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At the Helm, Kirk or Spock? The Pros and Cons of Charismatic Leadership

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Charismatic leaders are often desired. At the same, experience, especially with demagogues, as well as social science studies, raise doubts about such leaders. This paper offers explanations for charismatic leadership's "mixed report card." It offers insights into why and when charismatic leadership can be effective; which, when, and why certain groups will prefer more to less charismatic leaders; and how being more charismatic can make leaders worse in other dimensions, particularly causing them to work less hard on their followers' behalf.

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In the classic tv show *Star Trek*, command of the Starship Enterprise was given not to the smartest and most knowledgeable character, Spock, but to a more charismatic character, Kirk. In real life, as in fiction, charisma is valued: leaders able to connect with and inspire their followers at an emotional level are desired. At the same time, however, while charismatic leadership is prevalent and often deemed effective, experiences with demagogic leaders, as well as conflicting assessments from empirical and case studies, raise questions about the value of charismatic leadership. This paper develops a model of charismatic leadership

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that offers insights into why and when it can be effective; which, when, and why certain groups will prefer more to less charismatic leaders; and how charisma can be detrimental, in particular causing leaders to work less.

A preference for charismatic leadership—emotional appeals over reason—may seem puzzling. To reference another classic TV show, shouldn't followers want "just the facts"? Shouldn't a rational follower be suspicious of an upbeat demagogic appeal lacking in details? If the leader's case is truly strong, why doesn't she just present the facts? Yet, as I show, even wholly rational actors can respond positively to a charismatic leader's emotional appeals; in particular, work harder in response to a more charismatic leader's emotional appeal than in response to such an appeal from a less charismatic leader. It is possible, in fact, for an organization or society to *rationally* prefer a very charismatic, but ignorant, demagogue (a Kirk) to a knowledgeable leader lacking in charisma (a Spock).

At the same time, the power of charisma to induce greater effort does not make it an unalloyed good: in some circumstances, a less charismatic leader is preferable to a more charismatic one. Further, situations exist in which the leader's charisma proves irrelevant. As such, the paper provides a theoretical justification for the "mixed report card" the literature has given charisma: while many scholars offer evidence of charisma's benefit (see footnote 4 *infra*), there are others who argue emphasizing charisma when selecting leaders is misguided (see, e.g., Meindl, 1990 & 1995, and Khurana, 2002*a*,*b*) or too much is attributed to leaders' charisma (e.g., Weber et al., 2001, and Wasserman, Anand and Nohria, 2010).

While we have a general notion of what charisma means,[1] there is no consensus as to how it affects people.[2] That is, while psychology, sociology, and political science offer considerable evidence that charisma has demonstrable effects,[3] there

[1]A possible consensus definition is that charismatic leaders can "by the force of their personal abilities [have] profound … effects on followers" (House and Baetz, 1979, p. 339).

[2]In a sense, charisma is analogous to gravity: gravity clearly exists, but physics has yet to agree on *why* bodies with mass are attracted to each other (i.e., what mediates this attraction).

[3]See, e.g., Awamleh and Gardner (1999), Chatman and Kennedy (2010), Conger and Kanungo (1994), Greenstein (2004), House, Spangler and Woycke (1991), Howell and Shamir (2005), Nye (2008), Shamir,

is no one explanation for why charisma influences followers. As I show, however, that lack of consensus is not important to understanding the pros and cons of charismatic leadership. What is important—see Section I.B—is that, whatever one's conceptualization of charisma, it exhibit certain properties, which, critically, many of the conceptualizations from the literature do.

The model I develop rests on two pillars: first, although the majority of followers can be wholly rational and *directly* immune to the leader's charisma, charisma is assumed to resonate in some intrinsic way with a fraction of followers; who I call "emotional responders." An emotional appeal from a sufficiently charismatic leader engenders a positive response from emotional responders *ceteris paribus*.[4] As noted, Section I.B briefly considers explanations for why charisma affects at least some followers (i.e., why there are emotional responders).

The second pillar is that getting the cold hard facts across clearly to followers reduces an appeal's emotional effect. There are a number of reasons, detailed in Section I.C, for why this could be (e.g., it is hard to inculcate optimism while simultaneously providing evidence that the situation is bad). Hence, the leader faces a tradeoff between information and inspiration; she can make either an emotional appeal, which is inspirational but devoid of facts; or a *rational appeal*, which credibly conveys the relevant facts but is emotionally colder.

That an emotional appeal comes at the cost of providing followers information would seem to offer one explanation for charisma's mixed report card. As Hermalin (1998) notes, followers generally do better if they know, when choosing their actions, the return to them (the productivity state) than if ignorant. Hence, an emotional appeal, which conceals the state, imposes a cost on the followers. So if most followers are rational (i.e., not directly susceptible to emotional appeals) or the emotional responders only slightly susceptible or both, then it would seem

House and Arthur (1993), van Vugt and Ronay (2014), and Wang et al. (2011).

[4]Shamir, House and Arthur (1993), Chatman and Kennedy (2010), Wang et al. (2011), and van Vugt and Ronay (2014) survey the vast social-psychological evidence showing positive responses among (some) followers to charismatic leadership. In economics, Dal Bó and Dal Bó (2013) and Kvaløy, Nieken and Schöttner (2015) find evidence that emotional appeals act as incentives.

an obvious prediction that the followers do better without a charismatic leader.

That prediction, however, is incomplete: it overlooks that the leader could be "savvy"; that is, able to tailor her appeal to the circumstances. As shown below, a savvy leader makes an emotional appeal when "just the facts" provide followers too little incentive, but makes a rational appeal when the facts "speak for themselves." Followers (at least rational ones) understand this is how she behaves. In particular, the rational ones—called "sober responders"—will form pessimistic beliefs about the productivity state upon hearing an emotional appeal. But how pessimistic depends on how charismatic the leader is. Because a more charismatic leader is more inclined to make an emotional appeal *ceteris paribus*, sober responders are less pessimistic about the state when a more charismatic leader makes an emotional appeal than when a less charismatic leader does. So, even though not directly influenced by emotional appeals, sober (rational) responders work harder in equilibrium in response to an emotional appeal from a more charismatic leader than in response to such an appeal from a less charismatic leader.

If leaders are savvy, then, as just suggested, the informational loss from an emotional appeal is less when it comes from a more rather than less charismatic leader. Further, more charismatic leaders' emotional appeals induce better actions from *all* followers than do their less charismatic counterparts' (reflecting the direct effect of charisma on emotional responders as well as the indirect effect outlined in the previous paragraph). *Ex ante*, the followers' expected production is greater with a more charismatic leader than a less charismatic one (Proposition 2). As a consequence, sober responders—those *not* intrinsically susceptible to charisma—will prefer more charismatic leaders to less charismatic ones.

What about emotional responders? In some instances, an emotional appeal leads them to act at odds with their self interest. If they anticipate that, then they may prefer a leader with little charisma. An irony, therefore, is that followers directly immune to charisma want a more charismatic leader, while those who are susceptible can want a less charismatic one. See Section III for details.

Even when charisma is a desirable leadership characteristic, the analysis still sheds light on charisma's mixed report card: to charisma's many definitions, this paper adds, "charisma is the ability to get away with concealing bad news" (to be a bit flippant). In other words, when the situation is good, charisma is irrelevant; it matters only when the situation is bad. Hence, someone looking at the data might see that when entities do well, there is little evidence that the leader's charisma mattered. Conversely, it can help explain why leaders famous for their charisma were typically leaders in dire situations (e.g., Jeanne d'Arc at the siege of Orléans or Winston Churchill during the Battle of Britain).

Extending the model, what if the choice is not between equally knowledgeable leaders of varying charisma, but between a knowledgeable leader lacking charisma (a "professor") or a charismatic demagogue lacking knowledge? Now the incentive benefits of charisma must be weighed against followers' ignorance of the productivity state. As discussed in Section III, it is unclear whether followers do better with a professor or a demagogue at the helm; a finding that further explains the literatures's ambivalent assessment of charisma. Notably, however, a sufficiently charismatic demagogue will, though ignorant, be preferable to a professor.

In the first part of the paper, the leader is assumed to have been endowed (or not) with payoff-relevant information, her only decision is the type of appeal to make. A critical issue, however, is what effect charisma has on the leader's incentives to work on her followers' behalf. To analyze how charisma affects the leader's work incentives, Section IV assumes the leader must work to learn information. The analysis reveals that a downside to charisma is it tempts a leader to forgo effort. That model extension, thus, offers a further explanation for the literature's mixed assessment of charisma's value.

Prior economic models of leadership tend to adopt one of two approaches:[5] the

[5]For surveys of the economic literature on leadership, see Bolton, Brunnermeier and Veldkamp (2010), Zupan (2010), or Hermalin (2013). For a broader social science survey, see Nohria and Khurana (2010).

leader struggles to convey information credibly to followers;[6] or she has a bias ("leadership style") that commits her to take otherwise incredible actions.[7,8]

This paper connects to both approaches. In common with the first is information transmission from leader to followers. It differs from that prior literature in terms of how followers respond if the leader conceals information. In the prior literature, concealing information makes the followers so pessimistic that the leader does best if she can commit to always reveal information truthfully. In contrast, here, a charismatic leader can get away with concealing bad news without triggering overly pessimistic beliefs.

Like the second, this paper assumes the leader possesses a personality trait, her charisma. Unlike that earlier literature, in which the leader's trait, her "style," mean she acts differently than a rational actor would, here the leader is wholly rational; it is, instead, a fraction of her followers who are not wholly rational.

A paper outside this "two-approaches" taxonomy warrants comment: Kvaløy and Schöttner (2015) model a leader seeking to motivate a single follower. They do not, however, consider charisma nor does the leader possess private information. Additionally, in their paper, the follower is somewhat irrational, whereas here a key result is that a charismatic leader can influence wholly rational followers.

Proofs not given in the text appear in the appendix.

I. Basic Model

A. Assumptions

An entity has a single leader, n_E followers who respond emotionally, and n_S followers who are sober (fully rational) responders. Let $N = n_E + n_S$.

