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By SUMON MAJUMDAR AND SHARUN W. MUKAND*

Policy-making is an uncertain process, with policy makers often lacking a clear blueprint on the appropriate choice to be made. This uncertainty is rife in all arenas of policy-making—be it the impact of tax cuts, the extent of privatization, the timing of deregulation, or even the most effective way to deal with an external threat. Given the endemic nature of this uncertainty, simple policy experimentation can generate useful information about the "appropriateness" of a particular course of action. Indeed many successful policy innovations started out as experiments—be it the deregulation of the airline industry in the United States, temporary capital controls in Chile, "welfare reform" under President Clinton, or privatization in Thatcherite Britain. This suggests that an issue of central importance in the political economy of policy-making is the following: what factors influence a government's incentive to engage in policy experimentation *and* learn from the information so generated? In addressing the above issue this paper takes a first step towards developing a framework to analyze a government's incentives for learning and policy experimentation.

Even a cursory examination of the experience with policy experimentation suggests inefficiencies—with governments being inefficiently conservative on some occasions as well as inefficiently reckless on others. For instance,

merely learning about the (in)appropriateness of a particular policy is not useful, if on observing failure, the policy maker does not adapt and *change* course. Nevertheless, a striking aspect of the history of policy-making is the apparent unwillingness of leaders to learn from previous experiments. Political leaders are typically reluctant to change course midway, even if the policy is publicly perceived to be failing.[1] In the 1980's, Presidents Jose Sarney of Brazil and Alan Garcia of Peru persisted with "heterodox" reform packages long after it was obvious to most observers that it was a failed experiment (Rudiger Dornbusch and Sebastian Edwards, 1990). Similarly, governments in transition economies such as Russia and Ukraine persisted with a drastic form of "big-bang" privatization, despite awareness that a mid-course correction was needed (Chrystia Freeland, 2000; Anders Aslund, 2002). More recently, Domingo Cavallo, the architect of Argentina's experiment with a currency board, undertook desperate measures to persist with it in 2001, despite it being evident that retaining the currency board was likely to engender a crisis—as it eventually did.[2] Thus the puzzle that comes up is why, on observing failure, do politicians not learn from experience, but rather feel compelled to continue with a policy that no one is optimistic about. In many of these situations, it seems as if the only remaining special interest lobbying in favor of the policy is the policy maker himself.

This reluctance to learn from the results of an experiment makes it even more puzzling to understand why often the very same governments inefficiently gambled with the experiment in the

[1] In her sweeping survey of decision-making by leaders through history, *The March of Folly,* Barbara W. Tuchman (1984) puts it most pithily, "Persistence of error is the problem ... to recognize error, to cut losses, to alter course, is the most repugnant option in government. For a chief of state admitting error is almost out of the question."

[2] Indeed Domingo Cavallo was willing to undertake several drastic measures such as manipulating tariffs, taxing financial transactions, and giving export subsidies to prevent the visible collapse of the currency board (J. Onno de Beaufort Wijnholds, 2003).

first place. Such inefficiency in policy experimentation is suggested in the initiation of not only the (failed) "heterodox" experiments mentioned above, but also the experience of several of the experiments with large-scale economic reform in Eastern Europe and Africa. Indeed, the recklessness of such experimentation is documented by Kurt Weyland (2002, p. 111) in a number of case studies. For instance, he describes how newly elected President Carlos Perez of Venezuela disregarded information supplied by his economic advisers when he embarked on a recklessly bold experiment with neo-liberal reform. Likewise, on assuming office President Fernando Collor of Brazil defied his economic advisers and faced down public opposition when he initiated drastic privatization in the 1990's. Weyland further documents similar instances of gambles in the initiation of neo-liberal policy packages in Argentina and Peru since "rather than covering their bases, the initiators of neo-liberal plans put all eggs in one basket by linking their fate to the uncertain outcomes of drastic reform." Similarly, a newly elected President Clinton took a gamble in introducing legislation that involved a radical overhaul of health care (Robert Blendon et al., 1995), aware that ensuring its passage was difficult and that a more incremental approach had a better chance of success. Likewise, within days of assuming office Gustavo Noboa of Ecuador disregarded the advice of members of his economic team and initiated, in the face of public opposition, a drastic experiment with dollarization (Benjamin Cohen, 2000). These examples suggest that an additional puzzle is why governments may ignore information and instead choose to experiment with an unpopular policy. Thus it seems that at times some governments have a proclivity towards inefficient experimentation, while on other occasions they appear to be inefficiently conservative. In order to see why both types of inefficiencies may occur, we focus on a simple mechanism—a political leader's electoral concerns.

In this paper we develop a framework that helps examine the impact of electoral pressures on a government's incentives to engage in policy experimentation as well as learn from it.[3]

The government faces a choice between maintaining the safe, status quo policy or experimenting with a new, untried policy that may generate higher, though uncertain returns. If the experiment is perceived to be unsuccessful, the government always has the option of costlessly reverting back to the tried and tested status quo policy. The key aspect to observe is that policy experimentation results in learning not just by the political leader, but also by the citizen-voter. Through a policy's success or failure, the public learns not only about the appropriateness of the policy itself, but also about the incumbent's competence at identifying appropriate policies in the first place.

This results in inefficiencies of two kinds. While a policy experiment's poor performance generates valuable information for the policy maker about its (in)appropriateness and the need for its scrappage, he may fear that doing so will be interpreted as a sign that the government was not sure of its choice of policy in the first place. Thus, although the leader learns, he is afraid to publicly use this information in effecting a change in policy. The adverse reputational impact of a policy reversal gives the incumbent an incentive to ignore useful information produced by experimentation and inefficiently persist with its initial policy choice.

However, this raises the puzzling question of policy adoption: why would a leader who is so concerned with reelection as to inefficiently persist with a failed policy, be interested in inefficiently experimenting with a new policy of uncertain merit? Once again, we argue that reputational concerns are crucial and may give an incentive to either gamble recklessly and experiment with a new policy or alternatively, show an inefficient degree of conservatism in maintaining the status quo. Strikingly, our theory implies that a politician is likely to be inefficiently conservative in experimenting precisely when the costs of such experimentation are low or the payoffs are high. In such cases the reputational gains from successful experimentation are low, and this makes the incum-

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[3] Political theorists of the state such as Hugh Heclo (1974), Theda Skocpol (1985), and Peter Hall (1993) em-

phasize the autonomy of learning and policy experimentation from political pressures. In contrast, Timothy Besley (2001), Mukand and Dani Rodrik (2002), and Mariano Tomassi (2002) suggest that political factors may be an important influence on experimentation and learning.

bent more hesitant in launching an experiment. Our analysis suggests that both these inefficiencies in policy choice can be clearly related to the electoral cycle. While later on in their tenure, governments become too conservative and inefficiently persist with policies, earlier on in their tenure, governments may be either too conservative or too reckless in engaging in policy experimentation.

