Rents from Power for a Dissident Elite and Mass Mobilization - Supplementary Appendix

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Abstract

In this supplementary appendix, we discuss two variations of the model presented in the body of the paper (the "model"). The first variation assumes that the mass public is a single decision maker, whose uncertainty about the fundamental strength of the regime is akin to that of one individual citizen in the model. The main difference between this variation and the model is that in the former the opposition group faces increased strategic uncertainty. As a result, this variation is harder to solve than the model. In one equilibrium, numerical calculations suggest that the effect of rents from power, α, on the incidence of regime change has the same sign and roughly the same magnitude than the benchmark model.

The second variation studies another type of equilibrium in the sequential move game, which we call the case of "Symbolic Leader." In this case, an atomistic citizen gets to move first and all other players, including the opposition group, wait until the second period.

1 Sequential Case

In this section, we study endogenous leadership by allowing both types of players to wait one period before deciding whether to join the insurgency. This analysis enables to identify the informational impact of different timings on collective action. Considering different timings of mass mobilization is important not only because current theories of mass participation posit information at the heart of collective action (see e.g., Lohmann 1994, Little 2012, Chwe 2013, Bueno de Mesquita 2010), but because information about the regime interplays with rents and the timing of decisions. For example, a large enough number of individuals taking to the streets may reveal, to those in doubt, the regime is weak. A cohesive dissident group may use its organizational resources to mobilize, thereby indicating that the regime is weak enough to fall. Our model shows that when the dissident group moves first the mass public becomes less aggressive against the regime as rents from power for the group increase.[1] This is consistent with the information cascade arguments in Piven and Cloward (1979) and Lohmann (1994). This result, however, does not hold when agents move simultaneously. Our model shows that rents for the dissident group may actually *increase* the incidence of mass public mobilization when agents' decisions are simultaneous. Rents from power in this case encourage the dissident group to mobilize regardless of its information. The size of the group motivates individuals in the mass public to coordinate with the group against the regime in this case.

In one equilibrium in this sequential case, the only player who decides in the first period is the dissident group. Individuals wait until the second period to decide. The player who joins the insurgency in the first period does not observe the actions of those who move simultaneously. The player who moves in the first period, however, may signal its

[1]We use the word "aggressiveness" to refer to an increased proneness to mobilize against the regime. Its precise meaning should be clear when we discuss equilibrium behavior in the model.

information to other players. Since a particular individual from the mass public is incapable of influencing a substantial mass of other individuals or the group by virtue of size, it can only induce mobilization by being focal. Such an individual could only lead, therefore, if other individuals, as well as his or herself, believe he or she is a leader. Even though it is theoretically possible to devise equilibrium expectations that could lead to this kind of behavior (see supplementary appendix, “Symbolic Leaders”), we focus on the case in which no player believes that an individual from the mass public is able to influence anyone else by moving first.

If every individual waits for the second period to decide, the information the dissident group has will not improve if it also waits until the second period. If the dissident group moves in the first period, however, it reveals information about the strength of the regime to the public. As a result, the dissident group conditions its action on the information that this will convey to the masses. The dissident group finds this strategic advantage useful because it prefers that the masses coordinate in joining the insurgency in case it is optimistic about the viability of regime change.

In this situation, individuals receive two signals in the second period: the private signal x_i about θ and the dissident group's action. As before, let y^* denote the threshold that the dissident group employs in its decision.

Since individuals' posterior beliefs depend on the dissident group's action, their behavior depends on that action too. In particular, we can assume that individuals base their decisions on two thresholds x^*_M and x^*_R, used by individuals when the dissident group mobilizes or refrains from doing so, respectively. It follows that x^*_M and x^*_R are determined by the indifference conditions

$$P(\theta \leq \bar{\theta}|x_M^* \text{ and } y \leq y^*) = \frac{\int_{-\infty}^{\bar{\theta}} f\left(\frac{x_M^*-\theta}{\sigma}\right) G\left(\frac{y^*-\theta}{\tau}\right) d\theta}{\int_{-\infty}^{\infty} f\left(\frac{x_M^*-\theta}{\sigma}\right) G\left(\frac{y^*-\theta}{\tau}\right) d\theta} = \frac{1+\beta}{2}, \tag{1}$$

$$P(\theta \leq \underline{\theta}|x_R^* \text{ and } y > y^*) = \frac{\int_{-\infty}^{\underline{\theta}} f\left(\frac{x_R^*-\theta}{\sigma}\right) G\left(\frac{\theta-y^*}{\tau}\right) d\theta}{\int_{-\infty}^{\infty} f\left(\frac{x_R^*-\theta}{\sigma}\right) G\left(\frac{\theta-y^*}{\tau}\right) d\theta} = \frac{1+\beta}{2}. \tag{2}$$

The thresholds $\bar{\theta}$ and $\underline{\theta}$ are determined by

$$(1-\lambda)F\left(\frac{x_R^*-\underline{\theta}}{\sigma}\right) = \underline{\theta} \tag{3}$$

$$\lambda + (1-\lambda)F\left(\frac{x_M^*-\bar{\theta}}{\sigma}\right) = \bar{\theta}. \tag{4}$$

Finally, the dissident group's action depends on $\bar{\theta}$ and $\underline{\theta}$ via the following indifference condition:

$$(1+\alpha)G\left(\frac{\bar{\theta}-y^*}{\tau}\right) + (1-\alpha)G\left(\frac{\underline{\theta}-y^*}{\tau}\right) = 1-\alpha. \tag{5}$$

The system of equations (1) to (5) is harder to solve analytically than the equilibrium conditions that defined the equilibrium in the simultaneous move game. The main difference between these systems of equations lies in the posterior beliefs of individuals. In the sequential case, the posterior beliefs of an individual comprise information stemming from the private signal and the group's action. Processing the information revealed by the group's action adds an additional curvature to the posterior density functions, which keeps us from stating general uniqueness of equilibrium in threshold strategies when the dissident group moves first.[2]

[2]We provide a sufficient condition for the existence of equilibra in the online appendix

1.1 The Limiting Case

In this part we show results for different limiting cases. In proposition 1, the dissident group has arbitrarily better information than the mass public. Corollary 1 presents results for the case in which rents from office are extremely large. These two results combined show that the dissident group's action completely determines mass mobilization unless rents from office are extreme, i.e., $\alpha = 1$. In the extreme case, however, individuals ignore the dissident group's action and decide whether to mobilize simultaneously. Finally, proposition 2 summarizes the results for the case in which individuals have arbitrarily better information than the dissident group. In this case, rents from power do not affect the critical $\bar{\theta}$ and the dissident group influences mass mobilization only by virtue of size.

