BETTER STATISTICS, BETTER ECONOMIC POLICIES?*

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Abstract

More and more economic transactions leave a “digital footprint”. This trend opens unprecedented opportunities for improving economic statistics and underpins demands to give statistical agencies far-reaching access to private-sector data. We analyze the consequences of better economic statistics in a political-agency framework that includes fundamental uncertainty about the impact of potentially welfare-enhancing reforms. We demonstrate that improvements in economic statistics can inhibit—rather than stimulate—reform attempts. With better statistics, the government is less likely to receive the “benefit of the doubt” if the numbers suggest its past reforms are failing. Reforms therefore come with a higher risk of electoral losses, implying that the government has stronger incentives to preserve the status quo. We identify political environments that are particularly vulnerable to this mechanism and contribute to the debate on private-sector data access.

Keywords: Digitalization, economic statistics, political economy, reforms, uncertainty

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1 Introduction

In recent years, the amount of data available in digital form has been expanding fast (see, e.g., National Academies, 2017). An ever-growing number of devices generate data on people and businesses. More and more economic transactions automatically leave a “digital footprint”. These developments promise unprecedented opportunities for statistical offices in charge of key economic indicators such as GDP growth, inflation, and job creation (see, e.g., Coyle, 2014; Karabell, 2014; Jarmin, 2019). Sample frames can be broadened and data access accelerated at low cost. Proxy indices, useful inputs into estimations when timely survey data is missing, can be made more informative. More generally, “big data” offers opportunities to broaden the set of economic indicators with a view to specific evaluation tasks. To take advantage of these opportunities, statistical agencies around the world demand statutory changes that would give them the legal right to regularly access large amounts of private-sector data. The European Statistical System (2017, p. 2), for instance, suggested that the European Commission come up “with relevant provisions that would establish a general principle of access to privately-held data which are of public interest.”¹ The extent to which democratic societies should accede to such demands is among the key policy questions of our time. The present paper contributes to the current debate from a political-economy perspective.

Currently, official economic statistics suffer from several limitations. For one, economists have documented that GDP estimates are often imprecise and subject to large revisions (e.g., Croushore, 2011; Manski, 2015). As a result, policy makers and business leaders face significant uncertainty when consulting the latest estimates to gauge whether the economy has been gaining or losing momentum recently. At the same time, economists increasingly mind that the results of reforms and new programs are often context-specific and therefore hard to predict with accuracy (Manski, 2013).² So there is a rising interest in concepts such as growth diagnostics (Rodrik, 2010) and experimentation at scale (Muralidharan and Niehaus, 2017), i.e., approaches that emphasize “[policy] experimentation as a strategy for discovery of what works, along with monitoring and evaluation.” (Rodrik, 2010, p. 41). With these concepts in mind, improvements in the precision and breadth of economic statistics are highly welcome: evaluation processes become more informative, thereby speeding up the learning process about what “works”. In fact, improving the evaluations of reforms and new programs is an important argument in the statistical agencies’ quest for new data sources.

¹The UK Statistics Authority (2016) made a similar suggestion, which found its way into the [Digital Economy Act](#) of 2017. See Bostic et al. (2016) and Jarmin (2019, p. 177) for the state of the discussion in the US.

²Muralidharan and Niehaus (2017, p. 103) note that “[governments] often roll out new government programs representing millions (...) of dollars of expenditure with little evidence to indicate whether they will work.”

It is an obvious conclusion that better economic statistics are unambiguously helpful if politicians are guided by the common interest and pursue a “dashboard approach” to economic policy. In this paper, we ask whether this conclusion will continue to hold if politicians are self-interested and subject to a common choice distortion. The answer is no. Paradoxically, better economic statistics may weaken, rather than strengthen, politicians’ incentives to initiate promising reforms if the reforms’ optimal design is subject to substantial uncertainty and must be discovered in an experimental fashion. To grasp intuitively why progress in economic statistics may “backfire”, note that ambiguities and uncertainties in economic statistics often play a prominent role in the public discourse on policy outcomes. In particular, emphasizing limitations of economic statistics belongs to a common strategy of defense used by politicians when facing negative news on the economy: point to ambiguities and uncertainties in economic statistics and then appeal to voters for the benefit of the doubt.³ In other words, politicians opportunistically use the leeway offered by statistical ambiguities and uncertainties to cast doubt on an alleged unwelcome truth. When the leeway shrinks, so our argument, this strategy becomes less effective and starting reforms means a higher risk of electoral punishment, reducing politicians’ private valuation of reform experiments. As a result, reform experiments that are beneficial from a social perspective may not be pursued.

The opportunities big data promises for economic statistics have received a lot of attention lately, and so have the associated benefits that may emerge if economic policy were determined by benevolent and pragmatic policy makers. Potential costs and risks have attracted less coverage. Some existing worries concern privacy. Abowd and Schmutte (2019) point out that more accuracy inevitably means a loss in privacy.⁴ So how should societies trade off improvements in statistics against a common desire to guard privacy and trade secrets? While we recognize potential costs and risks, this paper scrutinizes the benefits for policy-making if politicians are not of the “ideal” kind described above. We show that the putative gains can easily turn into losses. Our model isolates a robust mechanism by which an improvement in statistics used for evaluating promising, yet uncertain, reforms may eliminate the incentive of politicians to go for them in the first place. Generally, our analysis suggests that—even if worries about privacy are ignored—maximalist demands regarding private-sector data access by statistical agencies deserve great skepticism. Granting them may actually obstruct evidence-based policy-making. More specifically, when it comes to calibrating private-sector data access,

³An earlier version of this paper (Binswanger and Oechslin, 2020, Sect. 3) provides a number of concrete examples of this defense strategy. The examples come from France, the United Kingdom and the United States.

⁴Another worry is that providing the government with enormous amounts of data on firms and citizens could be a first step away from liberal democracy towards a “big nudging” society (e.g., Helbing and Pournaras, 2015).

decision makers should not disregard a country’s political environment. In Section 7, we show how our model can be applied to obtain concrete predictions about the vulnerability of different political environments to the mechanism identified in this paper.

We propose a two-period political-agency model with an electorate and two parties. The party initially in power, the incumbent, is a priori preferred and up for re-election in the second period. Power comes with a private benefit for the party leadership. The leadership of the incumbent party chooses between a status quo policy and two alternative reform policies, both of which a priori sensible. Yet, in fact, only one of them is beneficial, while the other one is harmful. Which is which depends on the unobserved state of the economy. Implementing a reform, and then observing the output estimate, permits learning. But the scope for learning is limited due to imprecise estimation. The party leaders show characteristics that are widely observed in politics: they like private benefits and can be “stubborn”. By stubborn we mean a tendency to commit to own past decisions even if the evidence suggests that they are a failure. This phenomenon features prominently in the political science literature, which points to sunk-cost bias as a key explanation. Sheffer et al. (2018, p. 304) note that “commitment in face of sunk costs is seen as the central behavioral disposition accounting (...) for decisions to extend (...) failed programs and policies.”⁵ We capture this by assuming that there are two types of party leaderships, a “pragmatic” type and a “sunk-cost” type. While a pragmatic leader changes course whenever necessary, a sunk-cost type leader does not repeal its own past reforms but sticks to them even if the evidence advises otherwise.

In this setup, more precise output estimation means that the impact of a particular reform alternative can be assessed more clearly. For the leadership of the incumbent party, a clearer assessment is a mixed blessing. On the positive side, it helps in choosing the beneficial reform in the second period, thereby lifting the expected second-period output. On the negative side, it means that a low output estimate is a stronger signal that the implemented reform is harmful. The expected cost of not repealing the reform due to sunk-cost bias is thus higher. So the electorate has a stronger incentive to replace the incumbent and is less inclined to grant its a priori preferred party the benefit of the doubt, i.e., to discount a low output estimate as a mere reflection of imprecise estimation. For the incumbent, a clearer assessment thus means that reforms come with a higher risk of losing power. As the level of precision rises, this negative effect strengthens. Eventually, it may become sufficiently strong to discourage the incumbent party from reforms. In that case, the inefficient status quo prevails.

The rest of the paper is organized as follows. The next section discusses the related lit-

⁵Sheffer et al. (2018) find that politicians are even more prone to sunk-cost bias than ordinary citizens are.

erature. Sections 3 and 4, respectively, introduce and solve the model. Section 5 focuses on welfare and the comparative-static analysis. Section 6 assesses the robustness of our findings, while Section 7 demonstrates how they can be applied in practice. Section 8, finally, concludes.

2 Literature

Several recent papers consider politicians’ incentives to learn through policy experimentation, among them Callander and Hummel (2014) and Millner et al. (2014). These papers assume exogenous political turnover or electoral competition among well-intentioned parties and explore strategic experimentation as a means to influence the information set of future policy makers. Both papers identify incentives for strategic experimentation that induce incumbents to “over-experiment”. Our framework assumes office-seeking politicians and studies how politicians’ incentives to experiment with reforms change with the informativeness of the evidence on the effect of these reforms. We show that higher informativeness can lead to “under-experimentation”. There is thus a link to other theoretical studies focusing on policy inertia and reform delay. Fernandez and Rodrik (1991) show that uncertainty about the individual effects of a reform can lead to a status quo bias. In a setup featuring uncertainty about the aggregate effects of different reforms, Mukand and Rodrik (2005) demonstrate that politicians can have incentives to stick to a policy that—while being beneficial elsewhere—is a bad fit for their own country. Binswanger and Oechslin (2015) show that heterogeneous beliefs about the uncertain consequences of alternative reforms can be an obstacle to experimentation, thereby bolstering an inefficient status quo. Spiegler (2013) considers a model in which boundedly-rational voters always attribute a change in the relevant economic indicator, which shows mean reversion, to the latest policy intervention. In that setup, anticipating voters’ disregard of mean reversion, a policy maker delays the adoption of reforms until after a sufficiently negative shock has hit.⁶ None of these papers, though, explores a possible link between better statistics, re-election concerns, and status quo bias or reform delays.