Our benchmark model suggests that politicians are typically not rewarded for changing policies too often, because it signals incompetence. However, there are surely occasions where a politician who shows "flexibility" is electorally rewarded. In an extension, we show that for such flexibility to be rewarded, ideological considerations are likely to be an important part of the answer.

Given the preoccupation of politicians with their public reputation, it is hardly surprising that reputational models have been influential in the political agency literature (see Kenneth Rogoff, 1990). More in the spirit of the present paper is the literature which captures the effect of uncertainty on the mapping from policies to outcomes in electoral models, as in Joseph Harrington (1993) and Brandice Canes-Wrone et al. (2001). In an attempt to signal ability, governments may enact policies that "pander" to voter beliefs rather than their welfare. Similarly, Eric Maskin and Jean Tirole (2001) analyze constitutional design issues to show that signaling preferences may result in governmental pandering. Our framework instead focuses on a government's incentives to engage in policy experimentation and change course in response to dynamic learning by both itself and the electorate.

Our paper is clearly also related to the small but influential literature which addresses the puzzle of inefficient policy persistence. For instance, Alberto Alesina and Allan Drazen (1991) show how a "war of attrition" between different groups can endogenously result in a costly delay in policy enactment. A second mechanism, due to Raquel Fernandez and Rodrik (1991), emphasizes the role of individual-specific uncertainty in preventing the adoption of economic reforms. Finally, Stephen Coate and Stephen Morris (1999) argue that policies persist since, once implemented, a policy increases effectiveness of the lobbying efforts of its beneficiaries. Our framework is also closely related to the literature on reputational decision-making of managers, as in David Scharfstein and Jeremy Stein (1990), Marco Ottaviani and Peter Sorensen (2000), and especially Canice Prendergast and Lars Stole (1996). In contrast to the latter, our framework emphasizes the trade-off faced by leaders—experimentation with an uncertain policy against sticking to the certain status quo. Further, public observability of the impact of a policy is an important consideration in governmental decisions; accordingly we give it a central role in our analysis. Finally, the simplicity of our framework allows us to dispense with myopic decision-making on the part of the incumbent—resulting in the first-period policy choices being either too conservative *or* too radical.

In what follows we describe the basic model in Section I and the equilibrium is analyzed in Section II. Section III discusses further aspects of the model and Section IV concludes.

I. Description of the Model

We begin by giving an outline of the model.

A. *Policies*

Consider a government which has just been elected into office, and faces a window of opportunity to enact a new uncertain policy initiative a_N. Its choice of policy is governed by national welfare considerations as well as its own future reelection concerns. The incumbent assesses the situation and needs to decide whether to continue with the safe, status quo policy a_S or gamble and experiment with a_N. Both policies affect a publicly observable outcome, say, national income. An important feature of the technology of policy-making is that different policies are appropriate for different environments. For example, reforms which are successful in one country may not be suitable for another. Thus, we assume that success of the new policy a_N is contingent on the underlying state of the world, which may be one of two types, S and N, with a_S and a_N being the "appropriate" policies for the two environments respectively. If the underlying structure is S, then enacting the new policy initiative a_N causes a net loss in welfare. Thus, recognition of the appropriateness of a_N for the particular economy is crucial.

The status quo policy a_S is assumed to be one

whose efficacy for the economy is already well understood, and we normalize the gain (over and above what can already be achieved) to continuing with it in either state as 0. There is a cost c to enacting the new policy initiative, while the potential gain from it in national income is denoted by Δ. This gain, however, occurs only in state N, and even then with probability p. Thus, given the assumed technology, a success with the policy a_N yields an output gain of Δ, as well as valuable information that it is appropriate for the economy (i.e., that the underlying state is N), and therefore should be continued. We make the following assumption to ensure that the expected net payoff from enacting a_N in state N is positive.

ASSUMPTION 1: $p\Delta - c > 0$.

If, however, the economy is of type S, then there is no gain to national income from adopting a_N, and there is a net loss in welfare since a cost c has been incurred. Alternatively, c could also be interpreted as the output from policy a_S; enacting the new policy in place of the status quo then has an opportunity cost of c, and is incurred regardless of the success or failure of a_N.

Although simple, the above payoff structure is applicable in a variety of economic policy decisions where success is often crucially dependent on an accurate understanding of external and internal market conditions—the impact of tariff reduction on trade deficits, tax cuts on government revenue, or privatization on the efficiency of public good provision. Similarly, the cost c can be any and every cost that governments incur when they move away from the status quo. These can include the cost of making compensatory transfers to interest groups that lose out, or something as simple as the cost of training the bureaucracy to effectively administer the new policy. Similarly, if the issue being studied is conflict, the gain Δ from taking the new policy may well be the "peace dividend." Here the state of the world, which helps determine a policy's success or failure, could be the morale or preparedness of the enemy.

B. Politicians and Voters

The government is assumed to be run by an elected politician. Politicians differ in their ca-

pability to acquire or process information about the appropriateness of policies for the economy, and can be one of two types: either of high ability H, or of low ability L. In order to keep the analysis simple, we assume that a high-ability incumbent receives a perfectly reliable signal about the state of the world, i.e., he knows the true state of the world for sure. On the other hand, a low-ability politician only receives a signal x from the interval $[\underline{x}, \bar{x}]$. The probability of receiving a particular signal depends on the state: if the true state is S, then the density function for signal x is given by $\phi_S(x)$, while if the state is N, then the density is $\phi_N(x)$. We make the following assumptions on these densities.

ASSUMPTION 2: $g(x) = [\phi_N(x)/\phi_S(x)]$ is strictly increasing in x, with $g(x) \to 0$ as $x \to \underline{x}$, and $g(x) \to \infty$ as $x \to \bar{x}$.

This assumption (the monotone likelihood ratio property) implies that a higher value of the signal x corresponds to a greater likelihood that the state is N. If the prior about the state being N is given by π_0, then on seeing the signal x, a low-ability incumbent's belief that the state of the world is N is given by

$$b(x) = \Pr[N|x] = \frac{\pi_0 \phi_N(x)}{\pi_0 \phi_N(x) + (1 - \pi_0)\phi_S(x)}.$$

Assumption 2 implies that this posterior belief $b(x)$ is increasing in x. Since this belief will play a central role in the decision-making process of a low-ability government, we shall treat it directly as a random variable. Define

$$F_i(b) = \Pr[b(x) \le b|i]$$

$$= \Pr\left[x \le g^{-1}\left(\frac{1 - \pi_0}{\pi_0}\frac{b}{1 - b}\right)\Big|i\right],$$

where $i \in \{S, N\}$. Note that since the belief about the state being N is increasing in x, we have $F_N(b) \le F_S(b)$.