Proposition 1 *As $\frac{\sigma}{\tau} \to \infty$, the behavior of the dissident group completely determines individuals' behavior. That is, $x_M^* \to \infty$, $x_R^* \to -\infty$, $\bar{\theta} \to 1$, $\underline{\theta} \to 0$. Moreover, if $\tau \to 0$, then $\lim y^* = \lim \bar{\theta}$.*

If the dissident group is arbitrarily better informed than each individual, they ignore their private information and follow the dissident group's action. The dissident group uses the coordination power over individuals to influence them to mobilize whenever the regime is vulnerable (i.e., when $0 \leq \theta \leq 1$). Since the group's rents from office (i.e., α) are common knowledge, individuals know that the dissident group holds this coordination power. Every player also knows that the dissident group's signal is more reliable than the individuals' private signals. As a result, each individual knows the other individuals will follow the dissident group, he or she will follow the group as well. Even if the dissident group is biased toward mobilizing, its coordinating role makes individuals to dismiss their own private information.

The following corollary shows that whenever $\alpha \to 1$, not only do individuals ignore their private information but the dissident group does so as well.

Corollary 1 *As* $\frac{\sigma}{\tau} \to \infty$, $\tau \to 0$ *and* $\tau\ G^{-1}((1-\alpha)/(1+\alpha)) \to -\infty$, y^*, $x^*_M \to \infty$ *and* $x^*_R \to -\infty$.

The condition that $\tau \to 0$ and $\tau\ G^{-1}((1-\alpha)/(1+\alpha)) \to -\infty$ requires that the speed of convergence of α to 1 is high enough that increasing precision in the private information of the dissident group does not preclude it from mobilizing upon observing signals that are extremely in favor of the regime. In this limit case, the dissident group ignores its information because mobilizing is too profitable. Individuals ignore their own information because the dissident group has much better information and because the latter also has coordinating power over other individuals. The mass public follow the dissident group despite the fact that the group itself ignores its own private information and relies almost entirely on its coordinating power.

As long as $\tau > 0$ and $\alpha < 1$, there is uncertainty about the motivation of the dissident group. This uncertainty renders the dissident group's action informative. Whenever the dissident group mobilizes, individuals learn that the signal of the dissident group was low enough. Each individual knows that the signal of the dissident group is low and also that all other individuals are aware of this after the dissident group mobilizes. As a result most of the individuals choose to mobilize as well.

Let us consider the other extreme case, in which the information advantage of the dissident group vanishes. In this case, rents from power do not affect the critical state $\bar{\theta}$ and the dissident group exerts influence only by virtue of size. The following proposition states this result.

Proposition 2 *As* $\frac{\sigma}{\tau} \to 0$. *Then* $\bar{\theta} \to \lambda + (1+\beta)(1-\lambda)/2$ *and* $\underline{\theta} \to (1+\beta)(1-\lambda)/2$

The following proposition establishes the existence of an equilibrium in threshold strategies in the sequential case.

Proposition 3 *In the sequential-move game, there exists an equilibrium characterized by the 5-tuble* $(\bar{\theta}, \underline{\theta}, x_M^*, x_R^*, y^*)$*, which satisfies equilibrium conditions* (1) - (5) *if the following condition on signal distribution is satisfied:*

$$\textit{For any } k > 0 \quad \lim_{x \to -\infty} \frac{G(kx)}{F(x)} \geq 1.$$

Proof of Proposition 3 A corresponding existence result is present in Corsetti et al. (2004); however, they do not provide an explicit proof. We include the argument below for the sake of completeness.

Firstly, examining equations (3), (4) and (5) reveals that the equilibrium thresholds $\bar{\theta}$, $\underline{\theta}$ and y^* have unique and finite solutions given the signal thresholds x_M^* and x_R^*. To establish the existence of solutions to x_M^* and x_R^*, we will introduce the following notation:

$$\begin{aligned} \bar{\delta}_M &= \frac{\bar{\theta} - x_M^*}{\sigma}, \\ z_M &= \frac{\theta - x_M^*}{\sigma}, \\ \bar{\delta}_R &= \frac{\bar{\theta} - x_R^*}{\sigma}, \\ z_R &= \frac{\theta - x_R^*}{\sigma}. \end{aligned} \tag{6}$$

Note that

$$\frac{y^* - x_M^* - \sigma z_M}{\tau} = \frac{\sigma}{\tau}\left(\bar{\delta}_M - z_M + \frac{\bar{\theta} - y^*}{\sigma}\right).$$

Then, equation (1) becomes

$$\frac{\int_{-\infty}^{\bar{\delta}_M} f(z_M) G\left(\frac{\sigma}{\tau}\left(\bar{\delta}_M - z_M + \frac{\bar{\theta}-y^*}{\sigma}\right)\right) dz_M}{\int_{-\infty}^{\infty} f(z_M) G\left(\frac{\sigma}{\tau}\left(\bar{\delta}_M - z_M + \frac{\bar{\theta}-y^*}{\sigma}\right)\right) dz_M} = \frac{1+\beta}{2}, \tag{7}$$

or equivalently,

$$\frac{1}{1+\frac{\int_{\bar{\delta}_M}^{\infty} f(z_M)G\left(\frac{\sigma}{\tau}\left(\bar{\delta}_M - z_M + \frac{\bar{\theta}-y^*}{\sigma}\right)\right)dz_M}{\int_{-\infty}^{\bar{\delta}_M} f(z_M)G\left(\frac{\sigma}{\tau}\left(\bar{\delta}_M - z_M + \frac{\bar{\theta}-y^*}{\sigma}\right)\right)dz_M}} = \frac{1+\beta}{2}. \tag{8}$$

If x_M^* diverges to $-\infty$, $\bar{\delta}_M$ diverges to ∞, and so

$$\frac{\int_{\bar{\delta}_M}^{\infty} f(z_M)G\left(\frac{\sigma}{\tau}\left(\bar{\delta}_M - z_M + \frac{\bar{\theta}-y^*}{\sigma}\right)\right)dz_M}{\int_{-\infty}^{\bar{\delta}_M} f(z_M)G\left(\frac{\sigma}{\tau}\left(\bar{\delta}_M - z_M + \frac{\bar{\theta}-y^*}{\sigma}\right)\right)dz_M} \to 0, \tag{9}$$

since $\lim \bar{\theta}$ and $\lim y^*$ are finite as x_M^* diverges to $-\infty$.

(9) implies that LHS of equation (8) becomes greater than its RHS.

