Strategic Opposition Research

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Abstract

We develop a model of strategic opposition research within a campaign. A candidate faces an opponent of unknown relative quality. After observing an unverifiable private signal (e.g., rumor of a scandal), the candidate chooses whether to undertake opposition research, attempting a costly search for verifiable bad news, and then whether to reveal what the research found to the voters. Increasing the ex-ante quality of an opponent deters opposition research, but also increases voter response to any given revelation in equilibrium because the voter knows the (unobserved) private signal was sufficient to launch research. This "Halo Effect" can explain both why voters seem to react more to relatively smaller scandals by high-quality officials compared to low-quality ones, and why even high-quality challengers may want to raise the cost of searching their backgrounds, despite their expected lack of scandal. This effect may be sufficiently strong that parties prefer lower expected quality candidates on average. These results also rationalize the mixed empirical literature showing that exogenously generated negative information about candidates (i.e., experiments) tend to show smaller effects on voter behavior than endogenously generated negative information over the course of campaigns (i.e., surveys).

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1 Introduction

The 2016 election drew new attention to a long-simmering market within politics: hired opposition research. The Trump campaign consistently tried to dredge up dirt concerning scandals from Hillary Clinton's role as Secretary of State in the Obama administration and her life as a member of the broader Clinton clan dating to her husband's governorship of Arkansas. Meanwhile, the Clinton campaign infamously generated the "Access Hollywood" tape, in which Donald Trump was caught on a hot mic bragging about committing sexual harassment and assault.[1] There are credible beliefs in the political world that the election's outcome came down to Clinton facing the last scandal: a public re-opening of an investigation into her emails by FBI director James Comey.[2] Regardless of the veracity of that claim, the role of opposition research in the election has bled into the Trump administration, as many elements of the FBI's probe into the President were allegedly brought to their attention by the "Steele Dossier", a document produced by the Clinton campaign-hired FusionGPS agency, a fact that President Trump has tried to use to deflect attention to the validity of the investigation.

Despite the large sum of money spent on this fuel for negative campaigning, the empirical literature in political behavior attempting to identify how voters respond to negative information about candidates finds mixed results.[3] While observational studies (e.g., Freedman and Goldstein (1999); Lau and Pomper (2001); Goldstein and Freedman (2002); Martin (2004)) have tended to find that negative campaigning delivers its desired effect under many conditions, experimental designs have tended to deliver mixed-to-skeptical results (e.g., Clinton and Lapinski (2004); Brooks and Geer (2007); Dowling and Wichowsky (2015)).

To further understand the strategic incentives of this setting, we consider a formal model of a campaign which can choose to invest in strategic opposition research. After receiving

[1] For further detail on this and related scandals, see Alberta (2019) and related Politico excerpt.

[2] See, e.g., Silver (2017) and McElwee, McDermott and Jordan (2017) for journalistic data analyses; see Weinschenk and Panagopoulos (2018) for an academic rebuttal to this claim.

[3] See Lau, Sigelman and Rovner (2007) for an overview of the classical literature.

private (unverifiable) information about the existence (or non-existence) of a scandal which may be informative about their opponent's quality of governance, they decide whether to undertake costly research to try and retrieve verifiable evidence. If they do so, they in turn decide whether or not to reveal any uncovered evidence to the public. In the absence of information, voters are unable to distinguish between a search which reveals no information, and a campaign which undertook no search at all (i.e., which did not receive a sufficient initial signal of malfeasance).

We identify an important trade-off unique to the interaction between strategic search and strategic revelation: while politicians who are ex-ante higher quality (or have a higher cost of observation) will engender less research in equilibrium, any negative verifiable information found will have a greater ex-post impact upon voters' beliefs.[4] Voters know that higher quality candidates and/or candidates with more obtuse histories require a greater threshold of negative private information to generate research in the first place. In turn, this means the revelation of a (potentially negligible) scandal also carries the information that the investigating campaign had some (unverifiable) information that led them to dig deeper. In this way, it is possible that verifiable information which is not in-and-of-itself revealing of candidate quality turns the voter against a candidate.[5] We call this the "*Halo Effect*": voters respond more to scandals about high-quality candidates, because they know that there was a higher threshold necessary to invest in an investigation, and hence there might be even more information that remained unverified.[6]

This generates a commitment problem for the investigating campaign. Consider a front-running candidate with an arbitrarily low cost of being investigated. The underdog will

[4]While ex-ante candidate quality is kept abstract within the model, one can think of it as any observable heuristic voters use to estimate a politician's expected governance ability. This could be an experience-based measure (e.g., Jacobson and Kernell (1983); Jacobson (1989)), a measure of general character traits preferred by voters (e.g., Miller (1990); Hayes (2010)), or the subjective evaluation of expert election observers predicting voter behavior and political competence (e.g., Stone (2017)).

[5]Even in the absence of a signaling effect on the part of the candidates.

[6]Consider voters who turned against Hillary Clinton in the waning days of the 2016 election despite the only new information being the re-opening of an investigation. The effect of the Comey (non-) revelation seemed to dominate that of the verifiable, but potentially unrelated to governance, revelation of Donald Trump's Access Hollywood tapes.

always invest in opposition research, potentially even when they know for sure that the favorite is a high-quality type. This leads to voters knowing that the act of research carries no information, and in turn requiring pure verification of the inferiority of the current front-runner. In this case, there is an interior cost that the investigating campaign would prefer, as this would allow them to commit to *not* always investigating, and in turn allow the information they share to carry more bite. The higher the ex-ante quality of the candidate, the lower the cost necessary to relax this problem.

We focus our attention on two important cases. First, if major scandals are rarely found for high-quality types (i.e., no false positives), such that the presence of a major scandal is fully revealing for low-quality types, we show that the relationship between cost of investigation and probability of winning is non-monotonic for all front-running candidates. In particular, relatively low-quality candidates have a U-shaped probability of winning in their cost of being investigated. In fact, it is as good for (ex-ante) low-quality types to be as revealing as possible ($c = 0$) as it is for them to be fully obtuse ($c \to \infty$), as both require proof of their status as a low-type to be defeated. By contrast, relatively high-quality candidates have an inverse U-shaped probability of winning in cost, which features an interior optimum. This is because their status as a high-quality candidate already relaxes the commitment problem for the investigating campaign, and hence voters are more likely to believe that revelations are based on even stronger private information.

In this way, a party may actually prefer ex-ante high-quality candidates be more opaque than lower quality candidates, ceteris paribus. Based upon simple signaling logic, political observers may believe that a candidate who appears high-quality should actually try to be as revealing as possible. However, it may actually be those high-quality candidates who want to be more obtuse as voters will discount the marginal information found about low-quality candidates ("is that the most you could find?") when they can be investigated at low costs, leading such lower quality candidates to be more revealing. This helps explain why seemingly higher quality candidates (e.g., Hillary Clinton) may actually be more obtuse

than lower quality candidates (e.g., Donald Trump).

We also examine cases in which false positives occur with high probability. In this case, we re-obtain an expected monotonic preference for investigation cost on the part of low-quality candidates, and also a U-shaped probability of winning in cost for relatively high types, who can now eliminate negative attention by being fully revealing, causing skepticism of any information which is revealed. In this way, when even high-quality politicians are likely to be involved in scandals, the traditional intuition returns.

Taken together, we show that there exists a non-trivial range of parameter values for any signal structure such that parties would prefer to run a candidate with lower ex-ante quality *and* who is more transparent about their underlying (unobserved to the party) quality than a higher quality, more guarded candidate.

We build upon the vast empirical literature in political behavior attempting to identify how voters respond to negative campaigning about candidates, which has found mixed results. Prior attempts to rationalize the mixed results have focused upon the dynamic nature of campaigns (e.g., Banda and Windett (2016); Acharya et al. (2019)) or possible differences amongst respondents (e.g., gender in King and McConnell (2003); Galasso and Nannicini (2016)). We build upon these contributions by showing that the difference between observational and experimental studies may lie in the way the negative information was produced. In our model, voters know that negative information must first be produced before it can be revealed, and they take this search into consideration when updating to any verifiable information. Hence, it is consistent with our model that they would update more to negative information endogenously generated by a campaign and/or the media, as in observational studies, than to that information exogenously provided by an experimenter. The latter case is the equivalent of an investigation cost of zero in our model, which features the least updating by the voter. This is consistent with evidence that when voters are given negative information relevant to governance (e.g., Fridkin and Kenney (2011)) or before their vote choice (e.g., Krupnikov (2011)), they react stronger. Hence, real world results may not be

so mixed, explaining why such a large amount of campaign funding is spent on negative advertising and opposition research.

We also build upon a growing and important formal literature on the dynamics of campaigns and scandals. Mattes (2012) develops a model concerning the strategic decision of i) what issues to campaign upon, and ii) whether to go positive about one's self or negative about the opponent. Gratton, Holden and Kolotilin (2018) considers the optimal timing of releasing information about one's self and their opponent. Most closely related, Dziuda and Howell (2019) show how scandals can arise endogenously in a world in which information is privately revealed to (both) parties with exogenous probability and those parties must choose whether to claim (in a cheap talk manner) that some politician has engaged in a scandal. We build upon this literature by endogenizing the search for scandal while retaining the strategic decision about whether to reveal, providing a further dynamic for both i) voter updating, and ii) candidate transparency. Moreover, we consider what this tells us about optimal candidate selection by parties.

