is greater than the partial derivative of the RHS with respect to a , which is $2b/(a + b)^2 > 0$. This implies that

$$\ln\left(\frac{mp' + n(1 - p')}{2n(1 - p')}\right) > \frac{mp' - n(1 - p')}{mp' + n(1 - p')} > 0$$

for $mp' > n(1 - p')$, which implies that

$$-n(1 - p') > n(1 - p') \frac{mp' + n(1 - p')}{mp' - n(1 - p')} \ln \frac{2n(1 - p')}{mp' + n(1 - p')} \quad (\text{A11})$$

for $mp' > n(1 - p')$.

Now, $\beta = mp'/[mp' + n(1 - p')]$ in strategy I. Suppose this is an optimal strategy. Then, substituting into Equation (A8), one obtains

$$K = n(1 - p')[mp' + n(1 - p')]/[mp' - n(1 - p')],$$

Table 1
Expected net gains of the pivotal shareholder at time $t = 2$

#	Search and Optimal Voting Strategy of the Pivotal Shareholder	$\frac{mp'}{n(1-p')} < \frac{mp'}{n(1-p')}$	$\frac{mp'}{n(1-p')} = \frac{mp'}{n(1-p')}$	$\frac{mp'}{n(1-p')} > \frac{mp'}{n(1-p')}$
A	$\beta = 0.5, \psi^* = 1$	—	—	$\frac{mp'}{n(1-p')}$
B	$\beta = 0.5, \psi^* = [0, 1]$	—	—	—
C	$\beta = 0.5, \psi^* = 0$	0	0	—
D	$mp'/(mp' + n(1-p')) < 0.5 < n(1-p')/(mp' + n(1-p')) < \beta,$ $\psi_g^* = 1, \psi_b^* = 0$	$g(\beta)$	—	—
E	$mp'/(mp' + n(1-p')) < 0.5 < \beta = n(1-p')/(mp' + n(1-p')),$ $\psi_g^* = [0, 1], \psi_b^* = 0$	$-C(\beta)$	—	—
F	$mp'/(mp' + n(1-p')) < 0.5 < \beta < n(1-p')/(mp' + n(1-p')),$ $\psi_g^* = [0, 1], \psi_b^* = 0$	$-C(\beta)$	—	—
G	$mp'/(mp' + n(1-p')) = 0.5 = n(1-p')/(mp' + n(1-p')) < \beta,$ $\psi_g^* = 1, \psi_b^* = 0$	—	$g(\beta)$	—
H	$\beta > mp'/(mp' + n(1-p')) > 0.5 > n(1-p')/(mp' + n(1-p')),$ $\psi_g^* = 1, \psi_b^* = 0$	—	—	$g(\beta)$
I	$\beta = mp'/(mp' + n(1-p')) > 0.5 > n(1-p')/(mp' + n(1-p')),$ $\psi_g^* = 1, \psi_b^* = [0, 1]$	—	—	$g(\beta)$
J	$mp'/(mp' + n(1-p')) > \beta > 0.5 = n(1-p')/(mp' + n(1-p')),$ $\psi_g^* = 1, \psi_b^* = 1$	—	—	$\frac{mp'}{n(1-p')} - C(\beta)$

which implies that

$$K \ln\{2(1 - \beta^*)\} = \text{RHS of Equation (A11)} < -n(1 - p').$$

However, as $g^* > mp' - n(1 - p')$, it follows from Equation (A9) that

$$K \ln\{2(1 - \beta^*)\} > -n(1 - p').$$

This is a contradiction. ■

The following tie-breaking rule is adopted: if indifferent between buying a signal and not buying a signal, the pivotal shareholder does not buy the signal. This gives us the following theorem.

Theorem 1 (Optimal Search and Voting Strategies). (1.1) *Never buy a signal and never vote for the dissident. This is optimal if*

$$mp' < n(1 - p') \text{ and } g^* = mp' + K \ln\{[2K]/[2K + mp' + n(1 - p')]\} \leq 0. \quad (\text{A12})$$

(1.2) *Never buy a signal and always vote for the dissident. This is optimal if*

$$mp' - n(1 - p') \geq g^* = mp' + K \ln\{[2K]/[2K + mp' + n(1 - p')]\} > 0. \quad (\text{A13})$$

(1.3) *Always buy a signal ($\beta^* = [K + mp' + n(1 - p')]/[2K + mp' + n(1 - p')] > 0.5$), and only vote for the dissident if the signal says “good dissident.” This is optimal if*

$$(1.3.i) \ g^* = mp' + K \ln\{[2K]/[2K + mp' + n(1 - p')]\} > mp' - n(1 - p') > 0$$

or

$$(1.3.ii) \ g^* = mp' + K \ln\{[2K]/[2K + mp' + n(1 - p')]\} > 0 \geq mp' - n(1 - p').$$