A follower, m, takes an action $a_m \in \mathbb{R}_+$ at personal cost $c(a_m)$; the function

[6] Papers following this approach include Hermalin (1998), Kobayashi and Suehiro (2005), Andreoni (2006), Komai, Stegeman and Hermalin (2007), Komai and Stegeman (2010), and Zhou (2016).

[7] Papers following this approach include Rotemberg and Saloner (1993, 1994, 2000), Van den Steen (2005), Blanes i Vidal and Möller (2007), and Bolton, Brunnermeier and Veldkamp (2013).

[8] A small empirical literature in economics also exists; see Choudhury and Khanna (2013) for a partial survey. Hermalin (2013, §2.3.2.3) reviews some of the experimental work testing models of leadership.

$c : \mathbb{R}_+ \to \mathbb{R}_+$ is the same for all followers. To ensure unique best responses and to avoid corner solutions, assume: $c(\cdot)$ thrice continuously differentiable; $c(0) = c'(0) = 0$; and marginal cost, $c'(\cdot)$, to be increasing and unbounded.

Follower m receives a payoff of $V - c(a_m)$,[9] where

$$V = \theta \sum_{j=1}^{N} a_j \tag{1}$$

and $\theta \in (\underline{\theta}, \overline{\theta}) \subset \mathbb{R}_+$ is the marginal return to action (the "productivity state").[10] The most natural interpretation is that V is the value of a non-rivalrous public good:[11] follower m donates a_m in money, time, etc. to a cause (e.g., the leader's election, a civic activity, etc.), $c(a_m)$ is forgone utility from private consumption, alternative use of time, etc., and θ the return to donations, labor, etc. in terms of the objective (e.g., probability of electoral victory, societal wellbeing, etc.).

Assuming an additive production function (i.e., expression (1)) avoids a more complicated analysis that would ensue if the followers' actions were strategic substitutes or complements, thus permitting a focus on the roles of charisma and information.[12] That noted, the analysis does extend to other production functions—see the working-paper version (Hermalin, 2017). Furthermore, (1) seems a reasonable reflection of reality for the examples just given (e.g., donating to a cause or door-to-door canvassing); also keep in mind footnote 12 *supra*.

[9] Additive separability between benefit and cost of action is commonly assumed in the literature (see, e.g., Hermalin, 1998). Like any quasilinearity assumption, it eliminates "income" effects on the choice of action, vastly simplifying the analysis.

[10] Assuming an open interval for θ avoids dealing with special cases that could arise if $\underline{\theta} = 0$.

[11] Assuming a public rather than divisible good is without loss of generality; similar results hold if the followers' payoffs are $\sigma V - c(a)$, $\sigma > 0$ denoting a follower's share of V and $1 - N\sigma > 0$ the leader's.

[12] Having assumed production is additive, there is no greater generality to assuming

$$V = \theta \sum_{m=1}^{N} g(a_m)\,, \tag{♡}$$

$g(\cdot)$ increasing with diminishing marginal returns and $g(0) = 0$: as will be seen, followers solve programs of the form $\max_a \zeta g(a) - c(a)$, $\zeta > 0$. Via the change of variables $e = g(a)$, such programs are equivalent to $\max_e \zeta e - c\big(g^{-1}(e)\big)$. The composite function, $c\big(g^{-1}(\cdot)\big)$, satisfies the requisite properties for a cost-of-action function if $c(\cdot)$ does. Expression (1) is, thus, the more general (♡) after a change of variables.

The timing of the game is: 1) nature draws θ from a commonly known distribution function, which has a positive derivative (density) everywhere and mean $\mathbb{E}\theta$; 2) the leader learns the realization of θ, which is her private information; 3) the leader decides whether to make a rational or emotional appeal; 4) the followers choose their actions in response; and 5) payoffs are realized and the game ends.

Making a rational appeal means the leader provides *hard* information that reveals the productive state, θ, to her followers. An emotional appeal is one in which the leader suppresses information about θ and simply exhorts her followers to work hard. Sober responders can distinguish rational from emotional appeals. As discussed below, emotional responders may also be able to do so. Further details about appeals are given and justified in Section I.C.

Throughout it is assumed that the leader is selfish, concerned only with her expected utility. Hence, in this basic model, she seeks to maximize V given that she too benefits from the public good (e.g., a greater probability of her election).

A follower's objective depends on whether he is an emotional or sober responder. Regardless of appeal type, a sober follower's objective is to maximize

$$V - c(a)\,. \tag{2}$$

In contrast, an *emotional* responder behaves as if his objective is to maximize

$$R_\tau(\chi, \widehat{\theta})a - c(a)\,, \tag{3}$$

where $\chi \in [\underline{\chi}, \overline{\chi}) \subseteq \mathbb{R}_+$ is the leader's charisma, $\widehat{\theta}$ a rationally inferred estimate of θ (equal to θ if the leader makes a rational appeal), and $\tau \in \{0, 1\}$ denotes whether leader has made a rational ($\tau = 0$) or emotional ($\tau = 1$) appeal. As discussed below, R_τ is increasing in χ when $\tau = 1$. I defer details on how followers infer the productive state when the leader makes an emotional appeal to Section II.

Assume the leader's charisma, χ, is common knowledge. This could reflect an

earlier, unmodeled, stage in which followers get to know the leader.[13]

For any constant $\zeta > 0$, the properties of $c(\cdot)$ ensure a unique interior solution to the program $\max_a \zeta a - c(a)$, one that is increasing in ζ; let $a^*(\zeta)$ denote that program's solution. By the implicit function theorem, $a^*(\cdot)$ is differentiable. Given an inferred value $\widehat{\theta}$ for the productivity state, (3) entails an emotional responder's equilibrium action is $a^*\big(R_\tau(\chi, \widehat{\theta})\big)$. From (1) and (2), a sober responder's equilibrium response is $a^*(\widehat{\theta})$.

Assume throughout that the players participate. This follows if their reservation utilities are zero: because a follower could choose $a = 0$, at cost 0, his expected utility is non-negative in any equilibrium. The leader can also guarantee herself a non-negative expected utility. In keeping with leadership being an informal aspect of organization (see, e.g., Hermalin, 2013, for a discussion), there is no contracting between the leader and followers.

B. Modeling Charisma

As already noted, the literature on charisma offers no single explanation for its effect on followers. This subsection considers, briefly, two of a number of possible explanations.[14] Despite these explanations' differences, they share common properties—see Lemma 1 below—that permit one to analyze the effects of charisma even without consensus as to why charisma affects followers.

Charisma Reinforces Followers' Desires: An old idea, dating at least to the 14th century (Ibn Khaldûn, 2004), is that a successful leader identifies and taps into her followers' desires; she reinforces desired beliefs.[15] A charismatic leader is

[13]This common-knowledge assumption has empirical validity. Consensus is quickly reached on how charismatic politicians are. For example, as Nye (2008, p. 54) reports, even Tony Blair's severest critics agreed he was highly charismatic. Conversely, Clement Attlee was widely seen to lack charisma: "A modest man, but then he has so much to be modest about" (often attributed to Churchill, though he denied saying it). Additionally, various measures of charisma in the social-psychology literature have high cross-subject correlation (see, e.g., Conger and Kanungo, 1994, and Awamleh and Gardner, 1999).

[14]See the working-paper version, Hermalin (2017), for a discussion of other mechanisms.

[15]As Napoleon said, "A leader is a dealer in hope." See Howell and Shamir (2005) on the relation between charismatic leadership and followers' "self-concepts." Nye (2008, pp. 57–58) reviews historical cases in which charismatic leaders' successes are attributable to their having reflected back their followers'

someone able to convince at least some followers that the return to their actions are greater than they truly are.[16] Hence, whereas a wholly rational actor infers that the return is $\widehat{\theta}$, emotional responders are led to see it as $\widehat{\theta}$ plus something:

$$R_\tau(\chi, \widehat{\theta}\,) = \widehat{\theta} + \tau P(\chi, \widehat{\theta}\,)\,, \tag{4}$$

$P : \mathbb{R}^2_+ \to \mathbb{R}_+$ differentiable in both arguments, $\partial P/\partial \chi > 0$, and $\partial P/\partial \theta \geq -1$.[17]

Charisma and Identity: Psychological research finds that charisma induces followers to identify with the leader, the group, or both.[18] As a model, suppose an emotional responder weighs total welfare by $\tau\chi$ in his utility and his own private payoff by $1 - \tau\chi$; so he acts as if his marginal return to effort is

$$R_\tau(\chi, \widehat{\theta}\,) = (\tau\chi N + 1)\widehat{\theta}\,. \tag{5}$$

If, instead, he identifies with the leader only, his choice of a would maximize

$$\underbrace{(\tau\chi + 1)\widehat{\theta}}_{=R_\tau(\chi, \widehat{\theta}\,)} a - c(a)\,. \tag{6}$$

Properties of R: Observe specifications (4)–(6) entail

$$R_0(\chi, \widehat{\theta}\,) = \widehat{\theta}\,. \tag{7}$$

desire to be optimistic about the future.

[16] For evidence from psychology that people's beliefs can reflect wishful thinking see, e.g., Ditto and Lopez (1992) and Dunning, Leuenberger and Sherman (1995) on self-serving biases. Application in economics include Kőszegi (2006), Bénabou (2013), Möbius et al. (2013), and Augenblick et al. (2016).

[17] The functional forms underlying the figures *infra* are specific examples of (4).

[18] "Charismatic leadership works in part by influencing followers to identify with a collective enterprise and internalize group aspirations" (van Vugt and Ronay, 2014). Also see Shamir, House and Arthur (1993) and Howell and Shamir (2005) for evidence. In a non-leadership setting, Coffman and Niehaus (2020) find experimental evidence that sellers able to induce buyers to identify with them do better than sellers unable to do so. Also see Akerlof and Kranton (2000) on identity and economics.

Given (7), there is little ambiguity in just writing R rather than R_1; a convention that will be employed except when ambiguity would otherwise arise.

The following properties of R are readily verified, so stated without proof:

Lemma 1. *Assume the perceived return, R, to an emotional appeal is as given in one of the specifications* (4)–(6)*. Then:*

(i) Perceived return is greater the more charismatic the leader; that is, for all $\theta \in (\underline{\theta}, \overline{\theta})$, $R(\chi, \theta) > R(\chi', \theta)$ if $\chi > \chi'$.