2 The Model

2.1 The Election

There is an election consisting of two candidates, a favored politician F and an underdog U, competing for the votes of a representative voter V[7]. The voter faces a discrete choice of whether to vote for the favorite, $v \in \{U, F\}$.

The voter's utility is increasing in the perceived quality of elected candidate i. Let her utility be represented by the following:

$$U_V(v) = Q_v \tag{1}$$

For expositional simplicity, the expected quality of the underdog is known with certainty.

[7] This voter is a generalization of the (decisive) median voter

Without loss of generality, $Q_U = 0$. Hence, the relevant uncertainty for the voter is over the relative quality of the favorite. As this is a two-candidate setting, if the voters are uncertain over the quality of both candidates, this would generate a distribution of *relative quality* which is isomorphic to our variable of interest here.[8]

The favorite is one of two types, $\omega \in \{G, B\}$. The meaning of the types is straightforward: if $\omega = G$, $E[Q_F] > 0$, but if $\omega = B$, $E[Q_F] < 0$. Hence, if the favorite is a good type, the voter would prefer to elect them, while if the favorite is a bad type, the voter would prefer to elect the underdog.[9]

All players begin with a common prior belief of the favorite's relative quality, $\pi = Prob[\omega = G]$. Without loss of generality, $\pi \geq \frac{1}{2}$.

2.2 Investigation

Prior to the election, the underdog receives a (costless) signal of the opposition candidate's quality above and beyond the prior information shared by the voter: $s \in \{l, m, h\}$. This signal is drawn from the following technology:

[8]The proceeding analysis is easier to follow, as the favorite wins with certainty in the absence of opposition research against their campaign, and thus never needs to investigate the underdog in isolation. This is also consistent with standard formal theoretic logic and empirical evidence (e.g., Sigelman and Shiraev (2002)) that underdog campaigns will be the primary, verging on only, ones to engage in negative campaign behavior and costly opposition research.

An alternative interpretation of the model replaces "underdog" with "incumbent" and "favorite" with "opposition", as the voter is likely to have more precise information about the incumbent as they have already governed (see, e.g., Ashworth, de Mesquita and Friedenberg (2019)). This generates results for situations in which the incumbent's governance has been proven to be of a relatively low-quality, and hence they need to defeat a (potentially lower quality) opponent.

[9]All results extend to a standard continuous signal structure satisfying a monotone likelihood ratio property.

$$Prob[s = l|B] = Prob[s = h|G] = \alpha \tag{2}$$

$$Prob[s = h|B] = Prob[s = l|G] = \beta \tag{3}$$

$$Prob[s = m] = 1 - \alpha - \beta \tag{4}$$

where $\alpha > \beta$. In other words, α is the probability the signal is an accurate depiction of the candidate's quality, while β is the probability of a false signal. $s = m$ represents fully uninformative signals.

Upon seeing the signal, the underdog updates their belief about the opposition's quality according to Bayes' rule.

This initial signal is unverifiable information with respect to the voter. It represents a rumor that is delivered to the campaign, but which could easily be fabricated, and hence would be treated as cheap talk for the voter.[10] Hence, upon receiving the signal and updating their beliefs, the underdog must decide whether to undertake an investigation to acquire potential verifiable evidence concerning Q_F, $I \in \{0, 1\}$. If the investigation is undertaken ($I = 1$), then the campaign must pay a cost $c > 0$.

An investigation produces a verifiable signal $S \in \{L, M, H\}$ drawn with the same signal technology as the initial rumor[11]:

[10] In a cheap talk game within this setting, the unique equilibrium would be babbling.
[11] The results extend qualitatively if the signal technologies differ.

$$Prob[S = L|B] = Prob[S = h|G] = \alpha \tag{5}$$

$$Prob[S = H|B] = Prob[S = l|G] = \beta \tag{6}$$

$$Prob[S = M] = 1 - \alpha - \beta \tag{7}$$

Hence, the investigation I and corresponding signal S represents opposition research attempting to verify the credulity of the initial rumor s.

Once the underdog observes the signal, she can choose whether or not to reveal the evidence acquired via the investigation to the public, represented by $R \in \{0, 1\}$. Revelation carries a vanishingly small cost ϵ, such that when revelation does not change voting outcomes, the underdog will choose not to do so.[12]

An underdog's strategy σ is a pair of functions $\sigma = \{I(\cdot), R(\cdot)\}$ such that $I : s \to \Delta[0, 1]$ and $R : S \to \Delta[0, 1]$.

The underdog cares only about maximizing the probability of winning an election. They seek to maximize doing so, minus any potential campaign costs from undergoing opposition research. Their (expected) utility function can be represented by:

$$\begin{cases} U_U(I, R, s, S) = Prob[v(\emptyset) = U] & if\ R = 0 \\ U_U(I, R, s, S) = Prob[v(S) = U] - c & if\ R = 1 \end{cases} \tag{8}$$

2.3 Voter Updating

The voter observes one of four messages $M \in \{\emptyset, L, M, H\}$: either no evidence ($\emptyset$), or a verifiable signal $S^* \in (L, M, H)$.

[12] This eliminates trivial equilibria in which the favorite always reveals upon investigation. This assumption can be justified based upon the costs incurred in communicating in a verifiable way to the voting public.

If the voter observes no evidence, she will update accordingly. In this case there is no direct learning about candidates' types; however, there may still be some marginal learning. This is because she learns that one of two things occurred: either i) the underdog received an unverifiable signal such that they never investigated (s such that $I(s) = 0$), or ii) the underdog investigated, but received a verifiable signal that they chose not to reveal (s such that $I(s) = 1$ and S such that $R(S) = 0$). However, she can not distinguish between these two events. Hence, she will still use Bayes' rule to update her beliefs over the favorite's type, and form a posterior belief $P(G|\emptyset)$.

If the voter observes a verifiable signal, she will be able to update from that signal. In addition, while the underdog still cannot directly reveal any information about their initial, costless signal, the voter will implicitly learn something more about that signal as she knows it must have triggered an investigation (s such that $I(s) = 1$). Hence, the verifiable signal actually contains two pieces of information: the content of the investigation itself and the implicit information brought about by an investigation being undertaken.

Taken together, the voter will use Bayes' rule to update her beliefs over the favorite's type for a verifiable signal S^* and form posterior belief $P(G|S^*)$.

Given the posterior belief, she will choose for whom to vote. A voter's strategy is a function $v : M \to \Delta\{U, F\}$.

2.4 Timing and Equilibrium

In summation, the timing of the game is as follows:

1. Nature determines a state of the world $\omega \in \{G, B\}$,

2. The underdog observes a signal $s \in \{l, m, h\}$ and updates their beliefs,

3. The underdog chooses whether to investigate, $I \in \{0, 1\}$,

4. If $I = 1$, the underdog observes a verifiable signal $S \in \{L, M, H\}$ and decides whether to reveal the evidence to the public, $R \in \{0, 1\}$.

5. The voter observes an event $E \in \{\emptyset, L, M, H\}$, updates her beliefs, and chooses for whom to vote $v \in \{U, F\}$,

6. Utility is realized.

Given the preceding, a Perfect Bayesian Equilibrium (PBE) of the game is a tuple $\{I(\cdot), R\{\cdot), P(\cdot), v(\cdot)\}$ that satisfies the following conditions:

1. $I(s) = 1$ if $Prob[v = U|I, s] - v(\emptyset) > c$, $I(s) = 0$ if $Prob[v = U|I, s] - v(\emptyset) < c$, and $I(s) \in [0, 1]$ otherwise,

2. $R(S) = 1$ if $Prob[v(S) = U] > Prob[v(\emptyset) = U]$, $R(S) = 0$ if $Prob[v(S) = U] < Prob[v(\emptyset) = U]$, and $R(S) \in [0, 1]$ otherwise,

3. $P(M)$ follows Bayes' Rule, and

4. $Prob[v(E) = U] = 1$ if $P(G|E) < \frac{1}{2}$, $Prob[v(E) = U] = 0$ if $P(G|E) > \frac{1}{2}$, and $Prob[v(E) = U] \in [0, 1]$ otherwise.

3 Equilibrium Analysis

3.1 Preliminaries

We first dispense with some lemmas to focus our analysis.

Lemma 1 *In all equilibria,* $v(\emptyset) = F$.

Lemma 2 *If no equilibrium exists which gives each candidate a positive ex ante probability of winning, then there exists a unique equilibrium with* $v(E) = F \ \forall E$.

Lemma 3 *If there exists an equilibrium which gives each candidate a positive probability of winning, then it is the only equilibrium which exists and does so.*

Lemma 4 *Take the natural ordering of signals* $l < m < h$ $(L < M < h)$. *In any equilibrium,*

- *If* $I(s) > 0$ *for some* s, $I(s') = 1 \ \forall s' < s$,
- *if* $R(S) > 0$ *for some* S, $R(S') = 1 \ \forall S' < S$, *and*
- *if* $P[v(S) = U] > 0$ *for some* S, $P[v(S) = U] = 1 \ \forall S' < S$

First, in any equilibrium, the absence of additional information means the voter should follow their prior and vote for the favorite. Suppose this was not true. The challenger could simply do nothing and guarantee a victory, and hence would do so. This would mean that the voter is voting against their prior with no new information.