More broadly, this paper deals with the ambiguous role of information in (political) decision making. A large part of that literature focuses on transparency in agency relationships that involve career concerns. For instance, in a setting where generic expert agents differ in their ability to understand the state of the world, Prat (2005) shows that more transparency on the actions taken by an expert can hurt the principal because transparency strengthens the incentives of the agent to engage in conformist behavior. Focusing on committees of experts or

⁶As in Spiegler (2013), our setup assumes deviations from strict rationality. However, while Spiegler (2013) considers deviations by the public, we assume a behavioral bias on the part of the politicians.

politicians, Levy (2007) finds that under some voting rules a secretive committee (individual votes not disclosed) generates higher welfare than a transparent one. Considering transparency on outcomes, Bonfiglioli and Gancia (2013) show that politicians may invest more in long-term projects if the performance indicator is noisier and therefore gives them weaker incentives to focus on the short run in order to appear more talented. In a setup where an agent privately learns about the quality of an ongoing project and must decide when to abandon a bad one, Halac and Kremer (2020) demonstrate that welfare suffers if, at the outset, the public observes an imperfect signal on the project’s quality. None of these papers, however, considers a setup in which the agent must learn about alternative reform options by way of experimentation, a process that is often thought to benefit from better statistics.

Another important branch of the literature considers the acquisition of public information by committees that vote on policies involving uncertainty about which members will benefit and which ones will lose. Gersbach (1991; 2000), for instance, shows that the acquisition of relevant information prior to the vote can make a majority of members worse off, inducing the committee to choose ignorance. Our paper demonstrates that the possibility of a collective preference for ignoring (better) information on the effects of an untested policy is not a particularity of the committee setting with distributional uncertainty—the preference may also emerge if policies are chosen, and possibly revised, by office-seeking politicians.

3 Model

3.1 Basic Structure and Actors

We consider a two-period political-agency model. The list of actors includes the leaderships of two political parties, A and B , and an electorate. Party A holds political power in the first period. At the beginning of the second period, the electorate decides on whether to re-elect A or to replace it by B . The leadership of the party in power decides on economic policy, thereby affecting economic performance. Economic performance is estimated as the average output in a sample of firms, y_t^n , where $n \geq 1$ is the number of firms sampled by the statistical office and $t \in \{1, 2\}$ refers to time. Below, we detail how firms are affected by economic policy and how the statistical office computes the estimates of average firm output.

The two party leaderships care about economic performance as well as political power. The utility function of the leadership of party $j \in \{A, B\}$ is of the form

$$U^j = y_1^n + y_2^n + \delta I^j, \tag{1}$$

where I^j is a binary variable indicating which party holds power in the second period: $I^A = 1$ if party A holds power and $I^A = 0$ otherwise (I^B is defined analogously). The parameter $\delta > 0$ measures the (relative strength of the) private benefit from holding political power. It may capture ego rents (e.g., Rogoff, 1990) or any kind of personal material advantages to which politicians are entitled or that relate to opportunities for corruption.

With respect to policy-making, there are two types of party leaderships. A leadership that is of the “pragmatic” type does not hesitate to repeal its own past policy decisions whenever the evidence suggests it should; it simply maximizes the expected value of utility function (1). A “sunk-cost” type leadership, however, is subject to the corresponding bias. Political science considers sunk-cost bias to be widespread among real-world politicians (Sheffer et al., 2018). The bias makes politicians stick to a losing course of action just because they have invested resources—time, prestige, money—to bring it about. In the model, a sunk-cost type leadership deviates from the maximization of the expected value of (1) in one specific situation: if the maximization of (1) requires the leadership to repeal one of its own past reforms, it fails to do so.⁷ The probability that a leadership is of the sunk-cost type is $\varphi \in (0, 1)$. Leaderships know that they could be subject to the bias and learn their type if they are in a situation in which a decision between retaining and repealing an own past reform is due.

The electorate, too, is interested in economic performance. In addition, it has an a priori preference for one of the parties. Its utility function is represented by

$$V = y_1^n + y_2^n + \alpha I^A, \quad (2)$$

where the sign of $\alpha \lesseqgtr 0$ determines which party is preferred a priori, while the relative strength of the preference is measured by the absolute value of α . As in Besley et al. (2010), the party preference allows for the existence of additional salient political issues, orthogonal to economic policy, on which the electorate is more closely aligned with one of the two parties. A set of suitable examples would include “value issues”, for instance the degree to which foreign immigrants should be subjected to comprehensive integration requirements.

The statistical office is a non-strategic player. It collects firm-level output data, which it uses to compute y_t^n at the end of each period. Yet the office does not observe the entire universe of firms: y_t^n is based on a random sample of $n \geq 1$ firms, while the total number of firms is $N > n$. Because firms are affected by idiosyncratic shocks, the output estimates are subject

⁷Instead of making a direct assumption about behavior, one could capture sunk-cost bias within the expected-utility framework by assuming that sunk-cost types face a sufficiently large psychological cost when repealing an own past decision. We do not explicitly pursue this approach to keep the exposition as compact as possible.

to sampling error. As we will show, an increase in n reduces the standard deviation of the sampling error and hence permits more precise estimation. Since the purpose of this analysis is to identify possible consequences for economic policy if statistical offices were allowed to harness digitalization and big data to improve the precision of their estimates, the model treats n as an exogenous variable that can be increased from a lower to a higher level.

3.2 Firm Output and Economic Policy

All firms in the economy produce an identical good. Output by firm i in period t is given by

$$y_{it} = x_t + \sqrt{\sigma}\zeta_{it}, \quad (3)$$

where x_t is the random component of firm output that is affected by economic policy, ζ_{it} is an i.i.d. firm-specific disturbance with a standard normal distribution, and $\sigma > 0$ is a scale parameter.⁸ Equation (3) captures the basic idea that firms—while being subject to idiosyncratic disturbances—are affected by the general policy environment in similar ways. Following Binswanger and Oechsle (2015), we assume that there is a set of three policy options, $\{-1, 0, 1\}$, where -1 and 1 are two alternative “reform policies” and 0 is the “status quo policy”. The impact of policy option $P_t \in \{-1, 0, 1\}$ on firm output is described by

$$x_t = x(P_t, S) = \gamma P_t S, \quad (4)$$

where $\gamma > 0$ captures the economic significance of the reform and $S \in \{-1, 1\}$ refers to the unobserved state of the economy that materializes prior to the start of the game. Equation (4) implies that reform policy -1 is beneficial if $S = -1$, and vice versa. Switching from one policy to another does not involve any cost of change. So our setup mainly captures policy domains that, were it not for the political intricacies, would be particularly suitable for reform experiments. S takes each of its two possible values with probability $1/2$. This specific choice is made for analytical convenience and is not crucial for our argument. What matters is that there is some uncertainty regarding the direction of the impact of a given reform alternative. Allowing for two opposite reform options reflects reality in many policy domains (e.g., reducing vs. increasing the pace of fiscal consolidation). The model’s implications would be largely unchanged if there were only one deviation from the status quo.

⁸There is a possible micro foundation for (3): if firms face iso-elastic demand curves with two multiplicative “demand shifters”, $\exp(x_t)$ and $\exp(\sqrt{\sigma}\zeta_{it})$, y_{it} is the log of the profit-maximizing firm revenue. Moreover, note that the model’s implications would be identical if (3) included an additive constant $\chi > 0$.

3.3 Output Estimation and Policy Assessment

Each firm i observes its output, y_{it} , but does neither directly observe x_t nor ζ_{it} .⁹ If sampled, firms truthfully report output to the statistical office. The office draws a random sample of $n \geq 0$ firms. The resulting estimate of average firm output is given by

$$y_t^n = x(P_t, S) + \varepsilon_t^n, \quad (5)$$

where $\varepsilon_t^n \equiv (\sqrt{\sigma}/n) \sum_{i=1}^n \zeta_{it}$. Just like in the case of individual firms, the information available to the statistical office does not permit the separate identification of either x_t or ε_t^n (unless $P_t = 0$). Yet, although ε_t^n is generally not observed, all actors can infer its distribution. Because the firm-specific disturbances are standard normal, one obtains

$$\varepsilon_t^n \sim N(0, \sigma/n). \quad (6)$$

By definition, the sampling error associated with the statistical office's estimate is given by $y_t^n - y_t^N$. From equation (5), we conclude that $y_t^n - y_t^N = \varepsilon_t^n - \varepsilon_t^N$. Moreover, accounting for the distribution of ε_t^n , the distribution of the sampling error is given by

$$y_t^n - y_t^N \sim N\left(0, \frac{\sigma}{n} - \frac{\sigma}{N}\right). \quad (7)$$

From equation (7), it follows that an increase in sample size reduces the variance of the sampling error and hence improves the precision of the estimates. We henceforth assume that the total number of firms, N , is “very large”, such that there is virtually no limit to increases in sample size. Then, approximately, ε_t^n represents the sampling error and we can refer to

$$d \equiv \sqrt{\sigma/n} \quad (8)$$

as the standard deviation of the sampling error (formally, as $N \rightarrow \infty$, ε_t^N converges in probability to zero and $\varepsilon_t^n - \varepsilon_t^N$ converges in distribution to ε_t^n). As d falls from its maximum of $\sqrt{\sigma}$ towards 0 (i.e., as n grows large), the precision of output estimation improves and the effect of an adopted reform policy can be decided with increasing reliability. Note that the only role of the parameter σ is to scale the maximum of d . We assume that σ is large, implying that y_t^n contains little information for the purpose of reform evaluation if n is “small”.