(ii) Perceived return is nondecreasing in the inferred or estimated value of the productivity state, θ; that is, for all χ, $R(\chi, \theta) \geq R(\chi, \theta')$ if $\theta > \theta'$.

(iii) If an emotional appeal has a greater impact than a rational one for a given perceived productivity state, it will do so for all lesser states; that is, if $\theta > \theta'$, then $R(\chi, \theta) > \theta$ implies $R(\chi, \theta') > \theta'$.

(iv) The function R is differentiable in all arguments.

As will become evident, the results that follow hold for any specification of R (model of charisma) that satisfies (7) and properties (i)–(iv) of Lemma 1.

Interpret $\chi = \underline{\chi}$ to mean a total lack of charisma; reflecting that, assume

$$R(\underline{\chi}, \underline{\theta}) = \underline{\theta}\,. \tag{8}$$

From Lemma 1(iii), $R(\underline{\chi}, \theta) \leq \theta$, $\forall \theta$.

It speeds the analysis, without real loss of generality, to assume that no leader is so charismatic that she makes an emotional appeal regardless of the true state. For reasons that will become clear later, that holds if

$$n_S a^*(\mathbb{E}\theta) + n_E a^*\big(R(\overline{\chi}, \mathbb{E}\theta)\big) = N a^*(\overline{\theta})\,. \tag{9}$$

From Lemma 1(i) and continuity, expression (9) entails that, for all $\chi \in [\underline{\chi}, \overline{\chi})$,

there exists a $\theta_\chi < \overline{\theta}$ such that, if $\theta \in (\theta_\chi, \overline{\theta})$, then

$$n_S a^*(\mathbb{E}\theta) + n_E a^*\big(R(\chi, \mathbb{E}\theta)\big) < N a^*(\theta)\,. \tag{10}$$

C. Modeling Appeals

Built into the model is an assumption that the more fact-based a leader's speech, the less emotional impact it has. Among the rationales for that assumption are:

1) In experiments, Awamleh and Gardner (1999) find that speeches characterized by visionary content elicit higher ratings of leader charisma and effectiveness from the audience than speeches with non-visionary content.[19]

2) The widely accepted political adage "if you're explaining, you're losing" reflects the difficultly in simultaneously providing facts and exciting an audience (a point also made by Greenstein, 2004, and Nye, 2008, on what constitutes effective political speech).

3) It is impossible to inculcate optimism while simultaneously providing clear evidence to the contrary (i.e., the first rationale given above for why people respond to charisma is predicated on the leader concealing bad information).

II. Equilibrium of the Basic Model

Let $\Theta^{\mathbb{E}}(\zeta) \equiv \mathbb{E}\{\theta | \theta \leq \zeta\}$ denote the expectation of θ conditional on it not exceeding ζ. It follows that $\Theta^{\mathbb{E}}(\overline{\theta}) = \mathbb{E}\theta$ and $\Theta^{\mathbb{E}}(\underline{\theta}) = \underline{\theta}$. Because θ is distributed with an everywhere positive density, $\Theta^{\mathbb{E}}(\cdot)$ is increasing and $\Theta^{\mathbb{E}}(\theta) < \theta$ if $\theta > \underline{\theta}$.

The leader wishes to make an emotional appeal when the state is θ if and only

[19] In their study, visionary content was thematic and inspirational, whereas non-visionary content was "direct and information oriented" (Awamleh and Gardner, 1999, p. 353).

if that will yield a larger V than a rational appeal; that is, if and only if

$$\Big(n_S a^*(\widehat{\theta}\,) + n_E a^*\big(\underbrace{R(\chi,\widehat{\theta}\,)}_{=R_1(\chi,\widehat{\theta})}\big)\Big)\theta \geq \Big(n_S a^*(\theta) + n_E a^*\big(\underbrace{\theta}_{=R_0(\chi,\theta)\text{ by (7)}}\big)\Big)\theta = N a^*(\theta)\theta\,, \tag{11}$$

where, as before, $\widehat{\theta}$ is the followers' expectation of the state given an emotional appeal. Condition (11) is equivalent to

$$n_S a^*(\widehat{\theta}\,) + n_E a^*\big(R(\chi,\widehat{\theta}\,)\big) \geq N a^*(\theta)\,. \tag{12}$$

Because $a^*(\cdot)$ is increasing, it follows that the leader's best response to the followers' beliefs is a cutoff strategy: an emotional appeal if $\theta \leq \theta_C$ and a rational appeal if $\theta > \theta_C$, where either the cutoff, θ_C, equates the two sides of (12) or, if no such value exists, $\theta_C = \overline{\theta}$. In a perfect Bayesian equilibrium, followers' beliefs are consistent with this strategy; that is, $\widehat{\theta} = \Theta^{\mathbb{E}}(\theta_C)$.[20]

Proposition 1. *If the leader is minimally charismatic (i.e., $\chi = \underline{\chi}$), then the only perfect Bayesian equilibrium is one in which she makes a rational appeal only. Otherwise, the only perfect Bayesian equilibria are those in which the leader makes an emotional appeal given states below a cutoff level, $\theta_C \in (\underline{\theta}, \overline{\theta})$, a rational appeal for states about θ_C, and at least one such equilibrium exists.*[21]

The intuition for why the equilibrium must involve a cutoff strategy is clear from (12) and the arguments leading to it. That a minimally charismatic leader (i.e.,

[20] In a perfect Bayesian equilibrium, players' actions are sequentially rational and their beliefs consistent with Bayes rule given prior distributions and the equilibrium strategies. So, if the leader plays a cutoff strategy in equilibrium—makes an emotional appeal if $\theta \leq \theta_C$—the Bayesian estimate of the state is $\mathbb{E}\{\theta|\theta \leq \theta_C\} \equiv \Theta^{\mathbb{E}}(\theta_C)$. For impossible actions by an informed player given the strategy profiles of the presumptive equilibrium, which cannot therefore be conditioning events for Bayesian updating, the uninformed players' beliefs need to be specified as part of the description of the equilibrium; that, however, isn't necessary for an out-of-equilibrium rational appeal because information is hard. Out-of-equilibrium emotional appeals can be ruled out by having followers hold very pessimistic beliefs (i.e., $\widehat{\theta} = \underline{\theta}$) should a leader who, in equilibrium, is supposed to make a rational appeal deviate by making an emotional one, as the analysis will make clear.

[21] Observe no claim is made about uniqueness. For much of what follows, uniqueness is not critical. See Lemma A.1 in the appendix for conditions under which uniqueness is assured.

one for whom $\chi = \underline{\chi}$) never makes an emotional appeal follows because she would do better to make a rational appeal given any rational beliefs that an emotional appeal would engender. That a leader for whom $\chi > \underline{\chi}$ makes an emotional appeal for low values of θ and a rational appeal for high values follows, in part, because even if an emotional appeal from her engendered the most pessimistic beliefs about the state, she would still induce a better action from emotional responders than if she made a rational appeal if the state is indeed poor. On the other hand, if the state is very good, it behooves her to reveal it given that followers' rational expectation of the state when she conceals it (makes an emotional appeal) is inevitably lower than the true state. See the proof for details.

A key comparative static result behind what follows is that, comparing two leaders with levels of charisma χ' and χ, $\chi' < \chi$, if there is an equilibrium with the less charismatic leader in which her cutoff is θ'_C, then there is an equilibrium with the more charismatic leader in which her cutoff is $\theta_C > \theta'_C$. Observe this claim is immediate from Proposition 1 if $\chi' = \underline{\chi}$, so assume $\chi' > \underline{\chi}$. Consider a perfect Bayesian equilibrium in which the χ' leader makes an emotional appeal whenever $\theta \leq \theta'_C$. By definition of a cutoff:

$$n_S a^*\big(\Theta^{\mathbb{E}}(\theta'_C)\big) + n_E a^*\Big(R\big(\chi', \Theta^{\mathbb{E}}(\theta'_C)\big)\Big) = N a^*(\theta'_C)\,,$$

Lemma 1(i) and the fact that $a^*(\cdot)$ is increasing entail

$$n_S a^*\big(\Theta^{\mathbb{E}}(\theta'_C)\big) + n_E a^*\Big(R\big(\chi, \Theta^{\mathbb{E}}(\theta'_C)\big)\Big) > N a^*(\theta'_C)\,.$$

Given (10) and continuity, there must therefore exist a $\theta_C \in (\theta'_C, \overline{\theta})$ such that

$$n_S a^*\big(\Theta^{\mathbb{E}}(\theta_C)\big) + n_E a^*\Big(R\big(\chi, \Theta^{\mathbb{E}}(\theta_C)\big)\Big) = N a^*(\theta_C)\,.$$

hence, there's an equilibrium with the more charismatic leader in which the cutoff

is θ_C, $\theta_C > \theta'_C$. To summarize:

Lemma 2. *Consider two leaders with levels of charisma χ' and χ, $\chi' < \chi$. Fix a perfect Bayesian equilibrium in which the χ' leader makes an emotional appeal whenever $\theta \leq \theta'_C$. There exists a $\theta_C > \theta'_C$ such that there is a perfect Bayesian equilibrium in which the χ leader makes an emotional appeal whenever $\theta \leq \theta_C$.*

The next result compares the equilibrium actions induced by a more charismatic as opposed to a less charismatic leader. Specifically, an emotional appeal from the more charismatic leader induces better actions from *both* kinds of followers than does one from the less charismatic leader. Furthermore, the more charismatic leader generates (weakly) a higher value of the public good in all states and a strictly higher value in expectation.

Proposition 2. *Fix a perfect Bayesian equilibrium of the game with a less charismatic leader. There is a perfect Bayesian equilibrium of the game with a more charismatic leader such that, comparing the equilibria,* both *emotional and sober responders' actions are higher in response to an emotional appeal from the more charismatic leader than in response to such an appeal from the less charismatic leader. Additionally, for any perfect Bayesian equilibrium of the game with the less charismatic leader, there is a perfect Bayesian equilibrium of the game with the more charismatic leader in which, comparing the two equilibria,*

(i) the sum of the actions (i.e., $\sum_{m=1}^{N} a_m$) is never less with the more charismatic leader and it is strictly greater for a set of states of positive measure;

(ii) the value of the public good (i.e., V) is never less with the more charismatic leader and it is strictly greater for a set of states of positive measure; and

(iii) in expectation, the value of the public good is greater if the leader is the more charismatic of the two.