The following two lemmas show that we can focus on two discrete parameter sets. If there is no equilibrium in which both candidates win with positive probability, then we know that the unique equilibrium involves the front-runner always winning. Moreover, there exist at most two equilibria: one in which both candidates win with positive probability, and one in which the front-runner always wins. The latter may coexist due to the presence of a babbling equilibrium. Hence, we will focus on the equilibria where both candidates win with positive probability when it exists, calling it "the equilibrium".

Finally, all equilibria will be in thresholds: if a sender will investigate for some some signal s, they will also investigate for any sufficiently stronger signal of malfeasance s'. The same is true for their decision to reveal. For voters, the situation is reversed: if they will switch their vote to being against the favorite for some verifiable signal S, they will also do so for any stronger negative signal S^*.

Conditioning on the presence of the two-candidate equilibrium, we can begin characterizing comparative statics:

Proposition 1 *Let $I_c(s)$ be the equilibrium investment at each state s given a $c > 0$. Let $R_c(\cdot)$ and $v_c(\cdot)$ be equivalently defined, for S.*

1. *I_c is weakly decreasing in c $\forall s$,*

2. *R_c is weakly increasing in c $\forall S$,*

3. *$P[v(S) = U]$ is weakly increasing in c $\forall S$.*

The first part of the proposition is obvious. As the cost of investigation c increases, we will see a corresponding decrease in the level of investigation given any signal s to the underdog campaign. The investigating campaign needs better information about the potential scandals surrounding F to be willing to pay the cost.

However, the marginal decrease in the probability of investigation for any given set of information has a knock-on effect which is less obvious: for any given revelation, the voter will be more likely to update in a negative direction about the favored candidate, and hence $P[v(S) = U]$ increases.

Consider the information the voter receives from a verifiable signal. First, she gets the pure information itself, S. In addition, however, she also receives the following implicit information: the rumor received by the underdog campaign, s, must have cleared the threshold value such that investigation was possible ($I_c(s) > 0$). That threshold has increased such that, for some potential values of s, there will now be no investigation. Therefore, in equilibrium, the negative information received is more serious.

Due to this effect, the threshold for which the campaign will reveal the information their investigation gleaned will be decreasing, as marginal information to the voter will be more likely to help the underdog campaign.

Taken together, this introduces an ex-ante commitment problem on the part of the sending campaign. On the one hand, decreasing the cost of investigation will allow the campaign,

which will lose absent some positive shock, to investigate even the most trivial of rumors. On the other hand, as voters know that they will investigate *anything*, they will discount *everything* besides radically negative information about the favored candidate. Therefore, the investigating campaign may have preferred to tie their hands by limiting how many rumors they actually pursue.

To see when each effect dominates, we will consider two stark, important cases.[13]

3.2 Case 1: No False Signals ($\beta = 0$)

First, we will consider a scenario in which $\beta = 0$. We can interpret this as the case where only ex-ante low-quality candidates have major scandals, while good types may only have uninformative minor scandals. A negative signal is fully revealing; once you have discovered the damning information, you have sufficient information to turn against the favorite.

Figure 1 shows an example of the types of equilibria which emerge in this world (in this case, where $\alpha = \frac{2}{3}$).

First, suppose the challenger knew that *any* scandal, no matter how trivial, would lead to voters dismissing the favorite. There still exists a cost, $c = \alpha(1 - \pi)$, above which they would be unwilling to investigate for verifiable information absent some *serious* negative information about the favorite, i.e., $s = L$. This is because, given the real possibility that the investigation will turn up nothing verifiable, the underdog would prefer to take the loss in this election rather than pay the high cost for little benefit.

This further emphasizes the incentive from the previous proposition. High costs loosen the commitment problem for the investigator, as they can be trusted to only investigate on serious information rather than risk paying prohibitive costs.

Proposition 2 *Suppose $\beta = 0$. If $c > 1 - \alpha\pi$, the equilibrium involves the investigator investigating only when $s = L$, and the voter supporting the underdog whenever $M \in \{L, M\}$.*

[13] In the Appendix B, we report all results for the general case, as well as closed form probabilities of winning.

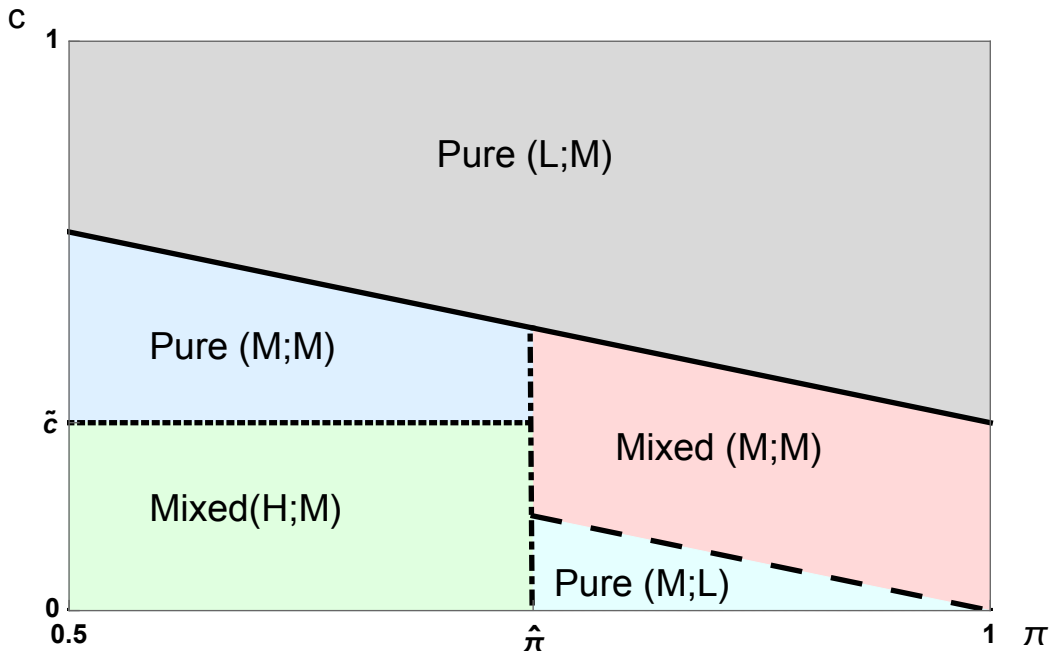

Figure 1: Equilibria with $\alpha = \frac{2}{3}$ and $\beta = 0$. Each area is labeled by $Type(i; j)$, which represents i) whether the equilibrium type involves pure or mixed strategies, ii) the greatest signal such that $I_c(i) > 0$, and iii) the greatest signal such that $Prob[v(j) = U] > 0$.

What occurs if the cost is insufficiently high to remove the commitment problem will depend upon the prior perceived quality of the front-runner. In particular, if the front-runner is of relatively low-quality, voters are sufficiently skeptical of the front-runner that they will choose (up to a limit) to ignore the fact that investigations are not driven by actual information:

Proposition 3 *Suppose* $\beta = 0$ *and* $\pi < \frac{1}{2-\alpha}$. *For all* c, $I_c(H) < 1$, *and* $Prob[v(M) = U] > 0$.

Corollary 1 *Suppose* $\beta = 0$, $\pi < \frac{1}{2-\alpha}$ *and* $c > 1 - \alpha$. $I_c(H) = 0$ *and* $Prob[v(M) = U] = 1$.

As long as the cost takes an intermediate value, as in the corollary, this will still deter politicians from investing when they *know* that their opponent is honest, even when voters are sufficiently skeptical as to throw out incumbents in the absence of explicit proof of their high-quality. In this intermediate cost, low-quality range, favorites will be thrown out simply because no one (the challenger nor the public) ever definitively discovered their high-quality.

In this way, this range is of the greatest value to the underdog: the cost is low enough that they can undertake investigations of all but the most provably honest politicians, but voters are sufficiently skeptical that as long as the campaign can show even ambiguous verifiable information, they will still throw them out.

Eventually, the cost will fall enough that, if voters behave as above, politicians will start investigating known (to them) honest politicians in order to search for such minor scandals. Even here, however, no level of insincere investigation on the part of the challenger will ever be enough to remove voter skepticism entirely: they will always vote out a favorite with positive probability on even minor (uninformative) scandals: if the favorite was really so good, why would the challenger have invested in attempting to find such a story? This problem becomes worse for the politician the more accurate the signal becomes (α increases): while the scandal might be uninformative in and of itself, the lack of verifiably good information is still something informative.

Now suppose that the candidate is of a relatively high-quality. In this case, the voter skepticism constraint is what binds first. At intermediate costs, as above, voters will no longer always find minor scandals sufficient to remove the candidate, and politicians will in turn begin investigating some minor scandals because they know they need to find provably damning evidence. Eventually the cost will become so low that they will always investigate any candidate who is not provably honest. In these cases, however, voters will in turn need proof to send away the favorite:

Proposition 4 *Suppose* $\beta = 0$, $\pi > \frac{1}{2-\alpha}$ *and* $c < \alpha(1-\pi)$. *The equilibrium involves* $v(M) = F$ *and* $v(L) = U$.