To show that as x_M^* diverges to ∞, the limit of LHS of equation (7) is less than 1/2, note that

$$\frac{\int_{\bar{\delta}_M}^{\infty} f(z_M)G\left(\frac{\sigma}{\tau}\left(\bar{\delta}_M - z_M + \frac{\bar{\theta}-y^*}{\sigma}\right)\right)dz_M}{\int_{-\infty}^{\bar{\delta}_M} f(z_M)G\left(\frac{\sigma}{\tau}\left(\bar{\delta}_M - z_M + \frac{\bar{\theta}-y^*}{\sigma}\right)\right)dz_M} \geq \frac{G\left(\frac{\sigma}{\tau}\left(2\bar{\delta}_M + \frac{\bar{\theta}-y^*}{\sigma}\right)\right)(1-2F(\bar{\delta}_M))}{F(\bar{\delta}_M)},$$

of which the limit is greater than 1, which sufficient to show that LHS of equation (8) becomes less than its RHS as $x_M^* \to \infty$. ■

Proof of Proposition 1

The proof here closely follows the proof of Proposition 7 in Corsetti et al. (2004). We include the proof for completeness.

We will use the notation that we defined in equations (6).

Suppose for a moment that the limit of $\frac{\bar{\theta}-y^*}{\sigma}$ is 0. Then $G\left(\frac{\sigma}{\tau}\left(\bar{\delta}_M - z_M + \frac{\bar{\theta}-y^*}{\sigma}\right)\right)$ converges to 1 for any $z < \bar{\delta}_M$, and converges to 0 for any $z > \bar{\delta}_M$. Thus

$$\frac{\int_{\bar{\delta}_M}^{\infty} f(z_M)G\left(\frac{\sigma}{\tau}\left(\bar{\delta}_M - z_M + \frac{\bar{\theta}-y^*}{\sigma}\right)\right)dz_M}{\int_{-\infty}^{\bar{\delta}_M} f(z_M)G\left(\frac{\sigma}{\tau}\left(\bar{\delta}_M - z_M + \frac{\bar{\theta}-y^*}{\sigma}\right)\right)dz_M} \to 0.$$

As a result, the LHS of (8), which equals to the LHS of equation (1) converges to

1. Therefore, the viability of mobilizing increases indefinitely for individuals; that is, x_M^* diverges to ∞. A similar argument shows that The LHS of (2) converges then to 0; that is, x_R^* diverges to $-\infty$.

To prove that the limit of $\frac{\bar{\theta}-y^*}{\sigma}$ is actually 0, note equation (5) implies that the limit of $G\left(\frac{\bar{\theta}-y^*}{\tau}\right)$ cannot be 0 or 1. Then

$$\lim \frac{\bar{\theta}-y^*}{\tau} \in (-\infty, \infty).$$

Since

$$\frac{\bar{\theta}-y^*}{\sigma} = \frac{\bar{\theta}-y^*}{\tau}\frac{\tau}{\sigma},$$

$$\lim \frac{\bar{\theta}-y^*}{\sigma} = 0.$$

Finally, if $\tau \to 0$, using an argument similar to the one used in Simultaneous-Move case, it is straightforward to show that $\lim y^* \neq \lim \bar{\theta}$ leads to contradiction. ■

Proof of Proposition 2 The analysis here is similar to the one of Proposition 8 in Corsetti et al. (2004).

If $\frac{\sigma}{\tau} \to 0$ equations (1) and (2) converge to

$$\frac{1}{1+\frac{1-F(\bar{\delta})}{F(\bar{\delta})}} = \frac{1+\beta}{2}$$
$$\frac{1}{1+\frac{1-F(\underline{\delta})}{F(\underline{\delta})}} = \frac{1+\beta}{2}.$$

Substituting these limits back to the equations (3) and (4) proves the first part. If the limit of σ is a finite number, then we must have $x_M^* \to \bar{\theta}$ and $x_R^* \to \underline{\theta}$. ■

1.2 Empirical Analysis

As a continuation of the descriptive statistics analysis we do in the paper, we check the relation between the rents from power and collective action when the dissident group acts publicly and prior to the mass public. For that purpose we create an indicator variable that equals one if there was no political assassinations, guerrilla warfare, or revolutions in the past year (we also check two and three years prior for robustness). This variable is meant to differentiate between protest events that could be initiated by an organized group from the ones that seemingly emerge simultaneously. This way we also provide the results of a specification that relates rents to mass mobilization when there is evidence of other collective action events in the past year.

Sequential Coll. Actions			
	Model(1)	Model(2)	Model(3)
GovRev	0.15^{***}		
	(0.03)		
GovRev *FewExeConst		0.20^{***}	0.18^{***}
		(0.04)	(0.05)
GDPpCap			-0.10^{**}
			(0.04)
LitRate			0.09^{**}
			(0.02)
Gr.Rate GDPpC			-0.04
			(0.02)
PopDens			-0.11
			(0.08)
Const	0.26^{***}	-0.25^{***}	-0.23^{***}
	(0.02)	(0.02)	(0.02)
N	2111	1925	1541
$\bar{R}^2$	0.023	0.019	0.021

Standard errors statistics in parentheses
* $p<0.05$, ** $p<0.01$, *** $p<0.001$

Table 1: Regression Results

2 Mass Public as a Single Player

In the benchmark model in the main body of the paper (hereafter, we will use "benchmark model" or just "model" to refer to main model in the paper), each citizen interacts simultaneously with each other and with the opposition elite. In the model, each citizen's mass in the population is atomistic, so they do not consider the impact of their decision on the overall level of mobilization. Moreover, the fact that there is an uncountable number of citizens eliminates the strategic uncertainty the opposition elite faces. When we assume the mass public is a single strategic player, in contrast, it has to consider its pivotal role in regime change. Although this model may seem less realistic than the one in which the mass public comprises many individuals, it is worth exploring as it exposes the consequences of two players being pivotal. This is the fundamental difference between the model and the variation considered here. We use capital initials to refer to Mass Public when we refer to the single-player variation.

Precisely, assume that the Mass Public receives a private signal with the same information content as one citizen would have received in the benchmark model. That is, the Mass Public receives

$$x = \theta + \sigma\varepsilon,$$

and the opposition elite receives

$$y = \theta + \tau\eta,$$

where ε and η are independent random variables, whose distributions are symmetric around zero.

Both the opposition elite and the Mass Public simultaneously choose whether to mobilize against the regime conditional on their private information about the strength of the regime θ. The size of the opposition elite is λ and the size of the Mass Public is $1 - \lambda$. Let s_{OE} (resp. s_{MP}) denote the mobilization decision of the opposition elite (resp. Mass Public).

The incidence of mobilization z is then

$$z = s_{OE}\lambda + s_{MP}(1 - \lambda).$$

The regime changes if $z \geq \theta$. We assume without loss of generality that the mobilization size λ of the opposition elites is less than 1/2. The analysis with $\lambda \geq 1/2$ is analogous.