The effect of greater charisma on emotional responders is not surprising. What is more interesting is that sober responders—those not inherently receptive to

emotional appeals—respond more to such appeals in equilibrium when they come from more charismatic leaders than when they come from less charismatic leaders. The reason is that more charismatic leaders know they have a greater influence on emotional responders than less charismatic leaders; hence, more charismatic leaders are willing to make emotional appeals for a wider range of states than less charismatic leaders. Consequently, sober responders rationally infer that the state is likely to be greater in expectation when they receive an emotional appeal from a more charismatic leader than when they receive such an appeal from a less charismatic leader, which causes them to take a better (higher) action.[22]

Points (ii) and (iii) in Proposition 2 clearly follow immediately from point (i). Point (i) holds because if the more charismatic leader makes a rational appeal, so too will the less charismatic one; hence, all followers supply the same effort. However, if the more charismatic leader makes an emotional appeal, she does so because it generates more total effort than a rational appeal would. Hence, she clearly generates more effort than a less charismatic leader would if that less charismatic leader would make a rational appeal. From the first part of Proposition 2, she also generates more total effort even if her less charismatic counterpart would also make an emotional appeal.

Proposition 2 hints at why an entity with a more charismatic leader could out perform one with a less charismatic leader: provided an entity has *any* emotional responders (i.e., provided $n_E > 0$), a more charismatic leader will generate better (higher) actions and greater value in expectation than a less charismatic leader.

Because leaders make rational appeals when the state is good, but not when it is bad, charisma is valuable when the state is low (i.e., less than θ_C) but not necessarily when it is high. This could explain why charisma is more valued in dire times (e.g., Churchill, whose inspirational leadership after the fall of France is considered, by many, to have been critical to Britain's survival, was voted out

[22] As an anonymous referee noted, if one views forgoing the benefits of an emotional appeal as an opportunity cost of making a rational one, then this reasoning is reminiscent of results in the literature on voluntary disclosure with disclosure costs (see, e.g., Verrecchia, 1983).

of office once victory had been achieved).

What follows does not really depend on whether the equilibrium in Proposition 1 is unique, but, for the sake of brevity and without consequence for the substantive conclusions, a unique equilibrium will be assumed henceforth to simplify the analysis (see Lemma A.1 for conditions that ensure uniqueness).[23]

It is useful to remember, in what follows, that the leader is indifferent between the two kinds of appeal when the state equals her cutoff, θ_C; that is,

$$n_S a^*\big(\Theta^{\mathbb{E}}(\theta_C)\big) + n_E a^*\Big(R\big(\chi, \Theta^{\mathbb{E}}(\theta_C)\big)\Big) = N a^*(\theta_C)\,. \tag{13}$$

It is often convenient to use the right side of (13) to substitute for the left.

III. Preferences Over Kinds of Leaders & Welfare

So far, the assumption has been the leader knows the state, θ, and is able to tailor her appeal to maximize the public good given how her followers respond to different appeals. Call such a leader *savvy*. Two alternative kinds of leaders, "professors" and "demagogues," will now be considered.

A *professor* is a leader with no charisma ($\chi = \underline{\chi}$). In terms of creating value, a professor is inferior to a charismatic savvy leader (Proposition 2).

A *demagogue* is a leader who does not know θ (her ignorance is common knowledge). A demagogue can, thus, make emotional appeals only.[24] Her followers can infer nothing about the state from her "decision" to make an emotional appeal; hence, their inferences about the state are independent of her charisma. In particular, a sober responder's action is always $a^*(\mathbb{E}\theta)$.

How professors and demagogues vary in terms of outcomes has to do with the

[23] Equivalently, invoke the equilibrium-selection rule: if multiple equilibria exist, the one with the highest cutoff, θ_C, is played. A justification for this rule is it yields the highest value of V and, thus, the leader has an incentive to select it by announcing her intention to play it prior to making any appeal.

[24] An alternative assumption is she could choose to remain silent. Silence would be the leader's best play if silence leads the followers to play $a^*(\mathbb{E}\theta)$ and her charisma is such that $R(\chi, \mathbb{E}\theta) < \mathbb{E}\theta$. The analysis that follows holds even if a demagogue could remain silent.

value of information. The following lemma is critical in that regard.

Lemma 3. *The function defined by* $\theta \mapsto \theta a^*(\theta) - c\big(a^*(\theta)\big)$ *is strictly convex. If, for all* $a \in \mathbb{R}_+$, marginal *disutility of action is log concave (i.e.,* $\log\big(c'(\cdot)\big)$ *is concave), then the function defined by* $\theta \mapsto \theta a^*(\theta)$ *is strictly convex.*

As but one example, the log-concavity condition holds if $c(a) = a^\gamma$, $\gamma > 1$. *Assume, henceforth, that* marginal *disutility is log concave* (does not accelerate too quickly). Note: only when Lemma 3 is invoked *below* is this assumption relevant; in particular, it is irrelevant for the prior propositions.

Given the lemma, Jensen's inequality implies that

$$\mathbb{E}\big\{\theta a^*(\theta)\big\} > \mathbb{E}\theta \times a^*(\mathbb{E}\theta) = \mathbb{E}\big\{\theta a^*(\mathbb{E}\theta)\big\};$$

hence, information about the state is valuable: an informed follower produces more in expectation than an uninformed follower (one who knows only the prior). A professor, therefore, generates greater expected value from sober responders than a demagogue. Consequently, if a demagogue's charisma is low enough, or emotional responders a small enough fraction of followers, or both, then a professor generates greater expected value in total. On the other hand, given (9), a maximally charismatic *savvy* leader (i.e., for whom $\chi = \overline{\chi}$) makes emotional appeals only and, thus, is equivalent to a maximally charismatic demagogue. From Proposition 2, a maximally charismatic savvy leader generates greater expected value than a minimally charismatic one (the equivalent of a professor). By continuity, then, a sufficiently charismatic demagogue must outperform a professor. It is, thus, ambiguous as to whether a professor generates more or less value in expectation than a demagogue: a demagogue with little charisma generates less than a professor, but a highly charismatic demagogue generates more.

What about welfare? As a benchmark, suppose that all responders are sober (i.e., $n_E = 0$). Because $\Theta^{\mathbb{E}}(\theta_C) < \theta_C$, (12) implies that a savvy leader facing only sober responders never makes an emotional appeal; her charisma is irrelevant.

Given Lemma 3, the function

$$\theta \mapsto (n_S - 1)\theta a^*(\theta) + \theta a^*(\theta) - c\big(a^*(\theta)\big)$$

is strictly convex. Jensen's inequality thus implies

$$\mathbb{E}\Big\{n_S\theta a^*(\theta) - c\big(a^*(\theta)\big)\Big\} > n_S \times \mathbb{E}\theta \times a^*(\mathbb{E}\theta) - c\big(a^*(\mathbb{E}\theta)\big)\,.$$

So, if all followers are sober, each strictly prefers a professor or savvy leader to a demagogue—their expected welfare is greater than with a demagogue.

Again assume that both sober and emotional responders exist. The presence of emotional responders makes the sober ones care about the leader's charisma; they will strictly prefer more charismatic savvy leaders to less charismatic ones:

Proposition 3. *Assume both sober and emotional responders exist, then sober responders prefer:*

(i) a more charismatic leader to a less charismatic one when leaders are savvy;

(ii) a sufficiently charismatic demagogue to a professor when leaders are demagogues or professors; but

(iii) a professor to an insufficiently charismatic demagogue when leaders are demagogues or professors.

Proof of point (i): Denote the distribution function over states by $F : (\underline{\theta}, \overline{\theta}) \to (0, 1)$. The expected payoff to a sober responder is

$$F(\theta_C)\Theta^{\mathbb{E}}(\theta_C)\left(n_S a^*\big(\Theta^{\mathbb{E}}(\theta_C)\big) + n_E a^*\Big(R\big(\chi, \Theta^{\mathbb{E}}(\theta_C)\big)\Big)\right) - F(\theta_C)c\Big(a^*\big(\Theta^{\mathbb{E}}(\theta_C)\big)\Big) + \int_{\theta_C}^{\overline{\theta}} \Big(\theta(n_S + n_E)a^*(\theta) - c\big(a^*(\theta)\big)\Big)dF(\theta)\,.$$

Given (i) $d\big(F(\theta)\Theta^{\mathbb{E}}(\theta)\big)/d\theta = \theta F'(\theta)$, (ii) expression (13), and (iii) the envelope theorem, the derivative of that expression with respect to χ proves to be

$$
\begin{aligned}
(14)\quad & \Bigg(F'(\theta_C)\left(c\big(a^*(\theta_C)\big) - c\Big(a^*\big(\Theta^{\mathbb{E}}(\theta_C)\big)\Big)\right) \\
& \qquad + n_E a^{*\prime}\Big(R\big(\chi, \Theta^{\mathbb{E}}(\theta_C)\big)\Big)\frac{\partial R}{\partial \theta}\Theta^{\mathbb{E}\,\prime}(\theta_C)\Theta^{\mathbb{E}}(\theta_C)F(\theta_C) \\
& \qquad + (n_S - 1)a^{*\prime}\big(\Theta^{\mathbb{E}}(\theta_C)\big)\Theta^{\mathbb{E}\,\prime}(\theta_C)\Theta^{\mathbb{E}}(\theta_C)F(\theta_C)\Bigg)\frac{d\theta_C}{d\chi} \\
& \qquad\qquad + n_E a^{*\prime}\Big(R\big(\chi, \Theta^{\mathbb{E}}(\theta_C)\big)\Big)\frac{\partial R}{\partial \chi}\Theta^{\mathbb{E}}(\theta_C)F(\theta_C) > 0
\end{aligned}
$$

(the sign follows because $\theta_C > \Theta^{\mathbb{E}}(\theta_C)$, $d\theta_C/d\chi > 0$, and $a^{*\prime}(\cdot) > 0$). ■

As expression (14) makes clear, sober responders benefit from charisma's direct effect on emotional responders (the last line of (14)). That is not surprising. More striking is that a sober responder also benefits because *all* his fellow followers are indirectly induced to work harder (choose a higher action)—an effect captured by the middle two lines of (14)—this is due to the higher expectation of the state that an emotional appeal from a more versus less charismatic leader generates.

