Why Could Political Incentives Be Different During Election Times?

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The literature on political cycles argues that the proximity of the next election date affects policy choices (Alesina, Roubini, and Cohen [1997]; Drazen [2000]; and Shi and Svensson [2003] present reviews of this literature).[1] Evidence of such cycles is stronger for economies that are less developed, have younger democracies, have less government transparency, have less media freedom, have a larger share of uninformed voters in the electorate, and have a higher re-election value. Brender and Drazen (2005) find evidence of a political deficit cycle in a large cross-section of countries but show that this finding is driven by the experience of "new democracies." The budget cycle disappears when the new democracies are removed from their sample. Similarly, using a large panel data set, Shi and Svensson (2006) find that, on average, governments' fiscal deficits increase by almost 1 percent of gross domestic product in election years, and that these political budget cycles are significantly larger and statistically more robust in developing than in developed countries. Using suitable proxies, they also find that the size of the electoral budget cycles increases with the size of politicians' rents from remaining in power, and with the share of informed voters in the electorate. Akhmedov and Zhuravskaya (2004) use a regional monthly panel from Russia and find a sizable and short-lived political budget cycle (public spending is

[1] Related work studies how political turnover causes movements in the real economy. Partisan cycles are studied, for example, by Alesina (1987), Azzimonti Renzo (2005), Cuadra and Sapriza (2006), and Hatchondo, Martinez, and Sapriza (forthcoming). Hess and Orphanides (1995, 2001) and Besley and Case (1995) study how the presence of term limits introduces electoral cycles between terms (while I focus on cycles within terms).

shifted toward direct monetary transfers to voters). They also find that the magnitude of the cycle decreases over time and with democracy, government transparency, media freedom, and voter awareness. They argue that the short length of the cycle explains underestimation of its size by studies that use lower frequency data.

Why would policymakers prefer to influence economic conditions at the end of their term rather than at the beginning of their term? This article discusses some answers to this question provided by the theoretical literature on political cycles.

More generally, this article discusses agency relationships in which an important part of the compensation is decided upon infrequently. For instance, my framework could be used to discuss incentives when a contract commits the employer to working with a certain employee for a number of periods, but allows the employer to replace this employee after the contract ends. Consider, for example, a professional athlete who signs a multi-year contract with a team, which is free to terminate its relationship with this athlete (or not) after the contract ends. Do athletes have stronger incentives to improve their performance just before their contract expires? Wilczynski (2004) and Stiroh (2007) present empirical evidence of a *renegotiation cycle:* performance improves in the year before the signing of a multi-year contract, but declines after the contract is signed. Renegotiation cycles resemble the cycles discussed in the political-economy literature. Even though my analysis applies to other employment relationships, for concreteness, this article refers to voters and policymakers.

I study political cycles in a standard three-period political-agency model of career concerns. An incumbent policymaker who starts his political career in period one with an average reputation can exert effort in periods one and two to increase his re-election probability. Each period, the incumbent's performance depends on his ability, his effort level, and luck. Voters do not observe the incumbent's ability, effort, and luck; instead, they observe his performance. Good current performance by the incumbent may signal that he is capable of good performance in the future. Voters re-elect the incumbent only if they expect that his performance will be good in the future. Since the incumbent wants to be re-elected, he may exert effort to improve his current performance.[2]

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[2] By assuming that the policymaker can influence the beliefs about his future performance, the literature on political cycles does not imply that he can fine-tune the aggregate economic effects of economic policy. One may think that the policymaker is evaluated on the quality of services he provides. For instance, Brender (2003) finds that "the incremental student success rate during the mayor's term had a significant positive effect on his reelection chances." The quality of education depends on economic policy (for example, it depends on the resources the policymaker makes available for education). Thus, the policymaker may decide to make more resources available for education (instead of keeping resources for his favorite interest group or himself) in order to increase his re-election probability.

Earlier theoretical studies of political cycles succeeded in showing that in environments with asymmetric information about the incumbent's unobservable and stochastically evolving ability (as the one studied in this article), cycles can arise with forward-looking and rational voters. These studies show that political cycles may arise because the incumbent's end-of-term performance may be *more informative* about the quality of his future (post-election) performance than his beginning-of-term performance. Therefore, the incumbent's end-of-term actions (that influence his end-of-term performance) may be *more effective* in influencing the election result than his beginning-of-term actions (that influence his beginning-of-term performance). Consequently, the incumbent may have stronger incentives to improve his performance at the end of his term. For expositional simplicity, these studies model this intuition in its most extreme form. That is, they assume that only the end-of-term incumbent's action is effective in changing the election result (see, for example, Rogoff [1990], Shi and Svensson [2006], and the references therein). Thus, re-election concerns play a role only at the end of a term, and, therefore, political cycles arise.

These earlier studies make three assumptions that imply that the incumbent only affects his re-election probability by influencing his end-of-term performance. The first assumption is that at the time of the election, only the end-of-term ability is not observable. If beginning-of-term ability is observable, the incumbent cannot influence voters' beliefs with his beginning-of-term actions and, therefore, cycles arise.

The second assumption is that only end-of-term ability is correlated with post-election ability. Consequently, only voters' inference about end-of-term ability directly influences their re-election decision.

The third assumption is that output is a perfect signal of ability. This implies that voters can learn the incumbent's end-of-term ability (which is correlated with his post-election ability) perfectly from his end-of-term performance, without considering his beginning-of-term performance. Therefore, beginning-of-term actions are not effective in changing the re-election probability.

The three assumptions described above imply strong asymmetries across periods. Political cycles in these earlier studies are a direct result of these asymmetries.