As in the benchmark model, we concentrate on the equilibrium in threshold strategies. We show there exist thresholds (x^*, y^*) such that the opposition elite (resp. Mass Public) chooses to mobilize if and only if its private signal $x \leq x^*$ (resp. $y \leq y^*$).

The strategic interaction between the Mass Public and the opposition elite here is different from the one in the benchmark model. As it is mentioned above, in the model an individual citizen cannot be pivotal. Thus, each citizen decides to mobilize based solely upon the trade-off between participating in an unsuccessful protest and missing on the opportunity to become a part of regime change. Moreover, since there is a continuum of citizens in the model, individual differences between citizens cancel out at the aggregate level, which eliminates the strategic uncertainty the elite face about the response of the mass public. Each player knows exactly the ratio of citizens who will choose to mobilize against the regime given any strength of the regime, θ. The only remaining strategic uncertainty is about the response of the opposition elite.

When the Mass Public is a single player, however, it is no longer the case that the Mass Public's response is deterministic. The response of the Mass Public depends on the particular realization of its private signal, therefore it is impossible for the elite to infer the behavior of the Mass Public with certainty for any given regime strength θ. This feature causes an additional non-linearity in the posterior assessments of players regarding regime change. We describe the posterior beliefs of players below.

We first consider the actions of the opposition elite. The elite mobilizes a λ share of the population, if it decides to do so. Therefore if $\theta \leq \lambda$, the regime changes irrespective of the action of the Mass Public. If θ is between λ and 1, the regime changes only if both players mobilize. The Mass Public mobilizes if $x \leq x^*$. The expected payoff to the elite for mobilizing is

$$(1+\alpha)(P(\theta \leq \lambda | y) + P(\lambda < \theta \leq 1 \quad \& \quad x \leq x^* | y)).$$

Similarly, the payoff from refraining is

$$(1-\alpha)(P(\theta > 1-\lambda | y) + P(0 < \theta \leq 1-\lambda \quad \& \quad x > x^* | y)).$$

The elite's posterior belief about θ is:

$$\begin{aligned} P(\theta \leq \lambda | y) &= \int_{-\infty}^{\lambda} P(\theta|y) d\theta = \frac{\int_{-\infty}^{\lambda} P(y|\theta) h(\theta-\theta_0) d\theta}{\int_{\infty}^{\infty} P(y|\theta) h(\theta-\theta_0) d\theta} \\ &= \frac{\int_{-\infty}^{\lambda} g\left(\frac{y-\theta}{\tau}\right) h(\theta-\theta_0) d\theta}{\int_{\infty}^{\infty} g\left(\frac{y-\theta}{\tau}\right) h(\theta-\theta_0) d\theta}, \end{aligned}$$

where $h(\cdot)$ is the prior distribution of regime strength (centered at zero), and θ_0 is corresponding expected value.

The elite's joint posterior belief about θ and the behavior of the Mass Public is more involved:

$$\begin{aligned} & P(\lambda < \theta \leq 1 \quad \& \quad x \leq x^* | y) = \int_{\lambda}^{1} P(\theta \quad \& \quad x \leq x^* | y) d\theta \\ = & \frac{\int_{\lambda}^{1} P(y \quad \& \quad \varepsilon < \frac{x^*-\theta}{\sigma} | \theta) h(\theta-\theta_0) d\theta}{\int_{-\infty}^{\infty} P(y \quad \& \quad \varepsilon < \frac{x^*-\theta}{\sigma} | \theta) h(\theta-\theta_0) d\theta} = \frac{\int_{\lambda}^{1} F\left(\frac{x^*-\theta}{\sigma}\right) g\left(\frac{y-\theta}{\tau}\right) h(\theta-\theta_0) d\theta}{\int_{-\infty}^{\infty} F\left(\frac{x^*-\theta}{\sigma}\right) g\left(\frac{y-\theta}{\tau}\right) h(\theta-\theta_0) d\theta}. \end{aligned}$$

Given these beliefs, the indifference condition for the opposition elite that determines the threshold y^* is given by:

$$\begin{aligned} & (1+\alpha)\left(\frac{\int_{-\infty}^{\lambda} g\left(\frac{y-\theta}{\tau}\right) h(\theta-\theta_0) d\theta}{\int_{\infty}^{\infty} g\left(\frac{y-\theta}{\tau}\right) h(\theta-\theta_0) d\theta} + \frac{\int_{\lambda}^{1} F\left(\frac{x^*-\theta}{\sigma}\right) g\left(\frac{y-\theta}{\tau}\right) d\theta}{\int_{-\infty}^{\infty} F\left(\frac{x^*-\theta}{\sigma}\right) g\left(\frac{y-\theta}{\tau}\right) h(\theta-\theta_0) d\theta}\right) \\ = & (1-\alpha)\left(\frac{\int_{1-\lambda}^{\infty} g\left(\frac{y-\theta}{\tau}\right) h(\theta-\theta_0) d\theta}{\int_{\infty}^{\infty} g\left(\frac{y-\theta}{\tau}\right) h(\theta-\theta_0) d\theta} + \frac{\int_{0}^{1-\lambda} F\left(\frac{\theta-x^*}{\sigma}\right) g\left(\frac{y-\theta}{\tau}\right) h(\theta-\theta_0) d\theta}{\int_{-\infty}^{\infty} F\left(\frac{\theta-x^*}{\sigma}\right) g\left(\frac{y-\theta}{\tau}\right) h(\theta-\theta_0) d\theta}\right). \end{aligned} \quad (10)$$

Similarly, the expected payoff to the Mass Public from mobilizing is

$$(1-\beta)(P(\theta \leq 1-\lambda|x) + P(1-\lambda < \theta \leq 1 \quad \& \quad y \leq y^*|x)),$$

and the expected payoff from refraining is

$$(1+\beta)(P(\theta > \lambda|x) + P(0 < \theta < \lambda \quad \& \quad y > y^*|x)).$$

The posterior belief of the Mass Public is analogous to that of the opposition elite:

$$P(\theta \leq 1-\lambda|x) = \frac{\int_{-\infty}^{1-\lambda} f\left(\frac{x-\theta}{\sigma}\right) h(\theta-\theta_0)d\theta}{\int_{-\infty}^{\infty} f\left(\frac{x-\theta}{\sigma}\right) h(\theta-\theta_0)d\theta},$$

and

$$P(1-\lambda < \theta \leq 1 \quad \& \quad y \leq y^*|x) = \frac{\int_{1-\lambda}^{1} G\left(\frac{y^*-\theta}{\tau}\right) f\left(\frac{x-\theta}{\sigma}\right) h(\theta-\theta_0)d\theta}{\int_{-\infty}^{\infty} G\left(\frac{y^*-\theta}{\tau}\right) f\left(\frac{x-\theta}{\sigma}\right) h(\theta-\theta_0)d\theta}.$$