Taking the above results together, we can compare the probabilities of winning for each type of favorite:

Theorem 1 *If $\beta = 0$, then:*

- *If $\pi > \frac{1}{2-\alpha}$, the probability of F winning is inverse U-shaped, minimized as $c \to 0$ and $c > \alpha(1-\pi)$, and maximized at $c = \alpha(1-\pi)$.*
- *If $\pi < \frac{1}{2-\alpha}$, the probability of F winning is U-shaped and minimized at $c = 1-\alpha$.*

If the candidate is of sufficiently high ex-ante quality, or signals are of sufficiently low-quality, then we uncover an interior optimum level of opacity for the campaign supporting the favorite. At very small costs, their opponent will always investigate them whenever they are not demonstrably high-quality. Hence, raising the cost has the obvious first-order effect of removing further investigation of some minor scandals. Once the cost is raised enough to eliminate sufficient investigation, however, raising the cost any further loosens the commitment problem for the investigator, making the voter put more weight on any verifiable negative information. Eventually, this effect is so dominant that it only takes one negative signal, even if unseen by the voters, to guarantee a loss: the exact same effect as if there was no cost to investigation at all.

Now suppose the candidate is low ex-ante quality (or the signal is sufficiently high-quality). In this case, the favorite is most likely to win when investigation is completely free. In that case, the commitment constraint binds at its fullest, and the favorite is treated the same as the high-quality candidate discussed above: the voter needs proof of their low-quality to oust them. Hence, only low ex-post quality favorites get removed, and even then only with proof; exactly the same outcome if costs of investigation were extremely high.

Here, however, raising costs from zero is bad for the favorite. Since the prior expected quality is sufficiently low, raising costs will have a bigger impact upon the commitment constraint for the investigator, and will allow the favorite to be ousted with positive probability even upon moderate scandals, as the challenger will not always investigate. It benefits candidates that begin with low perceptions of their quality to be as revealing as possible.

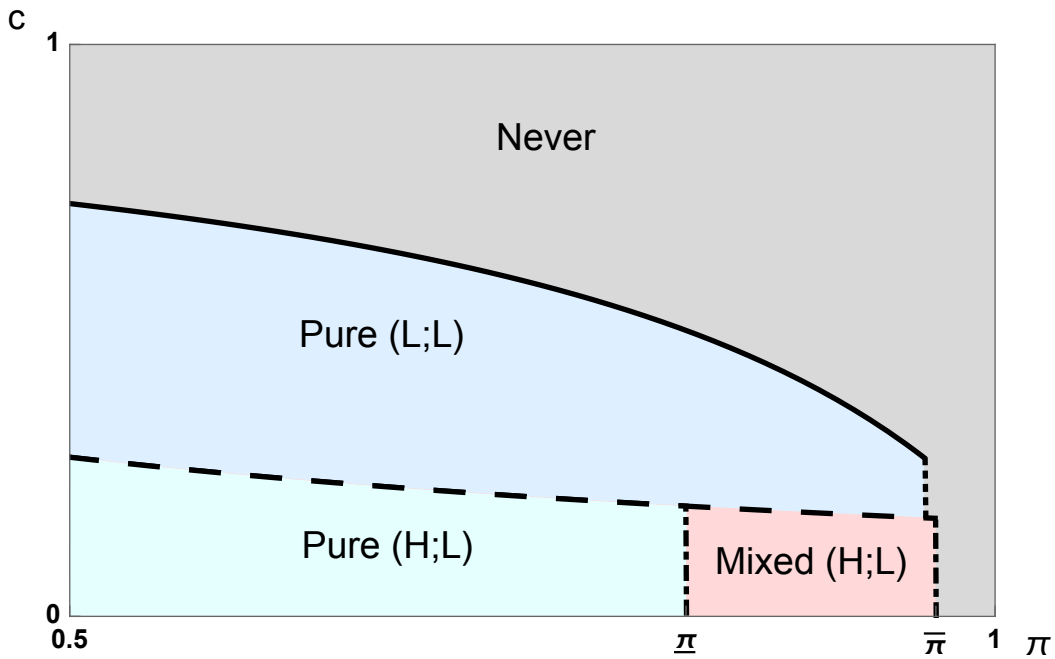

Figure 2: Equilibria with $\alpha = \frac{2}{3}$ and $\beta = \frac{1}{3}$. Each area is labeled by $Type(i;j)$, which represents i) whether the equilibrium type involves pure or mixed strategies, ii) the greatest signal such that $I_c(i) > 0$, and iii) the greatest signal such that $Prob[v(j) = U] > 0$.

3.3 Case 2: Signals Always Informative ($\alpha + \beta = 1$)

Consider a different binary signal. In this case, we have a world in which both types of candidates may inspire scandals, and both types may avoid them: in this case, a signal is always somewhat informative, but never fully.

Figure 2 shows the equilibria that may arise in such a case (again with $\alpha = \frac{2}{3}$):

In this case, it is not always possible for the underdog to win. As even a high-quality candidate can generate a scandal, it becomes possible for the favorite to guarantee election in two ways: either i) they are sufficiently high ex-ante expected quality that even the knowledge of two consecutive low signals is not sufficient to sway the voter, and hence investment in investigation is worthless, or ii) the cost is sufficiently prohibitive that even an initial strong rumor is not enough to get the opposition to investigate.

Proposition 5 *Suppose $\alpha + \beta = 1$, If either $c > \frac{\alpha^2+\pi-2\alpha\pi}{1+\alpha-2\alpha\pi}$ or $\pi > \frac{\alpha^2}{2\alpha^2+1-2\alpha}$, the favorite is a sure winner in equilibrium.*

When there are no mixed signals, the analysis becomes substantially simpler: if costs are too high, or the expected quality of the favorite is too high, then there is no way convince the voter (at an acceptable cost) to replace the favorite. As the cost lowers, the underdog will begin being able to win with positive probability, and hence will begin investigating, but this will have no effect upon voter behavior. Why? This is because there is only one signal, no matter investigation behavior, which can possibly indicate that the voter should turn on the favorite. The commitment problem is neutered in a world with no mixed signals.

We can again compare the probability of winning for each type of favorite:

Theorem 2 *If* $1 - \alpha - \beta = 0$*, then:*

- *If* $\pi \in (\alpha, \frac{\alpha^2}{2\alpha^2+1-2\alpha})$*, the probability of* F *winning is U-shaped, maximized at* $c \to 0$ *and* $c > \frac{\alpha^2+\pi-2\alpha\pi}{1+\alpha-2\alpha\pi}$*, and minimized at* $c = \frac{\alpha(1-\alpha)}{\alpha\pi+(1-\alpha)(1-\pi)}$*, and*
- *If* $\pi < \alpha$*, the probability of* F *winning is increasing in* c*.*

If a favorite is of sufficiently high ex-ante quality, they are guaranteed their re-election in two cases. First, if c is sufficiently large, it is never worthwhile for the opposition to try to investigate them as described above. Second, if $c = 0$, the opposition can never commit to not investigating, even on a high signal h. In this case, even if they reveal a negative signal L, it will be insufficient to convince the voter given the sufficiently strong priors. In these cases, the opposition prefers an interior cost, as it is low enough to allow investigation and hence gives them some chance of winning, but relaxes the commitment problem enough to be persuasive to the voter.

If the favorite is sufficiently low ex-ante quality, however, they will always prefer a higher cost of investigation. In such cases, a single L signal will be enough to convince the voter, and the favorite will always be better off simply avoiding as many investigations as possible.

4 Candidate Selection and Optimal Opacity

Consider the implications of the model for real world campaigns.

First, hold the ex-ante expected quality of a candidate constant and consider their optimal level of opacity (from the perspective of the campaign attempting to maximize its probability of winning[14]):

Definition 1 *Let c^* maximize the probability of winning for the favorite.*

Assumption 1 $c < \frac{\beta^2\pi+\alpha^2(1-\pi)}{\beta\pi+\alpha(1-\pi)}$ *and* $\pi < \frac{\alpha^2}{\alpha^2+\beta^2}$

We assume no candidate can ever have a c such that they can fully deter the other candidate from investigating. This simply restricts from uninteresting cases with favorites who are too strong to be defeated at any cost.

First, note that if the probability of a false signal (i.e., a high-quality candidate being caught in a major scandal) is sufficiently low, then higher quality candidates have higher optimal levels of opacity than low-quality candidates.

Proposition 6 *For sufficiently small values of β, there exists a positive range $[\underline{\pi}, \overline{\pi}]$ such that c^* is increasing in π.*

We call this effect ***The Candidate Halo Effect***. An assumption that is often made in politics is that if you have nothing to hide, you should be as transparent as possible. If you don't know what information exists about you or how it might be interpreted by voters, then this adage may not hold, and such an inference may be false.

A relatively low-quality candidate may maximize their probability of winning by effectively allowing free access to their lives, even without knowing what might be revealed. Doing so uses the commitment problem of the investigating opposition to their advantage.

[14] It is possible that, from the perspective of a party or a partisan voter, it would actually be preferable to not have a low-quality candidate win, even if they are co-partisans. If this is the case, maximum transparency is always optimal.