We assume that politicians care both about welfare of the population, as well as their own future electoral prospects. The latter may be because being in office gives them some private nonappropriable "ego rents." We capture this by

assuming that an incumbent's objective function is:

$$(1) \quad W_P = \gamma(\text{National Welfare})$$

$$+ (1 - \gamma)(\text{Prob. of Reelection})$$

where $\gamma \in (0, 1)$, is the relative weight that it puts on national welfare.[4]

Let us suppose that at the beginning of its term, public perception about the new government being of high ability is given by λ. At the end of the term, the government faces an election. There is a single representative voter who cares about her welfare (in this case, the net national income over the electoral cycle, after accounting for costs and benefits from policy) and thus would like to elect the most able government, i.e., one which is more likely to identify "appropriate" policies for the economy. This focus on a representative voter is deliberate, since we wish to explicitly minimize inefficiency in government decision-making due to voter heterogeneity and ideology. To this end, we assume that all voters (and incumbents) share the same prior π_0 on the effectiveness of the policy a_N for the economy, i.e., all believe the state to be N with probability π_0.

At the end of the term, a challenger is randomly drawn and public perception about his ability is given by ω, where ω is distributed over [0, 1] according to a distribution with cumulative distribution function (c.d.f.) given by $G(\omega)$. This perception may be on the basis of the challenger's performance in other arenas or through an unmodeled "charisma factor." Thus, if the voter's end-of-term assessment about the incumbent's ability is R, then the incumbent's *ex ante* probability of being reelected is $G(R)$.

C. *The Timing of Decision-Making*

At the beginning of its term ($T = 0$), the new government has for a limited time a "window of opportunity" to change the existing policy a_S.[5]

It receives a private signal about the appropriateness of the policies, i.e., the state of the world, and then faces the choice of either maintaining the status quo policy a_S or enacting the new policy a_N. If it decides to maintain the status quo, then output remains the same. On the other hand, if the new policy is enacted, a cost c is initially incurred and both the government and the electorate learn about its impact on output, which is realized midterm (i.e., at the beginning of $T = 1$). If the new policy turns out to be successful, everyone infers that the state is N, and therefore a_N is the appropriate policy. However, in the case where the gain of Δ is *not* realized, it is not clear whether this failure is due to a random draw or due to the policy being an inappropriate one; the government now faces the important decision of continuing with its policy initiative a_N or reverting back to the initial status quo a_S. If it continues with a_N, it again incurs a cost c, and its impact on output (i.e., Δ or 0) is observed before the election.[6] Thus the setup of the model gives the government a chance to experiment, learn, and react to the information thereby generated. The decision tree for a government, along with the timing of events, is shown in Figure 1.

The representative voter makes inferences on the ability of the incumbent based on the sequence of policy choices as well as the realization of their impact on output, and chooses either to reelect or throw out the government at the end of the term.

D. *Benchmark Case: Socially Efficient Decision-Making*

The focus of our analysis is to study the impact of electoral imperatives on a government's policy choices. In order to facilitate this examination, we study as a benchmark case, the policy choices of a government which cares *only* about national welfare.

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[4] All politicians here put the same relative weight $1 - \gamma$ on continuation in office. Incorporating differences in γ will introduce multidimensional differences across politicians, adding considerably to the model's complexity.

[5] This simplifying assumption can be relaxed, without altering the qualitative nature of our equilibrium [see the

working paper (Majumdar and Mukand, 2004) for a discussion on this issue].

[6] While we have assumed that the probability of success in state N viz. p, is the same in both periods, some policies may take time to show benefits. This can be easily incorporated into the model by assuming different probabilities of success p_1 and p_2 in the two periods; the general nature of the analysis remains similar.
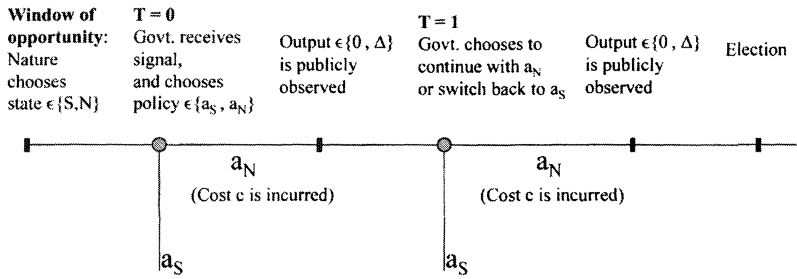
FIGURE 1. THE TIMING OF EVENTS

Since by assumption a high-ability incumbent receives a perfectly informative signal, he will always choose a policy in accordance with his private signal. Thus, he will find it optimal to enact a_N if he receives a signal that the state is N, and even in case of a first-period failure, he will optimally persist with a_N since by Assumption 1, $p\Delta - c > 0$. Similarly, if the signal is that the state is S, then a high-ability incumbent will choose to maintain the status quo policy a_S.

The low-ability incumbent receives a signal x which is only imperfectly correlated with the state of the world. So his efficient policy choices will be a function of the strength of this signal. Thus in analyzing the choices of a low-ability incumbent, there will be two cutoff beliefs, b_0 and b_1 [corresponding to two cutoff signals x_0 and x_1, with $b_0 = b(x_0)$ and $b_1 = b(x_1)$] with $b_0 < b_1$. Only if his belief about N exceeds b_0 will he enact policy a_N at $T = 0$. In the event of a success, it becomes clear that a_N is the appropriate policy. If, however, the realized midterm output from policy a_N is 0, the incumbent then updates his initial belief b (about the state being N) to $(1 - p)b/[(1 - p)b + 1 - b]$. In this case, those incumbents with beliefs between b_0 and b_1 will revert back to the status quo policy a_S, while only those with initial beliefs greater than b_1 will persist.

Indifference between continuing with a_N and switching back to a_S gives the efficient cutoff level of belief for $T = 1$ as

$$b_1^{\textit{eff}} = \frac{c}{p[c + (1 - p)\Delta]}.$$

A similar analysis of choices in the initial period gives the efficient cutoff level of belief for enacting a_N at $T = 0$ as

$$b_0^{\textit{eff}} = \frac{c}{p(\Delta + p\Delta - c)}.$$

To summarize, if the incumbent's belief about the state being N is greater than $b_0^{\textit{eff}}$, he will take the new policy initiative a_N, but only if his belief exceeds $b_1^{\textit{eff}}$ will he persist with this policy even if it does not find midterm success.

In this section we analyzed the benchmark case of an incumbent who cares *only* about the welfare of the representative voter. We now relax this extreme assumption of a purely benevolent politician and allow him to be also concerned about his future electoral prospects.