In Martinez (2009b), I explain why political cycles may arise even if the incumbent's end-of-term performance is not more informative about the quality of his future performance, and, consequently, the incumbent's end-of-term actions are not more effective in influencing the election result. In the model, the incumbent's equilibrium effort choice depends on both the proximity of the next election and his reputation (which I refer to as the beliefs about his ability). Recall that we want to study how the proximity of elections affects policy choices. Consequently, with political cycles I refer

to differences in the incumbent's choices within a term in office for a given reputation level. For a given reputation level, why would the incumbent exert more effort closer to the election? If the incumbent's reputation does not change between periods one and two, why would the incumbent exert more effort in period two than in period one?

The key insight to the answer to these questions comes from the characterization of the incumbent's effort-smoothing decision, which is such that he makes the marginal cost of exerting effort in period one (roughly) equal to the *expected* marginal cost of exerting effort in period two. This decision presents the typical intertemporal tradeoff in dynamic models: Having less utility in period one allows the incumbent to have more utility in period two. In this case, a lower expected effort level in period two compensates for a higher effort level in period one. In period one, the incumbent (whose reputation is average) knows that his reputation is likely to change and anticipates that this change will lead him to choose an effort level lower than the one he would choose in period two if his reputation remains average—extreme reputations imply low efforts. Consequently, the expected marginal cost of exerting effort in period two is lower than the marginal cost of the equilibrium period-two effort level for an average reputation (the marginal cost is an increasing function). Thus, the incumbent's effort-smoothing decision implies that the marginal cost of the equilibrium period-one effort level—which is equal to the expected marginal cost of exerting effort in period two—is lower than the marginal cost of the equilibrium period-two effort level for the same (average) reputation. Therefore, for the same reputation, the period-one equilibrium effort level is lower than that of period two. That is, incentives to influence the re-election probability are stronger closer to the election.

In another context, consider a professional athlete who has an average reputation at the beginning of a multi-year contract with a team and may want to exert effort in order to improve his reputation and obtain a good contract after his current contract ends. The discussion above indicates that the optimal strategy for the athlete is to wait until the end of his current contract to see whether it is worth exerting a high effort level. At the beginning of his current contract, he should choose an intermediate effort level. At the end of his contract, if his reputation remains average, he should choose a higher effort level. If his reputation became either very good or very bad (because his performance was very good or very bad), he should choose a lower effort level. Thus, for the same reputation level, the athlete exerts more effort at the end of his contract and there is a "renegotiation cycle."

This article first characterizes a model with the three simplifying assumptions adopted in earlier studies. Then, each of the three assumptions described above is relaxed, and yet the model still generates cycles without assuming strong asymmetries across periods because of the effort-smoothing considerations I first described in Martinez (2009b).

The rest of this article is structured as follows. Section 1 presents the main elements of a standard model of political cycles. Section 2 characterizes a benchmark with the three simplifying assumptions adopted in earlier studies. These assumptions are relaxed in Sections 3, 4, and 5. Section 3 assumes that beginning-of-term ability is not observable. It is shown that this does not change the incumbent's equilibrium decisions but it makes the optimal period-two effort level a function of the period-one effort level. In Section 4, I assume positive correlation between beginning-of-term ability and post-election ability. I show that the incumbent still chooses to exert zero effort at the beginning of the term, but his end-of-term equilibrium effort level depends on his period-one ability. In Section 5, it is assumed that observing performance in one period is not sufficient to fully learn ability, and it is explained how the incumbent's optimal effort-smoothing decision generates cycles. Section 6 concludes.

1.   THE MODEL

This article presents a three-period political-agency model of career concerns. In period one, there is a new policymaker in office. At the beginning of period three, elections are held: Voters decide whether to re-elect the incumbent policymaker or replace him with a policymaker who was not previously in office.

The amount of public good produced by the incumbent policymaker in period t, y_t, is a stochastic function of his ability, η_t, and his effort level, a_t. In particular,

$$y_t = a_t + \eta_t + \varepsilon_t, \tag{1}$$

where ε_t is a random variable.

Each period, the policymaker in office can exert effort to increase the amount of public good he produces. Voters do not observe the effort level (which is, of course, known by the incumbent policymaker).

The incumbent and voters do not know the incumbent's ability. The common belief about the ability of a new incumbent is given by the distribution of abilities in the economy.

The timing of events within each period is as follows. First, the incumbent decides on his effort level, after which η_t and ε_t are realized, and y_t is observed.

Voters' per-period utility is given by y_t. In period three, they decide on re-election in order to maximize the expected value of y_3.

A policymaker's per-period utility is normalized to zero if he is not in office. He receives $R > 0$ in each period during which he is in charge of the production of the public good. The cost of exerting effort is given by $c(a)$, with $c'(a) \geq 0$, $c''(a) > 0$, and $c'(0) = 0$. Let $\delta \in (0, 1)$ denote the voters'

and the incumbent's discount factor. I use backward induction to solve for the subgame perfect equilibrium of this game.

2. A BENCHMARK

This section provides a benchmark following earlier studies of political cycles by assuming that only the ability in the last period before the election is not observable at the time of the election, that ability follows a first-order moving average process, and that output is a perfect signal of ability (see, for example, Rogoff [1990], Shi and Svensson [2006], and the references therein).

The first period a policymaker is in office, his ability is given by $\eta_t = \gamma_t$, and in every other period, $\eta_t = \gamma_t + \gamma_{t-1}$, where γ_t is an i.i.d. random variable with mean m_1, differentiable distribution function Φ, and density function ϕ. When voters decide on re-election, γ_1 is known and γ_2 is not known. The production function is deterministic: $\varepsilon_t = 0$ for all t.