As they are known by voters to be of ex-ante low-quality, and they are known to be easy to investigate, the opposition will always go looking for information with positive probability, even when they know the candidate is almost certainly high-quality; hence, the voters will require proof that the candidate is indeed flawed ($S = L$). If all they come up with is middling information (e.g., $S = M$), considering they investigate in all states, that is insufficient to turn the voter.

By comparison, a high ex-ante quality candidate can always gain *something* from having positive costs of investigation. As the candidate themselves do not know whether they are ex-post high or low-quality, it is always beneficial to raise costs enough to deter the opposition from always investigating on even uninformative scandals: they are high-quality enough that these uninformative scandals will still not be enough to swing the voters by themselves, but this reduces the probability that rumor of a mild scandal can turn into verifiable evidence of a more legitimate one.

Above this optimal opacity, however, it is still possible for additional cost to be bad, as it loosens the commitment problem for the opposition. If the cost becomes too large, even a moderate, in and of itself uninformative, scandal can be enough to take down a candidate. While the verifiable signal in a vacuum says little about governing ability, its existence confirms that it emerged from an investigation that must have been based upon a sufficiently scandalous rumor to incentivize the opposition candidacy. In this way, even uninformative signals can carry information.

Now turn to candidate selection. Imagine a party choosing amongst candidates represented by a prior public quality π and a cost of investigation c.

First, consider the following partial equilibrium effect:

Proposition 7 *For any pair $\pi > \pi'$, there exists a $\overline{c} < 1$ and $\underline{c} > 0$ such that if $c \in (\underline{c}, \overline{c})$, the difference between the probability of π winning and π' winning is increasing in c.*

There exists a similar $\hat{c} < 1$ such that if $c > \hat{c}$,the difference between the probability of π winning and π' winning is decreasing in c.

To see why this is true, begin from a position in which costs are arbitrarily high and investigation is impossible. In this case, the favorite is never defeated.

As the cost decreases, initially only ex-ante low-quality candidates will be investigated, relatively increasing the value of being of an expected high-quality.

This effect does not last forever. Instead, as costs continue to lower, it will begin relaxing the commitment constraints for the investigating campaign. For the low-quality candidate, this is a benefit: they were already being investigated, and now it will be harder to convince voters that the investigation was founded on a high (unobserved) merit; now the opposition will need to produce verifiably hard evidence. For the high-quality campaign, however, this is not the case: voters were already skeptical of criticism, so they benefited from less campaigning.

This generates the following result:

Proposition 8 *Consider the space of possible pairs $\pi \times c$.*

Consider any pair $\{\alpha, \beta\}$. There exists at least two possible pairs $\{\pi, c\}$ and $\{\pi', c'\}$ such that:

1. $\pi' > \pi$,
2. $c' > c$, *and*
3. *The probability of victory for $\{\pi, c\}$ is greater than for $\{\pi', c'\}$*

We call this ***The Halo Effect***: there will always exist non-unique cases in which a party would prefer to run a candidate who is both i) lower ex-ante quality, and ii) more transparent about their quality candidate over one that is higher quality, but less transparent. In other words, parties prefer open candidates even when they are more more likely to be bad! In this case, the high-quality candidate is going to draw less investigation (due to both their higher expected quality and their higher cost of investigation) ex-ante, but this will make any evidence discovered about them more believable. By contrast, the low-quality, open

candidate gets investigated more often, but voters know this and therefore treat them with higher ex-interim quality, as the act of investigation carries no weight. In this way, voters will now require true verification of their low type and in its absence, will support the low-quality candidate.

The opposite direction holds as well:

Proposition 9 *Consider the space of possible pairs $\pi \times c$.*

Consider any pair $\{\alpha, \beta\}$. There exists at least two possible pairs $\{\pi, c\}$ and $\{\pi', c'\}$ such that:

1. $\pi' > \pi$,
2. $c' < c$, *and*
3. *The probability of victory for $\{\pi, c\}$ is greater than for $\{\pi', c'\}$*

Generally, there are many cases in which choosing a candidate with the right cost of investigation, relative to the signal probabilities α and β, will dominate candidate quality for the party.

5 Conclusion and Discussion

We show that it is crucial to consider the endogenous generation of opposition research to fully understand negative campaigning, voter responses to negative campaigns, politician transparency, and party candidate selection. In particular, we show that standard assumptions, such as that high-quality, transparent candidates are always better, or that only those more likely to have something to hide will obfuscate, are not always correct, and are often wrong. Moreover, these effect occur without any standard signaling story, which identifies new "Halo Effects" bedeviling ex-ante higher quality candidates.

This will be particularly important to empirical work if our preferred measure of quality is based primarily upon relevant experience (see, e.g., Jacobson and Kernell (1983); Jacobson

(1989)). In this case, we should expect high-quality officials to also be those with the most extant information and hence the lowest cost of investigation. While Ashworth, de Mesquita and Friedenberg (2019) shows how such a mechanism can rationalize an incumbency advantage, we show that it could also influence experienced, high ex-ante quality candidates attempting to achieve higher office in non-obvious ways due to its impact on endogenous information generation.

Consider the case of Hillary Clinton in 2016. It is a false inference to assume that her unwillingness to be fully revealing with all private information held by those who knew her said anything about her quality; as she was a (strong) favorite in the campaign, some level of opacity is optimal to deter the endless investigations that plague any moderately strong candidate in pursuit of upsetting them. However, it is reasonable to assume that an overly dark campaign would lead to voter assumptions that moderate scandals were simply the tip of the iceberg; this is rational based upon the fact that any lead is followed at some cost on the part of the opposition.

By contrast, consider Donald Trump in the 2016 Presidential election. As his life had been exceedingly public, the cost of looking for skeletons in his closet was lower than that of a normal candidate; however, when a new scandal would emerge, such as the Access Hollywood tape, it did not have a substantial impact upon his candidacy; it was bad, but not definitive proof of his quality as a leader. Given his low ex-ante quality, and hence voters' certainty that Democrats would search for information, they wanted more.

Living in the modern world, in which uncovering verifiable, otherwise private information about a candidate has become easier, may actually benefit lower quality candidates. In the past, these candidates were close enough to being thrown out that knowing that a (costly) investigation campaign could uncover even mildly damning information was enough to cause the voter to update against them. Instead, if a social media search fails to produce damning evidence, it will not be enough to throw out the candidate, regardless of ex-ante candidate quality. Hence, the probability of a low-quality candidate winning is actually going up at

the same time that of a high-quality candidate is going down (from greater investigation).

This is broadly a model of when it is possible for verifiable information to carry even more information to the receiver. When there is endogenous search, the revelation of some negative, or potentially even middling, information also carries the knowledge that the initial unverifiable signal carried a sufficiently negative signal to set off the search. If the cost of search is low, this result will be weak, but if the cost was high, it allows even nominally positive information to be perceived in a negative light. Consideration of these search costs when examining other settings such as, e.g., police investigations and prosecutions seems fruitful.

Hence, the mechanism in this model is not limited to campaign opposition research. It simply requires that there be a group which must endogenously choose whether to investigate a rumor for (costly) verifiable info and would prefer to do so if it has an impact on the outcome. In particular, it is easy to see this as a model of media in search for a scoop. Hence, these burdens on high (versus low) quality candidates will be even greater in the real world in which more agents than just the opposition candidate are looking for verification.

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A Preliminaries

A.1 Lemma 1

Suppose not. The underdog could always win by choosing $I = 0$.

This would result in a posterior of π.

Since $\pi > \frac{1}{2}$, $v(\emptyset) = 1$.

A.2 Lemma 2

If $v(E) \neq 1$ for some E, then there would exist some positive probability of the underdog winning.

Suppose the underdog was winning for sure.

This would require $v(H) = 0$, which violates rationality for the voter.

A.3 Lemma 3

Direct from proofs of existence in section B.

A.4 Lemma 4

For the voter, $P(G|M) = P(G|S, I = 1)$.

Since the investigation decision is independent of S, these are two independent signals.

By Bayes' Rule, $P(G|M)$ is increasing in S, and $Prob[v = O|S]$ is decreasing in S.

Given the threshold strategy for the voter, the revelation strategy for the campaign is trivially in thresholds.

Finally, we prove the threshold strategy for investigation.

Let S^* be the signals such that $S \in S^*$ if and only if $Prob[v(S^*) = O] = 1$, and S^{**} be the signal (if any) such that $Prob[v(S^{**}) = O] = \sigma$ for some σ.

$I(s) > 0$ if and only if $Prob[S \in S^*|s] + Prob[S = S^{**}|s]\sigma \geq c$.

Due to the threshold voting strategy and informative signals s, the left-hand side is decreasing in s, as a higher signal leads to reduced likelihood of winning verifiable signals.

Hence, for any s such that $I(s) > 0$, all signals $s' < s$ must feature $Prob[S \in S^*|s] + Prob[S = S^{**}|s]\sigma > c$, and $I(s') = 1$.