II. Policy-Making and the Electoral Imperative

Governments do care about national output and voter welfare. Electoral concerns, however, often weigh heavily on the policy choices they make. Since the representative voter's welfare here is a function of the ability of the government in identifying appropriate policies, she will always prefer to reelect the incumbent if his perceived ability is greater than that of the challenger. Therefore, voters attempt to glean all possible information that they can about the government's ability from its policy choices. In the face of uncertainty, experimentation with a new policy will result in learning about the appropriateness of alternative courses of action. However, a government that appears to learn from its performance and switches policies will be perceived not to have been confident about its choice of policy in the first place, since more able governments do not need to learn as much. Once account is taken of this signaling aspect of policy choices, inefficiencies may arise both in

the adoption of new policies as well as in the scrappage of adopted policies.

Let us consider a Bayes-Nash equilibrium of this political game in which the incumbent's objective function [given by (1)] contains both elements of national welfare considerations as well as its own reelection concerns. It will consist, for each type of incumbent, of a strategy for the initial period, i.e., whether or not to enact the new policy a_N, contingent on the private signal that it receives. If it decides to experiment, it will also have to decide whether or not to persist with a_N (or to revert back to a_S) after realization of the midterm output. Based on their observation of both outcomes as well as the sequence of policy choices, voters form (consistent) expectations about the government's ability and decide whether or not to reelect the incumbent.[7]

We begin by proposing the following equilibrium structure: high-ability governments always choose policies in accordance with their private signal. So they enact a_N only if the signal indicates that the state is N, but having done so, persist with a_N in the second period even in the case of a failure. For a low-ability government with the signal x, it takes the policy initiative a_N only if its belief $b(x)$ exceeds a certain cutoff value b_0^*. In the event that an output gain of Δ is realized by the middle of the term, it continues with a_N in the second period. However, in the case of failure, it persists with a_N only if its initial belief $b(x)$ exceeded the cutoff value b_1^*, where $b_1^* > b_0^*$; those with initial beliefs between b_0^* and b_1^* revert back to a_S.

We now analyze the equilibrium in more detail, starting with the second period.

A. The Second Period: Policy Persistence in the Face of Failure

Payoffs from the first-period policy choice are publicly realized at the beginning of the second period; thus if the initial policy choice was a_N, then the midterm results reveal (at least partially) the appropriateness of this policy for the economy. If the experiment resulted in an

output gain of Δ, everyone infers the state to be N, and the suitability of a_N is established; in such an event it is thus logical to continue with a_N.

On the other hand, if there has been no gain in output, then both the public and the low-ability incumbent downgrade their belief about the appropriateness of a_N. The incumbent now has two choices: either to persist with a_N or to revert back to the original status quo policy a_S. In the proposed equilibrium, a high-ability politician never switches back. Thus, if a government chooses to abandon policy a_N midterm, then the voter infers that it must be one of low ability.

If, however, the incumbent chooses to persist with a_N, then the voter is not sure whether it is one of high ability or if it is a low-ability type with a high enough belief (i.e., exceeding b_1^*). For the incumbent, persisting with a_N even in light of a midterm failure is a gamble: it may yield an output gain of Δ in the second period and a reputational boost. In particular, if despite a first-period failure the policy ends up successful in the second period, the voter's end-of-term assessment of the incumbent's ability is given by

$$R_S(b_1^*) = \frac{\lambda}{\lambda + (1 - \lambda)[1 - F_N(b_1^*)]}.$$

The other possibility from persisting with a_N is that it may fail in the second period, too. This further lowers the voter's personal belief about the appropriateness of a_N to $\pi_2 = (1 - p)^2 \pi_0 / [(1 - p)^2 \pi_0 + (1 - \pi_0)]$, and his assessment of the incumbent's ability in the event of failure is analogously given by

$$R_F(b_1^*) =$$

$$\frac{\lambda \pi_2}{\lambda \pi_2 + (1 - \lambda)[\pi_2(1 - F_N(b_1^*)) + (1 - \pi_2)(1 - F_S(b_1^*))]}.$$

As expected this reputation is lower than that under success, i.e., $R_S(b_1^*)$. Note that in our model, there is a dynamic sorting of types—all L types with beliefs below b_1^* shift back to the status quo a_S. Therefore, as b_1^* rises, the reputations of those who continue increase.

Overall, persisting with a_N even in the face of midterm failure yields an expected gain in output of $[(1 - p)b_1^*/(1 - pb_1^*)]p\Delta - c$, and a gamble over electoral prospects, with reputation

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[7] As we show in the proof of Proposition 1, in equilibrium the expected output is increasing in the ability of the incumbent, and hence the electorate would indeed wish to elect governments with a higher perceived ability.

in the events of success and failure given by $R_S(b_1^*)$ and $R_F(b_1^*)$, respectively. For an incumbent with belief b_1^* to be indifferent between persisting with a_N or switching back to a_S (and risk being immediately identified as being of low ability by the voters), we must have:

$$
(2) \quad \gamma \left\{ \frac{(1-p)b_1^*}{1-pb_1^*} \, p\Delta - c \right\}
$$

$$
+ (1-\gamma) \left\{ \frac{(1-p)b_1^*}{1-pb_1^*} \, pG(R_S(b_1^*)) \right.
$$

$$
\left. + \left(1 - \frac{(1-p)b_1^*}{1-pb_1^*} \, p \right) G(R_F(b_1^*)) \right\} = 0.
$$

Note that the incumbent's reputation from persisting with a_N [both $R_S(b_1^*)$ and $R_F(b_1^*)$] is always positive. Therefore the first term on the left-hand side of the above equation (which is the expected output from persisting with a_N) must be negative. This implies that there are beliefs under which *persisting with the policy is inefficient, yet the incumbent finds it optimal to do so.*[8]

This tendency for governments to *not* learn, but rather persist with a publicly discredited policy, gives rise to the following question. In the first period, will a newly elected government ever initiate a policy experiment when it is fully aware that it is unlikely to have the incentive to learn from its performance? We turn our attention to this question next.

[8] This result can be generalized to a model with a continuum of types (see the working paper, Majumdar and Mukand, 2004). In the version of the model presented here, while there are two types of governments, following the realization of beliefs, the *ex ante* difference between the types disappears. For example, an *H*- type government who gets perfect information that the state is *N*, is identical to an *L* type with the belief $b(x) = 1$, and their decisions will be the same. This feature of the model means that even if there were a continuum of types differing in their probability of getting a perfect signal (as we develop in the working paper version, Majumdar and Mukand, 2004), the equilibrium structure will again involve only two cut-off beliefs b_0^* and b_1^*, with all types with beliefs above b_0^* enacting a_N and only those with beliefs above b_1^* persisting in the face of failure. Secondly, in this modified model, the mean reputation from switching is not 0, but it is still discretely lower than either of the reputations from persisting, i.e., R_S and R_F. So the inefficient persistence result holds there too.