⁹In the context of the possible micro foundation of (3), discussed in Footnote 8, this means that the two multiplicative demand shifters $\exp(x_t)$ and $\exp(\sqrt{\sigma}\zeta_{it})$ are not individually observed by the firm.

If a reform policy is implemented in the first period ($P_1 \neq 0$), all actors assess its effect on the economy. After the publication of y_1^n by the statistical office, they compute

$$q(y_1^n) \equiv \Pr[P_1 = S | y_1^n], \quad (9)$$

the ex post probability that the implemented reform has had a positive impact on firm output.

3.4 Timing and Remaining Assumptions

Prior to the start of the game, nature determines the realizations of the random variables, i.e., the state of the economy, S , the firm-specific disturbances, $\{\zeta_{it}\}_{i=1}^N$, and the leadership types. While the state and the disturbances are not directly observed by anybody, the leadership of party A learns its type if re-elected. In the first period, the leadership of party A chooses the first-period policy, P_1 ; the statistical office publishes y_1^n ; if $P_1 \neq 0$, all actors compute $q(y_1^n)$. In the second period, the electorate decides on the allocation of political power; the leadership of the party in power chooses the second-period policy, P_2 ; the statistical office publishes y_2^n , and the game ends. As none of the strategic actors has private information, this is a dynamic game with complete information. It can be solved by backward induction.

Finally, we make assumptions with respect to the parameter constellation. We impose that

$$0 < \alpha < 2\varphi\gamma, \quad (\text{A1})$$

a constellation that avoids the trivial situations in which party A is either replaced under any circumstance (if $\alpha < 0$) or re-elected under any circumstance (if $\alpha > 2\varphi\gamma$).

4 Equilibrium

4.1 Second Period

Conditional on the implementation of a reform policy in the first period ($P_1 \neq 0$), the ex post probability that P_1 is the beneficial reform, $q(y_1^n)$, plays a crucial role for the decisions in the second period. Given this, we first characterize $q(y_1^n)$ before going backwards through the sequence of decisions. The Appendix (Lemma 1) establishes that

$$q(y_1^n) = \left[1 + \exp\left(-2\gamma \frac{y_1^n}{d^2}\right) \right]^{-1}. \quad (10)$$

Equation (10) implies that q is a strictly increasing function of y_1^n . It rises from 0 (if $y_1^n \rightarrow -\infty$) to $1/2$ (if $y_1^n = 0$) to 1 (if $y_1^n \rightarrow \infty$). The higher y_1^n , the larger the probability that the implemented reform is the beneficial one (i.e., matches state S).

Now consider the decision on P_2 , which is the final decision in the second period. At this point, maximizing the expected value of utility function (1) requires the leadership of the party in power to maximize the expectation of y_2^n (equation (1)). First suppose that in the preceding period the status quo was upheld ($P_1 = 0$). In this case, no additional information about S has been revealed, implying that the expectation of y_2^n is based on the a priori probability $\Pr[S = -1] = 1/2$. Given this, it follows from equations (4) and (5) that the expected value of y_2^n equals zero for any $P_2 \in \{-1, 0, 1\}$. As a result, the decision maker is indifferent. Without loss of generality, we henceforth assume that in this situation the status quo is again preserved:

$$P_2|_{P_1=0} = 0. \quad (11)$$

Now suppose that $P_1 \neq 0$. In that case, the expectation of y_2^n is based on the ex post probability $q(y_1^n)$. As a result, maximizing the expected value of (1) requires pragmatism: P_1 must be preserved if $q(y_1^n) \geq 1/2$ and turned into its opposite otherwise. Yet pragmatism does not necessarily get its way: if party A was re-elected and its leadership is of the sunk-cost type, it will always stick to its earlier policy decision. To summarize:

$$P_2|_{P_1 \neq 0} = \begin{cases} P_1 & : \quad q \geq 1/2; \text{ or } q < 1/2 \text{ and re-elected sunk-cost type leader} \\ -P_1 & : \quad \text{otherwise} \end{cases}. \quad (12)$$

Now consider the electorate's decision problem. When allocating political power in the second period, the electorate aims to maximize the expected value of $y_2^n + \alpha I^A$ (equation (2)). If $P_1 = 0$ or if $P_1 \neq 0$ and $q(y_1^n) \geq 1/2$, the electorate's decision problem is straightforward. In both cases, the two party leaderships will act in exactly the same way: they will uphold the first-period policy decision, thereby maximizing the expectation of y_2^n —which is aligned with the electorate's preferences. As a result, the electorate can simply follow its a priori party preference and re-elect party A . However, if $P_1 \neq 0$ and $q(y_1^n) < 1/2$, maximizing the expectation of y_2^n demands a switch to the alternative reform policy (equation (12)). The electorate is therefore presented with a trade-off: re-electing party A , while being consistent with its a priori preference, entails the risk that the party leadership in charge will be of the sunk-cost type and thus fail to deliver the required policy change. The electorate is willing to

take this risk as long as $q(y_1^n)$ is not too small.¹⁰ More precisely:

PROPOSITION 1 *In the second period, the electorate replaces party A by party B if and only if a reform policy was implemented in the first period ($P_1 \neq 0$) and*

$$q(y_1^n) < \frac{1}{2} \left(1 - \frac{1}{2} \frac{\alpha}{\gamma\varphi} \right) \equiv \mu \in (0, 1/2). \quad (13)$$

When expressed in terms of the first-period output estimate, y_1^n , cutoff rule (13) is given by

$$y_1^n < uv \cdot d \equiv \underline{y}_1^n \leq 0, \quad (14)$$

where

$$u \equiv \ln \left(\frac{\mu}{1-\mu} \right) \frac{1}{2} < 0 \quad \text{and} \quad v \equiv \frac{d}{\gamma} \geq 0. \quad (15)$$

Proof. See the Appendix. ■

Only if the output estimate is sufficiently low, and hence a failure to switch to the alternative reform sufficiently costly, the electorate votes in a fresh political force to “clean up the mess”.

Figure 1 here

Figure 1 summarizes how in the second period political power and economic policy depend on y_1^n if $P_1 \neq 0$. Party A is re-elected if $y_1^n \geq \underline{y}_1^n$ and replaced otherwise. The leaderships of both parties stick to the inherited first-period policy if $y_1^n \geq 0$ (or, equivalently, if $q(y_1^n) \geq 1/2$). If $y_1^n < 0$, maximizing the expectation of y_2^n requires a switch to the alternative reform policy. Yet, if $y_1^n \in [\underline{y}_1^n, 0)$, the required switch fails with probability φ .

4.2 First Period

To determine its policy choice in the first period, the leadership of party A compares the expected utility under the status quo policy to the utility under any of the two reform alternatives. In what follows, we use $\mathbb{E}\{\cdot\}$ to denote expectations formed at the start of the first period. Moreover, we assume that the leadership opts for reform -1 when deciding against the status quo (which is without loss of generality because of symmetry). If the leadership opts for the status quo ($P_1 = 0$), party A will definitely retain power (Proposition 1) and set $P_2 = 0$ (equation (11)). So the expected sum of average firm output estimates is zero, while there is

¹⁰From this discussion, it follows that the electorate would replace party A irrespective of the values of P_1 and $q(y_1^n)$ if α were negative, i.e., if the electorate had an a priori preference for party B.

no uncertainty as to the private benefit from holding power in the second period. Accordingly:

$$\mathbb{E}\{U^A \mid P_1 = 0\} = \delta. \quad (16)$$

Otherwise, if the leadership of party A sets out for reforms (e.g., $P_1 = -1$),

$$\mathbb{E}\{U^A \mid P_1 = -1\} = \mathbb{E}\{y_1^n + y_2^n \mid P_1 = -1\} + \mathbb{E}\{\delta I^A \mid P_1 = -1\}. \quad (17)$$

The Appendix establishes how the standard deviation of the sampling error, d , affects the two components on the right-hand side of equation (17). While the upper limit of d is $\sqrt{\sigma}$ (since $n \geq 1$), the analysis in the Appendix also considers $d \rightarrow \infty$, a benchmark that is useful to study as σ can take an arbitrarily high value. It turns out that the expected sum of average output estimates, $\mathbb{E}\{y_1^n + y_2^n \mid P_1 = -1\}$, is a monotonically decreasing function of d , falling from γ towards 0 as d increases from its minimum of 0 (Lemma 2). The logic behind these properties is evident. If $d \rightarrow 0$, y_1^n reveals state S and therefore the beneficial reform policy. So the decisions taken in the second period guarantee $x_2 = \gamma$.¹¹ As d rises, y_1^n becomes a less informative signal, reducing the probability that the beneficial reform will be implemented eventually. As a result, $\mathbb{E}\{y_1^n + y_2^n \mid P_1 = -1\}$ is a decreasing function of d . Finally, if $d \rightarrow \infty$, new information about state S is no longer revealed. Hence there is an equal probability that the second-period reform will be beneficial ($x_2 = \gamma$) or harmful ($x_2 = -\gamma$).

The Appendix further establishes that a fall in estimation precision increases the chance that party A can hold on to power: the expected private benefit accruing to the leadership of party A , $\mathbb{E}\{\delta I^A \mid P_1 = -1\}$, is a monotonically increasing function of d , rising from $\delta/2$ towards δ as d increases from its minimum of 0 (Lemma 3). An increase in d entails that $q(y_1^n)$ responds less sharply to realizations of y_1^n (equation (10)). So there is a smaller chance that $q(y_1^n)$ falls short of μ , the threshold for A 's re-election.