B Equilibria Existence, Characteristics and Probability of Winning

there are 9 possible non-babbling equilibria, the existence of which we examine in detail below. Each equilibrium is described by Type(i;j), which represents i) whether the equilibrium type involves pure or mixed strategies, ii) the greatest signal such that $I_c(i) > 0$, and iii) the greatest signal such that $Prob[v(j) = U] > 0$:

B.1 Pure (L;L)

The voter knows the campaign is only searching given a l signal, so

- $P(G|L) = \frac{P(L\&l|G)\pi}{P(L\&L|G)\pi + P(L\&l|B)(1-\pi)} = \frac{\beta^2\pi}{\beta^2\pi + \alpha^2(1-\pi)}$
- $P(G|M) = \frac{P(M\&l|G)\pi}{P(M\&l|G)\pi + P(M\&l|G)(1-\pi)} = \frac{\beta(1-\alpha-\beta)\pi}{\beta(1-\alpha-\beta)\pi + \alpha(1-\alpha-\beta)(1-\pi)}$

For $v(L) = U$ but $v(M) = F$, must be the case that $\beta^2\pi < \alpha^2(1-\pi)$, but $\beta(1-\alpha-\beta)\pi > \alpha(1-\alpha-\beta)(1-\pi)$

$$\frac{\alpha}{\alpha+\beta} < \pi < \frac{\alpha^2}{\alpha^2+\beta^2} \tag{9}$$

Given this voter behavior, the campaign needs to draw an L to win, so

- $P(L|l) = \beta\frac{\beta\pi}{\beta\pi+\alpha(1-\pi)} + \alpha\frac{\alpha(1-\pi)}{\beta\pi+\alpha(1-\pi)}$
- $P(L|m) = \beta\pi + \alpha(1-\pi)$

For $I(l) = 1$ but $I(m) = 0$:

$$\beta\pi + \alpha(1-\pi) < c < \frac{\beta^2\pi + \alpha^2(1-\pi)}{\beta\pi + \alpha(1-\pi)} \tag{10}$$

B.2 Pure (L;M)

By $B.1$, the voter behavior is consistent if and only if:

$$\pi < \frac{\alpha}{\alpha+\beta} \tag{11}$$

.

Given this voter behavior, the campaign needs to draw an L or M to win, or alternatively, need to not draw a H, so

- $1 - P(H|l) = 1 - \alpha\frac{\beta\pi}{\beta\pi+\alpha(1-\pi)} - \beta\frac{\alpha(1-\pi)}{\beta\pi+\alpha(1-\pi)} = \frac{(1-\alpha)\beta\pi+\alpha(1-\pi)}{\beta\pi+\alpha(1-\pi)}$

- $1 - P(H|m) = 1 - \alpha\pi - \beta(1-\pi)$

For $I(l) = 1$ but $I(m) = 0$:

$$1 - \alpha\pi - \beta(1-\pi) < c < \frac{(1-\alpha)\beta\pi + \alpha(1-\pi)}{\beta\pi + \alpha(1-\pi)} \tag{12}$$

B.3 Mixed (M;L)

Let q be the probability the campaign investigates on M, and r be the probability $v(L) = U$.

For the voter to be indifferent at L, $P(G|L\&[l \ or \ q * m]) = \frac{1}{2}$

$\rightarrow \frac{\beta(\beta+q(1-\alpha-\beta))\pi}{\beta(\beta+q(1-\alpha-\beta))\pi+\alpha(\alpha+q(1-\alpha-\beta))(1-\pi)} = \frac{1}{2}$

$\rightarrow \beta(\beta + q(1-\alpha-\beta))\pi = \alpha(\alpha + q(1-\alpha-\beta))(1-\pi)$

$\rightarrow \beta^2\pi + \beta\pi(1-\alpha-\beta)q = \alpha^2(1-\pi) + \alpha(1-\pi)(1-\alpha-\beta)q$

$$q = \frac{\alpha^2(1-\pi) - \beta^2\pi}{(1-\alpha-\beta)((\beta+\alpha)\pi - \alpha)} \tag{13}$$

For the politician to be indifferent m, $r * P(L|m) = c$

$$r = \frac{c}{\beta\pi + \alpha(1-\pi)} \tag{14}$$

B.4 Pure (M;L)

The voter knows the campaign is searching whenever it did not receive a h signal:

- $P(G|L) = \frac{P(L\&\not{h}|G)\pi}{P(L\&\not{h}|G)\pi+P(L\&\not{h}|B)(1-\pi)} = \frac{\beta(1-\alpha)\pi}{\beta(1-\alpha)\pi+\alpha(1-\beta)(1-\pi)}$
- $P(G|M) = \frac{(1-\alpha)\pi}{(1-\alpha)\pi+(1-\beta)(1-\pi)}$

For $v(L) = U$ but $v(M) = F$, must be the case $\beta(1-\alpha)\pi < \alpha(1-\beta)(1-\pi)$, but $(1-\alpha)\pi > (1-\beta)(1-\pi)$

$$\frac{1-\beta}{2-\alpha-\beta} < \pi < \frac{\alpha(1-\beta)}{\beta - 2\beta\alpha + \alpha} \tag{15}$$

Given this voter behavior, the campaign needs to draw an L to win, so

- $P(L|m) = \beta\pi + \alpha(1-\pi)$
- $P(L|h) = \beta\frac{\alpha\pi}{\alpha\pi+\beta(1-\pi)} + \alpha\frac{\beta(1-\pi)}{\alpha\pi+\beta(1-\pi)}$

For $I(m) = 1$ but $I(h) = 0$:

$$\frac{\alpha\beta}{\alpha\pi + \beta(1-\pi)} < c < \beta\pi + \alpha(1-\pi) \tag{16}$$

B.5 Mixed (M;M)

Let q be the probability the campaign investigates on M, and r be the probability $v(L) = U$.

For the voter to be indifferent at M, $P(G|M\&[l\ or\ q*m]) = \frac{1}{2}$

$\rightarrow \frac{(\beta+q(1-\alpha-\beta))\pi}{(\beta+q(1-\alpha-\beta))\pi+(\alpha+q(1-\alpha-\beta))(1-\pi)} = \frac{1}{2}$

$\rightarrow (\beta + q(1-\alpha-\beta))\pi = (\alpha + q(1-\alpha-\beta))(1-\pi)$

$\rightarrow \beta\pi + \pi(1-\alpha-\beta)q = \alpha(1-\pi) + (1-\pi)(1-\alpha-\beta)q$

$$q = \frac{\alpha(1-\pi) - \beta\pi}{(1-\alpha-\beta)(2\pi-1)} \tag{17}$$

For the campaign to be indifferent at m, $P([L\ or\ r*M]|m) = c$

$$r = \frac{c - \beta\pi - \alpha(1-\pi)}{1-\alpha-\beta} \tag{18}$$

B.6 Pure (M;M)

Given $B.3$, the voter behavior is consistent if and only if\

$$\pi < \frac{1-\beta}{2-\alpha-\beta} \tag{19}$$

Given this voter behavior, the campaign needs to draw an L or M to win, or alternatively, need to not draw a H, so

- $1 - P(H|m) = 1 - \alpha\pi - \beta(1-\pi)$
- $1 - P(H|h) = 1 - \alpha\frac{\alpha\pi}{\alpha\pi+\beta(1-\pi)} - \beta\frac{\beta(1-\pi)}{\alpha\pi+\beta(1-\pi)}$

For $I(m) = 1$ but $I(h) = 0$:

$$\frac{\alpha(1-\alpha)\pi + \beta(1-\beta)(1-\pi)}{\alpha\pi + \beta(1-\pi)} < c < 1 - \alpha\pi - \beta(1-\pi) \tag{20}$$

B.7 Mixed (H;L)

Let q be the probability the campaign investigates on M, and r be the probability $v(L) = U$.

For the voter to be indifferent at L, $P(G|[L\&l \ or \ m \ q * h]) = \frac{1}{2}$

$\rightarrow \frac{\beta(1-(1-q)\alpha)\pi}{\beta(1-(1-q)\alpha)\pi+\alpha(1-(1-q)\beta)(1-\pi)} = \frac{1}{2}$

$\rightarrow \beta(1-(1-q)\alpha)\pi = \alpha(1-(1-q)\beta)(1-\pi)$

$$q = 1 - \frac{\beta\pi - \alpha(1-\pi)}{\alpha\beta(2\pi - 1)} \tag{21}$$

For the campaign to be indifferent at h, $r * P(L|h) = c$

$$r = \frac{c(\alpha\pi + \beta(1-\pi))}{\alpha\beta} \tag{22}$$

B.8 Pure (H;L)

Given the campaign is always researching, the voter only learns from the revealed signal.

$P(G|L) = \frac{\beta\pi}{\beta\pi+\alpha(1-\pi)}$

$v(L) = U$ if and only if

$$\pi < \frac{\alpha}{\alpha + \beta} \tag{23}$$

Given voter behavior, the campaign needs to draw an L to win.

$$c < \frac{\alpha\beta}{\alpha\pi + \beta(1-\pi)} \tag{24}$$

.

B.9 Mixed (H;M)

Let q be the probability the campaign investigates on M, and r be the probability $v(L) = U$.