The indifference condition that determines the threshold x^* is as follows:

$$\begin{aligned}(1-\beta)&\left(\frac{\int_{-\infty}^{1-\lambda} f\left(\frac{x-\theta}{\sigma}\right) h(\theta-\theta_0)d\theta}{\int_{-\infty}^{\infty} f\left(\frac{x-\theta}{\sigma}\right) h(\theta-\theta_0)d\theta} + \frac{\int_{1-\lambda}^{1} G\left(\frac{y^*-\theta}{\tau}\right) f\left(\frac{x-\theta}{\sigma}\right) h(\theta-\theta_0)d\theta}{\int_{-\infty}^{\infty} G\left(\frac{y^*-\theta}{\tau}\right) f\left(\frac{x-\theta}{\sigma}\right) h(\theta-\theta_0)d\theta}\right)\\ &= (1+\beta)\left(\frac{\int_{\lambda}^{\infty} f\left(\frac{x-\theta}{\sigma}\right) h(\theta-\theta_0)d\theta}{\int_{-\infty}^{\infty} f\left(\frac{x-\theta}{\sigma}\right) h(\theta-\theta_0)d\theta} + \frac{\int_{0}^{\lambda} G\left(\frac{\theta-y^*}{\tau}\right) f\left(\frac{x-\theta}{\sigma}\right) d\theta}{\int_{-\infty}^{\infty} G\left(\frac{\theta-y^*}{\tau}\right) f\left(\frac{x-\theta}{\sigma}\right) d\theta}\right). \qquad (11)\end{aligned}$$

Even though the model and the case analyzed here are fundamentally different, the effect of rents from power α on the endogenous variables seems to be the same (at least numerically) as in the model. As α increases, the threshold ys used by the opposition elite to decide whether to mobilize goes up—the elite is increasingly likely to mobilize ex-ante. The Mass Public sees in α a cue to infer the elite's behavior. A higher α increases the Mass Public assessment about the likelihood of regime change. Coordination therefore encourages the Mass Public to mobilize against regime. Figure 1 shows the numerical ex-ante probability of regime change for the case in which the Mass Public is a single player and compares this probability to the case in the model. Note that as α increases, the ex-ante probability of regime change increases in both models. Moreover, such probabilities have very similar values.

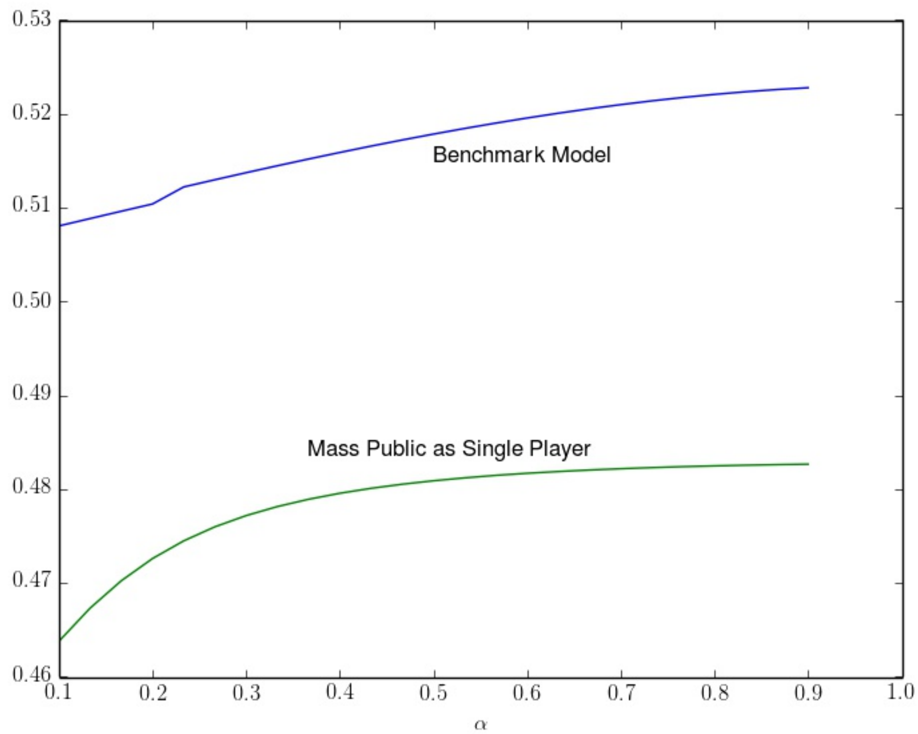

Figure 1: Ex-ante Probability of Revolution - Many Citizens vs Mass Public as Single Player

$$\sigma, \tau = 1,\ \beta, \lambda = 0.1,\ \theta_0 = 0.5$$

The patterns in Figure 1 do not seem to be coincidental (and suggest a unique equilibrium given by the equations above). Figure 2 illustrates the effect of various levels of information precision for the Mass Public (σ) and the size of opposition elite (λ). We numerically computed the ex-ante probability of revolution as a function of α when $\sigma = .5, 2$ and when $\lambda = 0.5, 0.75$ as well. Both graphs show that the ex-ante probability is increasing in α for all the values of σ and λ considered.

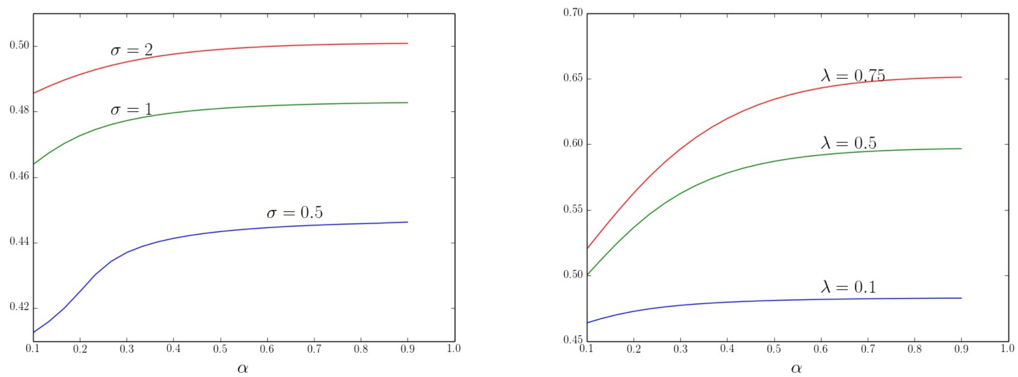

Figure 2: Ex-ante Probability of Revolution

$\tau = 1$, $\beta = 0.1$, $\theta_0 = 0.5$

3 Symbolic Leaders

In the sequential version of the model, we focus on the case in which the elite move first. The sequential case assumes that every player would ignore any player other than the elite moving first. We focus on the equilibria driven by this assumption because it seems a natural scenario if we think of the opposition elite as a prominent political player. However, it is possible to think about examples in which individuals who are not explicitly backed by sizable groups may take the initiative moving against the regime (e..g, the lone protester in Tiananmen Square).