B. *The First Period: Inefficient Policy Experimentation?*

We now examine a new government's incentives in deciding on its first-period choice on whether or not to experiment with the policy initiative a_N. It recognizes that while a success would enhance its reputation amongst the electorate, a failure may need to be accompanied by a politically costly reversal in policy. On the other hand, maintaining the status quo a_S means that there is no gain in national output, while voters' perception of the ability of a government that does so is given by

$$
(3) \quad R_{\text{status quo}}(b_0^*) = P(H|a_S) =
$$

$$
\frac{\lambda(1-\pi_0)}{\lambda(1-\pi_0) + (1-\lambda)[\pi_0 F_N(b_0^*) + (1-\pi_0)F_S(b_0^*)]}.
$$

In equilibrium, the status quo is maintained both by high-ability incumbents who know the inappropriateness of the alternative (i.e., that the state is S), as well as by low-ability governments whose private belief is below b_0^*. As b_0^* increases, it becomes more likely that a government which maintains the status quo a_S is of low ability; thus $R_{\text{status quo}}$ is decreasing in b_0^*.

Taking the policy initiative a_N can result either in midterm success or failure. If the experiment works and yields an output gain of Δ by the middle of the term, the voter learns that the incumbent had initially chosen the "appropriate" policy and (as with success in the second period) his perception about the incumbent's ability is given by $R_S(b_0^*)$. As one would expect, successful policy experimentation boosts reputation above λ. However (as $b_0^* < b_1^*$), it is smaller than $R_S(b_1^*)$, the public perception about a government that persists with a_N even in the face of failure and ultimately achieves success. This is related to the dynamic nature of our game in which the separation of types takes place temporally: as more of the L types drop out over time, anyone who persists with a_N is likely to see his reputation enhanced.

On the other hand, a_N may not result in an output gain by the middle of the term. In this case, abandoning the policy in favor of the original status quo a_S reveals the government to be of low ability and has disastrous political consequences. Thus, in evaluating the conse-

quences of enacting a policy experiment a_N versus maintaining the status quo a_S, a low-ability government with the marginal belief b_0^* will be indifferent between the two options if:

$$(4) \quad \gamma[pb_0^*(\Delta + p\Delta - c) - c]$$
$$= (1 - \gamma)[G(R_{\text{status quo}}(b_0^*)) - pb_0^*G(R_S(b_0^*))].$$

In making its choice, the government balances its national welfare considerations (given by the left-hand side of the equation) against its electoral gamble (represented on the right-hand side). As the low-ability incumbents become more discerning in their decision to experiment, i.e., as b_0^* increases, the reputation from maintaining the status quo diminishes, while that from successful experimentation is enhanced. This of course encourages more low types to experiment, thereby pushing down the belief of the marginal experimenter b_0^*. Therefore under suitable conditions on the end points, there exists a unique value of $b_0^* \in (0, 1)$ that satisfies the above equation.

An additional consideration for the above structure to be an equilibrium is that b_1^* should exceed b_0^*, i.e., it is inoptimal for the marginal first-period experimenter to persist with a_N in the face of midterm failure. Since the two equations (2) and (4) for determining b_1^* and b_0^* are independent of each other, it is therefore possible that *all* incumbents who start with policy a_N will persist with it, even in the face of failure. Assumption 3 below gives a sufficient condition under which b_0^* is less than b_1^*. If the probability of success p is high, then the updated beliefs following a first-period failure are pessimistic enough so that only for very high initial beliefs b_1^* will the government choose to persist with a_N. Secondly, comparing gains from the two periods, success in the first period has the additional option value $p\Delta - c$ of implementing a_N in the second period too. When this value is high, it will push b_0^* to be low, and lead it to be lower than b_1^*. Also note that b_1^{eff} exceeds b_0^{eff}; thus if the relative weight on output γ is high enough, then b_0^* will be below b_1^*. All of these effects are captured in the assumption below.

ASSUMPTION 3: $(2 - p)(\Delta/p\Delta - c) < (\gamma c/[1 - \gamma])$.

The following proposition summarizes our preceding discussion and its proof (given in the Appendix) completes the argument for demonstrating the existence of equilibrium.

PROPOSITION 1: *Under Assumptions 1–3, the unique equilibrium of the political game has the following structure: there exist b_0^* and $b_1^* \in$ (0, 1) with $b_0^* < b_1^* < b_1^{\text{eff}}$, such that (i) in the first period, only those low-ability governments with beliefs $b(x) \geq b_0^*$, and high-ability governments who are informed that the state is N, experiment with the new policy initiative a_N; all others maintain the status quo policy a_S. (ii) If an output gain of Δ is not realized in the first period, then in the second period both low-ability governments with beliefs $b(x) \geq b_1^*$, and high-ability governments who are informed that the state is N, persist with the policy a_N; all others switch to a_S.*

In making its policy choice the government faces a trade-off between its own electoral chances and national income. The above proposition demonstrates the existence of an equilibrium where an incumbent's electoral imperatives affects policy decisions in both periods. The first notable aspect of the equilibrium is that it shows the possibility of inefficient persistence with a previously enacted policy. Since a high-ability government already knows the appropriate policy sequence to be adopted, it has nothing to learn from a policy's performance. In contrast, an incumbent that flip-flops by changing policies after a poor realization of output, suggests indecision and a lack of confidence in adopting the policy in the first place. It is fear of the adverse electoral impact that such a policy reversal entails, which gives the incumbent an incentive to ignore useful information produced by experimentation and inefficiently persist with a policy that he no longer believes to be optimal. The second notable aspect of the equilibrium is that in the first period, anticipation of getting mired in a policy quagmire affects the government's decision of whether or not to experiment. Balancing it is the possibility of significant electoral gains in the event that the experiment is successful (as opposed to maintaining the status quo). Thus, there is no reason why b_0^* should equal b_0^{eff}. We examine both these inefficiencies in greater detail in the next section.