For the voter to be indifferent with M, $P(G|[M\&l \ or \ m \ q * h]) = \frac{1}{2}$

$\rightarrow \frac{(1-(1-q)\alpha)\pi}{(1-(1-q)\alpha)\pi+(1-(1-q)\beta)(1-\pi)} = \frac{1}{2}$

$\rightarrow (1-(1-q)\alpha)\pi = (1-(1-q)\beta)(1-\pi)$

$$q = 1 - \frac{2\pi - 1}{((\alpha+\beta)\pi - \beta)} \tag{25}$$

For the campaign to be indifferent with h, $P(L|h) + r * P(M|h) = c$

$$r = \frac{c - \frac{\alpha\beta}{\alpha\pi+\beta(1-\pi)}}{1-\alpha-\beta} \tag{26}$$

B.10 Summary

All of the above 18 conditions taken together, we have the following ranges[15]:

1. If $\pi > \frac{\alpha^2}{\alpha^2+\beta^2}$, F is sure winner
2. If $\pi \in (\frac{\alpha(1-\beta)}{\beta-2\beta\alpha+\alpha}, \frac{\alpha^2}{\alpha^2+\beta^2})$
   (a) If $c < \beta\pi + \alpha(1-\pi)$, Mixed(M;L)
   (b) If $\beta\pi + \alpha(1-\pi) < c < \frac{\beta^2\pi+\alpha^2(1-\pi)}{\beta\pi+\alpha(1-\pi)}$, Pure(L;L)
   (c) If $c > \frac{\beta^2\pi+\alpha^2(1-\pi)}{\beta\pi+\alpha(1-\pi)}$, F is sure winner
3. If $\pi(\frac{\alpha}{\alpha+\beta}, \frac{\alpha(1-\beta)}{\beta-2\beta\alpha+\alpha})$:

[15] These are the full set of possible ranges: not all these ranges exist for all parameter values and not all equilibria types within the ranges exist for all parameter values.

(a) If $c < \frac{\alpha\beta}{\alpha\pi+\beta(1-\pi)}$, Mixed(H;L)

(b) If $c \in (\frac{\alpha\beta}{\alpha\pi+\beta(1-\pi)}, \beta\pi + \alpha(1-\pi))$, Pure(M;L)

(c) If $\beta\pi + \alpha(1-\pi) < c < \frac{\beta^2\pi+\alpha^2(1-\pi)}{\beta\pi+\alpha(1-\pi)}$, Pure(L;L)

(d) If $c > \frac{\beta^2\pi+\alpha^2(1-\pi)}{\beta\pi+\alpha(1-\pi)}$, F is sure winner

4. If $\pi \in (\frac{1-\beta}{2-\alpha-\beta}, \frac{\alpha}{\alpha+\beta})$:

(a) If $c < \frac{\alpha\beta}{\alpha\pi+\beta(1-\pi)}$, Pure(H;L)

(b) If $c \in (\frac{\alpha\beta}{\alpha\pi+\beta(1-\pi)}, \beta\pi + \alpha(1-\pi))$, Pure(M;L)

(c) If $c \in (\beta\pi + \alpha(1-\pi), 1 - \alpha\pi - \beta(1-\pi))$, Mixed(M;M)

(d) If $c \in (1 - \alpha\pi - \beta(1-\pi), \frac{(1-\alpha)\beta\pi+\alpha(1-\pi)}{\beta\pi+\alpha(1-\pi)})$, Pure(L;M)

(e) If $c > \frac{(1-\alpha)\beta\pi+\alpha(1-\pi)}{\beta\pi+\alpha(1-\pi)}$, F is sure winner

5. If $\pi < \frac{1-\beta}{2-\alpha-\beta}$

(a) If $c < \frac{\alpha\beta}{\alpha\pi+\beta(1-\pi)}$, Pure(H;L)

(b) If $c \in (\frac{\alpha\beta}{\alpha\pi+\beta(1-\pi)}, \frac{\alpha(1-\alpha)\pi+\beta(1-\beta)(1-\pi)}{\alpha\pi+\beta(1-\pi)})$, Mixed(H;M)

(c) If $c \in (\frac{\alpha(1-\alpha)\pi+\beta(1-\beta)(1-\pi)}{\alpha\pi+\beta(1-\pi)}, 1 - \alpha\pi - \beta(1-\pi))$, Pure(M;M)

(d) If $c \in (1 - \alpha\pi - \beta(1-\pi), \frac{(1-\alpha)\beta\pi+\alpha(1-\pi)}{\beta\pi+\alpha(1-\pi)})$, Pure(L;M)

(e) If $c > \frac{(1-\alpha)\beta\pi+\alpha(1-\pi)}{\beta\pi+\alpha(1-\pi)}$, F is sure winner

B.11 Probabilities of Winning

The following table contains the ex-ante probability of the favorite winning for each equilibrium type:

Type	Prob(F)
Pure(L;L)	$(1-\beta^2)\pi + (1-\alpha^2)(1-\pi)$
Pure(L;M)	$(1-\beta+\alpha\beta)\pi + (1-\alpha+\alpha\beta)(1-\pi)$
Mixed(M;L)	$(1-\beta-\frac{\alpha^2(1-\pi)-\beta^2\pi}{(\beta+\alpha)\pi-\alpha}+(\beta+\frac{\alpha^2(1-\pi)-\beta^2\pi}{(\beta+\alpha)\pi-\alpha})(1-\beta+(1-\frac{c}{\beta\pi+\alpha(1-\pi)})\beta))\pi+$ $(1-\alpha-\frac{\alpha^2(1-\pi)-\beta^2\pi}{(\beta+\alpha)\pi-\alpha}+(\alpha+\frac{\alpha^2(1-\pi)-\beta^2\pi}{(\beta+\alpha)\pi-\alpha})(1-\alpha+(1-\frac{c}{\beta\pi+\alpha(1-\pi)})\alpha))(1-\pi)$
Pure(M;L)	$(1-\beta+\alpha\beta)\pi + (1-\alpha+\alpha\beta)(1-\pi)$
Mixed(M;M)	$(1-\beta-\frac{\alpha(1-\pi)-\beta\pi}{2\pi-1}+(\frac{\alpha(1-\pi)-\beta\pi}{2\pi-1}+\beta)(1-c+(\alpha-\beta)(1-\pi)))\pi+$ $(1-\alpha-\frac{\alpha(1-\pi)-\beta\pi}{2\pi-1}+(\frac{\alpha(1-\pi)-\beta\pi}{2\pi-1}+\alpha)(1-c-(\alpha-\beta)\pi))(1-\pi)$
Pure(M;M)	$((2-\alpha)\alpha)\pi + ((2-\beta)\beta)(1-\pi)$
Mixed(H;L)	$(\frac{\beta\pi-\alpha(1-\pi)}{\beta(2\pi-1)}+((1-\frac{\beta\pi-\alpha(1-\pi)}{\alpha\beta(2\pi-1)})\alpha+1-\alpha)(1-\beta+\beta(1-\frac{c(\alpha\pi+\beta(1-\pi))}{\alpha\beta})))\pi+$ $(\frac{\beta\pi-\alpha(1-\pi)}{\alpha(2\pi-1)}+((1-\frac{\beta\pi-\alpha(1-\pi)}{\alpha\beta(2\pi-1)})\beta+1-\beta)(1-\alpha+\alpha(1-\frac{c(\alpha\pi+\beta(1-\pi))}{\alpha\beta})))(1-\pi)$
Pure(H;L)	$(1-\beta)\pi + (1-\alpha)(1-\pi)$
Mixed(H;M)	$((\frac{2\pi-1}{(\alpha+\beta)\pi-\beta})\alpha+((1-\frac{2\pi-1}{(\alpha+\beta)\pi-\beta})\alpha+1-\alpha)(1-\beta-c+\frac{\alpha\beta}{\alpha\pi+\beta(1-\pi)}))\pi+$ $((\frac{2\pi-1}{(\alpha+\beta)\pi-\beta})\beta+((1-\frac{2\pi-1}{(\alpha+\beta)\pi-\beta})\beta+1-\beta)(1-\alpha-c+\frac{\alpha\beta}{\alpha\pi+\beta(1-\pi)}))(1-\pi)$

C Proofs

C.1 Proposition 1

Direct from section B.

C.2 Proposition 2

Direct form $B.2$, equation 12 with $\beta = 0$.

C.3 Proposition 3

Direct from $B.10.5$ with $\beta = 0$.

C.4 Proposition 4

Direct from $B.4$ with $\beta = 0$.

C.5 Theorem 1

If $\pi > \frac{1}{2-\alpha}$, we have the following equilibria (with corresponding probabilities of winning):

		P(F wins)
If $c < \alpha(1-\pi)$	Pure(M;L)	$(1-\beta+\alpha\beta)\pi + (1-\alpha+\alpha\beta)(1-\pi)$
If $c \in (\alpha(1-\pi), 1-\alpha\pi)$	Mixed(M;M)	$(1-\beta-\frac{\alpha(1-\pi)-\beta\pi}{2\pi-1}+(\frac{\alpha(1-\pi)-\beta\pi}{2\pi-1}+\beta)(1-c+(\alpha-\beta)(1-\pi)))\pi+$ $(1-\alpha-\frac{\alpha(1-\pi)-\beta\pi}{2\pi-1}+(\frac{\alpha(1-\pi)-\beta\pi}{2\pi-1}+\alpha)(1-c-(\alpha-\beta)\pi))(1-\pi)$
If $c > 1-\alpha\pi$	Pure(L;M)	$(1-\beta+\alpha\beta)\pi + (1-\alpha+\alpha\beta)(1-\pi)$

For low values of c, there is no change in the probability of winning.

