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Elections and Macroeconomic Policy Cycles

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There is an extensive empirical literature on political business cycles, but its theoretical foundations are grounded in pre-rational expectations macroeconomic theory. Here we show that electoral cycles in taxes, government spending and money growth can be modeled as an equilibrium signaling process. The cycle is driven by temporary information asymmetries which can arise if, for example, the government has more current information on its performance in providing for national defence. Incumbents cheat least when their private information is either extremely favourable or extremely unfavourable. An exogeneous increase in the incumbent party's popularity does not necessarily imply a damped policy cycle.

1. INTRODUCTION

At one time, research on political business cycles received a great deal of attention. Nordhaus (1975) and McRae (1977) provide important examples.[1] Their models suggest that politicians will inflate during election years in order to exploit a Phillips curve tradeoff which is more favourable in the short run than in the long run. Interest in these adaptive expectations models waned, however, after the rational expectations revolution of the seventies. As long as private agents (such as wage setters) understand the government's incentives, one would not expect to observe any systematic rise in employment prior to elections.[2] But the objections to conventional political business cycle models go beyond their Phillips curve formulation, and apply to any model in which the government takes artificial measures to make itself look good. Suppose the government tries to please the public before elections by raising transfers or by lowering taxes; according to Tufte (1978), this is the most robust empirical characteristic of the electoral cycle. Why should voters prefer a candidate who is suboptimally distributing tax distortions over time? Moreover, why should such actions suggest that the incumbent will do a good job over the course of the *coming* term?

Here we argue that electoral cycles in certain macroeconomic policy variables—such as taxes, government spending, deficits and money growth—derive from temporary information asymmetries.[3] We assume that the government observes an indicator of its performance (e.g. in providing national defence efficiently) before the representative voter does. Administrative performance is correlated over time; hence prior to election periods the incumbent has an incentive to try to "signal" that it is doing well. This gives rise to an electoral cycle in macroeconomic policy. (It is important to stress that our model does not directly provide a rationale for an electoral cycle in unemployment.)[4]

In Section 2 we present the basic model. Governments in this setup are differentiated in part by their level of "competency". Although the analysis could be extended to encompass other aspects of a government's performance, the notion of competency that we use is as follows: the more competent that a government is, the less revenue it needs to provide a given level of government services. This particular measure of competency stresses the administrative abilities of the policymaker. Naturally, other things being equal, voters prefer more competent governments. The government obtains information about its (serially-correlated) competency more quickly than voters can. However, at the beginning of each period voters receive a signal; they learn the level at which the government is going to set income or poll taxes. Because taxes are set at the beginning of the period, any (intentional or unintentional) error the government makes must be made up through the use of a distorting seignorage tax. (In other variants of the model, government spending can also be adjusted, and bonds can be issued to finance a deficit.) Thus the public observes the government's competency directly, but with a lag. During an election year, a vote-conscious incumbent party has an incentive to make its most recent "competency shock" appear large. The incumbent party's incentive to "cheat" (rely excessively on seignorage) is tempered only by the fact that it places some weight on social welfare.

There is one important difference between the incumbent party and the opposition party in our model. The opposition party has no credible way to "signal" the effectiveness of its policies. Obviously, there are many factors other than "competency" which influence the outcome of an election, but our model treats these as exogenous. Nevertheless, the framework developed here is sufficient to capture the essential elements of a political business cycle.

In Section 3, we consider equilibria in which voters' expectations depend only on known characteristics of the two parties, past observations on the competency shocks, and the government's most recent tax bill. In particular, expectations do not depend on how much a party might have "cheated" (set taxes suboptimally low) in previous elections. The equilibria in Section 3 are the only possible equilibria when the political parties have finite horizons, given the assumed information structure. Using only mild restrictions, we are able to prove the existence of a unique separating equilibrium, in which voters are able to exactly infer the incumbent's information from the tax bill.[5] Because the competency shock is directly observed by the public with a lag, there is never any cheating during off-election periods.

During election periods, the equilibrium has the following characteristics: If the incumbent party knows that its competency shock is the lowest possible, then it will not cheat at all. This result obtains even if the incumbent's temptation to improve its image is greatest when its competency is lowest. The use of seignorage is increasing over a range of realizations of the unobservable competency shock, but is declining at higher levels of competency. Incumbents of intermediate ability cheat the most. (This conclusion must be amended if there is an upper bound to the level at which taxes can be set.) The model also yields some interesting conclusions with respect to changes in observable factors. For example, the conventional wisdom is that the incumbent party will inflate less if it becomes more popular for noneconomic reasons. We show, however, that although an increase in popularity may cause the incumbent to cheat less if its unobservable competency shock is high, it will cheat more if it's competency is low.