The above proposition demonstrates that a government's electoral concerns may introduce inefficiencies both in the initiation and scrappage of policy initiatives. Our framework is perhaps most applicable to policy experiments that are highly visible to the voting public and where introduction of the policy is closely associated with the political incumbent. Therefore our analysis is perhaps more relevant for cases such as experimentation with various "large-scale" economic reform packages in different countries in Latin America, institutional innovations such as the currency board in Argentina,[9] dollarization in Ecuador, and "big-bang" privatization in Russia. Inefficient persistence is perhaps seen most sharply in the foreign policy arena. For example, it is difficult to avoid the impression that President Lyndon Johnson's decision to persist with (and escalate) the conflict in Vietnam was a last ditch gamble to preserve his reputation and save his presidency (see Tuchman, 1984).[10]

An appealing aspect of our dynamic signaling framework is its analytical simplicity. Two features of our framework help achieve this. First is the assumption that one type is perfectly informed about the underlying state. While important, this assumption is not crucial and can be relaxed somewhat (see the working paper, Majumdar and Mukand, 2004). The key distinctive feature of our model is best seen by considering equation (2), which determines the second period cutoff belief b_1^*—it is independent of the first-period cutoff belief b_0^*. This feature of the model, which is analytically convenient and holds even if we extend the model to more periods, is due to two reasons. Firstly, for those continuing with a_N, everyone deduces that their belief must be above b_1^*, and thus their reputation is only a function of b_1^*. Secondly, the reputation from switching back to policy a_S is independent of b_0^*. This feature is true even in a more general version of the model where there
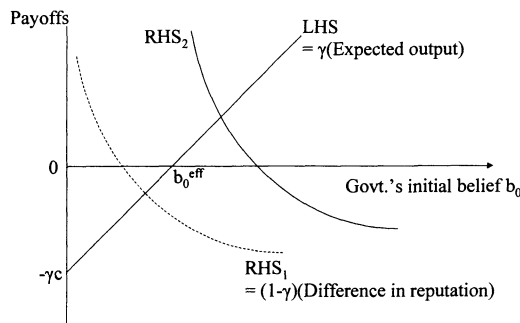

FIGURE 2. EQUILIBRIUM DECISION FOR AN L TYPE IN THE FIRST PERIOD, OBTAINED FROM EQUATION (4)

is a continuum of types (see the working paper, Majumdar and Mukand, 2004), and when there are more periods under consideration.

C. Comparative Statics

Some new governments that are uncertain may wish to adopt the new policy, but are wary that the experiment may result in a low output and reveal it to the voter to be of low ability. Others may believe that the new initiative is unlikely to work, yet may adopt it as a gamble to bolster their reputation and the resulting electoral prospects. This decision on whether or not to experiment with the uncertain policy initiative a_N, as captured by (4), weighs a possible gain in output (given by the left-hand side of the equation) against the difference in expected reputation from the two courses of action (given by the right-hand side). The trade-off is illustrated in Figure 2, which also depicts the fact that for different values of the parameters, the right-hand side of (4) may intersect the left-hand side either to the left or to the right of b_0^{eff}. Therefore, compared with efficient decision-making, a low-ability government may be *more* or *less* likely to experiment with a new policy initiative in the first period. If $b_0^* > b_0^{eff}$, then there are situations when the expected output from implementing a_N is positive, yet the government chooses not to do so [i.e., for $b_0 \in (b_0^{eff}, b_0^*)$]. Conversely, when $b_0^* < b_0^{eff}$, the government is too liberal in the sense that there are situations when expected output from implementing a_N is negative, and yet it does so.

Thus, depending on the parameters, the government's first-period policy choice may be ei-

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[9] Consistent with our focus on reputational considerations, Paul Krugman argues that (*The New York Times*, July 15, 2001) "Mr. Cavallo ... is understandably unwilling to abandon his creation. It would be a humiliating blow to his and his government's credibility."

[10] As argued by Herbert Y. Schandler (1977), "Johnson found it politically and personally impossible to change publicly the policy that he had tenaciously pursued for so long."

ther too conservative (in the sense of choosing to retain the status quo a_S when adopting a new policy would be optimal) or too radical (in the sense of taking a new policy initiative when it is not needed). The following proposition discusses the effects of some of the parameters on this choice and also summarizes the comparative static results on the second-period decision threshold b_1^*.

PROPOSITION 2: *Assume that the conditions of Proposition 1 hold. Then an L-type government's policy choices will be such that:*

(1) *it is inefficiently conservative in experimenting with a new policy in the first period, i.e.,* $b_0^* > b_0^{eff}$ *if either (i) the opportunity cost of experimentation c is sufficiently small, or the potential gains Δ or p is sufficiently large, or (ii) there is a sufficiently high ex ante probability that a low-ability incumbent will receive accurate information, i.e., if $F_N(b_0^{eff}) < (1 - \pi_0)[1 - F_S(b_0^{eff})]$.*

(2) *the likelihood of inefficiently persisting with a_N in the face of failure is decreasing in the output Δ, the initial reputation λ, and increasing in the cost of experimentation c.*

In making its decision of whether or not to experiment with a new policy, under what conditions is a government likely to be inefficiently conservative or inefficiently radical? As the above proposition demonstrates, a randomly drawn government is *less* likely to experiment especially when the economic payoffs are large and/or the cost of experimentation is small. While this might seem somewhat surprising, it accords well with our emphasis on the reputational underpinning of inefficient policy gambles. For instance, lower costs and larger potential gains make it more likely that *all* governments (irrespective of ability or information) have a greater incentive to enact a_N. Thus any reputational (and electoral) gain from successful experimentation is likely to be relatively small—thereby making a government more reluctant to experiment in the first place. Ipso facto, a government is more likely to gamble precisely when the public perceives the costs of such a gamble to be large. Therefore, in making unpopular and risky policy choices, some leaders take a gamble in the hope that the experi-

ment succeeds and yields a reputational payoff—be it the decision to experiment with a neo-liberal economic reform package, "big-bang" privatization, or even the decision to embark on a foreign intervention.

To cite one example, consider the unfolding of President Perez's experiment with neo-liberal policies in Venezuela (documented in detail by Weyland, 2002, pp. 110, 135). On assuming office in 1990, (in accordance with our first-period result) he decided to ignore the advice of members of his economic team and initiated an extreme neo-liberal reform package (drastic privatization, elimination of subsidies, controls on the exchange rate and interest rate, etc.). However, as it got implemented, the inappropriateness of the drastic experiment became clear when it was met with large-scale riots. In the face of widespread opposition (and consistent with the prediction of Proposition 1), "Perez refused to compromise and insisted on sticking to the original plan." Indeed at this later stage even the IMF suggested that he delay the pace of the experiment. Finally however, his luck ran out since despite persistence with his economic experiment, the economy still did not recover, resulting in his losing office in May 1993.

On the other hand, under condition 1(ii) above, the government is likely to show an inefficiently high degree of conservatism. When the random chance that an L type gets a high enough signal in state N [i.e., $1 - F_N(b_0^{eff})$] is big, then the reputational boost from a successful experiment is likely to be relatively small. This reduces the incumbent's desire to gamble by experimenting with the new policy initiative. If condition (ii) does not hold, then the incumbent's initial reputation λ plays an important role in its decision to experiment or not. In particular under some conditions (e.g., uniformity of G), incumbents with a low initial reputation are more likely to be tempted to inefficiently experiment (hoping that such a gamble pays off in resurrecting their electoral chances), while those with high initial reputations will tend to be inefficiently conservative.