At $c = \alpha(1-\pi)$, there is a discontinuous increase in the probability of F winning as no the campaign no longer investigates on a m with certainty.

While $c \in (\alpha(1-\pi), 1-\alpha\pi)$, the probability of F winning is decreasing in c.

At $c > 1-\alpha\pi$, the probability of F winning is constant, at the same value as when $c < \alpha(1-\pi)$

If $\pi < \frac{1}{2-\alpha}$, we have the following equilibria (with corresponding probabilities of winning:

		P(F wins)
If $c < 1-\alpha$	Mixed(H;M)	$((\frac{2\pi-1}{(\alpha+\beta)\pi-\beta})\alpha + ((1-\frac{2\pi-1}{(\alpha+\beta)\pi-\beta})\alpha+1-\alpha)(1-\beta-c+\frac{\alpha\beta}{\alpha\pi+\beta(1-\pi)}))\pi+$ $((\frac{2\pi-1}{(\alpha+\beta)\pi-\beta})\beta + ((1-\frac{2\pi-1}{(\alpha+\beta)\pi-\beta})\beta+1-\beta)(1-\alpha-c+\frac{\alpha\beta}{\alpha\pi+\beta(1-\pi)}))(1-\pi)$
If $c \in (1-\alpha, 1-\alpha\pi)$	Pure(M;M)	$((2-\alpha)\alpha)\pi + ((2-\beta)\beta)(1-\pi)$
If $c > 1-\alpha\pi$	Pure(L;M)	$(1-\beta+\alpha\beta)\pi + (1-\alpha+\alpha\beta)(1-\pi)$

If $c < 1-\alpha$, the probability F wins is decreasing in c.

At $c = 1-\alpha$, the probability F wins jumps discontinuously as the campaign no longer ever investigates on h.

The probability of F winning jumps again at $c = 1-\alpha\pi$.

C.6 Proposition 5

Direct from $B.10$ with $\alpha + \beta = 1$.

C.7 Theorem 2

If $\pi \in (\alpha, \frac{\alpha^2}{2\alpha^2+1-2\alpha})$, we have the following equilibria (with corresponding probabilities of winning):1

		P(F) Wins
If $c < \frac{\alpha(1-\alpha)}{(2\alpha-1)\pi+(1-\alpha)}$	Mixed(H;L)	$(\frac{\beta\pi-\alpha(1-\pi)}{\beta(2\pi-1)} + ((1 - \frac{\beta\pi-\alpha(1-\pi)}{\alpha\beta(2\pi-1)})\alpha + 1 - \alpha)(1 - \beta + \beta(1 - \frac{c(\alpha\pi+\beta(1-\pi))}{\alpha\beta})))\pi +$ $(\frac{\beta\pi-\alpha(1-\pi)}{\alpha(2\pi-1)} + ((1 - \frac{\beta\pi-\alpha(1-\pi)}{\alpha\beta(2\pi-1)})\beta + 1 - \beta)(1 - \alpha + \alpha(1 - \frac{c(\alpha\pi+\beta(1-\pi))}{\alpha\beta})))(1 - \pi)$
If $c \in (\frac{\alpha(1-\alpha)}{(2\alpha-1)\pi+(1-\alpha)}, \frac{\alpha^2+\pi-2\alpha\pi}{1+\alpha-2\alpha\pi})$	Pure(L;L)	$(1 - \beta^2)\pi + (1 - \alpha^2)(1 - \pi)$
If $c > \frac{\alpha^2+\pi-2\alpha\pi}{1+\alpha-2\alpha\pi}$	Babbling	1

If $c = 0$, $P(F) = 1$.

As c increases but remains below $\frac{\alpha(1-\alpha)}{(2\alpha-1)\pi+(1-\alpha)}$, the probability of F winning decreases.

When $c = \frac{\alpha(1-\alpha)}{(2\alpha-1)\pi+(1-\alpha)}$, the probability of F winning takes a discontinuous jump as the campaign no longer ever investigates on H.

Finally, it takes another discontinuous jump and reaches 1 again once the unique equilibrium is babbling.

If $\pi < \alpha$, we have the following equilibria (with corresponding probabilities of winning):

		P(F) Wins
If $c < \frac{\alpha(1-\alpha)}{(2\alpha-1)\pi+(1-\alpha)}$	Pure(H;L)	$(1 - \beta)\pi + (1 - \alpha)(1 - \pi)$
If $c \in (\frac{\alpha(1-\alpha)}{(2\alpha-1)\pi+(1-\alpha)}, \frac{\alpha^2+\pi-2\alpha\pi}{1+\alpha-2\alpha\pi})$	Pure(L;L)	$(1 - \beta^2)\pi + (1 - \alpha^2)(1 - \pi)$
If $c > \frac{\alpha^2+\pi-2\alpha\pi}{1+\alpha-2\alpha\pi}$	Babbling	1

Even at $c = 0$, the probability of F winning is interior, and takes discontinuous jumps at all points where the equilibrium changes and the campaign increases their investigating threshold.

C.8 Proposition 6

Suppose $\beta = 0$. This is direct from Theorem 1.

Let $\beta > 0$ but small. By the continuity of the thresholds in section B, the matrix will remain the same as the proofs in Theorem 1, and hence the result still hold until β becomes too large.

C.9 Proposition 7

Direct from $B.10$ and $B.11$.

See mathematica code to find relevant ranges for any pair $\{\pi, \pi'\}$

C.10 Proposition 8

Generically there will be many cases, as found in sections $B.10$ and $B.11$, but to prove existence consider the following pair of relationships:

1. $\frac{\alpha}{\alpha+\beta} < \pi < \pi' < \frac{\alpha^2}{\alpha^2+\beta^2}$
2. $0 < c < c' < \frac{(1-\alpha)\beta\pi+\alpha(1-\pi)}{\beta\pi+\alpha(1-\pi)}$

Let $c \to 0$. The equilibrium will be be a mixed strategy equilibrium with $v(M) = 0$ (and hence only $v(L) > 0$).

With c arbitrarily small, the only way to make the campaign willing to mix is for $v(L)$ to be arbitrarily small.

By continuity, for a range of parameter values c sufficiently small, $\{\pi, c\}$ is approximately close to a sure winner.

By contrast, $\{\pi', c'\}$ wins with positive probability, but also loses with positive probability if it obtains a pure strategy or a mixed strategy where $v(L) = U$.

Suppose it also obtains a mixed strategy where only $v(L) > 0$.

Both feature the winning probability $(\frac{\beta\pi-\alpha(1-\pi)}{\beta(2\pi-1)} + ((1 - \frac{\beta\pi-\alpha(1-\pi)}{\alpha\beta(2\pi-1)})\alpha + 1 - \alpha)(1 - \beta + \beta(1 - \frac{c(\alpha\pi+\beta(1-\pi))}{\alpha\beta})))\pi + (\frac{\beta\pi-\alpha(1-\pi)}{\alpha(2\pi-1)} + ((1 - \frac{\beta\pi-\alpha(1-\pi)}{\alpha\beta(2\pi-1)})\beta + 1 - \beta)(1 - \alpha + \alpha(1 - \frac{c(\alpha\pi+\beta(1-\pi))}{\alpha\beta})))(1 - \pi)$

As long as π' is sufficiently close to π, the result holds.

C.11 Proposition 9

Generically there will be many cases, as found in sections $B.10$ and $B.11$, but to prove existence consider the following pair of relationships:

1. $\pi < \pi' < \frac{1-\beta}{2-\alpha-\beta}$
2. $0 < c' < 1 - \alpha\pi - \beta(1-\pi) < c$

For $\{\pi, c\}$, there are two possible equilibrium states: Pure(L;M) or F is the sure winner.

If F is the sure winner obtains, the result is trivial.

Suppose Pure(L;M) obtains.

In this case, $v(L) = v(M) = U$.

In this case, the probability of winning is $(1-\beta+\alpha\beta)\pi + (1-\alpha+\alpha\beta)(1-\pi)$

For $\{\pi', c'\}$,there are three possible equilibrium states: Pure(H;L), Mixed(H;M), or Pure(M;M).

If either Pure(H;L) or Pure(M;M) obtains, the result is trivial.

Suppose Mixed(H;M) obtains.

Let c' be arbitrarily close to $\frac{\alpha(1-\alpha)\pi+\beta(1-\beta)(1-\pi)}{\alpha\pi+\beta(1-\pi)}$

In this case, to make the campaign indifferent to searching even when drawing h, $r \approx 1$, and the $v(L) \approx v(M) \approx U$.

In this case, the probability of winning is $\approx$

$((\frac{2\pi'-1}{(\alpha+\beta)\pi'-\beta})\alpha + ((1-\frac{2\pi'-1}{(\alpha+\beta)\pi'-\beta})\alpha + 1 - \alpha)(1-\beta))\pi' + ((\frac{2\pi'-1}{(\alpha+\beta)\pi'-\beta})\alpha + ((1-\frac{2\pi'-1}{(\alpha+\beta)\pi'-\beta})\beta + 1-\beta)(1-\alpha))(1-\pi')$

Since the former case features the campaign only investigating on l, while the latter involves the campaign investigating on l, m, and sometimes h, as long as $\pi' - \pi$ is not too large, the result holds.