Proof of points (ii) and (iii) of Proposition 3: To establish point (ii), consider a savvy leader with charisma $\overline{\chi}$: she always makes an emotional appeal and is, thus, equivalent to a demagogue of equal charisma. A professor is a savvy leader who lacks charisma. The result follows from point (i) and the continuity of payoffs.

Point (iii): observe

$$
\begin{aligned}
(15)\quad \mathbb{E}\Big\{(n_S + n_E)\theta a^*(\theta) - c\big(a^*(\theta)\big)\Big\} &> (n_S + n_E) \times \mathbb{E}\theta \times a^*(\mathbb{E}\theta) - c\big(a^*(\mathbb{E}\theta)\big) \\
&\geq \mathbb{E}\theta \times \Big(n_S a^*(\mathbb{E}\theta) + n_E a^*\big(R(\underline{\chi}, \mathbb{E}\theta)\big)\Big) - c\big(a^*(\mathbb{E}\theta)\big)\,;
\end{aligned}
$$

the first inequality follows from Lemma 3, the second because $\mathbb{E}\theta \geq R(\underline{\chi}, \mathbb{E}\theta)$ given the definition of $\underline{\chi}$ and Lemma 1(iii). The first expression in (15) is a sober responder's expected payoff under a professor, the last his expected payoff under a demagogue with charisma $\underline{\chi}$. The rest follows given continuity of payoffs.[25] ■

What about emotional responders' preferences over leaders? The issue is complicated and depends on the following: are the true payoffs of emotional responders given by expression (3) or do those responders merely behave as if that is their payoff? If the latter, what are their true payoffs? Also, if the latter, how aware are they that their behavior is or will be at odds with their true payoffs?

Rather than consider all possibilities, limit attention to emotional responders whose true payoff is given by (2), but who behave as if it is (3). Assume, too, that these followers know they are emotional responders and will behave inconsistently with their true preferences in response to an emotional appeal (i.e., they know that they tend to get caught up in the heat of the moment).

The expected utility of such an emotional responder is

(16)
$$\int_{\underline{\theta}}^{\theta_C} \Big(\theta\Big(n_S a^*\big(\Theta^{\mathbb{E}}(\theta_C)\big) + n_E a^*\big(R(\chi, \Theta^{\mathbb{E}}(\theta_C))\big)\Big) - c\Big(a^*\big(R(\chi, \Theta^{\mathbb{E}}(\theta_C))\big)\Big)\Big) dF(\theta) + \int_{\theta_C}^{\overline{\theta}} \Big(\theta(n_S + n_E)a^*(\theta) - c\big(a^*(\theta)\big)\Big) dF(\theta)\,.$$

Differentiating (16) with respect to χ, making use of both (13) and the envelope

[25] If a sufficiently uncharismatic demagogue can remain silent and $R(\underline{\chi}, \mathbb{E}\theta) < \mathbb{E}\theta$, then the middle expression in (15) is a sober responder's expected payoff under a demagogue. Clearly, the result still holds.

theorem, yields

$$
\begin{aligned}
(17)\quad & \overbrace{-F'(\theta_C)\Big(c\big(a^*(R)\big)-c\big(a^*(\theta_C)\big)\Big)\frac{d\theta_C}{d\chi}}^{\mathsf{X}} \\
& \overbrace{-F(\theta_C)\Big(c'\big(a^*(R)\big)-c'\big(a^*\big(\Theta^{\mathbb{E}}(\theta_C)\big)\big)\Big)a^{*\prime}(R)\left(\frac{\partial R}{\partial\theta}\Theta^{\mathbb{E}\,\prime}(\theta_C)\frac{d\theta_C}{d\chi}+\frac{\partial R}{\partial\chi}\right)}^{\mathsf{I}} \\
& \qquad \underbrace{+\,n_S a^{*\prime}\big(\Theta^{\mathbb{E}}(\theta_C)\big)\Theta^{\mathbb{E}\,\prime}(\theta_C)\frac{d\theta_C}{d\chi}\Theta^{\mathbb{E}}(\theta_C)F(\theta_C)}_{\mathsf{A}_S} \\
& \qquad \underbrace{+\,(n_E-1)a^{*\prime}(R)\left(\frac{\partial R}{\partial\theta}\Theta^{\mathbb{E}\,\prime}(\theta_C)\frac{d\theta_C}{d\chi}+\frac{\partial R}{\partial\chi}\right)\Theta^{\mathbb{E}}(\theta_C)F(\theta_C)}_{\mathsf{A}_E}\,.
\end{aligned}
$$

The X term reflects such a follower's extra effort (note $R\big(\chi,\Theta^{\mathbb{E}}(\theta_C)\big) > \theta_C$ as otherwise a savvy leader would have made a rational appeal); it is a loss to him. The I term is the penalty for being inconsistent. The A_S term is the additional production that a more charismatic leader generates indirectly from sober responders. The A_E term is the additional production directly and indirectly generated from the *other* emotional responders. Those last two terms are positive. If n_E and n_S are large enough, then $\mathsf{A}_S+\mathsf{A}_E-\mathsf{X}-\mathsf{I}>0$: an emotional responder is better off with a more charismatic leader than a less charismatic one. As (17) equals $-\mathsf{X}-\mathsf{I}$ if $n_E=1$ and $n_S=0$, conditions exist such that an emotional responder does better with a less charismatic leader. Figure 1 illustrates this ambiguity.

If emotional responders are aware of their vulnerability to charisma, then whether they desire a charismatic leader depends on the sign of (17). If it's negative, then, ironically, it is the sober responders—those not directly affected by charisma—who favor a more charismatic leader, while the emotional responders—those directly affected by charisma—who favor a less charismatic leader.

To summarize, the analysis of this section demonstrates:

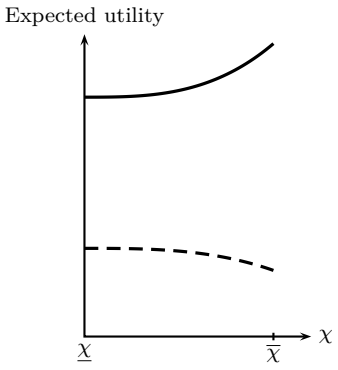

FIGURE 1. EMOTIONAL RESPONDER'S EXPECTED AS A FUNCTION OF THE LEADER'S CHARISMA UNDER TWO CONDITIONS. COMMON TO BOTH IS $c(a) = a^2/2$, θ DISTRIBUTED UNIFORMLY ON $(0,1)$, AND $R(\chi,\theta) = \chi/2 + \theta/2$. SOLID CURVE ASSUMES $n_E = n_S = 5$. DASHED CURVE ASSUMES $n_E = n_S = 2$.

Proposition 4. *Assume savvy leaders. Provided the number of emotional responders is positive, expected welfare is greater with a more charismatic leader relative to a less charismatic one if the ratio of sober responders to emotional responders is large enough or if the total number of followers is large enough.*

IV. Charm vs. Hard Work: The Leader's Incentives

So far, if the leader knows the state, it is because she was endowed with that knowledge. This section explores the alternative that she must discover the state through her own costly effort. Specifically, assume the leader incurs a cost, κ, to learn the state. Assume that the leader learns θ with certainty if she spends κ, but learns nothing if she doesn't. Whether or not she learns the state is a hidden action. Her payoffs are $V - \kappa$ if she learns and V if she does not.

In what follows, assume that a leader with information is savvy. If she fails to obtain information, then she has no choice but to act as a demagogue.

To determine the equilibrium, first suppose the followers expect the leader to

learn the state. Her expected payoff (gross of her cost) if she indeed does is

$$\mathbb{E}V_{\text{L}} \equiv \int_{\underline{\theta}}^{\theta_C} \theta N a^*(\theta_C) dF(\theta) + \int_{\theta_C}^{\overline{\theta}} \theta N a^*(\theta) dF(\theta)$$

(note the use of (13)). If she deviates by not learning, her expected payoff is

$$\mathbb{E}V_{\neg\text{L}} \equiv \int_{\underline{\theta}}^{\overline{\theta}} \theta N a^*(\theta_C) dF(\theta)\,.$$

The difference is

$$\Delta(\theta_C) \equiv \mathbb{E}V_{\text{L}} - \mathbb{E}V_{\neg\text{L}} = \int_{\theta_C}^{\overline{\theta}} \theta N \big(a^*(\theta) - a^*(\theta_C)\big) dF(\theta)\,. \tag{18}$$

If $\theta_C = \overline{\theta}$, then $\Delta(\theta_C) = 0$; if $\theta_C < \overline{\theta}$, then $\Delta(\theta_C) > 0$. Because no leader would learn the state otherwise, assume $\Delta(\underline{\theta}) > \kappa$.

By continuity, there exists a $\theta_D \in (\underline{\theta}, \overline{\theta})$ such that $\Delta(\theta_D) = \kappa$. From (18), $\Delta(\cdot)$ is decreasing, so θ_D is unique. Moreover, because (i) $\theta_C = \underline{\theta}$ for a leader with charisma $\underline{\chi}$; (ii) $\theta_C = \overline{\theta}$ for a leader with charisma $\overline{\chi}$; and (iii) θ_C is continuous and increasing in charisma (uniqueness of equilibrium and Lemma 2), there exists a unique charisma level χ_D, $\chi_D \in (\underline{\chi}, \overline{\chi})$, such that $\theta_C = \theta_D$ if $\chi = \chi_D$. Observe it is a best response, for a leader with $\chi \leq \chi_D$ to learn the state if expected to do so; a leader with charisma greater that χ_D, however, does better not to learn the state when expected to learn it.