In contrast, the impact of a higher initial reputation on the second-period decision is to exacerbate the degree of inefficient persistence with a failing policy. As this initial reputation λ increases, so does the electoral payoff [both $R_S(\cdot)$ and $R_F(\cdot)$] from continuing, resulting in a decrease in b_1^*. In other words, the higher the

initial reputation of any low-ability incumbent, the more reluctant he would be to switch back to the status quo a_S, since such an incumbent stands to lose most reputationally (and electorally) from a policy reversal. Finally, an increase in the economic gains Δ or a decrease in the cost c results in greater persistence, i.e., b_1^* falls.

III. Additional Considerations

In this section we briefly discuss some additional aspects of the basic framework.

A. Cost of Experimentation and the Degree of Inefficiency

Experimenting with the new policy initiative entails costs. As mentioned earlier, these may be costs of administering a new policy and/or making compensatory transfers to potential "losers," or the output from the status quo policy. In analyzing the welfare impact of changes over time in the opportunity cost of experimentation, consider a slightly modified version of the model in which the first-period cost of enacting the new policy is c_0 and the second-period cost is c_1, with c_0 not necessarily being equal to c_1. A decrease in c_0 has the effect of raising the reputation from maintaining the status quo policy, while it lowers that from achieving success with policy a_N. From an electoral point of view, it thus makes maintaining the status quo more attractive and therefore, if the incumbent was too conservative in enacting policy a_N in the first place, then any lowering of c_0 exacerbates the degree of inefficiency. Hence, somewhat surprisingly, a lowering of the cost of experimentation worsens matters, precisely when the Δ is large or p is high (i.e., when $b_0^* > b_0^{eff}$). In contrast, a decrease in the second-period cost of experimentation c_1 reduces the degree of inefficiency.

B. Reputation and Ideology

In our benchmark model we have suppressed ideological predilections of the government in power. While clearly important, the role of ideological factors in explaining a government's policy decisions should not be exaggerated—many policies engender relatively low dimensional conflict amongst voters (e.g., war,

foreign policy, inflation). Nevertheless, the introduction of ideology into the model may yield interesting insights.

So far, we assumed that the initial priors on the state being N, i.e., π_0, are common between the incumbent and the electorate. A simple way to introduce ideological considerations in the model would be to assume (as in Harrington, 1993) that the incumbent's prior beliefs π^I are different from the citizen-voter's beliefs π_0.[11] Furthermore, this difference in priors is assumed to be known to the electorate. For example, a "conservative" government may be commonly identified as being a strong believer in the efficacy of certain types of policies (e.g., the status quo).

The structure of the preceding analysis is unchanged except that as π^I increases, then for any received signal x, the government's belief on the state being N becomes stronger in the sense of first-order stochastic dominance, i.e., $F_i(b) = \Pr[b(x) \le b|i] = \Pr[x \le g^{-1}(\{(1 - \pi^I)/\pi^I\}\{b/(1 - b)\})|i]$ decreases. Given this, any time a government with a higher π^I maintains the status quo, its reputation is higher; at the same time, its reputation from achieving success with the policy a_N is lower. Together, they imply that a government that is known to be *ex ante* more optimistic about the policy a_N (i.e., one with a higher π^I), will in fact be more conservative in adopting it, and the bias in the first period is more likely to be in favor of the status quo. On the other hand as π^I increases, inefficient policy persistence in the second period is likely to be lessened, since now the reputations from continuing, i.e., both $R_S(b_1^*)$ and $R_F(b_1^*)$, are lower.

Politicians are typically not rewarded for changing policies too often. However, there are occasions where it seems that a politician who shows "flexibility" is electorally rewarded; the above example suggests that ideology may be part of the answer. Here, capable governments

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[11] This is perhaps the simplest way of capturing ideological considerations without altering the model's fundamental structure. Roland Benabou and Tirole (2002) show how a notion of "ideological beliefs" can arise as part of a dynamic learning process (also see Thomas Piketty, 1995, and Luis Madrazo, 2003). In our context, a more complete (and complicated) treatment of ideology would allow for heterogeneity in preferences, as well as the possibility of correlation between "ideology," beliefs, and ability.

are those that take the correct action in accordance with the underlying state. Incompetent governments try to imitate them and get their highest electoral reward by appearing to contradict their own prior. A similar point is made by Alex Cukierman and Tommasi (1998) who argue that policy changes are often implemented by unlikely parties since the credibility of a policy proposal is enhanced when proposed by such a party. In our framework, an incumbent's willingness to choose a policy that contradicts his ideological predilections is solely due to reputational reasons.

Finally, observe that a change in the electorate's initial perception about the state being N has the opposite effect on the government's decisions. It lowers the incumbent's reputation from maintaining the status quo, while that from success is unchanged (as a success reveals perfectly that the state is N). Thus, a higher π_0 means that the government will experiment more in the first period; at the same time, it also results in more inefficient persistence.

IV. Conclusion

The appropriateness of many policies for a particular economic or institutional structure is plagued by uncertainty. Given this uncertainty, governmental learning and policy experimentation take on an important role. In this paper we took a first step in analyzing the impact of electoral imperatives on a government's decision to learn through policy experimentation. Our reputational framework is perhaps particularly applicable to analyzing policy experiments that are widely visible to the public and whose initiation is closely related to the incumbent. In this framework, two kinds of inefficiencies can be identified. Early on in their tenure, governments have a tendency to gamble by either recklessly experimenting with new policies, or being inefficiently conservative by sticking to the status quo. However, over time a government acquires a reputational stake in policies that it previously enacted, and becomes inefficiently reluctant to change course.

A number of issues raised in this paper warrant further exploration. Firstly, while our analysis of ideological considerations yielded some interesting insights, it is rather preliminary. A more systematic analysis of the role of voter heterogeneity (in both beliefs and preferences) and ideology in influencing policy experimentation and persistence would be useful. A second point worth exploring is the impact of electoral imperatives on the government's incentive to experiment with and choose between policies that require a varying length of time to show results (i.e., short versus medium or long term). Of course, this would require the development of a more elaborate dynamic structure than we have here. Finally, for some policies, it is possible that the underlying state of the world changes, even if only gradually. If so, the importance of policy experimentation becomes even more acute. We leave this and much else for future work.