From these results, it immediately follows that the limits of $\mathbb{E}\{U^A \mid P_1 = -1\}$ are given by

$$\lim_{d \rightarrow 0} \mathbb{E}\{U^A \mid P_1 = -1\} = \gamma + \delta/2 \quad \text{and} \quad \lim_{d \rightarrow \infty} \mathbb{E}\{U^A \mid P_1 = -1\} = \delta. \quad (18)$$

Now consider the limiting case of $d \rightarrow 0$ (reform impact unambiguously revealed ex post). For this case, equations (16) and (18) imply that the leadership of party A picks the status quo if

$$\delta > 2\gamma. \quad (\text{R1})$$

¹¹If $d \rightarrow 0$, we know that $y_1^n = 0$ (equation (14)) and that y_1^n is either $-\gamma$ or γ (equation (5), with $\varepsilon_1^n = 0$). In the former case, party B takes over, thereby ensuring that the required policy switch is implemented.

That is, if condition (R1) holds, the party leadership prefers the combination of an assured re-election and economic stagnation to the alternative combination of a one-half chance of re-election and an assured output gain in the future. In the rest of this section, we assume condition (R1) to be satisfied (and discuss the opposite constellation in Section 5). It appears natural to assume that the private benefit from holding power is large as compared to the indirect benefit of a higher average output in the future.

Figure 2 here

Assuming that condition (R1) holds, the Appendix (Lemma 4) establishes two further important properties of the relationship between $\mathbb{E}\{U^A \mid P_1 = -1\}$ and d , both of which visible in Figure 2a. First, $\mathbb{E}\{U^A \mid P_1 = -1\}$ has an interior global maximum at point $\eta > 0$. Second, there must be a decisive threshold $\theta \in (0, \eta)$ that satisfies

$$\mathbb{E}\{U^A \mid P_1 = -1\} \begin{cases} < \delta & : d < \theta \\ = \delta & : d = \theta \\ > \delta & : d > \theta \end{cases} . \quad (19)$$

Given this, we can state the main result of the analysis:

PROPOSITION 2 *Suppose that condition (R1) holds. Then, in equilibrium, the leadership of party A opts for a reform policy in the first period (e.g., $P_1 = -1$) if and only if $d \geq \theta$, i.e., if and only if output estimation is sufficiently imprecise.*

Proof. Follows from equations (16) and (19). ■

Proposition 2 is illustrated by Figure 2a. The proposition suggests that the leadership of party A behaves in a simple—if perhaps surprising—way: it starts a reform process if the standard deviation of the sampling error is sufficiently large to exceed θ ; otherwise, the status quo is preserved. So the leadership finds it optimal to experiment with reforms if and only if the reform's ex post assessment remains sufficiently vague.

4.3 The Benefit of the Doubt

A natural way to describe the logic behind Proposition 2 is to interpret the election as a hypothesis test performed by the electorate if party A has started a reform process in the first period. In this test, the Null hypothesis, H_0 , holds that party A has implemented the beneficial reform alternative. The electorate replaces party A if and only if the realization of y_1^n leads

to a rejection of the Null. To see how the precision of output estimation affects the test, note that the electorate can commit two different types of errors: a type-I error (true H_0 rejected) and a type-II error (false H_0 not rejected). All else equal, the leadership of party A prefers the test to have a small chance of a type-I error (high significance) and a large chance of a type-II error (low power). This combination guarantees that the overall probability that party A will be replaced, either mistakenly or correctly, is just small.

Whether or not the electorate commits an error depends on the realization of ε_1^n . Figure 3 shows the distribution of ε_1^n/d (which is standard normal). There are two sub-figures, one assuming imprecise estimation and the other precise estimation. In each sub-figure, two areas are of interest: the gray-shaded area and the red-shaded area. The gray-shaded area is the chance of a type-I error, conditional on the implementation of the beneficial reform.¹² The red-shaded area is the chance of a type-II error, conditional on the implementation of the harmful reform. Clearly, with imprecise estimation, the test is no threat to party A : the chance of a type-I error is negligible, while the chance of a type-II error is large; so the party is almost certainly re-elected. Intuitively, with imprecise estimation, party A can count on being given the benefit of the doubt: unless the realization of ε_1^n (and thus of y_1^n) is very small, the electorate will not switch parties; as a result, starting reforms *does not* cause a meaningful reduction in the expected second-period private benefit.

Figure 3 here

With precise estimation, the situation is very different: the chance of a beneficial type-II error is much smaller, while there is only a slight drop in the chance of a harmful type-I error. As a result, the overall probability that party A will be replaced is much larger. More precise estimation essentially means that party A must pass a much more powerful test for re-election. Put differently, the benefit of the doubt is no longer freely given. Starting reforms therefore *does* cause a large drop in the expected second-period private benefit. It is true that more precise estimation also increases the expected second-period output estimate. However, as any possible reform-related output gain is small relative to the private benefit from holding political power (condition (R1)), a sufficiently large improvement in estimation precision must cause party A to switch from embracing reforms to embracing the status quo.

¹²Since the probability of $P_1 = S$ is $1/2$, the unconditional probability of a type-I error is one-half times the gray-shaded area, as is indicated in the figure. An analogous remark applies to the red-shaded area.

5 Precision and Welfare

5.1 Basic Relationship

We now explore how in equilibrium the precision of output estimation relates to the utility expected by the electorate. In a first step, we consider the expected utility for a given P_1 . If $P_1 = 0$, the above analysis immediately implies

$$\mathbb{E}\{V | P_1 = 0\} = \alpha. \quad (20)$$

For the case $P_1 = -1$, the Appendix establishes that $\mathbb{E}\{V | P_1 = -1\}$ is a monotonically decreasing function of d , falling from $\gamma + \alpha/2$ towards α as d increases from its minimum of 0 (Lemma 5). Conditional on a reform policy being implemented in the first period, less precise estimation makes the electorate worse off since $\mathbb{E}\{y_1^n + y_2^n | P_1 = -1\}$ is a decreasing function of d (Subsection 4.2). The electorate loses, although less precise estimation means a lower chance that it will replace its a priori preferred party at the beginning of the second period. This result reflects that the potential gain from starting reforms is large relative to the benefit from having party A re-elected (equation (A1)).

In Figure 2b., we plot the utility expected by the electorate as a function of d , separately for the cases $P_1 = 0$ and $P_1 = -1$. Together, the two parts of Figure 2 imply that the electorate and the leadership of party A may have a shared interest in more precise estimation: as d starts to fall from a high level, both $\mathbb{E}\{V | P_1 = -1\}$ and $\mathbb{E}\{U^A | P_1 = -1\}$ rise monotonically; however, as soon as d reaches η , further improvements will reduce the leadership's expected utility, while the electorate continues to benefit.

As to the utility expected by the electorate in *equilibrium*, we now conclude the following:

PROPOSITION 3 *Suppose that condition (R1) holds. Then, in equilibrium, $\mathbb{E}\{V\} > \alpha$ if $d \geq \theta$, i.e., if output estimation is sufficiently imprecise so that a reform policy is implemented in the first period; otherwise, $\mathbb{E}\{V\} = \alpha$. As long as $d > \theta$, a (marginal) rise in the precision of output estimation increases $\mathbb{E}\{V\}$.*

Proof. Follows from Proposition 2, equation (20), and Lemma 5 in the Appendix. ■

Proposition 3 implies that there are situations in which a trend towards more precise output estimation will eventually harm the electorate (as is also apparent from Figure 2b.). When precision reaches a critical threshold, a further improvement prevents party A from starting reforms and so pushes the economy from an experimentation to a stagnation equilibrium in

which the status quo wins and learning is absent.

5.2 The Role of Political Parameters

In the model, the political environment is captured by three political parameters: the strength of the electorate's a priori preference for party A ; the prevalence of sunk-cost type leaderships; and the size of the private benefit. All of them have a clear-cut effect on the critical threshold:

PROPOSITION 4 *Suppose that condition (R1) holds. Then, the critical threshold θ takes on a higher value (i) if the electorate's a priori preference for party A is less strong (i.e., if α is lower); (ii) if sunk-cost type leaderships are more prevalent (i.e., if φ is higher); and (iii) if holding political power offers a larger private benefit (i.e., if δ is higher).*

Proof. See the Appendix. ■

All else equal, a less strong party preference and/or a higher prevalence of sunk-cost type leaderships make the leadership of party A expect a smaller net gain from initiating reforms because of a higher risk of losing power once the reform process has started (in Figure 2a., $\mathbb{E}\{U^A | P_1 = -1\}$ shifts downward); so the level of imprecision at which the status quo becomes the preferred option must be higher. On the other hand, an increase in the private benefit leads to a larger expected gain if the leadership sticks to the status quo: without reforms, the private benefit is certain, while it materializes with a probability of strictly less than one in the case of a reform (in Figure 2a., $\mathbb{E}\{U^A | P_1 = 0\}$ shifts upward by a larger amount than $\mathbb{E}\{U^A | P_1 = -1\}$ does); again, this means that the level of imprecision at which the status quo becomes the preferred option must be higher.

So far, when discussing changes to parameters, we have assumed that condition (R1) remains satisfied. This condition ensures that the private benefit from holding power is “large” relative to the possible gain coming from higher average output in the future, a constellation we consider most relevant. We now explain the consequences for the critical threshold if a fall in the private benefit leads to a violation of (R1):

PROPOSITION 5 *Suppose that condition (R1) is violated. Then, a threshold θ such that $P_1 = 0$ for all $d < \theta$ no longer exists. Depending on parameters, two situations are possible: (i) either the leadership of party A opts for a reform policy in the first period (e.g., $P_1 = -1$) irrespective of the value of d ; or (ii) the leadership opts for a reform policy unless $d \in (\underline{\theta}, \bar{\theta})$, where $\underline{\theta}$ and $\bar{\theta}$ are strictly positive and finite values.*

Proof. See the Appendix. ■

If political power offers only a small private benefit, a trend towards more precise estimation is either unambiguously beneficial or will eventually be beneficial (as $\underline{\theta}$ is strictly positive). In the latter case, as the private benefit falls, the range of values of d that are associated with the status quo narrows monotonically (and vanishes eventually).