We focus on the class of equilibria in which every player reacts to the information provided by the emergence of a symbolic leader. In this situation the elite does not gain anything by moving first, because moving first does not sway the mass public. As a result, the elite waits and learns from the symbolic leader's decision. In this class of equilibria, any citizen from the mass public is "designated" to move first and all the other players move afterward (in the "second period"). This implicitly assumes that taking the initiative is not conditional on the realization of the signal. In other words, we can think of the individual who takes the initiative to be selected before the game is played.

In this section we state the necessary conditions describing such class of equilibria. These conditions, however, do not allow us to derive analytic solutions for the equilibrium thresholds, so we rely on numerical calculations to compare the results obtained here with those in the model.

The symbolic leader receives the signal

$$z = \theta + \sigma\varepsilon.$$

Conditional on the realization of this signal, she will choose to mobilize (M) or refrain from mobilizing (R). The rest of the players play a simultaneous-move game similar to the one in the model except that now they condition their decision on the behavior of the symbolic leader in addition to their private signal. Accordingly, the play in the second period is characterized by eight thresholds: $\{\{y^*_M, x^*_M, \bar{\theta}_M, \underline{\theta}_M\}, \{y^*_R, x^*_R, \bar{\theta}_R, \underline{\theta}_R\}\}$, where the subscripts denote whether the symbolic leader mobilizes or refrains. Anticipating the behavior of the followers, the symbolic leader bases her decision on these eight thresholds. The condition that determines the threshold on the leader's private signal, z^*, is given by

$$(1-\beta)p_M = (1+\beta)(1-p_R), \tag{12}$$

where p_M is the posterior belief of the symbolic leader that regime change will occur given that she chooses M, and p_R is the probability of the same event given that she chooses R. Condition (12) parallels the indifference condition of the large player in the sequential version of the model. In both cases, the leaders face a trade-off between their biases favoring a particular option and the uncertainty about the outcome of the game. There are, however, two important differences between this case and the case in the model. Firstly, the preferences of the symbolic leader are not different from the preferences of all the other citizens. The symbolic leader exerts power over the elite through its effect on the mass public's decision. Secondly, the symbolic leader faces strategic uncertainty regarding the behavior of the elite in addition to the uncertainty about the strength of the regime θ. In the model, in contrast, the elite (acting as a leader) has different preferences and infer the behavior of the mass public perfectly by the law of large numbers. It is the strength of the regime its sole source of uncertainty.

After the symbolic leader chooses M (R), coordination on M can occur if a) the opposition elite choose M and θ is less than $\bar{\theta}_M$ ($\bar{\theta}_R$) or b) the opposition elite chooses R and θ is less than $\underline{\theta}_M$ ($\underline{\theta}_R$). The posterior beliefs of the symbolic leader in each case are given by

$$p_M = P(y \leq y_M^* \quad \text{and} \quad \theta \leq \bar{\theta}_M|z) + P(y \geq y_M^* \quad \text{and} \quad \theta \leq \underline{\theta}_M|z)$$
$$p_R = P(y \leq y_R^* \quad \text{and} \quad \theta \leq \bar{\theta}_R|z) + P(y \geq y_R^* \quad \text{and} \quad \theta \leq \underline{\theta}_R|z).$$

We calculate first p_M. The first term is given by

$$P(y \leq y_M^* \quad \text{and} \quad \theta \leq \bar{\theta}_M|z) = \int_{-\infty}^{\bar{\theta}_M} P(y \leq y_M^* \& \theta|z) d\theta$$
$$= \frac{\int_{-\infty}^{\bar{\theta}_M} P(y \leq y_M^* \& z|\theta) d\theta}{\int_{-\infty}^{\infty} P(y \leq y_M^* \& z|\theta) d\theta} = \frac{\int_{-\infty}^{\bar{\theta}_M} G\left(\frac{y_M^*-\theta}{\tau}\right) f\left(\frac{z-\theta}{\sigma}\right) d\theta}{\int_{-\infty}^{\infty} G\left(\frac{y_M^*-\theta}{\tau}\right) f\left(\frac{z-\theta}{\sigma}\right) d\theta}.$$

The second term is given by

$$P(y \geq y_M^* \quad \text{and} \quad \theta \leq \underline{\theta}_M|z) \quad = \quad \frac{\int_{-\infty}^{\underline{\theta}_M} G\left(\frac{\theta-y_M^*}{\tau}\right) f\left(\frac{z-\theta}{\sigma}\right) d\theta}{\int_{-\infty}^{\infty} G\left(\frac{\theta-y_M^*}{\tau}\right) f\left(\frac{z-\theta}{\sigma}\right) d\theta}.$$

Similarly, the two terms comprising p_R are given by

$$P(y \leq y_R^* \quad \text{and} \quad \theta \leq \bar{\theta}_R|z) \quad = \quad \frac{\int_{-\infty}^{\bar{\theta}_R} G\left(\frac{y_R^*-\theta}{\tau}\right) f\left(\frac{z-\theta}{\sigma}\right) d\theta}{\int_{-\infty}^{\infty} G\left(\frac{y_R^*-\theta}{\tau}\right) f\left(\frac{z-\theta}{\sigma}\right) d\theta},$$
$$P(y \geq y_R^* \quad \text{and} \quad \theta \leq \underline{\theta}_R|z) \quad = \quad \frac{\int_{-\infty}^{\underline{\theta}_R} G\left(\frac{\theta-y_R^*}{\tau}\right) f\left(\frac{z-\theta}{\sigma}\right) d\theta}{\int_{-\infty}^{\infty} G\left(\frac{\theta-y_R^*}{\tau}\right) f\left(\frac{z-\theta}{\sigma}\right) d\theta}.$$