Appendix

PROOF OF PROPOSITION 1:

From our discussion of second-period (first-period, respectively) decision-making by low-ability governments in Section II, subsection A (section II, subsection B, resp.), the expected payoff from policy a_N is increasing in b_1 (b_0 resp.) while that from a_S is constant. Therefore, all incumbents with beliefs above b_1^* (b_0^* resp.) persist (choose a_N in the first period, resp.), while those with beliefs less than b_1^* revert back to a_S (choose a_S in the first period, resp.). Note that an H-type government who receives perfect information that the state is N (S resp.) has belief $b_0 = 1$ ($b_0 = 0$ resp.) and therefore it is optimal for such a government to enact a_N and persist with it (maintain a_S, resp.). Thus, to prove the existence of this equilibrium, we now need to show that there exist solutions to equations (2) and (4), and that $b_0^* < b_1^* < b_1^{eff}$.

Since $R_S(b)$ and $R_F(b)$ are both continuous and increasing in b, and $R_S(b) \geq R_F(b)$, the left-hand side (LHS) of (2) is continuous and increasing in b. At $b = b_1^{eff}$, LHS(2) > 0; while at $b = 0$, LHS(2) = $-\gamma c + (1 - \gamma)G[\lambda\pi_2/(\lambda\pi_2 + 1 - \lambda)]$ which is negative by Assumption 3. Thus by continuity, a solution to (2) exists, is unique and lies in the interval $[0, b_1^{eff})$. Similarly, by examining

the LHS and right-hand side (RHS) of (4), it can be shown that a solution b_0^* to equation (4) exists and is unique.

Next we need to show that b_0^* is less than b_1^*.

Let us rewrite equations (2) and (4) for determining b_1^* and b_0^* in terms of a general belief b as:

$$(2') \qquad \gamma[pb\Delta - c] + (1 - \gamma)pbG[R_S(b)] + (1 - \gamma)\left(\frac{1 - pb}{1 - p} - pb\right)G[R_F(b)]$$

$$- \gamma c \frac{p}{1 - p}(1 - b) = 0$$

$$(4') \quad \gamma[pb\Delta - c] + (1 - \gamma)pbG[R_S(b)] + \gamma pb(p\Delta - c) - (1 - \gamma)G[R_{\text{status quo}}(b)] = 0.$$

The LHS of both equations are increasing in b and we know that $b_1^* < b_1^{eff}$. So if we can show that the LHS of (2') is less than that of (4') for all $b \in [0, b_1^{eff}]$, then any solution to (4'), i.e., b_0^*, will be smaller than that for (2'), i.e., b_1^*. Thus, we require to show that:

$$\left(\frac{1 - pb}{1 - b} + \frac{p}{1 - p}\right)G(R_F(b)) + \frac{1}{1 - b}G(R_{\text{status quo}}(b)) < \frac{\gamma}{1 - \gamma}\left(\frac{pc}{1 - p} + \frac{pb}{1 - b}(p\Delta - c)\right)$$

$$\text{for } b \in [0, b_1^{eff}].$$

Note that the first part on the LHS of the above inequality is bounded above by: $(1 - pb_1^{eff})/(1 - b_1^{eff}) + p/(1 - p)$, while the second part is bounded above by $1/(1 - b_1^{eff})$. Using $b_1^{eff} = c/(p[c + (1 - p)\Delta])$ gives an upper bound for the LHS of the above inequality as: $(2 - p)[p/(1 - p)][\Delta/(p\Delta - c)]$. On the other hand, the RHS of the above inequality is bounded below by $[\gamma/(1 - \gamma)][pc/(1 - p)]$. That this expression is greater than the upper bound of the LHS is stated as Assumption 3.

Ex ante, the expected output in this equilibrium is:

$$2\pi[p\Delta - c]\{\lambda + (1 - \lambda)(1 - F_N(b_1^*))\} + \pi(1 - \lambda)[p\Delta - c](1 + p)(F_N(b_1^*) - F_N(b_0^*))$$

$$- c(1 - \pi)(1 - \lambda)\{2 - F_S(b_1^*) - F_S(b_0^*)\}.$$

This is increasing in λ, implying that the expected output from having a more able government is higher.

Observe that the above equilibrium involved all possible action-sequences being played in equilibrium, and all the actions and beliefs were determined uniquely. Thus, any other equilibrium would necessarily involve some action-sequence being not undertaken. Consider for example, a potential equilibrium where no one undertakes policy a_N in the initial period, with the associated out-of-equilibrium belief the most pessimistic possible, i.e., anyone who enacts a_N is considered to be a low type. Then for an H-type government who has received a perfect signal that the state is N, its payoff from enacting a_N is then $2\gamma[p\Delta - c] + (1 - \gamma)G(0)$, while its payoff from maintaining a_S is given by $(1 - \gamma)G(R_{\text{status quo}})$. Now, if $\gamma/(1 - \gamma)$ exceeds $1/[2(p\Delta - c)]$ (which is implied by Assumption 3), the former payoff is higher than the latter, and therefore there cannot be an equilibrium where no government enacts a_N. Under Assumption 3, one can rule out other similar equilibria and show that the equilibrium discussed in Proposition 1 is the unique equilibrium of the model.

PROOF OF PROPOSITION 2:

Observe that at $b_0 = b_0^{eff}$, the LHS of equation (4) is 0. Therefore, whether $b_0^* \gtrless b_0^{eff}$ depends on

whether the RHS of (4) (which is decreasing in b_0) at b_0^{eff} is greater or less than 0, i.e., $b_0^* \gtrless b_0^{eff}$ according as

$$(5) \quad G\left(\frac{\lambda(1 - \pi_0)}{\lambda(1 - \pi_0) + (1 - \lambda)\left[\pi_0 F_N\left(\frac{c}{p[\Delta + p\Delta - c]}\right) + (1 - \pi_0)F_S\left(\frac{c}{p[\Delta + p\Delta - c]}\right)\right]}\right)$$

$$\gtrless \frac{c}{\Delta + p\Delta - c} G\left(\frac{\lambda}{1 - (1 - \lambda)F_N\left(\frac{c}{p[\Delta + p\Delta - c]}\right)}\right)$$

(i) The impact of parameters c, Δ, and p follows from the fact that the LHS of (5) is decreasing in $c/[p(\Delta + p\Delta - c)]$ while the RHS is increasing in $c/[p(\Delta + p\Delta - c)]$.

(ii) $F_N(c/[p(\Delta + p\Delta - c)]) < (1 - \pi_0)(1 - F_S(c/[p(\Delta + p\Delta - c)]))$ implies that $R_{\text{status quo}}$ exceeds R_s, both evaluated at b_0^{eff}. As $c/[p(\Delta + p\Delta - c)] < 1$, it implies that the LHS of (5) > RHS and thus $b_0^* > b_0^{eff}$.

The comparative static results on b_1^* follow similarly from analyzing equation (2).

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