Observing output y_t allows voters and the incumbent to compute the values of η_t and γ_t using their knowledge of the effort exerted by the incumbent and the production function. Let η_{vt} and η_{it} denote the ability computed by voters and by the incumbent, respectively. Let γ_{vt} and γ_{it} denote the value of γ_t computed by voters and the incumbent, respectively. The incumbent knows the effort level he chooses and, therefore, he always can compute $\eta_t = y_t - a_t$ correctly (i.e., $\eta_{it} = \eta_t$). Using η_1, he can compute the value of γ_2:

$$\gamma_{i2} = y_2 - \eta_1 - a_2 = \gamma_2.$$

Voters compute η_2 and γ_2 using equilibrium effort levels. They are rational and understand the game. In particular, they know the incumbent's equilibrium strategy. At the time the incumbent decides his period-two effort level, he knows a_1 and y_1. Recall that the latter is a function of a_1 and, therefore, we can summarize the information available to the incumbent by the effort component, a_1, and the stochastic component, $\eta_1 = y_1 - a_1$, of y_1. For any value of η_1 and a_1, let $\alpha_2(\eta_1, a_1)$ denote the incumbent's equilibrium period-two effort level. Let a_1^* denote the incumbent's equilibrium period-one effort level. Voters compute

$$\gamma_{v2} = y_2 - \eta_1 - \alpha_2\left(\eta_1, a_1^*\right) = \gamma_2 + a_2 - \alpha_2\left(\eta_1, a_1^*\right). \qquad (2)$$

In period three, there is no future re-election probability that could be influenced by the incumbent. Therefore, any policymaker would exert zero effort. Consequently, when forward-looking voters decide on re-election, they compare the incumbent's period-three expected ability with the period-three expected ability of a policymaker who was not previously in office. The incumbent's period-three expected ability computed by voters is equal to γ_{v2}. The expected period-three ability of a policymaker who was not in office before is m_1. Consequently, voters re-elect the incumbent if and only if $\gamma_{v2} > m_1$.

That is, the incumbent is re-elected if and only if $\gamma_2 + a_2 - \alpha_2\left(\eta_1, a_1^*\right) > m_1$, or equivalently $\gamma_2 > m_1 + \alpha_2\left(\eta_1, a_1^*\right) - a_2$. Thus, exerting effort in period two decreases the minimum realization of γ_2 that would allow the incumbent to be re-elected and, therefore, it increases the re-election probability.

The incumbent's period-two maximization problem reads

$$\max_{a_2 \geq 0}\left\{\delta R\left[1 - \Phi\left(m_1 + \alpha_2\left(\eta_1, a_1^*\right) - a_2\right)\right] - c\left(a_2\right)\right\}, \tag{3}$$

where $1 - \Phi\left(m_1 + \alpha_2\left(\eta_1, a_1^*\right) - a_2\right)$ is the probability of re-election. Note that the incumbent can compute equilibrium effort levels as voters do (all information available to voters is also available to the incumbent) and, therefore, he can compute $\alpha_2\left(\eta_1, a_1^*\right)$.

In this article, I characterize the incumbent's equilibrium effort levels through the first-order condition of his maximization problems.[3] Note that for finding the equilibrium effort level, we solve a fixed-point problem. The effort level that maximizes the incumbent's expected utility in (3) depends on the effort level voters use to compute the signal, $\alpha_2\left(\eta_1, a_1^*\right)$. In equilibrium, the incumbent's effort level must be equal to the effort level voters use to compute the signal.

The optimal period-two effort level satisfies

$$c'\left(\alpha_2\left(\eta_1, a_1\right)\right) = \delta R\phi\left(m_1 + \alpha_2\left(\eta_1, a_1^*\right) - \alpha_2\left(\eta_1, a_1\right)\right). \tag{4}$$

Let a_2^* denote the period-two equilibrium effort level. In equilibrium, $a_1 = a_1^*$ and, therefore, a_2^* satisfies

$$c'\left(a_2^*\right) = \delta R\phi\left(m_1\right) > 0. \tag{5}$$

Equation (5) shows that the equilibrium effort level is such that the marginal cost of exerting effort is equal to the marginal benefit of exerting effort. The incumbent benefits from exerting effort because this increases the re-election probability. The marginal benefit of exerting effort is given by the change in the probability of re-election multiplied by R (the value of winning the election) and the discount factor, δ.

It should be mentioned that, in models of career concerns, equilibrium effort levels are typically inefficient (for a more thorough discussion of this issue, see Foerster and Martinez [2006]). The efficient effort level is the one a benevolent social planner would force the incumbent to exert (if he could observe the effort exerted by the incumbent). This effort level can be defined as the one at which the social marginal cost of exerting effort (the incumbent's marginal cost) equals the social marginal benefit of exerting effort (the increase

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[3] As in previous models of political agency, assumptions are necessary to guarantee the concavity of these problems in which the re-election probability may not be a concave function of the incumbent's decision. For example, the first term in the objective function in (3) may not be globally concave. In order to assure global concavity of the incumbent's problems, it is sufficient to assume enough convexity in the cost of the effort function.

in output implied by an extra unit of effort, which according to the production function in equation 1 is equal to one). Since the incumbent's marginal benefit of exerting effort represented in the right-hand side of equation (5) is typically different from the marginal productivity of effort, the equilibrium effort level is typically inefficient. Furthermore, since the social marginal benefit and marginal cost of exerting effort are the same every period, political cycles (differences in effort levels within a term) imply inefficiencies.

Note that a_2^* does not depend on η_1 or a_1. Equation (4) shows that, since the period-two equilibrium effort level does not depend on η_1 or a_1, off the equilibrium path (i.e., when $a_1 \neq a_1^*$) the optimal period-two effort level does not depend on η_1 or a_1 (for a more thorough discussion of how the history of the game affects the agent's strategy in models of career concerns, see Martinez [2009a]). Furthermore, since $c'\left(a_2^*\right) > 0$, $a_2^* > 0$.

In period one, the incumbent anticipates equilibrium play in the subsequent periods. In particular, the incumbent anticipates that the probability of re-election is given by $1 - \Phi(m_1)$ and does not depend on his period-one effort level. Consequently, the period-one equilibrium effort level is given by $a_1^* = 0 < a_2^*$.