In Section 4, we briefly discuss reputational equilibria which can arise if the two political parties have infinite horizons. In the conclusions, we discuss some empirical implications of the model, and some possible extensions.

2. THE MODEL

Every other period, atomistic voters choose between two political parties, "R" and "D". A major factor in the election is voters' perception of how "competent" each of the parties would be in administering the production of public goods. A party's competency is defined as follows. All governments are required to provide a fixed (observable) level of government services, G. The more competent the government, the less revenue it requires to deliver G:

$$G = \varepsilon + \tau + \Delta, \tag{1}$$

where ε is the government's competency. τ and Δ are two alternative forms of taxation: τ is a nondistorting (lump-sum) poll "tax" and Δ is a distortionary "seignorage" tax. Subject to the constraint (1), either taxes or seignorage can be negative.[6]

Each of the identical voters has a time-separable indirect utility function which depends on poll taxes and seignorage, and on a non-pecuniary incumbent-party specific shock, η. Period t social welfare is given by

$$\Omega_t = \bar{y} - \tau - \Delta - W(\Delta) + \eta_t, \tag{2}$$

where $\bar{y}$ is a constant which may be thought of as exogenous nonstoreable output, and W represents the distortions arising from use of the seignorage tax. These distortions are minimized when $\Delta = 0$; specifically, $W' > (<) 0$ for $\Delta > (<) 0$, and $W'' > 0$.[7] (The otherwise twice continuously differentiable function $W: (-\bar{\Delta}, \bar{\Delta}) \to R$ is not required to be differentiable at zero, and $W(\Delta) \to \infty$ as $\Delta \to \bar{\Delta}$.) From inspection of equations (1) and (2), it is obvious that it would always be socially efficient for the government to rely entirely on poll taxes τ, and to set seignorage $\Delta = 0$, regardless of its competency ε. (Consequently, we will sometimes refer to Δ as "cheating".) It is also obvious that other things equal, voters prefer the party with the higher ε.

Competency is stochastic. Each party's competency shock is serially correlated, so that for party $j = D, R$,

$$\varepsilon_t^j = \alpha_t^j + \alpha_{t-1}^j, \tag{3}$$

where $\{\alpha_t^j\}$ is an i.i.d. stochastic process on $A \equiv [0, \bar{\alpha})$, where $\bar{\alpha}$ may be infinite. For every s and t, α_t^D and α_s^R are independent, and they have the same twice-continuously differentiable distribution function. The mean of α is given by $E(\alpha_t^j) = \hat{\alpha}$. It is crucial that $\{\varepsilon_t^j\}$ display some serial correlation, or there would be no reason to vote for a party just because it appears more competent today. The assumption that the competency shocks follow first-order moving average [$MA(1)$] processes simplifies the analysis by making it possible to treat elections as independent. However, we present results in Section 3 indicating some qualitative features of the more general case. The fact that the shocks vary over time may be justified by noting that the leaders of a political party change, and that policy prescriptions suited for one historical episode may be inappropriate in other circumstances.

We assume that exogenous, party-specific, non-economic preference shocks also follow a first-order moving average process so that

$$\eta_t^R - \eta_t^D = q_t + q_{t-1}, \tag{4}$$

where $\{q_t\}$ is an i.i.d. stochastic process on R. The density function of q is unimodal, twice continuously differentiable, and symmetrically distributed around zero. η captures incumbent-specific factors uncorrelated with administrative competency. (For example, the party leader's looks or moral leadership.)

Any promises the two parties might make before an election have no impact on the voters in our model, since neither party has any incentive to be honest. What does make an impression on voters is their observations on the incumbent party's performance, from which they can infer something about its most recent competency shock. (We will describe the information structure shortly.) A macroeconomic policy cycle will arise because the incumbent party has an incentive to try to *signal* that its most recent competency shock is high. The opposition party can make promises, but it lacks an effective way to reveal how well it would have performed if it were currently in office. In fact, all the public knows about the opposition party is the probability distribution of its competency factor, ε. Because ε is an $MA(1)$ process, the fact that the opposition party may once have been in power is not informative.