In sum,

$$p_M = \frac{\int_{-\infty}^{\bar{\theta}_M} G\left(\frac{y_M^* - \theta}{\tau}\right) f\left(\frac{z-\theta}{\sigma}\right) d\theta}{\int_{-\infty}^{\infty} G\left(\frac{y_M^* - \theta}{\tau}\right) f\left(\frac{z-\theta}{\sigma}\right) d\theta} + \frac{\int_{-\infty}^{\underline{\theta}_M} G\left(\frac{\theta - y_M^*}{\tau}\right) f\left(\frac{z-\theta}{\sigma}\right) d\theta}{\int_{-\infty}^{\infty} G\left(\frac{\theta - y_M^*}{\tau}\right) f\left(\frac{z-\theta}{\sigma}\right) d\theta}$$

$$p_R = \frac{\int_{-\infty}^{\bar{\theta}_R} G\left(\frac{y_R^* - \theta}{\tau}\right) f\left(\frac{z-\theta}{\sigma}\right) d\theta}{\int_{-\infty}^{\infty} G\left(\frac{y_R^* - \theta}{\tau}\right) f\left(\frac{z-\theta}{\sigma}\right) d\theta} + \frac{\int_{-\infty}^{\underline{\theta}_R} G\left(\frac{\theta - y_R^*}{\tau}\right) f\left(\frac{z-\theta}{\sigma}\right) d\theta}{\int_{-\infty}^{\infty} G\left(\frac{\theta - y_R^*}{\tau}\right) f\left(\frac{z-\theta}{\sigma}\right) d\theta}. \quad (13)$$

Given the action of the symbolic leader, the thresholds for θ are determined as in the model (these are the "critical mass" conditions):

$$(1-\lambda) F\left(\frac{x_M^* - \underline{\theta}_M}{\sigma}\right) = \underline{\theta}_M$$

$$\lambda + (1-\lambda) F\left(\frac{x_M^* - \bar{\theta}_M}{\sigma}\right) = \bar{\theta}_M$$

$$(1-\lambda) F\left(\frac{x_R^* - \underline{\theta}_R}{\sigma}\right) = \underline{\theta}_R$$

$$\lambda + (1-\lambda) F\left(\frac{x_R^* - \bar{\theta}_R}{\sigma}\right) = \bar{\theta}_R. \quad (14)$$

The large player's posterior probability about θ incorporates information from both her private signal and the publicly observable action of the symbolic leader. It is given by

$$P(\theta | y \quad \text{and} \quad z \leq z^*) = \frac{g\left(\frac{y-\theta}{\tau}\right) F\left(\frac{z^*-\theta}{\sigma}\right)}{\int_{-\infty}^{\infty} g\left(\frac{y-\theta}{\tau}\right) F\left(\frac{z^*-\theta}{\sigma}\right) d\eta},$$

$$P(\theta | y \quad \text{and} \quad z > z^*) = \frac{g\left(\frac{y-\theta}{\tau}\right) F\left(\frac{\theta - z^*}{\sigma}\right)}{\int_{-\infty}^{\infty} g\left(\frac{y-\theta}{\tau}\right) F\left(\frac{\theta - z^*}{\sigma}\right) d\eta}. \quad (15)$$

The thresholds y_M^* and y_R^* ("cut-off" conditions) for the large player are given by

$$(1+\alpha) P(\theta \leq \bar{\theta}_M | y_M^* \quad \text{and} \quad z \leq z^*) = (1-\alpha) P(\theta \geq \underline{\theta}_M | y_M^* \quad \text{and} \quad z \leq z^*),$$

$$(1+\alpha) P(\theta \leq \bar{\theta}_R | y_R^* \quad \text{and} \quad z > z^*) = (1-\alpha) P(\theta \geq \underline{\theta}_R | y_R^* \quad \text{and} \quad z > z^*). \quad (16)$$

Finally, each citizen follower i forms his posteriors as follows:

$$P(\theta|x_i \quad \text{and} \quad z \leq z^*) = \frac{f\left(\frac{x_i-\theta}{\tau}\right) F\left(\frac{z^*-\theta}{\sigma}\right)}{\int_{-\infty}^{\infty} f\left(\frac{x_i-\theta}{\tau}\right) F\left(\frac{z^*-\theta}{\sigma}\right) d\theta},$$
$$P(\theta|x_i \quad \text{and} \quad z > z^*) = \frac{f\left(\frac{x_i-\theta}{\tau}\right) F\left(\frac{\theta-z^*}{\sigma}\right)}{\int_{-\infty}^{\infty} f\left(\frac{x_i-\theta}{\tau}\right) F\left(\frac{\theta-z^*}{\sigma}\right) d\theta}. \tag{17}$$

Given these posteriors, the "cut-off" conditions for the citizens are determined as in the simultaneous case:

$$\frac{\int_{-\infty}^{\underline{\theta}_M} f\left(\frac{x_i-\theta}{\tau}\right) F\left(\frac{z^*-\theta}{\sigma}\right) d\theta}{\int_{-\infty}^{\infty} f\left(\frac{x_i-\theta}{\tau}\right) F\left(\frac{z^*-\theta}{\sigma}\right) d\theta} + \frac{\int_{\underline{\theta}_M}^{\bar{\theta}_M} f\left(\frac{x_i-\theta}{\tau}\right) F\left(\frac{z^*-\theta}{\sigma}\right) G\left(\frac{y_M^*-\theta}{\tau}\right) d\theta}{\int_{-\infty}^{\infty} f\left(\frac{x_i-\theta}{\tau}\right) F\left(\frac{z^*-\theta}{\sigma}\right) G\left(\frac{y_M^*-\theta}{\tau}\right) d\theta} = \frac{1+\beta}{2},$$
$$\frac{\int_{-\infty}^{\underline{\theta}_R} f\left(\frac{x_i-\theta}{\tau}\right) F\left(\frac{\theta-z^*}{\sigma}\right) d\theta}{\int_{-\infty}^{\infty} f\left(\frac{x_i-\theta}{\tau}\right) F\left(\frac{\theta-z^*}{\sigma}\right) d\theta} + \frac{\int_{\underline{\theta}_R}^{\bar{\theta}_R} f\left(\frac{x_i-\theta}{\tau}\right) F\left(\frac{\theta-z^*}{\sigma}\right) G\left(\frac{y_R^*-\theta}{\tau}\right) d\theta}{\int_{-\infty}^{\infty} f\left(\frac{x_i-\theta}{\tau}\right) F\left(\frac{\theta-z^*}{\sigma}\right) G\left(\frac{y_R^*-\theta}{\tau}\right) d\theta} = \frac{1+\beta}{2}. \tag{18}$$

The "critical mass" and "cut-off" conditions together determine the equilibria. Although we are not able to obtain analytical solutions for the thresholds, we believe it is instructive to compare the symbolic leader case we discuss here with the sequential-move game discussed in the model at least numerically.