6 Robustness

A key feature of our model is that the electorate faces a “dilemma” when a first-period reform is followed by a low output estimate: re-electing the incumbent party is consistent with the electorate’s a priori party preference but entails the risk of being stuck with a failing reform; voting for the opposition guarantees a repeal of the reform but goes against the electorate’s party preference. This dilemma arises from a number of specific modeling choices, among them: the introduction of a fixed party preference into utility function (2); the assumption that the experiences gained with implementing a reform do not provide the incumbent party with superior information; and the absence of any reason that could prevent the newly elected opposition party from repealing a failing reform. This section explains to what extent our analysis is robust to modifications to these modeling choices.

We consider one modification at a time and start with the party preference. Our baseline analysis assumes that α is a strictly positive constant, implying that the leadership of party A can be sure that its party is a priori preferred by the electorate. We can weaken this assumption without affecting the model’s main implications. In fact, it is sufficient that there be a strictly positive probability that in the second period party A is a priori preferred. One could model α as a random variable that, for instance, takes a value $\alpha^h > 0$ with probability r (A preferred) and a value $\alpha^l < 0$ (B preferred) with probability $1 - r$, where $0 < r < 1$. This would capture that politics is a “volatile business”, i.e., that the salience of (additional) political issues is to some degree shaped by exogenous, accidental forces. In this modified setup, the threshold θ continues to exist. Yet, all else equal, θ takes a lower value, implying that improvements in economic statistics are beneficial over a broader range. With uncertainty regarding the party preference, sticking to the status quo policy is a less reliable approach to secure re-election; this makes starting a reform process more attractive in relative terms.¹³

The baseline model does not allow for the possibility that the experiences gained with implementing a reform provide party A with additional knowledge that is not available to the other players. This is clearly restrictive. However, the baseline model is robust to introducing

¹³The equivalents of (A1) and (R1) are given by $\alpha^h < 2\varphi\gamma$ and $\delta > 2\gamma/r$, respectively. The latter is stricter than in the baseline model since adherence to the status quo no longer guarantees re-election.

this possibility. Consider the following modification. If party A implements a reform policy in the first period, its leadership receives with probability $\psi > 0$ an exact signal about the state of the economy; the signal is private and its existence cannot be verified by the electorate. We continue to assume that sunk-cost type leaderships fail to repeal own past reforms no matter how strong the evidence against a reform is (also note that (A1) and (R1) do not require any modification). We find that in this version of the model the electorate is more reluctant to replace party A as the party may have information that the opposition lacks. Reflecting this, all else equal, the threshold θ takes a lower value; yet, once again, the threshold continues to exist. The logic is as follows. If the output estimates are relatively precise, the possible signal to the leadership of party A does not confer a big informational advantage. As a result, with precise estimation, the electorate's incentives to replace party A in the case of a low output estimate are nearly as strong as in the baseline model. Therefore, as in the baseline, party A will stick to the status quo if the output estimates are sufficiently precise.

Finally, the baseline model assumes that, in situations where the evidence suggests a repeal of a reform, party B would reliably do so, while party A would fail to act with a probability of $\varphi > 0$. In practice, though, there are good reasons (e.g., inexperience) to expect that the reliability of a newly elected party is less than perfect. Yet perfect reliability is not necessary for the model to work. Suppose that party A , if re-elected, fails to repeal an apparently harmful reform with probability $\varphi^A > 0$, while party B would fail with probability $\varphi^B > 0$. In this modified setup, the threshold θ continues to exist if φ^A is sufficiently larger than φ^B .¹⁴ The model's implications survive as long as voting for the opposition means a sufficiently large increase in the chance that an apparently failing reform will be repealed.

7 Applying the Model

What constellations are well suited for improvements in economic statistics? With some additional work, our analysis offers concrete answers. To turn the model into a practical guide, its political parameters must be linked to features of real-world political environments. We now establish these links and provide examples of polities that are more or less vulnerable to the mechanism identified in the previous analysis. When using the model as a practical guide, it is important to keep two limitations in mind. First, our analysis focuses on statistics used *ex post* in the evaluation of uncertain reforms (rather than *ex ante* in their design). Second, our analysis considers reforms that affect everyone in exactly the same way (size uncertainty only).

¹⁴The equivalents of (A1) and (R1) are given by $\alpha < 2\gamma(\varphi^A - \varphi^B)$ and $\delta > 2\gamma(1 - \varphi^B)$, respectively. The former is stricter than in the baseline since electing B no longer guarantees repeal of a failing reform.

Two of the model’s political parameters, α and δ , reflect salient aspects of a country’s political institutions. The electorate’s a priori preference for the incumbent party, α , can be interpreted as an inverse measure of the extent to which a country’s party system is fragmented. While this can be shown formally in an extended version of the model, the logic is evident even without formal modeling.¹⁵ All else equal, stronger fragmentation means a more competitive party system in the sense that the pivotal voter’s attachment to the incumbent party is weaker: with a larger set of alternative parties to choose from, handing the government to a fresh party or coalition of parties can be accomplished with a smaller cost in terms of deviation from the a priori party preference. In the model, this means a smaller α . Note that fragmentation refers exclusively to the additional (and orthogonal) political issue that underlies party preferences. The two reform policies continue to affect everyone in exactly the same way. Distributional uncertainty, as for example considered in Gersbach (1991; 2000), is absent.

The second institutional parameter, the size of the private benefit associated with holding political power, δ , can be linked to a country’s electoral system. In particular, δ can be interpreted as an inverse measure of the degree to which the electoral system holds incumbent politicians accountable to the voters. Again, this link can be established formally, for instance by associating low accountability with closed party lists and high accountability with open party lists.¹⁶ All else equal, an important consequence of a low-accountability system is that the average incumbent politician has a larger private interest in being re-elected: with closed party lists, the voters have less latitude in rejecting rent-seeking (or plainly corrupt) office holders in elections. In the model, this means a larger δ . Lastly, it is plausible to link the share of sunk-cost type leaders, φ , to the voters’ attitudes towards incumbent politicians: φ can be interpreted as an inverse measure of the level of general trust voters place in the national government. Why? In a broader interpretation of the model, one can think of $1 - \varphi$ as the extent to which voters trust the incumbent government to take action in order to avert economic damage, provided that the situation requires it.¹⁷ Based on this interpretation, in the model, a lower level of general trust in the government means a larger φ .

With the help of these interpretations, Propositions 4 and 5 allow us to assess real-world political environments with regard to the vulnerability to the mechanism identified in the previous analysis. At the positive end of the spectrum, there are places where the party system shows little fragmentation, the electoral system enforces a high degree of accountability, and

¹⁵The party system of the extended version would feature a third party, in addition to parties A and B . The third party would be in the “middle”, i.e., between A and B , in terms of the additional political issue.

¹⁶If a list is open, voters may replace any list member with another member of the same party. Closed lists preclude this option. Empirically, open lists are associated with less corruption (Persson et al., 2003).

¹⁷Experience may teach voters about φ . More instances of inaction imply a higher φ and erode general trust.

the national government commands high levels of trust. In these places, there is more scope for improving economic statistics without pushing the government into embracing the status quo. At the negative end, one finds places where the party system is highly fragmented, accountability to voters is weak, and trust in the national government runs low. In these places, improvements in economic statistics more quickly trigger the mechanism. If the political parameter constellation brightens along some dimension(s), the scope for beneficial improvements widens accordingly. Similarly, the leeway for beneficial improvements grows in the relevance of the modifications discussed in Section 6. For instance, if the salience of additional political issues, and thus the party preferences, become more volatile, it takes more to trigger the mechanism since retaining the status quo is a less reliable path to re-election.

Finally, for the sake of concreteness, consider New Zealand and Italy, two countries that may delimit the spectrum. In New Zealand, there is more scope for improving economic statistics without triggering the mechanism: the two largest parties typically account for close to four-fifths of votes in national parliamentary elections; accountability to voters is strong, not least because just one-third of the members of parliament (MPs) are elected on closed party lists; and the level of trust in the national government is among the highest in the OECD. Thus, our analysis does not offer strong reasons for denying the country’s statistical agencies far-reaching private-sector data access. Italy is closer to the opposite end of the spectrum: the party system is highly fragmented; two-thirds of MPs are elected on closed party lists; and the level of trust in the national government is among the lowest in the OECD.¹⁸ So Italy, compared to New Zealand, is more vulnerable to the mechanism identified in this paper. Accordingly, demands to give Italy’s statistical agencies far-reaching private-sector data access deserve more scrutiny.

8 Conclusion

Do improvements in economic statistics that are used for evaluation purposes advance the cause of evidence-based policy-making, as is often claimed in the debate on the extent to which statistical agencies should obtain access to the expanding universe of private-sector data? To address this question, we propose a political-agency model in which politicians can learn what policies work. In the model, the notion that better economic statistics improve evidence-based policy-making does not hold universally. In fact, better statistics may imply less experimentation and learning: with better statistics, voters are less inclined to grant politicians the benefit of the doubt in case of disappointing economic data, thereby weakening

¹⁸See the [New Zealand Electoral Commission](#) and Chiamonte and D’Alimonte (2018) for details about the two countries’ electoral systems. See OECD (2017, pp. 214-5) for data on trust in the national government.

politicians' incentives to set out for reforms in the first place. According to our analysis, the scope for beneficial improvements in statistics is narrower if the party system is fragmented, the electoral system implies weak accountability, and voters cannot count on incumbent politicians to revisit their own decisions. Regarding the debate on private-sector data access, it follows that indiscriminate calls for maximum access may not be warranted.