(1.3.i) and (1.3.ii) could be summarized as

$$\min\{mp', n(1 - p')\} > -K \ln\{[2K]/[2K + mp' + n(1 - p')]\}. \quad (\text{A14})$$

Proof. If $mp' < n(1 - p')$, then g^* can have either sign. If $g^* \leq 0$, given the tie-breaking rule, strategy *C* dominates. This gives us Theorem 1.1. If $g^* > 0$, strategy *D* dominates. This gives us Theorem 1.3.ii (the inequality part).

If $mp' = n(1 - p')$, then, from Equation (A8), $\beta^* > 0.5$. Then, from Equation (A10), g^* is positive. So, the dominant strategy is strategy *G*. This gives us Theorem 1.3.ii (the equality part).

If $mp' > n(1 - p')$, then g^* is positive [from Equation (A10)]. Then, if $0 < g^* \leq mp' - n(1 - p')$, given the tie-breaking rule, strategy *A*

Table 2
Expected net gains of the dissidents at time $t = 1$

Dissident Type	Dissident Action	$\beta = 0.5,$ $\psi = 1$	$\beta > 0.5,$ $\psi_g = 1, \psi_b = 0$
Good	Solicit proxy	x	$\beta x - (1 - \beta)C$
	Inactive	0	0
Bad	Solicit proxy	y	$(1 - \beta)y - \beta C$
	Inactive	0	0

dominates. This gives us Theorem 1.2. If $g^* > mp' - n(1 - p') > 0$, strategy H dominates. (Lemma 3 showed that Strategy I was not optimal). This gives us Theorem 1.3.i. ■

I shall henceforth ignore the never search/never vote strategy. If this strategy survives in equilibrium, no proxy solicitation will take place at all. If we make the assumption that x is ϵ higher than y (this is not an assumption for the “Private Benefit” interpretation, because there $x > y$), this equilibrium is ruled out by applying the Banks and Sobel (1987) Universal Divinity refinement criteria. If there is an out-of-equilibrium deviation, it is likely to come from the good type. Concentrate posterior beliefs on him, and vote for him. All dissidents will deviate.

Best response of the two dissident types. Confining ourselves to the examination of the last two strategies of the pivotal shareholder, I now analyze the best response of the dissidents. Given these two possible search and vote strategies of the pivotal shareholder, the expected gains of the dissidents for each of their actions could be summarized in Table 2. As argued in the text, separating responses are ruled out. The following pooling and semipooling strategies are best responses.

Theorem 2 (Best Response of the Dissidents). (2.1) *If the pivotal shareholder is conjectured to adopt the never search/always vote for the dissident strategy — the strategy outlined in Theorem 1.2 — then $\alpha_g^* = \alpha_b^* = 1$.*

(2.2) *If the pivotal shareholder is conjectured to adopt the always search/vote only for the dissident strategy if the signal says good dissident — the strategy outlined in Theorem 1.3 — then $\alpha_g^* = \alpha_b^* = 1$ if $y/C > \beta/(1 - \beta)$.*

(2.3) *If the pivotal shareholder is conjectured to adopt the always search/vote only for the dissident if the signal says good dissident — the strategy outlined in Theorem 1.3 — then $\alpha_g^* = 1$ and $\alpha_b^* = [0, 1]$ if $y/C = \beta/(1 - \beta)$.*

Proof. When $\beta = 0.5$, as $x \geq y > 0$, Theorem 2.1 follows. When $\beta > 0.5$, as $x \geq y > 0$, if $y/C > \beta/(1 - \beta)$, then $\beta x - (1 - \beta)C > (1 - \beta)y - \beta C > 0$. So Theorem 2.2 follows. When $\beta > 0.5$, as $x \geq y > 0$, if $y/C = \beta/(1 - \beta)$, then $\beta x - (1 - \beta)C > (1 - \beta)y - \beta C = 0$. So Theorem 2.3 follows. ■

We now analyze which of the above best-response strategies are equilibrium strategies.