Suppose, instead, the followers expect the leader *not* to learn the state and, hence, to behave as a demagogue. A sober responder will choose action $a^*(\mathbb{E}\theta)$ in response to the expected emotional appeal and an emotional responder $a^*\big(R(\chi, \mathbb{E}\theta)\big)$.[26]

[26]The presumption is the leader *must* make an appeal (cannot be silent). The results, though, are not dependent on this: if silence meant both kinds of responders played $a^*(\mathbb{E}\theta)$, then the quantity $\widetilde{\theta}$, shortly to be introduced, would only be greater. It would thus continue to be true that $\Delta(\widetilde{\theta}) < \Delta(\theta_C)$, which is all that is required to establish Proposition 5 *infra*.

Because $\chi < \overline{\chi}$, a $\widetilde{\theta} \in (\underline{\theta}, \overline{\theta})$ exists such that

$$Na^*(\widetilde{\theta}) = n_S a^*(\mathbb{E}\theta) + n_E a^*\big(R(\chi, \mathbb{E}\theta)\big)\,.$$

Consequently, the leader's expected payoff if she indeed does not learn is

$$\mathbb{E}\widetilde{V}_{\neg \mathrm{L}} \equiv \int_{\underline{\theta}}^{\overline{\theta}} \theta N a^*(\widetilde{\theta}) dF(\theta)\,.$$

If she deviates by learning, her expected payoff (gross of her cost) is

$$\mathbb{E}\widetilde{V}_{\mathrm{L}} \equiv \int_{\underline{\theta}}^{\widetilde{\theta}} \theta N a^*(\widetilde{\theta}) dF(\theta) + \int_{\widetilde{\theta}}^{\overline{\theta}} \theta N a^*(\theta) dF(\theta)\,.$$

The difference is $\Delta(\widetilde{\theta})$.

Because $\chi < \overline{\chi}$, $\theta_C < \overline{\theta}$; hence, $\Theta^{\mathbb{E}}(\theta_C) < \mathbb{E}\theta$. It follows, therefore, that $\widetilde{\theta} > \theta_C$ and, thus, that $\Delta(\widetilde{\theta}) < \Delta(\theta_C)$. Consequently, if a leader of a given charisma would deviate from learning when expected to learn, then she would *not* deviate from remaining ignorant when expected to remain ignorant. To summarize the preceding analysis:

Proposition 5. *There is a pure-strategy perfect Bayesian equilibrium of the game in which the leader decides whether to learn the payoff-relevant state, θ, such that a leader with charisma not exceeding a threshold χ_D, $\chi_D \in (\underline{\chi}, \overline{\chi})$, will learn, but a leader with charisma above that threshold will not.*

Proposition 5 establishes that, when becoming informed is a choice, a sufficiently charismatic leader will choose to be a demagogue in equilibrium.

Because $\widetilde{\theta} > \theta_C$ for any level of charisma, the Proposition 5 equilibrium is not unique: there is a lower threshold, $\widetilde{\chi}_D$, such that, if the followers expect a leader with charisma $\chi \in (\widetilde{\chi}_D, \overline{\chi})$ to remain ignorant, it is indeed her best response to do so; that is, for any $\widehat{\chi} \in [\widetilde{\chi}_D, \chi_D]$ a pure-strategy equilibrium exists in which

leaders with charisma less than $\widehat{\chi}$ learn and those with more charisma don't. For the sake of brevity, attention will be limited to the Proposition 5 equilibrium.

In the Proposition 5 equilibrium, the public good's expected value, $\mathbb{E}V$, is

$$\mathbb{E}V = \begin{cases} \int_{\underline{\theta}}^{\theta_C} \theta N a^*(\theta_C) dF(\theta) + \int_{\theta_C}^{\overline{\theta}} \theta N a^*(\theta) dF(\theta)\,, \text{ if } \chi \leq \chi_D \\ \Big(n_S a^*(\mathbb{E}\theta) + n_E a^*\big(R(\chi, \mathbb{E}\theta)\big)\Big)\mathbb{E}\theta\,, \text{ if } \chi > \chi_D \end{cases} . \tag{19}$$

Unlike Proposition 2, in which $\mathbb{E}V$ was strictly increasing in the leader's charisma, $\mathbb{E}V$ may not be monotone in charisma when the leader can decide whether to learn the state. Figure 2 plots expression (19) under two different scenarios. Common to both: $c(a) = a^2/2$, θ distributed uniformly on the unit interval, $R(\chi, \theta) = \chi$, and $N/\kappa = 10$. In panel A of the figure, it is assumed that the number of sober and emotional responders is the same. In panel B, 90% of the followers are sober responders. In the first scenario, this entails $\overline{\chi} = 3/2$ and $\chi_D \approx .767$. In the second, $\overline{\chi} = 11/2$ and $\chi_D \approx 2.81$.

The figure reflects two offsetting effects. On one hand, if the leader remains uninformed in equilibrium, then the organization is without valuable information (Lemma 3 means sober responders yield greater value in expectation when informed than when not). On the other, because the leader can effectively commit to be ignorant, the followers' inference about the state given an emotional appeal is less pessimistic than it would be if the leader could strategically reveal or conceal information (necessarily, $\mathbb{E}\theta > \Theta^{\mathbb{E}}(\theta_C)$). When there are relatively many emotional responders, the leader is more inclined to make an emotional appeal than when there are relatively few. Hence, followers will already have less cause to be pessimistic upon receiving an emotional appeal, which means the loss-of-information effect dominates the reduced-pessimism effect, as seen in Panel A of Figure 2. The reverse is true when emotional responders are relatively rare, as seen in Panel B of Figure 2.

Sober responders' preferences around *intermediate* levels of charisma are thus

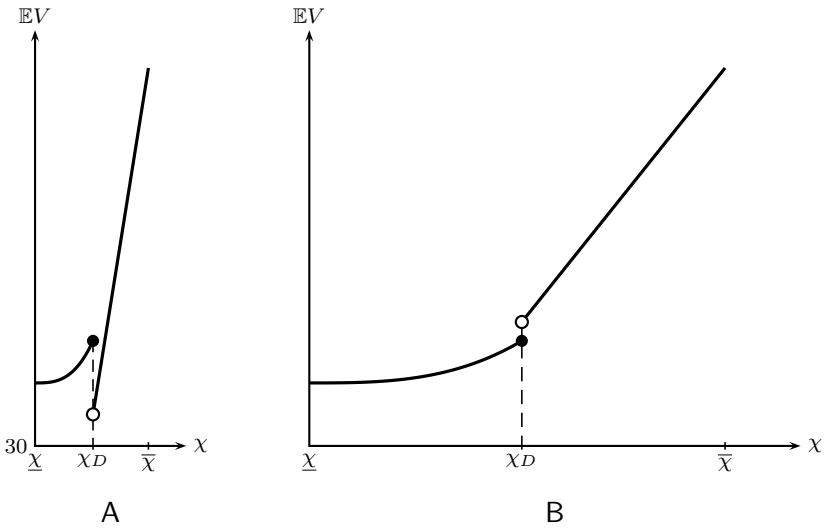

FIGURE 2. EXPECTED VALUE OF THE PUBLIC GOOD AS A FUNCTION OF THE LEADER'S CHARISMA WHEN THE LEADER DECIDES WHETHER TO LEARN θ. HORIZONTAL & VERTICAL AXES NOT ON THE SAME SCALE. SEE TEXT FOR THE PARAMETER VALUES AND FUNCTIONAL FORMS BEING ASSUMED. IN PANEL A, THE NUMBER OF SOBER AND EMOTIONAL RESPONDERS IS EQUAL; IN PANEL B, 90% ARE SOBER RESPONDERS.

ambiguous. As an example, a sober responder's expected utility in Panel A when $N = 10$ and $\kappa = 1$ would be approximately 3.34 if a leader of charisma χ_D chose to become informed and 3.04 if she chose not to become informed. By continuity, a sober responder must prefer leaders whose charisma is in some interval to the left of χ_D to any leader whose charisma is an interval to the right. In general, when the team is large enough, the effect endogenous demagoguery has on $\mathbb{E}V$ is more important to a sober responder than the possible reduction in expected disutility of action he might enjoy with an endogenous demagogue. Hence, if, as in Panel A, $\mathbb{E}V$ drops at χ_D, sober responders in large teams will have *non*-monotonic preferences over their leader's charisma.

What is unambiguous, though, is that sober responders still prefer sufficiently charismatic leaders: as $\chi \to \overline{\chi}$, the endogeneity of the information becomes irrelevant—even if informed, such a leader will almost surely make an emotional appeal and Proposition 3 already tells us that sober responders most prefer a

maximally charismatic leader despite her never revealing the state.

Given the discussion at the end of the previous section, as well as here, it is clear that emotional responders' preferences vis-à-vis leaders' charisma are ambiguous when information acquisition is endogenous. Hence, so too must the effect of greater charisma on overall welfare be ambiguous. In other words, when the leader must incur a cost to learn the payoff-relevant state, θ, it is ambiguous as to whether her being more charismatic would enhance the wellbeing of sober responders, emotional responders, and overall welfare. In particular, circumstances exist in which all three measures are *decreasing* in the leader's charisma. At high enough levels of charisma, however, greater charisma is preferred by *sober* responders to less charisma.

V. Summary and Directions for Future Work

This paper offers insights into why an entity (organization, society, etc.) can—but need not always—benefit from having a charismatic leader, even if it consists primarily (but not exclusively) of rational actors immune to any direct effect of charisma. Among the paper's findings:

1) If an entity has even only a few followers directly susceptible to charisma, an emotional appeal from a more charismatic leader will induce greater effort from wholly rational followers *not* directly susceptible to charisma than such an appeal from a less charismatic leader (Proposition 2). Hence, an entity with a more charismatic leader outproduces, in expectation, an entity with a less charismatic leader (Proposition 2).

2) Followers *not* directly susceptible to charisma prefer a more charismatic leader to a less charismatic one (Proposition 3), but followers who *are* directly susceptible can prefer a less to more charismatic leader (Figure 1). If an entity has enough followers, all followers prefer a more charismatic leader and welfare is greater with such a leader (Proposition 4).