When the opposition elite mobilize in the first period, each individual citizen knows that a non-zero mass λ of the population have already mobilized against the regime, making it vulnerable against further mass public mobilization. Moreover, mobilization by the elite conveys to citizens a the regime is weak. Each citizen, however, has to consider that the opposition elite is also motivated by rents from power (α). Increasing rents from power renders the elite's mobilization less informative about the actual strength of the regime. Therefore, as rents from power increase mobilization by the mass public goes down.

Although the symbolic leader adds negligible mass to the mobilization, her decision is influential as her payoffs are the same as those ones of the citizens in any contingency. Whenever she mobilizes against the regime, she sends a very strong signal to the rest of the citizens that mass mobilization is likely to be successful. Citizens do not discount their beliefs about mass mobilization as they do when the opposition elite move first. This is an additional source of power for the symbolic leader that the opposition elite does not have.

Figure 3 shows the size of the interval in which the leader is pivotal for each α, for each of the two cases analyzed (symbolic leader and the model in the paper). A small interval means that for most of the values of θ the resulting regime does not depend on whether the leader mobilizes. In other words, Figure 3 compares the importance of a symbolic leader and the opposition elite in the model in the paper. As it is explained in the paper, the interval for the model in the paper decreases in α as rents from power confuse the greed of the opposition elite with correct information about the regime's strength. In the symbolic leader case here, increasing α allows everyone else to entertain higher expectations about elite mobilization. Thus, this makes the symbolic leader to mobilize as well. Whenever the symbolic leader does not mobilize she conveys the regime is strong enough to cope with a highly incentivized opposition elite and everyone else seeking to coordinate with the elite.

Figure 4 shows the size of the interval in which the leader is pivotal for each σ, for the symbolic leader case and the model in the paper. In the model, if the individuals' information is less precise than the opposition elite's, the latter is more effective in influencing the masses. In the symbolic leader case, on the other hand, the symbolic leader loses its influence over the mass public and the elite as the relative precision of her information falls. Therefore, as Figure 4 illustrates, the region where the symbolic leader is pivotal shrinks.

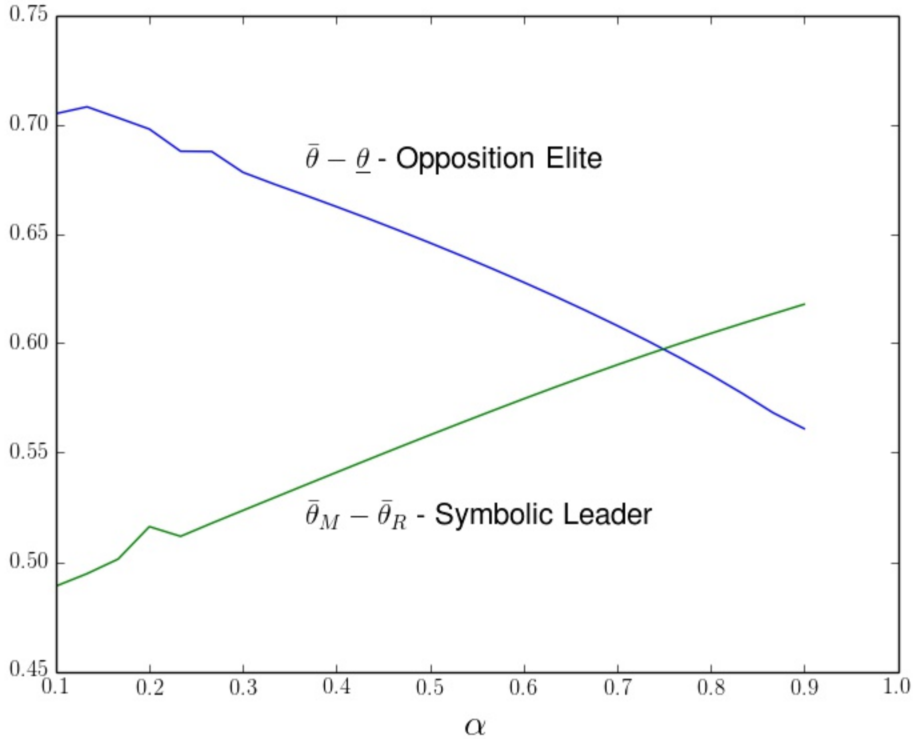

Figure 3: Pivotality of the Leader - Rents from Power

$\sigma, \tau = 1,\ \beta, \lambda = 0.1$

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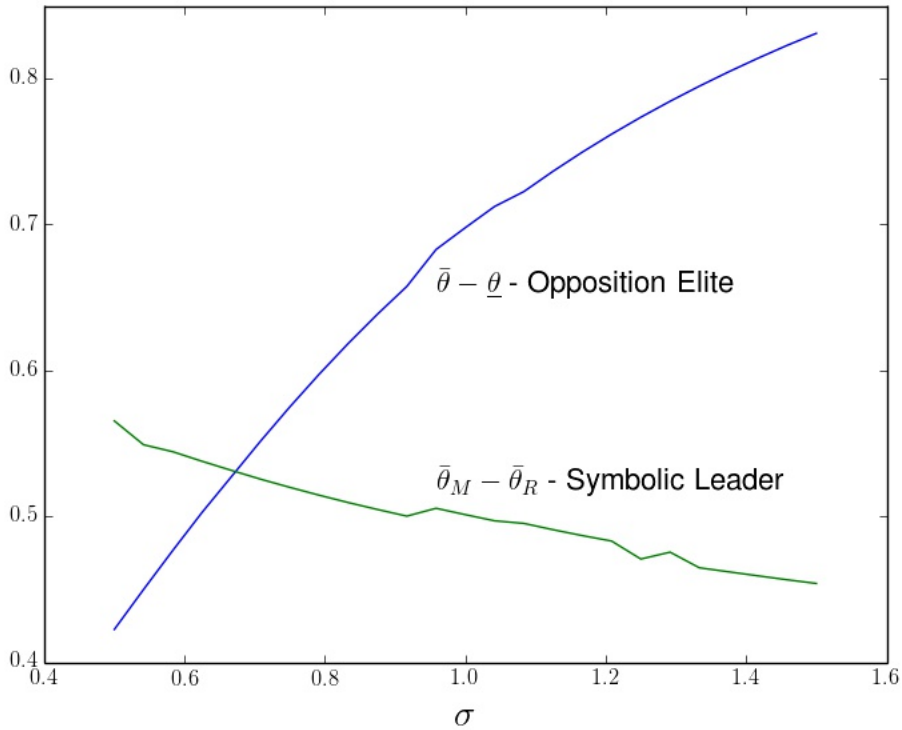

Figure 4: Pivotality of the Leader - Information Asymmetry

$\sigma = 1,\ \beta, \lambda = 0.1,\ \alpha = 0.2$

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