Equilibria

Theorem 3 (Equilibria). (3.1) *The pivotal shareholder never buys a signal and he always votes for the dissident. The dissidents always solicit proxies. Formally, the strategies in this equilibrium are*

$$\beta^* = 0.5, \psi^* = 1, \alpha_g^* = \alpha_b^* = 1.$$

The two restrictions needed on exogenous parameters for this equilibrium to survive are

$$mp > -K \ln\{[2K]/[2K + mp + n(1 - p)]\} \geq n(1 - p). \quad (\text{A15})$$

(3.2) *The pivotal shareholder always buys a signal, and he only votes for the dissident if the signal says “good dissident.” The dissidents always solicit proxies. Formally, the strategies in this equilibrium are*

$$\begin{aligned} \beta^* &= [K + mp + n(1 - p)]/[2K + mp + n(1 - p)] > 0.5, \\ \psi_g^* &= 1 \text{ and } \psi_b^* = 0, \text{ and } \alpha_g^* = \alpha_b^* = 1. \end{aligned}$$

The first restriction needed on exogenous parameters for this equilibrium to survive is that

$$\min\{mp, n(1 - p)\} > -K \ln\{[2K]/[2K + mp + n(1 - p)]\}. \quad (\text{A16})$$

The second restriction needed on exogenous parameters for this equilibrium to survive is that

$$y/C > \beta^*/(1 - \beta^*) = [mp + n(1 - p) + K]/K. \quad (\text{A17})$$

(3.3) *The pivotal shareholder always buys a signal, and he only votes for the dissident if the signal says “good dissident.” The good dissident always solicits proxies, the bad dissident sometimes solicits proxies. Formally, the strategies in this equilibrium are*

$$\beta^* = y/(y + C), \psi_g^* = 1 \text{ and } \psi_b^* = 0,$$

$$\alpha_g^* = 1 \text{ and } \alpha_b^* = [p(m - k(y/C - 1))]/[(1 - p)(k(y/C - 1) - n)].$$

The restrictions needed on exogenous parameters for this equilibrium to survive are

$$\min\{mp', n(1 - p')\} > -K \ln\{[2K]/[2K + mp' + n(1 - p')]\} \quad (\text{A18})$$

and

$$p' > p, \quad (\text{A19})$$

where $p' = [K(y/C - 1) - n]/[m - n]$.

Substituting the above expression for p' in Inequality (A18), we can combine the two above restrictions and obtain

$$\begin{aligned} [1 - Kn^{-1} \ln\{(C + y)/2C\}] &> p' \\ &= [K(y/C - 1) - n]/[m - n] \\ &> \max[p, Km^{-1} \ln\{(C + y)/2C\}]. \end{aligned} \quad (\text{A20})$$

Proof. Theorem 3.1 follows from Theorem 1.2 and Theorem 2.1. As $p = p'$ in this equilibrium, the restrictions of Inequality (A13) reduce to Inequality (A15).

Theorem 3.2 follows from Theorem 1.3 and Theorem 2.2. As $p = p'$ in this equilibrium, the restriction of Inequality (A14) reduces to Inequality (A16). The restriction of Inequality (A17) is just the condition $y/C > \beta/(1 - \beta)$ from Theorem 2.2 with β replaced by its optimal value from Equation (A8).

Theorem 3.3 follows from Theorem 1.3 and Theorem 2.3. The optimal value of β comes from solving the condition $y/C = \beta/(1 - \beta)$ in Theorem 2.3. Substitute this β^* in Equation (A8) to back out p' . This p' is given in Inequality (A20). The expression for α_b^* comes from solving for α_b^* in the definition $p' \equiv \{p\alpha_g^*\}/\{p\alpha_g^* + (1 - p)\alpha_b^*\}$ and obtaining $\alpha_b^* = p(1 - p')/[p'(1 - p)]$. Substitute the value of p' here. The restrictions of Inequalities (A14) and (A18) are the same. The restriction of Inequality (A19) comes from the requirement that α_b^* must be less than one. ■

Corollary 1 (Properties of the Pooling Equilibria). (i) These equilibria may exist if $m = n$, (ii) the two equilibria will not coexist, (iii) K is bounded below in the first pooling equilibrium; K is bounded above in the second pooling equilibrium.

Proof. (i) If $m = n$, the equilibrium strategies and the parameter restrictions of these equilibria are well-defined.

(ii) The two restrictions of Inequalities (A15) and (A16) are mutually exclusive.

(iii) Since $mp > n(1 - p)$ in Inequality (A15), $g^* = mp + K \ln\{[2K]/[2K + mp + n(1 - p)]\} > 0$ [from (A9) and (A10)]. So $mp > -K \ln\{[2K]/$

$[2K + mp + n(1 - p)]$, which implies that Inequality (A15) is equivalent to

$$mp > n(1 - p) \text{ and } -K \ln[2K]/[2K + mp + n(1 - p)] \geq n(1 - p).$$

As $-K \ln\{[2K]/[2K + mp + n(1 - p)]\}$ increases in K , it follows that there is a lower bound on K if the above equivalent formulation of Inequality (A15) is to be satisfied, and an upper bound on K if Inequality (A16) is to be satisfied. ■

Lemma 4 (Property of the log function). $|y/C - 1| \geq |\ln((C + y)/2C)|$ for $y, C > 0$. The inequality is strict for $y \neq C$.