Thus, I have shown that, under the standard assumptions in earlier studies of political cycles, the incumbent can affect his re-election probability only with the last effort level prior to the election and, therefore, cycles appear (the incumbent only chooses a positive effort level in period two). In the next sections, I shall discuss the consequences of relaxing these assumptions.

3.   SYMMETRIC OBSERVABILITY

In Section 2, the incumbent's period-one ability, η_1, was observable and, therefore, there was nothing the incumbent could do in period one to influence voters' beliefs about his post-election ability and the re-election probability. In this section, I assume that η_1 is not observable. I will show that this complicates the analysis, but that not exerting effort in period one is still optimal for the incumbent. The period-two equilibrium effort level is also identical to the one found in Section 2. The assumption on the observability of η_1 only affects the incumbent's off-equilibrium period-two optimal effort choices.

Let

$$\eta_{v1} = y_1 - a_1^* = \eta_1 + a_1 - a_1^* \tag{6}$$

denote the period-one ability computed by voters using the equilibrium effort level. Using η_{v1} and the equilibrium effort strategies, voters compute

$$\gamma_{v2} = y_2 - \eta_{v1} - \alpha_2\left(\eta_{v1}, a_1^*\right) = \gamma_2 + a_2 - a_1 + a_1^* - \alpha_2\left(\eta_{v1}, a_1^*\right). \tag{7}$$

As in Section 2, the incumbent is re-elected if and only if $\gamma_{v2} > m_1$. He can compute a_1^* and η_{v1} as voters do and, therefore, he can compute $\alpha_2\left(\eta_{v1}, a_1^*\right)$.

Thus, the incumbent's period-two maximization problem reads

$$\max_{a_2 \geq 0} \left\{ \delta R \left[1 - \Phi \left(m_1 + a_1 - a_1^* + \alpha_2 \left(\eta_{v1}, a_1^* \right) - a_2 \right) \right] - c \left(a_2 \right) \right\}. \quad (8)$$

The solution of problem (8), $\alpha_2 \left(\eta_1, a_1 \right)$, satisfies

$$c' \left(\alpha_2 \left(\eta_1, a_1 \right) \right) = \delta R \phi \left(m_1 + a_1 - a_1^* + \alpha_2 \left(\eta_{v1}, a_1^* \right) - \alpha_2 \left(\eta_1, a_1 \right) \right). \quad (9)$$

In equilibrium, $a_1 = a_1^*$ and, therefore, $\alpha_2 \left(\eta_1, a_1 \right) = \alpha_2 \left(\eta_{v1}, a_1^* \right)$ (see equation 6). Consequently, the period-two equilibrium effort level is the same as in Section 2 (i.e., it is given by $c' \left(a_2^* \right) = \delta R \phi \left(m_1 \right) > 0$).

Note that, as in Section 2, the equilibrium period-two effort level does not depend on η_1 and a_1. However, if η_1 is not observable, off equilibrium the optimal period-two effort level depends on a_1. Let $\hat{\alpha}_2 \left(a_1 \right)$ denote this optimal effort level, which satisfies

$$c' \left(\hat{\alpha}_2 \left(a_1 \right) \right) = \delta R \phi \left(m_1 + a_1 - a_1^* + a_2^* - \hat{\alpha}_2 \left(a_1 \right) \right).$$

At the beginning of period two, the incumbent's expected utility is given by

$$W_2 \left(a_1 \right) = R - c \left(\hat{\alpha}_2 \left(a_1 \right) \right) + \delta R \left[1 - \Phi \left(m_1 + a_1 - a_1^* + a_2^* - \hat{\alpha}_2 \left(a_1 \right) \right) \right]. \quad (10)$$

The period-one incumbent's maximization problem is given by

$$\max_{a_1 \geq 0} \left\{ \delta W_2 \left(a_1 \right) - c \left(a_1 \right) \right\}.$$

Recall that, since the incumbent's period-one ability, η_1, is not observable, the period-one ability computed by voters, η_{v1}, is increasing with respect to a_1. Thus, in period one, the incumbent could choose a higher effort level in order to make voters believe that he has more ability. However, the incumbent's continuation utility is lower when voters believe that his period-one ability is higher. There are two reasons for this.

First, under the assumptions in this section (and in earlier studies of political cycles), only period-two ability is correlated with period-three ability and, therefore, only period-two ability directly influences the re-election decision. Consequently, the incumbent would only want to influence voters' period-one inference in order to influence their period-two inference.

Second, for any period-two output observation, y_2, voters' inference about the period-two ability, γ_{v2}, is decreasing with respect to η_{v1} (see equation 7). If η_{v1} is higher, voters believe that y_2 is the result of a higher period-one ability and a lower period-two ability.

Since the incumbent's continuation utility is lower when voters believe that his period-one ability is higher, $W_2 \left(a_1 \right)$ is decreasing with respect to a_1 (recall that equation 6 shows that η_{v1} is increasing with respect to a_1). That is, the incumbent does not have incentives to exert effort in period one. If he exerted effort, he would both suffer the cost of exerting effort and decrease

his continuation utility. Therefore, the period-one equilibrium effort level is given by $a_1^* = 0 < a_2^*$. Thus, equilibrium effort levels are identical to those found in Section 2, and the assumption on the observability of η_1 only affects the incumbent's off-equilibrium period-two optimal effort choices.

4. A RANDOM WALK PROCESS FOR ABILITY

In the previous section, I showed that when the incumbent's period-one ability is not correlated with his post-election ability (and, therefore, his period-one effort cannot directly influence the re-election probability), the incumbent does not want to exert effort in period one. This section studies the effects of allowing for correlation between the period-one ability and the post-election ability.