3) If learning payoff-relevant information requires effort, then sufficiently charismatic leaders will *choose* to be uninformed demagogues. Consequently, entities can do better with less rather than more charismatic leaders (Section IV, Figure 2, and connected discussion).

Although this paper offers many insights into charismatic leadership, work remains. First, many attributes associated with charisma, such as confidence (Conger and Kanungo, 1994), have been modeled elsewhere as having a direct effect on leaders' effectiveness (recall the discussion of leadership style in the Introduction; see also footnote 7 *supra*). Future research may, therefore, wish to explore the complementarities between the analysis here and in that earlier literature.

Another avenue of research might address whether charisma is innate or something that can be taught. Based on their curriculum, many business schools clearly believe that it can be taught. But what is being taught? A possible answer is that would-be leaders' are being taught to read their followers better. After all, to make an emotional connection with her followers, a leader must know what makes them tick.[27] This suggests that charismatic leadership works best when the leader knows her followers. A successful charismatic leader may simply be someone who has come to understand her followers. The question is how?

Grasping what makes followers tick is presumably easier the more homogenous they are and the more immersed the leader already is in the relevant society. To an extent, Ibn Khaldûn made this point over 600 years ago: how, he asked, could relatively small and primitive tribes topple large and sophisticated empires? His answer was the former had stronger *asabîyah* (usually translated as social cohesion), which permitted them to "box above their weight." Relative to this paper, his argument corresponds to one in which the relative heterogeneity of an empire and the social isolation of rulers from subjects foreclosed charismatic leadership in empires, but the closeness of tribal leaders to their followers and

[27] A fact long recognized; see, e.g., the 14th-century *Muqaddimah* by Ibn Khaldûn. For a more contemporary discussion, see Howell and Shamir (2005). Hermalin (2013) also makes this point in the context of the interplay between leadership and corporate culture.

the followers to each other allowed for charismatic leadership in tribes. Using the models above, it is easily shown that an entity led by a highly charismatic leader can outproduce, in expectation, a larger entity led by an uncharismatic leader. Fleshing these ideas out fully, as well as tying them more to *asabîyah* and organizational culture, remain, though, topics for future research.

Finally, many of the paper's implications can be tested experimentally. Information-transmission models of leadership have enjoyed considerable success in laboratory settings (see, e.g., Hermalin, 2013, §2.3.2.3, for a partial survey). Further, social psychology offers many assessment tools for measuring both charisma and followers' receptivity to it (Conger and Kanungo, 1994; Awamleh and Gardner, 1999; and Wong and Law, 2002). Using these assessments to distinguish sober from emotional responders, many of this paper's propositions are amenable to testing. In particular, an especially straightforward one is that followers' responses to an emotional appeal should be more varied than to a rational appeal.

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Appendix: Proofs & Ancillary Material

Proof of Proposition 1: For a minimally charismatic leader, $R(\underline{\chi}, \underline{\theta}) = \underline{\theta}$ by (8). Suppose there were an equilibrium in which such a leader made an emotional appeal, so $\theta_C > \underline{\theta}$. Consistency of beliefs implies $\widehat{\theta} = \Theta^{\mathbb{E}}(\theta_C) < \theta_C$. Hence,

$$\text{(A1)} \quad n_S a^*\big(\Theta^{\mathbb{E}}(\theta_C)\big) + n_E a^*\Big(R\big(\underline{\chi}, \Theta^{\mathbb{E}}(\theta_C)\big)\Big)$$
$$\leq n_S a^*\big(\Theta^{\mathbb{E}}(\theta_C)\big) + n_E a^*\big(\Theta^{\mathbb{E}}(\theta_C)\big) = N a^*\big(\Theta^{\mathbb{E}}(\theta_C)\big) < N a^*(\theta_C)\,,$$

where the first inequality follows from Lemma 1(iii) and the fact that $a^*(\cdot)$ is strictly increasing; the latter fact also yields the second inequality. Payoffs are

continuous, so (A1) contradicts the leader's wishing to make an emotional appeal for *all* $\theta < \theta_C$, as required by a cutoff strategy. *Reductio ad absurdum*, there is no equilibrium in which a leader of such limited charisma makes an emotional appeal. In this case, the equilibrium is the leader makes rational appeals only and followers believe an (out-of-equilibrium) emotional appeal means $\theta = \underline{\theta}$.

Suppose $\chi > \underline{\chi}$, so $R(\chi, \underline{\theta}) > \underline{\theta}$ by (8) and Lemma 1(i). There is no equilibrium in which the leader never makes an emotional appeal: even if followers believed such an appeal meant $\theta = \underline{\theta}$, continuity and the fact that

$$n_S a^*(\underline{\theta}) + n_E a^*\big(R(\chi, \underline{\theta})\big) > N a^*(\underline{\theta}) \tag{A2}$$

mean there are states in which the leader would do better to make an emotional rather than rational appeal even if followers held such pessimistic beliefs.

Recalling that $R(\chi, \underline{\theta}) > \underline{\theta}$, $\underline{\theta} = \Theta^{\mathbb{E}}(\underline{\theta})$, and $a^*(\cdot)$ is increasing, we have

$$n_S a^*\big(\Theta^{\mathbb{E}}(\underline{\theta})\big) + n_E a^*\Big(R\big(\chi, \Theta^{\mathbb{E}}(\underline{\theta})\big)\Big) > n_S a^*(\underline{\theta}) + n_E a^*(\underline{\theta}) = N a^*(\underline{\theta})\,. \tag{A3}$$

Expression (10) entails

$$n_S a^*\big(\Theta^{\mathbb{E}}(\overline{\theta})\big) + n_E a^*\Big(R\big(\chi, \Theta^{\mathbb{E}}(\overline{\theta})\big)\Big) < N a^*(\overline{\theta})\,, \tag{A4}$$

given $\chi < \overline{\chi}$ and Lemma 1(i) (recall $\Theta^{\mathbb{E}}(\overline{\theta}) = \mathbb{E}\theta$). Expressions (A3) and (A4) and continuity imply a $\theta_C \in (\underline{\theta}, \overline{\theta})$ exists such that

$$n_S a^*\big(\Theta^{\mathbb{E}}(\theta_C)\big) + n_E a^*\Big(R\big(\chi, \Theta^{\mathbb{E}}(\theta_C)\big)\Big) = N a^*(\theta_C)\,,$$

which establishes that there is an equilibrium in which an emotional appeal is made if $\theta \leq \theta_C$ and a rational appeal made otherwise. ■

Lemma A.1. *Assume that R is defined by one of (4)–(6). The equilibrium of Proposition 1 is unique if*

(i) $\partial R/\partial\theta \leq 1$ for all χ and θ, the reverse hazard rate associated with the distribution of states is decreasing,[28] *and $c(a) = a^2/\gamma$;* or

(ii) $\partial R/\partial\theta \leq 2$ for all χ and θ, $\underline{\theta} = 0$, the distribution of states is uniform, $a^*(\cdot)$ concave, and $a^{*\prime}(\theta/2) \leq a^{*\prime}(\theta)(1/2)^k$, for some $k \in (-1, 0)$.[29]

Proof: Define

$$\Lambda(\theta) \equiv n_S a^*\big(\Theta^{\mathbb{E}}(\theta)\big) + n_E a^*\Big(R\big(\chi, \Theta^{\mathbb{E}}(\theta)\big)\Big) - N a^*(\theta)\,.$$

As Proposition 1 establishes there is at least one value of θ such that $\Lambda(\theta) = 0$. Moreover, as the proof of that proposition makes clear, any θ for which $\Lambda(\theta) = 0$ is an equilibrium cutoff; hence, if $\Lambda(\cdot)$ has only one zero (i.e., a unique θ such that $\Lambda(\theta) = 0$), then there is a unique equilibrium. Clearly, there can be only one zero if $\Lambda(\cdot)$ is a monotone function.

Suppose condition (i). It is readily shown that $a^*(\zeta) = \gamma\zeta/2$. It is also readily shown that $\partial R/\partial\theta = \beta$, where β is a constant with respect to θ, if R is defined by one of (4)–(6). By assumption, $\beta \leq 1$. It follows that $\Lambda'(\theta)$ is proportional to

$$(n_E\beta + n_S)\Theta^{\mathbb{E}\prime}(\theta) - N \tag{A5}$$

Given that $n_E\beta + n_S \leq n_E + n_S = N$, (A5) is negative and, thus, $\Lambda(\cdot)$ monotone

[28] Many distributions exhibit a decreasing reverse hazard rate, among them are the uniform, beta distributions under wide range of parameter values, and triangle distributions (i.e., distributions whose density functions form a triangle).

[29] The conditions on $a^*(\cdot)$ would, for example, be satisfied if $c(a) = a^\gamma/\gamma$, $\gamma > 1$, as, then, $a^*(\theta) = \theta^{1/\gamma}$, which is concave, and

$$a^{*\prime}\left(\frac{\theta}{2}\right) = \frac{1}{\gamma}\left(\frac{\theta}{2}\right)^{-\frac{\gamma-1}{\gamma}} = \frac{1}{\gamma}\theta^k\left(\frac{1}{2}\right)^k = a^{*\prime}(\theta)\left(\frac{1}{2}\right)^k\,,$$

where $k = -(\gamma - 1)/\gamma$.

if $\Theta^{\mathbb{E}}{}'(\theta) < 1$ or, equivalently if $\Theta^{\mathbb{E}}(\theta) - \theta$ is decreasing in θ. Noting that

$$\Theta^{\mathbb{E}}(\theta) = \frac{1}{F(\theta)} \int_{\underline{\theta}}^{\theta} t f(t) dt = \frac{1}{F(\theta)} \left(tF(t) \Big|_{\underline{\theta}}^{\theta} - \int_{\underline{\theta}}^{\theta} F(t) dt \right)$$

via integration by parts, where $F(\cdot)$ is the distribution function over states and $f(\cdot)$ the corresponding density, it follows that

$$\Theta^{\mathbb{E}}(\theta) - \theta = -\frac{1}{F(\theta)} \int_{\underline{\theta}}^{\theta} F(t) dt \,;$$

hence, $\Theta^{\mathbb{E}}(\theta) - \theta$ is decreasing in θ if $F(\theta) / \int_{\underline{\theta}}^{\theta} F(t) dt$ is a decreasing function of θ. Observe

$$\frac{d}{d\theta} \frac{F(\theta)}{\int_{\underline{\theta}}^{\theta} F(t) dt} \propto f(\theta) \int_{\underline{\theta}}^{\theta} F(t) dt - F(\theta)^2 \propto \int_{\underline{\theta}}^{\theta} \frac{f(\theta)}{F(\theta)} F(t) dt - F(\theta) \,, \tag{A6}$$

where $\propto$ denotes "proportional to" or "same sign as." Because the reverse hazard rate, $f(t)/F(t)$, is decreasing, we have

$$\int_{\underline{\theta}}^{\theta} \frac{f(\theta)}{F(\theta)} F(t) dt - F(\theta) < \int_{\underline{\theta}}^{\theta} \frac{f(t)}{F(t)} F(t) dt - F(\theta) = F(\theta) - F(\theta) = 0 \,.$$

Hence, $\Theta^{\mathbb{E}}(\theta) - \theta$ is decreasing in θ and, therefore, $\Lambda(\cdot)$ is decreasing (monotone).