In practice, incumbent politicians typically have a larger action space than our model assumes. For instance, politicians determine the budget of the statistical agencies and may have some direct control over the agencies' mandates or operations. Politicians may also be in a position to undermine the public's trust in official economic figures by setting up partisan statistical outfits in order to add noise to the overall picture painted by the official statistics. Above all, politicians have a say in the fundamental matter of statistical agencies' access to the expanding universe of private-sector data. Analyzing models with such extended action spaces will further deepen our understanding of the political and economic consequences of moving towards a data-rich world that offers unprecedented opportunities for improving official economic statistics. We consider this a promising line for future work.

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Online Appendix for

BETTER STATISTICS, BETTER ECONOMIC POLICIES?

September 28, 2020

Lemmas

LEMMA 1 *Suppose that $P_1 \neq 0$. Then, conditional on the observation of y_1^n , the probability of $P_1 = S$, $q(y_1^n)$, is given by equation (10).*

Proof. If $P_1 \neq 0$, it follows from equations (4) to (6) that the distribution of y_1^n is either $N(\gamma, d^2)$ or $N(-\gamma, d^2)$ with probability 1/2 each. As a consequence, Bayes' rule implies

$$q(y_1^n) = \frac{(1/2) \cdot f(y_1^n | P_1 = S)}{(1/2) \cdot f(y_1^n | P_1 = S) + (1/2) \cdot f(y_1^n | P_1 = -S)}, \quad (\text{A1})$$

where $f(y_1^n | \cdot)$ is the probability density function associated with distribution $N(\gamma P_1 S, d^2)$. Using the functional form of $f(y_1^n | \cdot)$, we can rearrange (A1) to obtain (10). ■

LEMMA 2 *Conditional on a reform being implemented in the first period (e.g., $P_1 = -1$), the expected sum of average output estimates, $\mathbb{E}\{y_1^n + y_2^n | P_1 = -1\}$, falls monotonically from*

$$\lim_{d \rightarrow 0} \mathbb{E}\{y_1^n + y_2^n | P_1 = -1\} = \gamma \quad \text{to} \quad \lim_{d \rightarrow \infty} \mathbb{E}\{y_1^n + y_2^n | P_1 = -1\} = 0$$

as the standard deviation of the sampling error increases from zero to infinity.

Proof. Using the fact that $S \in \{-1, 1\}$ takes each of its two possible values with probability 1/2, the first component of (17) can be rewritten as

$$\begin{aligned} \mathbb{E}\{y_1^n + y_2^n | P_1 = -1\} &= (1/2)\mathbb{E}\{y_1^n + y_2^n | S = P_1 = -1\} \\ &+ (1/2)\mathbb{E}\{y_1^n + y_2^n | S \neq P_1 = -1\}. \end{aligned} \quad (\text{A2})$$

First consider the sum's expected value given $S = P_1 = -1$. In this case, the expectation of y_1^n is γ (equations (4) and (5), together with $\chi = 0$). To find the expectation of y_2^n , one needs

to consider how P_2 depends on y_1^n . Figure 1 suggests that (i) P_2 switches to 1 if $y_1^n < \underline{y}_1^n$; (ii) P_2 switches to 1 with probability $1 - \varphi$ and is unchanged with probability φ if $\underline{y}_1^n \leq y_1^n < 0$; (iii) P_2 is unchanged if $0 \leq y_1^n$. Because we consider the case $S = P_1 = -1$, switching to policy 1 will be harmful (i.e., $x_2 = -\gamma$) and maintaining policy -1 will be beneficial (i.e., $x_2 = \gamma$). Putting everything together, we obtain

$$\begin{aligned} \mathbb{E} \{y_1^n + y_2^n | S = P_1 = -1\} &= \gamma - \Pr[y_1^n < \underline{y}_1^n] \cdot \gamma - \Pr[\underline{y}_1^n \leq y_1^n < 0] \cdot (1 - \varphi)\gamma \quad (\text{A3}) \\ &+ \Pr[\underline{y}_1^n \leq y_1^n < 0] \cdot \varphi\gamma + \Pr[0 \leq y_1^n] \cdot \gamma. \end{aligned}$$

Considering $y_1^n = \gamma + \varepsilon_1^n$ (equations (4) and (5), together with $\chi = 0$ and $S = P_1 = -1$), the fact that $\varepsilon_1^n \sim N(0, d^2)$, and the definition of $\underline{y}_1^n$, equation (A3) can be rearranged to obtain

$$\mathbb{E} \{y_1^n + y_2^n | S = P_1 = -1\} = 2\gamma [1 - \varphi\Phi(uv - 1/v) - (1 - \varphi)\Phi(-1/v)], \quad (\text{A4})$$

where we use $\Phi(\cdot)$ to refer to the distribution function of the standard normal distribution.

Now suppose that $S \neq P_1 = -1$. In this case, an approach similar to the one above leads to the analog of equation (A3), which in turn can be rearranged to obtain

$$\mathbb{E} \{y_1^n + y_2^n | S \neq P_1 = -1\} = 2\gamma [-1 + \varphi\Phi(uv + 1/v) + (1 - \varphi)\Phi(1/v)]. \quad (\text{A5})$$

Together, equations (A4), (A5), and (A2) imply

$$\begin{aligned} \mathbb{E} \{y_1^n + y_2^n | P_1 = -1\} &= \gamma\varphi [\Phi(uv + v^{-1}) - \Phi(uv - v^{-1})] \quad (\text{A6}) \\ &+ \gamma(1 - \varphi) [\Phi(v^{-1}) - \Phi(-v^{-1})]. \end{aligned}$$

Observing the definition of v given in Proposition 1, we get

$$\begin{aligned} \frac{d\mathbb{E} \{y_1^N + y_2^N | P_1 = -1\}}{dd} &= -\frac{1}{\sqrt{2\pi}} \frac{1}{v^2} e^{-(1/2)(u^2v^2 + v^{-2})} \quad (\text{A7}) \\ &\cdot \left\{ \varphi [e^u(uv^2 + 1) - e^{-u}(uv^2 - 1)] + (1 - \varphi)2e^{(1/2)u^2v^2} \right\}. \end{aligned}$$

The first line of the right-hand side (RHS) of equation (A7) is strictly negative for $\forall v^2 \in (0, \infty)$, while the second line is strictly positive because $u < 0$ implies $-e^{-u}(uv^2 - 1) > e^u(uv^2 + 1)$. It follows that derivative (A7) is strictly negative for $\forall v^2 \in (0, \infty)$, implying that $\mathbb{E} \{y_1^N + y_2^N | P_1 = -1\}$ is a strictly decreasing function of d on the interval $(0, \infty)$. For $v^2 = 0$ and for $v^2 \rightarrow \infty$, the derivative equals zero, and so we conclude that $\mathbb{E} \{y_1^N + y_2^N | P_1 = -1\}$

must fall monotonically as d rises from 0 to ∞ . Finally, we note that the two limiting values of $\mathbb{E}\{y_1^N + y_2^N \mid P_1 = -1\}$ stated in the lemma follow from the properties of the distribution function of the standard normal distribution. ■

LEMMA 3 *Conditional on a reform being implemented in the first period (e.g., $P_1 = -1$), the expected private benefit accruing to the leadership of party A, $\mathbb{E}\{\delta I^A \mid P_1 = -1\}$, rises monotonically from*

$$\lim_{d \rightarrow 0} \mathbb{E}\{\delta I^A \mid P_1 = -1\} = (1/2)\delta \quad \text{to} \quad \lim_{d \rightarrow \infty} \mathbb{E}\{\delta I^A \mid P_1 = -1\} = \delta$$

as the standard deviation of the sampling error increases from zero to infinity.

Proof. To find the expectation of I^A , we need to consider how the allocation of power in the second-period depends on y_1^n . Proposition 1 and equation (14) suggest $I^A = 0$ if $y_1^n < \underline{y}_1^n$ and $I^A = 1$ otherwise. Taking into account that y_1^n is either equal to $\gamma + \varepsilon_1^n$ or equal to $-\gamma + \varepsilon_1^n$ with probability 1/2 each, it follows that

$$\mathbb{E}\{\delta I^A \mid P_1 = -1\} = \delta \left\{ (1/2) \Pr[\gamma + \varepsilon_1^n \geq \underline{y}_1^n] + (1/2) \Pr[-\gamma + \varepsilon_1^n \geq \underline{y}_1^n] \right\}. \quad (\text{A8})$$

Considering $\varepsilon_1^n \sim N(0, \sigma/n)$ and using the definition of $\underline{y}_1^n$, equation (A8) can be turned into

$$\mathbb{E}\{\delta I^A \mid P_1 = -1\} = \delta \left\{ 1 - (1/2) [\Phi(uv - v^{-1}) + \Phi(uv + v^{-1})] \right\}, \quad (\text{A9})$$

where we use $\Phi(\cdot)$ to refer to the distribution function of the standard normal distribution.