Following Holmström's (1999) seminal paper on career concerns, I assume that $\eta_{t+1} = \eta_t + \xi_t$, where ξ_t is normally distributed with mean 0 and precision h_ξ (the variance is $\frac{1}{h_\xi}$), and it is unobservable. The common belief about the ability of a new incumbent is given by the distribution of abilities in the economy, which is normally distributed with mean m_1 and precision h_η (these are the beliefs about the period-one incumbent's ability). Thus, results presented in this section are a special case of the results presented in Martinez (2009b). Let $\phi(v; x, z)$ denote the density function for a normally distributed random variable V with mean x and precision z, and let $\Phi(v; x, z)$ denote the corresponding cumulative distribution function.

As in previous sections, the incumbent is re-elected if and only if his expected period-three ability is higher than the expected period-three ability of a policymaker who was not previously in office. That is, the incumbent is re-elected if and only if $\eta_{v2} = \eta_2 + a_2 - \alpha_2\left(\eta_{v1}, a_1^*\right) > m_1$ (i.e., the incumbent is re-elected if and only if $\eta_2 > m_1 + \alpha_2\left(\eta_{v1}, a_1^*\right) - a_2$). Thus, the incumbent's period-two maximization problem reads

$$\max_{a_2 \geq 0} \left\{ \delta R \left[1 - \Phi\left(m_1 + \alpha_2\left(\eta_{v1}, a_1^*\right) - a_2; \eta_1, h_\xi\right) \right] - c\left(a_2\right) \right\}. \quad (11)$$

The solution of (11), $\alpha_2\left(\eta_1, a_1\right)$, satisfies

$$c'\left(\alpha_2\left(\eta_1, a_1\right)\right) = \delta R \phi\left(m_1 + \alpha_2\left(\eta_{v1}, a_1^*\right) - \alpha_2\left(\eta_1, a_1\right); \eta_1, h_\xi\right).$$

In equilibrium, $a_1 = a_1^*$ and, therefore, $\eta_{v1} = \eta_{i1} = \eta_1$ and $\alpha_2\left(\eta_{v1}, a_1^*\right) = \alpha_2\left(\eta_1, a_1\right)$. Let $a_2^*\left(\eta_1\right) \equiv \alpha_2\left(\eta_1, a_1^*\right)$ denote the period-two equilibrium effort level, which is given by

$$c'\left(a_2^*\left(\eta_1\right)\right) = \delta R \phi\left(m_1; \eta_1, h_\xi\right). \quad (12)$$

Note that, in this section, the period-two equilibrium effort level depends on the period-one ability η_1 (recall this was not the case in previous sections). The realization of period-one ability shock affects the distribution of the period-two ability shock.

At the beginning of period two, the incumbent's expected utility is given by

$$
\begin{aligned}
W_2\left(\eta_1, a_1\right) \;=\;& R - c\left(\alpha_2\left(\eta_1, a_1\right)\right) \\
& + \delta R\left[1 - \Phi\left(m_1 + a_2^*\left(\eta_1\right) - \alpha_2\left(\eta_1, a_1\right); \eta_1, h_\xi\right)\right].
\end{aligned}
$$

The period-one incumbent's maximization problem is given by

$$
\max_{a_1 \geq 0} \int W_2\left(\eta_1, a_1\right) \phi\left(\eta_1; m_1, h_\eta\right) d\eta_1 - c\left(a_1\right).
$$

Let $a_2^{*\prime}\left(\eta_1\right)$ denote the derivative of the period-two equilibrium effort level with respect to the period-one ability. The following proposition presents the incumbent's effort-smoothing decision (see Appendix A for the proof).

Proposition 1 *There exists a unique period-one equilibrium effort level that satisfies*

$$
c'\left(a_1^*\right) = \delta \int -a_2^{*\prime}\left(\eta_1\right) c'\left(a_2^*\left(\eta_1\right)\right) \phi\left(\eta_1; m_1, h_\eta\right) d\eta_1. \qquad (13)
$$

The Euler equation (13) represents the typical intertemporal tradeoff in dynamic models: Having less utility in period one allows the incumbent to have more utility in period two. In this case, a lower expected effort level in period two compensates for a higher effort level in period one. The incumbent knows that he could affect the re-election probability by exerting effort in periods one and two. He could exert more effort in period one and less effort in period two (or vice versa) and still have the same re-election probability.

Equation (13) shows that the optimal effort-smoothing decision depends on the cost and the effectiveness of exerting effort in each period. In equation (13), $-a_2^{*\prime}\left(\eta_1\right)$ represents the *relative effectiveness* in changing η_{v2} (and, therefore, the re-election probability) of a_1 (compared with a_2). The incumbent's period-one effort level affects η_{v1} directly, and it affects η_{v2} through η_{v1}. His period-two effort level affects η_{v2} directly. Thus, the relative effectiveness is the derivative of $\eta_{v2} = y_2 - a_2^*\left(\eta_{v1}\right)$, with respect to η_{v1}. For example, if voters expect a lower period-two effort level from an incumbent who is perceived to be better, then, by choosing a higher effort level in period one, and making η_{v1} higher, the incumbent would make voters expect a lower period-two effort level. Consequently, voters would think that the period-two outcome is the result of a lower period-two effort level and a higher period-two ability. Thus, the incumbent's period-one effort would have a positive effect on the voters' period-two learning.