Suppose condition (ii): If the distribution is uniform with $\underline{\theta} = 0$, then $\Theta^{\mathbb{E}}(\theta) = \theta/2$. Observe that $\Lambda'(\theta)$ has a constant sign if

$$\lambda a^{*\prime}\big(\Theta^{\mathbb{E}}(\theta)\big)\Theta^{\mathbb{E}}{}'(\theta) + (1-\lambda) a^{*\prime}\Big(R\big(\chi, \Theta^{\mathbb{E}}(\theta)\,\big)\Big) \frac{\partial R}{\partial \theta} \Theta^{\mathbb{E}}{}'(\theta) - a^{*\prime}(\theta) \tag{A7}$$

has constant sign, where $\lambda = n_S/N$ and, thus, $1 - \lambda = n_E/N$. Substituting, (A7) is equal to

$$\text{(A8)} \qquad \lambda a^{*\prime}(\theta/2)\frac{1}{2} + (1-\lambda)a^{*\prime}\Big(R\big(\chi, \Theta^{\mathbb{E}}(\theta)\,\big)\Big)\frac{\beta}{2} - a^{*\prime}(\theta)\,.$$

Because the leader would strictly prefer a rational appeal if $\theta \geq R\big(\chi, \Theta^{\mathbb{E}}(\theta)\,\big)$, concavity of $a^*(\cdot)$ entails that (A8) cannot exceed

$$\lambda a^{*\prime}(\theta/2)\frac{1}{2} + (1-\lambda)a^{*\prime}(\theta)\frac{\beta}{2} - a^{*\prime}(\theta)\,.$$

Given $a^{*\prime}(\theta/2) \leq a^{*\prime}(\theta)(1/2)^k$, that does not exceed

$$\text{(A9)} \qquad \lambda a^{*\prime}(\theta)\left(\frac{1}{2}\right)^{k+1} + (1-\lambda)a^{*\prime}(\theta)\frac{\beta}{2} - a^{*\prime}(\theta)\,.$$

The sign of (A9) is the same as

$$\lambda\left(\frac{1}{2}\right)^{k} + (1-\lambda)\beta - 2 < 0$$

(the inequality follows because $(1/2)^k < 2$ if $k \in (-1, 0)$ and $\beta < 2$). Hence, (A7) is negative; that is, $\Lambda'(\cdot)$ has a constant sign, which entails $\Lambda(\cdot)$ is monotone ■

Proof of Proposition 2: Consider two charisma levels, $\chi > \chi'$. From Lemma 2, if θ'_C is the equilibrium cutoff with a leader of charisma χ', then there is an equilibrium with cutoff $\theta_C > \theta'_C$ in the game with the more charismatic leader. Because $\Theta^{\mathbb{E}}(\cdot)$ is increasing, it follows that

$$a^*\left(\Theta^{\mathbb{E}}(\theta_C)\right) > a^*\left(\Theta^{\mathbb{E}}(\theta'_C)\right) \text{ and } a^*\Big(R\big(\chi, \Theta^{\mathbb{E}}(\theta_C)\big)\Big) > a^*\Big(R\big(\chi', \Theta^{\mathbb{E}}(\theta'_C)\big)\Big)\,,$$

which establishes the claim for sober and emotional responders, respectively.

Now turn to the "additionally" part of the proposition. Consider leaders with

charisma χ' and χ, $\chi' < \chi$. Consider any equilibrium with the less charismatic leader and corresponding cutoff θ'_C. From Lemma 2, there is an equilibrium of the game with the more charismatic leader such that her cutoff, θ_C, is strictly greater. Because the distribution over states is strictly increasing (has an everywhere positive density), the interval $[\theta'_C, \theta_C)$ has positive measure. Likewise, because $\chi' > \underline{\chi}$, $\theta'_C > \underline{\theta}$, so the interval $(\underline{\theta}, \theta'_C)$ has positive measure.

Consider the intervals $(\underline{\theta}, \theta'_C)$, $[\theta'_C, \theta_C)$, and $(\theta_C, \overline{\theta})$. For θ in the first interval, total actions under the less and more charismatic leaders are, respectively, the left and righthand sides of

$$n_E a^*\Big(R\big(\chi', \Theta^{\mathbb{E}}(\theta'_C)\big)\Big) + n_S a^*\big(\Theta^{\mathbb{E}}(\theta'_C)\big) < n_E a^*\Big(R\big(\chi, \Theta^{\mathbb{E}}(\theta_C)\big)\Big) + n_S a^*\big(\Theta^{\mathbb{E}}(\theta_C)\big)\,,$$

where the inequality follows by Lemma 1 and because $\Theta^{\mathbb{E}}(\cdot)$ and $a^*(\cdot)$ are increasing. For θ in the second interval, total actions under the less and more charismatic leaders are, respectively, the left and rightmost terms of

$$n_S a^*(\theta) + n_E a^*(\theta) = N a^*(\theta) < n_E a^*\Big(R\big(\chi, \Theta^{\mathbb{E}}(\theta_C)\big)\Big) + n_S a^*\big(\Theta^{\mathbb{E}}(\theta_C)\big)\,,$$

where the inequality follows because the more charismatic leader strictly prefers an emotional appeal for all $\theta \in [\theta'_C, \theta_C)$. Finally, this comparison for θ in the third interval is

$$n_S a^*(\theta) + n_E a^*(\theta) = n_S a^*(\theta) + n_E a^*(\theta)\,,$$

as both leaders make rational appeals. This proves point (i).

Point (ii) follows because V is θ times total action. Point (iii) because there are intervals of positive measure in which the more charismatic leader everywhere generates greater value and none in which she generates less. ■

Proof of Lemma 3: As preliminaries, note $\zeta \equiv c'\big(a^*(\zeta)\big)$ from the first-order condition defining $a^*(\cdot)$; hence,

$$1 \equiv c''\big(a^*(\zeta)\big)a^{*\prime}(\zeta) \implies a^{*\prime}(\zeta) \equiv \frac{1}{c''\left(a^*(\zeta)\right)}\,. \tag{A10}$$

Consequently,

$$a^{*\prime\prime}(\zeta) = -\frac{c'''\left(a^*(\zeta)\right)a^{*\prime}(\zeta)}{c''\left(a^*(\zeta)\right)^2} = -\frac{c'''\left(a^*(\zeta)\right)}{c''\left(a^*(\zeta)\right)^3}\,. \tag{A11}$$

To prove the first claim: fix θ and θ', $\theta \neq \theta'$. Let $\lambda \in (0,1)$ and define $\theta_\lambda = \lambda\theta + (1-\lambda)\theta'$. Because $a^*(\zeta)$ is the unique solution to

$$\max_a \zeta a - c(a) \tag{A12}$$

and $a^*(\zeta) \neq a^*(\zeta')$ if $\zeta \neq \zeta'$, it follows that

$$\begin{aligned}\lambda\Big(\theta a^*(\theta) - c\big(a^*(\theta)\big)\Big) &> \lambda\Big(\theta a^*(\theta_\lambda) - c\big(a^*(\theta_\lambda)\big)\Big) \text{ and}\\ (1-\lambda)\Big(\theta' a^*(\theta') - c\big(a^*(\theta')\big)\Big) &> (1-\lambda)\Big(\theta' a^*(\theta_\lambda) - c\big(a^*(\theta_\lambda)\big)\Big)\,.\end{aligned}$$

Summing, those two expressions imply

$$\lambda\Big(\theta a^*(\theta) - c\big(a^*(\theta)\big)\Big) + (1-\lambda)\Big(\theta' a^*(\theta') - c\big(a^*(\theta')\big)\Big) > \theta_\lambda a^*(\theta_\lambda) - c\big(a^*(\theta_\lambda)\big)\,,$$

which establishes convexity.

To prove the second claim: the function $\theta \mapsto \theta a^*(\theta)$ is the sum of the functions $\theta a^*(\theta) - c\big(a^*(\theta)\big)$ and $c\big(a^*(\theta)\big)$. The first function was just shown to be strictly convex, so $\theta \mapsto \theta a^*(\theta)$ is strictly convex if $c\big(a^*(\cdot)\big)$ is convex. Recalling (A10) and

(A11), the second derivative of $c\big(a^*(\theta)\big)$ with respect to θ is

$$c''\big(a^*(\theta)\big)a^{*\prime}(\theta)^2 + c'\big(a^*(\theta)\big)a^{*\prime\prime}(\theta) = \frac{1}{c''\big(a^*(\theta)\big)} - \frac{c'\big(a^*(\theta)\big)c'''\big(a^*(\theta)\big)}{c''\big(a^*(\theta)\big)^3}\,. \tag{A13}$$

The function $c\big(a^*(\cdot)\big)$ is convex if (A13) is non-negative. To see it is non-negative, observe that $d\log\big(c'(a)\big)/da = c''(a)/c'(a)$ and the derivative of that, which is

$$\frac{c'''(a)c'(a) - c''(a)^2}{c'(a)^2}\,, \tag{A14}$$

is non-positive by the assumption of log concavity. It is readily seen that (A14) being non-positive implies (A13) is non-negative. ■