Proof. Note that the two expressions equal zero at $y = C$. The first derivative of $(y/C - 1)$ with respect to y/C is 1 and this is greater than the first derivative of $\ln((C + y)/2C)$ with respect to y/C (which is $1/(1 + y/C)$). ■

Corollary 2 (Properties of the semipooling equilibrium).

(i) This equilibrium does not exist if $m = n$, (ii) this equilibrium implies $y > C$, (iii) K has a lower and an upper bound in this equilibrium.

Proof. (i) p' is not defined if $m = n$.

(ii) The second inequality in Inequality (A20) implies that p' is positive.

Suppose $m > n$. Since p' is positive, this implies that $K(y/C - 1) > n$. This in turn implies that $y > C$. However, if $y > C$, the first inequality in Inequality (A20) implies that $1 > p'$. So $0 < p' < 1$, $y > C$ and $m > K(y/C - 1) > n$ in this case.

Suppose $m < n$. Since p' is positive, this implies that $K(y/C - 1) < n$. The first inequality in Inequality (A20) can be rewritten as

$$[1 - Kn^{-1} \ln\{(C + y)/2C\}] > p' = [n - K(y/C - 1)]/[n - m] > 0.$$

This simplifies to the condition

$$nK[y/C - 1] - \ln\{(C + y)/2C\} > m[n - K \ln\{(C + y)/2C\}]. \quad (\text{A21})$$

Now, if $y \leq C$, from Lemma 4, $\{y/C - 1\} - \ln\{(C + y)/2C\} \leq 0$. So the LHS of Inequality (A21) is nonpositive. Further, if $y \leq C$, $n - K \ln\{(C + y)/2C\} \geq 0$. So the RHS of Inequality (A21) is nonnegative. Hence, for Inequality (A21) to be satisfied, $y > C$. However, if $y > C$, the first inequality in Inequality (A20) implies that $1 > p'$. So $0 < p' < 1$, $y > C$ and $m < K(y/C - 1) < n$ in this case.

So p' is a legitimate probability. Since $1 > p' > 0$ in all cases (just proved) and $p' > p$ [the second inequality in Inequality (A20)],

it follows that $0 < \alpha_b^* = p(1 - p')/p'(1 - p) < 1$. So α_b^* is also a legitimate probability.

Finally, as $y > C > 0$ in all cases (just proved), $0.5 < \beta^* = y/(y + C) < 1$. So β^* is also a legitimate probability.

(iii) Suppose $m > n$. As K increases, p' increases. The upper bound on p' , from Inequality (A20), decreases, but the lower bound on p' , from Inequality (A20), increases. From Lemma 4, this latter increase is, however, lower than the increase in p' . So we hit the upper bound of p' for a certain large K . As K decreases, p' decreases. The upper bound on p' , from Inequality (A20), increases, but the lower bound on p' , from Inequality (A20), decreases. From Lemma 4, this latter decrease is, however, lower than the decrease in p' . So we hit the lower bound of p' for a certain small K . The proof for the case $m < n$ is similar. ■

The proof of Corollary 2(ii) implies that

$$p' = \begin{cases} \frac{K(\frac{y}{C} - 1) - n}{m - n} & \text{if } m > n \\ \frac{n - K(\frac{y}{C} - 1)}{n - m} & \text{if } n > m. \end{cases} \quad (\text{A22})$$

This leads to the next set of proofs.

Proof of Proposition 3. (i) Substitute the value of p' from Equation (A22) in Equation (7). If $n > m$, the derivative of θ is positive with respect to K and is positive with respect to y/C . The signs are reversed if $m > n$.

(ii) Here $\theta = 1$ as $p = p'$. ■

Proof of Proposition 4. Note that

$$\lambda = \frac{\gamma}{\theta} = \frac{p'[p\beta^*\alpha_g^*(1 - p)(1 - \beta^*)\alpha_b^*]}{p}. \quad (\text{A23})$$

(i) For the semipooling equilibrium, substitute $y/(C + y)$ for β^* and $p(1 - p')/[(1 - p)p']$ for α_b^* in Equation (A23) to get

$$\lambda = \frac{p'(\frac{y}{C} - 1) + 1}{\frac{y}{C} + 1}. \quad (\text{A24})$$

Substitute the value of p' from Equation (A22) in Equation (A24). If $n > m$, the derivative of λ is negative with respect to K . λ has a global maximum with respect to y/C . This maximum is at the point $m + n = K(y/C - 1)/(y/C + 3)$. The results are reversed if $m < n$.