This section introduces incentives to exert effort at the beginning of a term. These incentives were not present in previous sections, where beginning-of-term ability was not correlated with post-election ability. A positive relative effectiveness implies that period-one effort was effective in changing η_{v2} (and,

therefore, the re-election probability). Thus, in period one, the incumbent may want to exert effort. Recall that, in Section 2, the relative effectiveness is zero (period-one effort is not effective), and in Section 3 it is negative (with the moving-average assumption, the incumbent's expected post-election ability is decreasing with respect to the beginning-of-term ability inferred by voters). In this section, the relative effectiveness of period-one effort could be positive. It could even be higher than one (implying that beginning-of-term effort is more effective than end-of-term effort in changing the re-election probability). However, the next proposition shows that, even though the incumbent could use beginning-of-term effort to increase the re-election probability, under the assumptions in this section, the incumbent chooses to exert zero effort at the beginning of the term because the expected relative effectiveness is equal to zero (see Appendix B for the proof).[4]

Proposition 2 *In period one, the incumbent chooses not to exert effort.*

Loosely speaking, proposition 2 shows that the incumbent does not expect his period-one effort level to be effective in changing the re-election probability and, therefore, he does not exert effort in period one. There are two reasons for this. First, on average, the effect of period-one effort on period-two learning is zero. Second, period-one learning does not have a direct effect on the re-election probability (i.e., period-one effort may only affect the re-election probability through its effect on period-two learning). Since there is no noise in the production process, learning the incumbent's period-two performance is enough to perfectly learn his type. Thus, the policymaker's behavior is different closer to the election because we assume that his actions can only have a direct effect on the re-election probability closer to the election. The next section explains how the model can generate a cycle without this assumption.

5. A STOCHASTIC PRODUCTION FUNCTION

In previous sections, cycles arise because I assume differences across periods (besides the proximity of the election). In particular, in Section 4, I showed that assuming that output is a perfect signal of ability generates a strong asymmetry across periods. In this section I relax this assumption. In particular, as in Holmström (1999), I assume that ε_t is a normally distributed random variable with expected value 0 and precision h_ε—consequently, I can interpret the results in Section 4 as the limit of the results presented in this section when h_ε goes to infinity. Thus, the model studied in this section is the one-election version of the model I study in Martinez (2009b).

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[4] As shown in the proof of proposition 2, the symmetry of the equilibrium effort strategy is necessary to prove this result. In Martinez (2009b), I show that, in a version of the model with more than three periods in which the incumbent can be re-elected more than once, even if the ability distribution is symmetric, the equilibrium effort strategy may not be symmetric.

Since there is noise in production, observing output only allows voters and the incumbent to compute a "signal" of the incumbent's ability. This is in contrast with previous sections, where observing output allows voters and the incumbent to compute the incumbent's ability. Define $s_t \equiv \eta_t + \varepsilon_t$. I refer to s_t as the period-t *signal* of the incumbent's ability. Voters and the incumbent use the signal they compute to update their beliefs about the incumbent's ability. From this point forward, *belief* refers to *belief about the incumbent's ability* unless stated otherwise.

Beliefs are Gaussian and, therefore, they can be characterized by their mean and their precision. Depending on the precision of the shock that determines the evolution of the incumbent's ability, h_ξ, the precision of beliefs may be increasing or decreasing with respect to the number of performance observations (see Holmström 1999).[5] For simplicity, I assume that h_ξ is such that the precision of beliefs is constant. That is, I assume

$$h_\xi = \frac{h_\eta^2 + h_\eta h_\varepsilon}{h_\varepsilon}. \qquad (14)$$

By making an assumption that guarantees that the precision of beliefs is constant, I can keep track of their evolution by following the evolution of their mean. This simplifies the analysis.

Equation (14) implies that for any t, the precision of the period-$t + 1$ beliefs about the signal s_{t+1} is equal to the precision of the period-t beliefs about the signal s_t. This precision is given by

$$H \equiv \frac{h_\eta h_\varepsilon}{h_\varepsilon + h_\eta}. \qquad (15)$$

Since beliefs about the signal are also Gaussian and have a constant precision, the evolution of these beliefs can also be summarized by the evolution of their mean, which is equal to the mean of the beliefs about ability.

As in previous sections, the incumbent is re-elected if and only if his expected period-three ability is higher than the expected period-three ability of a policymaker who was not previously in office. Let m_{vt} and m_{it} denote the mean of the voters' and the incumbent's beliefs *at the beginning of period t* (from here on, *at period t*). I refer to a *belief with mean m* as *belief m*. The incumbent is re-elected if and only if $m_{v3} > m_1$.

Bayes' rule implies that the mean of beliefs at $t + 1$ is a weighted sum of the mean at t and the period-t signal. Equation (14) implies that the weight of the period-t mean belief in the period-$t + 1$ mean belief does not depend on the number of observations of the incumbent's performance. This weight

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[5] In general, the precision of $t + 1$ believes h_{t+1} is given by

$$h_{t+1} = \frac{(h_t + h_\varepsilon) h_\xi}{h_t + h_\varepsilon + h_\xi}.$$

is given by

$$\mu = \frac{h_\eta}{h_\eta + h_\varepsilon}. \tag{16}$$

Let s_{vt} and s_{it} denote the period-t signal computed by voters and by the incumbent, respectively. Since the incumbent knows the effort he exerted, he can compute the true signal, i.e., $s_{it} = y_t - a_t = s_t$. Thus, $m_{it+1} = \mu m_{it} + (1 - \mu) s_{it} = \mu m_{it} + (1 - \mu) s_t$.

Voters compute the signal using equilibrium effort strategies. In Section 4, I wrote the incumbent's period-two equilibrium strategy as a function of his period-one ability and effort level. In this section, at the time of the period-two effort decision, the incumbent does not know his period-one ability, but he learned the signal s_1. Instead of writing his period-two equilibrium strategy as a function of a_1 and s_1, for expositional simplicity, I will write the equilibrium strategy as a function of a_1 and $m_2 = \mu m_1 + (1 - \mu)s_1$, $\alpha_2(m_2, a_1)$. Thus, the period-two signal computed by voters is given by

$$s_{v2} \equiv y_2 - \alpha_2(m_{v2}, a_1^*) = s_2 + a_2 - \alpha_2(m_{v2}, a_1^*), \tag{17}$$

where

$$\begin{aligned} m_{v2} &= \mu m_1 + (1 - \mu)s_{v1} = \mu m_1 + (1 - \mu)\left(s_1 + a_1 - a_1^*\right) = \\ &\quad m_2 + (1 - \mu)\left(a_1 - a_1^*\right). \end{aligned}$$

Consequently,

$$m_{v3} = \mu m_{v2} + (1 - \mu)s_{v2} = \mu m_{v2} + (1 - \mu)[s_2 + a_2 - \alpha_2(m_{v2}, a_1^*)]. \tag{18}$$

Equation (18) shows how exerting effort helps the incumbent increase the re-election probability. The expected ability in the voters' belief is increasing with respect to effort, and voters re-elect the incumbent if and only if they expect his ability to be good enough.