Observing the definition of v given in Proposition 1, we get

$$\begin{aligned} \frac{d\mathbb{E}\{\delta I^A \mid P_1 = -1\}}{dd} &= -\frac{1}{\sqrt{2\pi}} \frac{1}{v^2} e^{-(1/2)(u^2 v^2 + v^{-2})} \\ &\cdot \left[\frac{\delta/2}{\gamma} e^u (uv^2 + 1) + \frac{\delta/2}{\gamma} e^{-u} (uv^2 - 1) \right]. \end{aligned} \quad (\text{A10})$$

The first line of the RHS of equation (A10) is identical to the first line of the RHS of equation (A7) and hence strictly negative for $\forall v^2 \in (0, \infty)$. Since $u < 0$, it follows that $e^{-u}(uv^2 - 1) < 0$ is larger in absolute value than $e^u(uv^2 + 1)$. So the second line of the RHS of equation (A10) is strictly negative, too, implying that derivative (A7) is strictly positive for $\forall v^2 \in (0, \infty)$. As a result, $\mathbb{E}\{\delta I^A \mid P_1 = -1\}$ is a strictly increasing function of d on the interval $(0, \infty)$. For $v^2 = 0$ and for $v^2 \rightarrow \infty$, the derivative equals zero, and so we conclude that $\mathbb{E}\{\delta I^A \mid P_1 = -1\}$ must rise monotonically as d rises from 0 to ∞ . Finally, we note that the two limiting values of

$\mathbb{E}\{\delta I^A | P_1 = -1\}$ stated in the lemma follow from the properties of the distribution function of the standard normal distribution. ■

LEMMA 4 *Suppose that condition (R1) holds. Then, $\mathbb{E}\{U^A | P_1 = -1\}$ is a function of $d \in [0, \infty)$ that has an interior global maximum at point $\eta > 0$. Moreover, there exists a threshold $\theta \in (0, \eta)$ such that: (i) $\mathbb{E}\{U^A | P_1 = -1\} = \delta$ if d is equal to θ ; (ii) $\mathbb{E}\{U^A | P_1 = -1\} < \delta$ for all d strictly less than θ ; and (iii) $\mathbb{E}\{U^A | P_1 = -1\} > \delta$ for all d strictly greater than θ .*

Proof. We start by deriving properties of the derivative of $E\{U^A | P_1 = -1\}$ with respect to d . Combining equations (A7) and (A10) yields

$$\frac{dE\{U^A | P_1 = -1\}}{dd} = D_1(v^2) \cdot D_2(v^2), \quad (\text{A11})$$

where

$$D_1(v^2) \equiv -\frac{1}{\sqrt{2\pi}} \frac{1}{v^2} e^{-(1/2)(u^2 v^2 + v^{-2})} \quad (\text{A12})$$

and

$$\begin{aligned} D_2(v^2) \equiv & \left[\left(\frac{\delta/2}{\gamma} + \varphi \right) e^u - \left(\frac{\delta/2}{\gamma} - \varphi \right) e^{-u} \right] \\ & + \left[\left(\frac{\delta/2}{\gamma} + \varphi \right) e^u + \left(\frac{\delta/2}{\gamma} - \varphi \right) e^{-u} \right] u v^2 + (1 - \varphi) 2e^{(1/2)u^2 v^2}. \end{aligned} \quad (\text{A13})$$

Equation (A12) implies that $D_1(v^2) < 0$ for $\forall v^2 \in (0, \infty)$. Regarding $D_2(v^2)$, which is a continuous function of v^2 , we note three properties: first, $D_2(0) < 0$ is equivalent to

$$\delta > 2\gamma \frac{\varphi(e^{-u} + e^u) + (1 - \varphi)2}{e^{-u} - e^u}; \quad (\text{R2})$$

second, $\lim_{v^2 \rightarrow \infty} D_2(v^2) = \infty$ because $(1 - \varphi)2 \exp[(1/2)(u^2 v^2)]$ is an exponential function of v^2 , while the first term on the same line – which is negative because $u < 0$ and $\delta/(2\gamma) - \varphi > 0$ – is a linear function of v^2 ; third, the second derivative of $D_2(v^2)$ with respect to v^2 is strictly positive for any $v^2 \geq 0$, implying that $D_2(v^2)$ is strictly convex.

To prove the lemma, we now consider two different situations in turn: first, (R2) holds and, second, (R2) does not hold. If (R2) is satisfied, $D_2(0) < 0$. Due to the continuity and strict convexity of $D_2(v^2)$, and because $\lim_{v^2 \rightarrow \infty} D_2(v^2) = \infty$, there must exist a unique $\hat{v} \in (0, \infty)$ that satisfies $D_2(\hat{v}^2) = 0$, $D_2(v^2) < 0$ for all $v < \hat{v}$, and $D_2(v^2) > 0$ for all $v > \hat{v}$. Observing

that $D_1(v^2) < 0$ for $\forall v^2 \in (0, \infty)$, we therefore conclude from equation (A11) that

$$\frac{d\mathbb{E}\{U^A | P_1 = -1\}}{dd} \begin{cases} > 0 & : v = d/\gamma \in (0, \hat{v}) \\ = 0 & : v = d/\gamma = \hat{v} \\ < 0 & : v = d/\gamma \in (\hat{v}, \infty) \end{cases} . \quad (\text{A14})$$

Now consider the behavior of $\mathbb{E}\{U^A | P_1 = -1\}$ as d (and hence v) increases from 0 to infinity: according to equation (A14), $\mathbb{E}\{U^A | P_1 = -1\}$ is strictly increasing on $(0, \hat{v}\gamma)$, reaches its global maximum at point $\eta \equiv \hat{v}\gamma$, and then is strictly decreasing on $(\hat{v}\gamma, \infty)$, falling monotonically towards its limit δ (equation (18)). Therefore, and because $\mathbb{E}\{U^A | P_1 = -1\} < \delta$ at $d = 0$ (condition (R1)), $\mathbb{E}\{U^A | P_1 = -1\}$ must cross the δ -threshold exactly once (from below) at a value of d that is strictly positive and strictly less than η .

Now suppose that (R2) is violated. Then, $D_2(0) \geq 0$, implying that $\mathbb{E}\{U^A | P_1 = -1\}$ is a (weakly) decreasing function of d in the vicinity of 0 (equations (A11) and (A12)). However, because $\mathbb{E}\{U^A | P_1 = -1\} < \delta$ at $d = 0$ (condition (R1)) and $\lim_{d \rightarrow \infty} \mathbb{E}\{U^A | P_1 = -1\} = \delta$ (equation (18)), it follows that – as d rises – $D_2(v^2)$ must change its sign at some point, thereby turning $\mathbb{E}\{U^A | P_1 = -1\}$ into a strictly increasing function of d . With $D_2(v^2)$ strictly negative, a sequence of arguments similar to those above suggests that—as d rises further— $\mathbb{E}\{U^A | P_1 = -1\}$ crosses the δ -threshold (from below) at some strictly positive level of d , thereafter reaches its global maximum at some strictly higher level of d (point η), and then monotonically falls towards its limit δ .

We conclude that in both cases $\mathbb{E}\{U^A | P_1 = -1\}$ has a global maximum at point $\eta > 0$ and that there exists a $\theta \in (0, \eta)$ that satisfies the properties specified in the lemma. ■

LEMMA 5 *Conditional on a reform being implemented in the first period (e.g., $P_1 = -1$), the utility expected by the electorate, $\mathbb{E}\{V | P_1 = -1\}$, falls monotonically from*

$$\lim_{d \rightarrow 0} \mathbb{E}\{V | P_1 = -1\} = (\alpha/2) + \gamma \quad \text{to} \quad \lim_{d \rightarrow \infty} \mathbb{E}\{V | P_1 = -1\} = \mathbb{E}\{V | P_1 = 0\} = \alpha,$$

as the standard deviation of the sampling error increases from zero to infinity.

Proof. The electorate's objective function is specified in equation (2). For $P_1 = -1$, the value of V expected prior to the implementation of P_1 is

$$\mathbb{E}\{V | P_1 = -1\} = \mathbb{E}\{y_1^n + y_2^n | P_1 = -1\} + \mathbb{E}\{\alpha I^A | P_1 = -1\}, \quad (\text{A15})$$

where $\mathbb{E}\{y_1^n + y_2^n | P_1 = -1\}$ is stated in Lemma 2 and $\mathbb{E}\{\alpha I^A | P_1 = -1\}$ can be obtained by

swapping the δ for an α in the corresponding expression in Lemma 3. Thus,

$$\begin{aligned}\mathbb{E}\{V|P_1 = -1\} &= \alpha + \gamma(1 - \varphi) [\Phi(1/v) - \Phi(-1/v)] \\ &\quad - \left(\frac{\alpha}{2} - \gamma\varphi\right) \Phi(uv + 1/v) - \left(\frac{\alpha}{2} + \gamma\varphi\right) \Phi(uv - 1/v).\end{aligned}\tag{A16}$$

The two limiting values of $\mathbb{E}\{V|P_1 = -1\}$ stated in the lemma follow from the properties of the distribution function of the standard normal distribution. Moreover, the discussion preceding equation (16) immediately implies $\mathbb{E}\{V|P_1 = 0\} = \alpha$.

The derivative of $\mathbb{E}\{V|P_1 = -1\}$ with respect to d is given by

$$\frac{d\mathbb{E}\{V|P_1 = -1\}}{dd} = D_1(v^2) \cdot \tilde{D}_2(v^2),\tag{A17}$$

where $D_1(v^2)$ is specified in equation (A12) and

$$\begin{aligned}\tilde{D}_2(v^2) &\equiv \left[\left(\frac{\alpha/2}{\gamma} + \varphi \right) e^u - \left(\frac{\alpha/2}{\gamma} - \varphi \right) e^{-u} \right] \\ &\quad + \left[\left(\frac{\alpha/2}{\gamma} + \varphi \right) e^u + \left(\frac{\alpha/2}{\gamma} - \varphi \right) e^{-u} \right] uv^2 + (1 - \varphi) 2e^{(1/2)u^2v^2}.\end{aligned}\tag{A18}$$

The first term in square brackets on the right-hand side of equation (A18) is strictly positive because of equation (A1). Observing the definition of u given in Proposition 1, the second term in square brackets can be shown to be zero. Thus, $\tilde{D}_2(v^2)$ must be strictly positive. Because $D_1(v^2) < 0$ for $\forall v^2 \in (0, \infty)$ (see the proof of Lemma 4), it follows that $d\mathbb{E}\{V|P_1 = -1\}/dd$ is strictly negative for all $v^2 \in (0, \infty)$, implying that $\mathbb{E}\{V|P_1 = -1\}$ is a strictly decreasing function of d on the interval $(0, \infty)$. For $v^2 = 0$ and for $v^2 \rightarrow \infty$, derivative (A17) equals zero, and so we conclude that $\mathbb{E}\{V|P_1 = -1\}$ must fall monotonically as d rises from 0 to ∞ . ■