- (ii) For the first pooling equilibrium, $\lambda = 1$.
- (iii) For the second pooling equilibrium, substitute p' for p , and the optimal β^* from Theorem 3.2 in Equation (A23) to get

$$\lambda = \frac{p(mp + n(1 - p)) + K}{mp + n(1 - p) + 2K}.$$

If $p > 0.5$, the derivative of λ is negative with respect to K . The results are reversed if $p < 0.5$. The other variables have no effect. ■

Proof of Proposition 5. Note from the proofs of Propositions 1 and 2 that all the three equilibria survive only if the pivotal shareholder's wealth gain, net of signal cost (if any), is positive. As the other shareholders' wealth gain is the pivotal shareholder's gross wealth gain — the other shareholders bear no signal cost — their gain is positive. So the announcement of an unanticipated contest is associated with a stock price increase.

- (i) For the semipooling equilibrium, substitute $y/(C + y)$ for β^* and the expression for p' from Equation (A22) in Equation (8) to get

$$\Delta W_{S_s} = \begin{cases} m \frac{K(\frac{y}{C} - 1) - n}{m - n} - K \frac{\frac{y}{C} - 1}{\frac{y}{C} + 1} & \text{if } m > n \\ m \frac{n - K(\frac{y}{C} - 1)}{n - m} - K \frac{\frac{y}{C} - 1}{\frac{y}{C} + 1} & \text{if } n > m. \end{cases}$$

If $n > m$, the derivative of ΔW is negative with respect to K , and is negative with respect to y/C . The results are reversed if $m > n$.

- (ii) For the first pooling equilibrium, $\Delta W = [pm - (1 - p)n]/s_s$, and this is independent of K , y , or C .

- (iii) For the second pooling equilibrium, from Equation (8), $\Delta W = [pm\beta^* - (1 - p)(1 - \beta^*)n]/s_s$.

$\beta^* = [pm + (1 - p)n + K]/[pm + (1 - p)n + 2K]$ from Theorem 3.2. So the derivative of ΔW is negative with respect to K . It does not depend on y or C . ■

Proof of Proposition 6. The comparative statics of θ and λ with respect to y/C have been documented in the proofs of Propositions 3 and 4. ■

Proof of Proposition 7. (i) For the semipooling equilibrium, substitute

$y/(C + y)$ for β^* and p' from Equation (A22) in Equation (9) to get

$$\Delta W(P) = \begin{cases} m \frac{K(\frac{y}{C} - 1) - n}{m - n} - K \ln \frac{C + y}{2C} & \text{if } m > n \\ m \frac{n - K(\frac{y}{C} - 1)}{n - m} - K \ln \frac{C + y}{2C} & \text{if } n > m. \end{cases}$$

If $n > m$, the derivative of $\Delta W(P)$ is negative with respect to K , and is negative with respect to y/C . The results are reversed if $m > n$.

(ii) For the first pooling equilibrium, $\Delta W(P) = [pm - (1 - p)n]$, and this is independent of K , y , or C .

(iii) For the second pooling equilibrium, from Equation (9), $\Delta W = [pm\beta^* - (1 - p)(1 - \beta^*)n] + K[\ln\{2(1 - \beta^*)\} + 2\beta^* - 1]$. Here $\beta^* = [pm + (1 - p)n + K]/[pm + (1 - p)n + 2K]$ from Theorem 3.2. So the derivative of $\Delta W(P)$ is negative with respect to K . It does not depend on y or C . ■

Proof of Proposition 8. (i) For the semipooling equilibrium, from Equation (10), $Z = p(1 - \beta^*) + (1 - p)(1 - \alpha_b^*(1 - \beta^*))$. Substitute $y/(C + y)$ for β^* and $p(1 - p')/[(1 - p)p']$ for α_b^* . β^* does not depend on K . If $n > m$, p' is decreasing in K [from Equation (A22)], which implies that α_b^* is increasing in K and Z is decreasing in K . The result reverses if $m > n$.

(ii) For the first pooling equilibrium, Z is zero.

(iii) For the second pooling equilibrium, from Equation (10), $Z = p(1 - \beta^*) + (1 - p)\beta^*$. Here $\beta^* = [pm + (1 - p)n + K]/[pm + (1 - p)n + 2K]$ from Theorem 3.2. If $p < 0.5$, the derivative of Z is negative with respect to K . The result reverses if $p > 0.5$. ■

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