Recall that voters and the incumbent have the same period-one belief. Moreover, in any period in which the incumbent exerts the equilibrium effort level, voters and the incumbent compute the same signal. Consequently, in equilibrium, the voters' and the incumbent's beliefs coincide ($m_{vt} = m_{it}$). The incumbent is re-elected if and only if $s_2 > \frac{m_1 - \mu m_{v2}}{1-\mu} + \alpha_2(m_{v2}, a_1^*) - a_2$ (i.e., if and only if $m_{v3} > m_1$). Let $M_{v2}(m_2, a_1) \equiv m_2 + (1 - \mu)\left(a_1 - a_1^*\right)$ denote the mean of the voters' period-two belief when m_2 is the mean of the incumbent's period-two belief and a_1 is the period-one effort level. Thus, the incumbent's period-two maximization problem can be written as

$$\max_{a_2 \geq 0} \left\{ \delta R \left[1 - \Phi\left(\frac{m_1 - \mu M_{v2}(m_2, a_1)}{1 - \mu} \right. \right. \right.$$
$$\left. \left. \left. + \alpha_2(M_{v2}(m_2, a_1), a_1^*) - a_2; m_2, H \right) \right] - c(a_2) \right\}. \tag{19}$$

The following proposition shows that a unique fixed point that solves for the period-two equilibrium effort strategy exists (see Martinez [2009b] for the proof).[6]

Proposition 3 *(Martinez 2009b): Let m_2 denote the voters' and the incumbent's beliefs at the beginning of period two. The unique period-two equilibrium effort strategy $a_2^*(m_2)$ satisfies*

$$c'\left(a_2^*(m_2)\right) = \delta R \phi \left(\frac{m_1 - \mu m_2}{1 - \mu}; m_2, H\right) > 0. \qquad (20)$$

Thus, for any reputation m_2, the equilibrium period-two effort level $a_2^*(m_2)$ is positive.

Let $M_2(s_1) \equiv \mu m_1 + (1 - \mu)s_1$ denote the mean of the incumbent's period-two posterior belief when s_1 is the signal he uses to update his prior. The period-one incumbent's maximization problem is given by

$$\max_{a_1 \geq 0} \left\{ \delta \int W_2 \left(M_2(s_1), a_1\right) \phi\left(s_1; m_1, H\right) ds_1 - c\left(a_1\right) \right\},$$

where

$$
\begin{aligned}
W_2 \left(m_2, a_1\right) &= R - c\left(\alpha_2(m_2, a_1)\right) \\
&\quad + \delta R \left[1 - \Phi \left(\frac{m_1 - \mu M_{v2}\left(m_2, a_1\right)}{1 - \mu} \right. \right. \\
&\quad \left. \left. + a_2^*(M_{v2}\left(m_2, a_1\right)) - \alpha_2(m_2, a_1); m_2, H\right) \right]
\end{aligned}
$$

denotes the incumbent's expected utility at the beginning of period two when his belief is characterized by m_2 and he chose a_1. The following proposition presents the incumbent's period-one effort-smoothing decision (Martinez [2009b] presents the proof).

Proposition 4 *(Martinez 2009b): There exists a unique and positive period-one equilibrium effort level a_1^* that satisfies*

$$c'\left(a_1^*\right) = \delta \mu \int_{-\infty}^{\infty} c'\left(\alpha_2(M_2(s_1))\right) \phi\left(s_1; m_1, H\right) ds_1 > 0. \qquad (21)$$

In equation (21), the expected *relative effectiveness* in changing the re-election probability of the incumbent's period-one effort (compared with his period-two effort) is represented by $\mu > 0$, which indicates the relative weight of s_{v1} (compared with s_{v2}) in

$$m_{v3} = \mu^2 m_1 + (1 - \mu)s_{v2} + \mu(1 - \mu)s_{v1}.$$

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[6] Note that, for $\mu = 0$ (and, therefore, for $m_2 = \eta_1$), the equilibrium effort strategy in equation (20) coincides with the one in equation (12).

Thus, the expected relative effectiveness, μ, indicates the relative importance of the direct effect on the re-election probability of appearing more talented in period one (recall the incumbent is re-elected if and only if $m_{v3} > m_1$).[7]

Since the equilibrium period-two effort level in equation (20) is a function of the incumbent's period-two reputation, m_2, differences in the incumbent's behavior during his term in office could be the result of changes in his reputation and may not imply that he is deciding differently because the election time is closer. I want to focus on differences in the incumbent's behavior that are *due to the proximity of the election*. Therefore, I refer to differences in behavior across the incumbent's term *for a given reputation level* as political cycles. The next proposition shows that the model generates such cycles (I present the proof in Martinez [2009b]).

Proposition 5 *(Martinez 2009b): For the same reputation level (m_1), the period-two equilibrium effort level is higher than the period-one equilibrium effort level.*

Recall that the lessened effectiveness of effort further from the election is the force behind political cycles in previous sections, which present this mechanism in its most extreme form by making assumptions that imply that beginning-of-term effort is not expected to be effective in increasing the re-election probability. In particular, the equilibrium strategy in Section 4 is a special case of the equilibrium strategy presented in this section for which period-one effort is not expected to be effective ($\mu = 0$). In contrast, proposition 5 shows that a standard model can generate cycles for all possible values of μ. In particular, the model can generate cycles if the effectiveness of beginning-of-term actions is arbitrarily close to the effectiveness of end-of-term actions (μ is arbitrarily close to 1). The proposition also shows that discounting is not necessary for generating cycles in the model: Cycles arise for all values of δ, including $\delta = 1$.