Proofs of Propositions

Proof of Proposition 1. Suppose that $P_1 \neq 0$ and condition (13) holds. For this case, equation (12) implies that the party holding power in the second period will attempt a switch to the alternative reform policy (i.e., to set $P_2 = -P_1$). This switch will succeed with probability $1 - \varphi < 1$ if party A remains in power and with probability 1 if party B takes over. As a result, the expected value of $y_2^n + \alpha I^A$ is given by $(1 - \varphi) [(1 - q)\gamma - q\gamma] + \varphi [q\gamma - (1 - q)\gamma] + \alpha$ if party A remains in power and by $(1 - q)\gamma - q\gamma$ if party B takes over. Since the expected value of $y_2^n + \alpha I^A$ is what the electorate wants to maximize at this point of the game, party A

is replaced by party B if

$$(1 - \varphi) [(1 - q)\gamma - q\gamma] + \varphi [q\gamma - (1 - q)\gamma] + \alpha < (1 - q)\gamma - q\gamma. \quad (\text{A19})$$

Because conditions (13) and (A19) are equivalent, it follows that party A is replaced by party B if $P_1 \neq 0$ and condition (13) holds. Equation (A1) ensures that $\mu \in (0, 1/2)$

To prove the converse, suppose that party A is replaced by party B . Then, the paragraph preceding Proposition 1 implies that we can rule out the case $P_1 = 0$ and the case $P_1 \neq 0$ and $q \geq 1/2$. To complete the proof, we have to show that the case $P_1 \neq 0$ and $q \in [\mu, 1/2)$ can be ruled out as well. So assume that – contrary to what we want to show – $P_1 \neq 0$ and $q \in [\mu, 1/2)$. Then, the expected value of $y_2^n + \alpha I^A$ under the two different parties would again be given by the expressions stated in the first paragraph of this proof. However, if $q \in [\mu, 1/2)$, the expected value of $y_2^n + \alpha I^A$ under party A is at least as high as the expected value of $y_2^n + \alpha I^A$ under party B . As a result, the electorate would not replace party A , implying that the case $P_1 \neq 0$ and $q \in [\mu, 1/2)$ can indeed be ruled out. As a result, the only remaining possibility is $P_1 \neq 0$ and $q < \mu$.

Finally, condition (14) can be obtained from condition (13) by using equation (10). Note that $u < 0$ because equation (A1) and the first part of the proposition imply $0 < \mu < 1/2$. As a result, the threshold $\underline{y}_1^n$ is strictly negative. ■

Proof of Proposition 4. According to Lemma 4, the threshold θ is the unique value of d that satisfies $\mathbb{E}\{U^A | P_1 = -1\} = \delta$; it is strictly positive and finite.

(i) Implicit differentiation of $\mathbb{E}\{U^A | P_1 = -1\} = \delta$ with respect to α and d yields

$$\frac{d\theta}{d\alpha} = - \frac{d\mathbb{E}\{U^A | P_1 = -1\}/du \, du \, d\mu}{d\mathbb{E}\{U^A | P_1 = -1\}/dd \, dd \, d\alpha}. \quad (\text{A20})$$

We now determine the signs of the four derivatives in (A20). At $d = \theta$, $d\mathbb{E}\{U^A | P_1 = -1\}/dd$ is strictly positive since $\mathbb{E}\{U^A | P_1 = -1\}$ intersects the δ -threshold from below (Proof of Lemma 4). The definitions of u and μ provided in equations (15) and (13), respectively – imply $du/d\mu > 0$ and $d\mu/d\alpha < 0$. Finally,

$$\begin{aligned} \frac{d\mathbb{E}\{U^A | P_1 = -1\}}{du} &= -(\delta/2 - \varphi\gamma) \cdot \phi(uv + v^{-1}) \cdot v \\ &\quad - (\delta/2 + \varphi\gamma) \cdot \phi(uv - v^{-1}) \cdot v < 0, \end{aligned} \quad (\text{A21})$$

where $\phi(\cdot)$ refers to the probability density function of the standard normal distribution. The

strict negativity of $d\mathbb{E}\{U^A|P_1 = -1\}/du$ follows from (R1) and the fact that $v = d\gamma^{-1}$ is strictly positive and finite. From these findings, we conclude that $d\theta/d\alpha < 0$. Therefore, as stated in the proposition, θ increases as α falls.

(ii) Implicit differentiation of $\mathbb{E}\{U^A|P_1 = -1\} = \delta$ with respect to φ and d yields

$$\frac{d\theta}{d\varphi} = -\frac{d\mathbb{E}\{U^A|P_1 = -1\}/d\varphi}{d\mathbb{E}\{U^A|P_1 = -1\}/dd}. \quad (\text{A22})$$

As discussed under (i), the denominator of (A22) is strictly positive. The numerator is given by

$$\begin{aligned} \frac{d\mathbb{E}\{U^A|P_1 = -1\}}{d\varphi} &= \gamma \{ \Phi(-v^{-1}) - \Phi(uv - v^{-1}) - [\Phi(v^{-1}) - \Phi(uv + v^{-1})] \} \\ &+ \frac{d\mathbb{E}\{U^A|P_1 = -1\}}{du} \frac{du}{d\mu} \frac{d\mu}{d\varphi}. \end{aligned} \quad (\text{A23})$$

where $\Phi(\cdot)$ refers to the distribution function of the standard normal distribution. Since $v = d\gamma^{-1}$ is strictly positive and finite and $u < 0$ (equation (15)), the properties of the standard normal distribution imply that the first line of the RHS of (A23) is strictly negative. From (i), we further know that $d\mathbb{E}\{U^A|P_1 = -1\}/du$ is strictly negative and that $du/d\mu$ is strictly positive. Finally, the definition μ – provided in equation (13) – implies $d\mu/d\varphi > 0$. As a result, the numerator of (A22) is strictly negative, implying that $d\theta/d\varphi$ is strictly positive. Therefore, as stated in the proposition, θ increases in φ .

(iii) Implicit differentiation of $\mathbb{E}\{U^A|P_1 = -1\} = \delta$ with respect to δ and d yields

$$\frac{d\theta}{d\delta} = \frac{1}{2} \frac{[\Phi(uv - v^{-1}) + \Phi(uv + v^{-1})]}{d\mathbb{E}\{U^A|P_1 = -1\}/dd}. \quad (\text{A24})$$

Because $\Phi(\cdot)$ denotes the cumulative distribution function of the standard normal distribution, and because $v = d\gamma^{-1}$ is strictly positive and finite, the numerator of (A24) is strictly positive. As discussed above, the denominator is strictly positive as well. From these findings, we conclude that $d\theta/d\delta > 0$. Therefore, as stated in the proposition, θ increases in δ . ■

Proof of Proposition 5. This proof draws on the Proof of Lemma 4. We again distinguish situations in which condition (R2) holds from situations in which (R2) is violated. If (R2) is satisfied, the basic pattern of the relationship between $\mathbb{E}\{U^A|P_1 = -1\}$ and d is unchanged from the pattern described in the corresponding part of the Proof of Lemma 4: as d increases from 0 to infinity, $\mathbb{E}\{U^A|P_1 = -1\}$ rises monotonically to some global maximum and then falls monotonically towards its limit δ . However, because we now assume that condition (R1) is

violated, we have $\mathbb{E}\{U^A \mid P_1 = -1\} > \delta$ if $d = 0$. It therefore follows that $\mathbb{E}\{U^A \mid P_1 = -1\} > \mathbb{E}\{U^A \mid P_1 = 0\} = \delta$ for all finite values of d . As a result, party A prefers reform alternative -1 to the status quo policy irrespective of the value of d , as is stated in part (i) of the proposition.

Now suppose that condition (R2) is violated. Then, it is again the case that the basic pattern of the relationship between $\mathbb{E}\{U^A \mid P_1 = -1\}$ and d is the same as the one described in the corresponding part of the Proof of Lemma 4: As d increases from 0 to infinity, $\mathbb{E}\{U^A \mid P_1 = -1\}$ falls monotonically to some global minimum, then rises monotonically to some global maximum (that exceeds δ), and eventually falls monotonically towards its limit δ . Two different situations can now be distinguished. Since $\mathbb{E}\{U^A \mid P_1 = -1\} > \delta$ if $d = 0$, the global minimum can be greater or less than δ . If it is greater than δ , it is again the case that $\mathbb{E}\{U^A \mid P_1 = -1\} > \mathbb{E}\{U^A \mid P_1 = 0\} = \delta$ for all finite values of d , implying that the government behaves as is stated in part (i) of the proposition.

On the other hand, if the global minimum is less than δ , $\mathbb{E}\{U^A \mid P_1 = -1\}$ must intersect the δ -threshold exactly once from above at a strictly positive value of d , denoted by $\underline{\theta}$; as d rises further, $\mathbb{E}\{U^A \mid P_1 = -1\}$ crosses the δ -threshold exactly once from below at a finite value of d , denoted by $\bar{\theta} > \underline{\theta}$, and then remains above δ as d goes to infinity. So, in this case, $\mathbb{E}\{U^A \mid P_1 = -1\} < \mathbb{E}\{U^A \mid P_1 = 0\} = \delta$ if $d \in (\underline{\theta}, \bar{\theta})$ and $\mathbb{E}\{U^A \mid P_1 = -1\} \geq \mathbb{E}\{U^A \mid P_1 = 0\} = \delta$ otherwise, implying that party A behaves as stated in part (ii) of the proposition. ■

FIGURE 1: Political power and economic policy in period 2, conditional on $P_1 \neq 0$

FIGURE 2: Economic policy and expected utilities in period 1

FIGURE 3: The election as a hypothesis test

a. Imprecise estimation (large d)

b. Precise estimation (small d)