How could political cycles arise in an economy without no discounting where manipulating policy is equally effective in every period? As I explain in Martinez (2009b), cycles could still arise in such an economy because at the beginning of his term, the incumbent knows that his reputation is likely to change, and he anticipates that this change will lead him to choose an effort level lower than the one he would choose at the end of his term for his beginning-of-term reputation level. Note first that the period-two equilibrium effort strategy defined in equation (20) is a hump-shaped function of the

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[7] As in Section 4, because of the symmetry of the equilibrium period-two effort strategy, the incumbent does not expect that his period-one effort will affect the re-election probability through the period-two effort level used by voters for their period-two learning. In Martinez (2009a), I present a more thorough discussion of the relative effectiveness and this indirect effect of current-period effort on next-period learning.

incumbent's period-two reputation, m_2, as is the signal density function.[8] That is, in period two, the incumbent exerts less effort when his reputation has more extreme values. Thus, in period one, he anticipates that if his reputation does not change, he will choose $\alpha_2(m_1)$ in period two. He also anticipates that, for example, if his period-one performance turns out to be either very good or very bad (and, therefore, his period-two reputation is either very good or very bad), he will exert a lower effort level in period two. In particular, the expected period-two effort level is lower than $\alpha_2(m_1)$, and the expected marginal cost of exerting effort in period two is lower than $c'(\alpha_2(m_1))$. Therefore, the effort-smoothing rule in (21) implies that $c'\left(a_1^*\right) < c'(\alpha_2(m_1))$, and the incumbent chooses $a_1^* < \alpha_2(m_1)$.

In Martinez (2009b), I analyze the multiple-election version of the model presented in this section. That is, I analyze a model with more than three periods in which the incumbent could run for re-election more than once. Such a model allows for the study of situations that do not arise in the one-election version: With multiple elections, the beginning-of-term reputation may be better than the average reputation, and the end-of-term effort may not be maximized at the beginning-of-term reputation. Recall that in the one-election version of the model, at the beginning of the term, there is a new incumbent with an average reputation, and the proof of proposition 5 (which shows that a political cycle arises in the one-election version of the model) is based on the end-of-term equilibrium effort strategy being such that it is optimal to exert the maximum effort level for the beginning-of-term reputation. In Martinez (2009b), I show that the insight described in the one-election version of the model helps us understand political cycles with multiple elections: For the same reputation, end-of-term effort is higher if, at the beginning of the term, the incumbent anticipates that changes in his reputation will, on average, lead him to choose an end-of-term effort level lower than the one he would choose for his beginning-of-term reputation. I also show that the model can generate expected end-of-term effort levels higher than the beginning-of-term effort level.

6. CONCLUSIONS

Using a career-concern model of political cycles, this article discusses why political incentives could be different in election times. First, I show that cycles could arise if end-of-term political actions are more effective in changing the re-election probability than beginning-of-term actions. Following earlier

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[8] As I explain in Martinez (2009b), one can expect equilibrium effort to be hump-shaped in the incumbent's belief if better incumbents are less (more) likely to produce bad (good) signals. One can expect equilibrium effort to be hump-shaped in the voters' belief if extreme signals are less likely than average signals.

theoretical studies of political cycles, I model this intuition in its most extreme form. In particular, I assumed that at the time of the election, only the end-of-term ability is not observable; that only the incumbent's end-of-term performance is correlated with his post-election performance; and that the incumbent's performance is a perfect signal of his type. Then, I relax each of these assumptions and discuss how they affect results. In particular, I show that the model still generates cycles without assuming strong asymmetries across periods because of the effort-smoothing considerations I first described in Martinez (2009b). The analysis in this article helps one understand other agency relationships in which an important part of the compensation is decided upon infrequently.

APPENDIX A   : PROOF OF PROPOSITION 1

In equilibrium, $a_1^* = a_1$ and, therefore, the first-order condition of the incumbent's period-one problem reads

$$c'\left(a_1^*\right) = \delta \int -\delta R a_2^{*\prime}\left(\eta_1\right) \phi\left(m_1; \eta_1, h_\xi\right) \phi\left(\eta_1; m_1, h_\eta\right) d\eta_1. \qquad (22)$$

Equation (12) shows that

$$\delta R \phi\left(m_1; \eta_1, h_\xi\right) = c'\left(a_2^*\left(\eta_1\right)\right). \qquad (23)$$

Plugging equation (23) into equation (22), we obtain equation (13). Since there is a unique period-two equilibrium strategy, $a_2^*\left(\eta_1\right)$, defined by equation (12), there is a unique period-one equilibrium effort level, a_1^*, that can easily be obtained from equation (13) (the right-hand side of equation 13 does not depend on the period-one effort level).

APPENDIX B   : PROOF OF PROPOSITION 2

Recall that $\phi\left(m_1; \eta_1, h_\xi\right)$ is symmetric with respect to η_1 with the maximum at $\eta_1 = m_1$. Consequently, $c'\left(a_2^*\left(\eta_1\right)\right)$ is a symmetric function with the maximum at $\eta_1 = m_1$ (see equation 12). Moreover, $\phi\left(\eta_1; m_1, h_\eta\right)$ is a symmetric function with respect to η_1 with the maximum at $\eta_1 = m_1$. In addition, $a_2^{*\prime}\left(m_1\right) = 0$, and, for any $A \in \Re$, $a_2^{*\prime}\left(m_1 + A\right) = -a_2^{*\prime}\left(m_1 - A\right)$

(see equation 12). Consequently,

$$\int a_2^{*\prime}\left(\eta_1\right) c'\left(a_2^*\left(\eta_1\right)\right) \phi\left(\eta_1; m_1, h_\eta\right) d\eta_1 = 0,$$

and according to equation (13), $a_1^* = 0$.

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