It would be pointless for the incumbent party to try to deceive the public unless it has an information advantage. Our assumptions about the information structure and the timing of events are as follows. The incumbent party directly observes its most recent competency shock α_t. At this point, before it observes q_t, the government is required to set poll taxes, τ_t. Any shortfall in revenue must later be made up via the distorting seignorage tax, Δ_t. Citizens observe α_t only with a one-period lag, though they are able to draw inferences about α_t based on τ_t. After receiving their poll tax bills and after observing q_t, citizens vote if t is an election period. After the election, at the end of the period, the government collects taxes and produces G, using the seignorage tax if it set τ too low. Citizens observe Δ_t at this point and can deduce ε_t using the government budget constraint (1). However, we make the stronger assumption that by period $t+1$, citizens observe α_t directly. The reader may wish to refer to the depiction of the information structure given in Table I. The above scenario is consistent with the lag between conception and implementation of fiscal policy. The seignorage tax can be adjusted much more quickly than direct taxes. The q shock might be associated with the results of election-eve debates or a last-minute foreign policy crisis.

TABLE I

The Timing of Events

The incumbent party observes the latest shock to its competency level, α_t. The government sets tax rates for period t.	All agents observe the most recent shock to voter preferences, q_t, and elections are held.	Markets clear. Voters observe α_t directly and the level of seignorage (or of the deficit).	The winner of the period t election takes office for two periods. The timing of events is the same as in t, except there is no election. The next election is at $t+2$.
	Election		
	Period t		Period $t+1$

At time t, voters will prefer party R to party D if their expected utility from having party R in office during periods $t+1$ and $t+2$ is greater than that from having party D in office. Thus, party R will win if

$$E_t^P[\Omega_{t+1}^R+\Omega_{t+2}^R-(\Omega_{t+1}^D+\Omega_{t+2}^D)]\geqq 0, \tag{5}$$

where E_t^P is the expectations operator conditioned on time-t public information, which includes α_{t-1}, τ_t, G_t, q_{t-1} and q_t. We will temporarily conjecture that voters' expectations about Δ_{t+1} and Δ_{t+2} (suboptimal use of seignorage) do not depend on which party wins. This assumption will turn out to be correct in equilibrium because:

(a) no party ever chooses to inflate in the off-election year $t+1$, and

(b) conditional on time t information, α^D_{t+2} and α^R_{t+2} have the same distribution. Thus, despite the fact that Δ_{t+2} will turn out to be a function of α_{t+2}, voters have no information at time t to help predict which party will set Δ_{t+2} higher.

Given our assumptions on $E^P_t(\Delta_{t+1})$ and $E^P_t(\Delta_{t+2})$, equations (1)–(5) imply that

$$E^P_t(\Omega^R_{t+2}) = E^P_t(\Omega^D_{t+2}), \tag{6}$$

and

$$E^P_t(\Omega^R_{t+1} - \Omega^D_{t+1}) = E^P_t[(\varepsilon^R_{t+1} + \eta^R_{t+1}) - (\varepsilon^D_{t+1} + \eta^D_{t+1})]. \tag{7}$$

Without loss of generality, we will assume that the R party is the incumbent in period t. As the opposition D party has no way to signal its most recent competency shock, then by (3),

$$E^P_t(\varepsilon^R_{t+1} - \varepsilon^D_{t+1}) = E^P_t(\alpha^R_t) - \hat{\alpha}. \tag{8}$$

$\hat{\alpha}$ is simply the mean of the pool of possible competency types for the D party; we will analyse how $E^P_t(\alpha^R_t)$ is formed in Section 3. Combing equations (4), (7), and (8), the incumbent R party will win if

$$E^P_t(\alpha^R_t) - \hat{\alpha} + q_t \geqq 0. \tag{9}$$

The incumbent party, R, does not observe the disturbance to voters' preferences, q_t, at the time it sets taxes. Therefore its estimate of the probability it will win the election is[8]

$$U^R_t = U[E^P_t(\alpha^R_t)] = \text{Prob}\,[E^P_t(\alpha^R_t) - \hat{a} + q_t \geqq 0]. \tag{10}$$

Given our assumptions about the distribution of q, we can infer that U is twice-continuously differentiable, strictly increasing in $E^P_t(\alpha^R_t)$, $U'[E^P(\alpha_t)] \to 0$ as $E^P_t(\alpha_t) \to \infty$, and $U''[E^P_t(\alpha^R_t)] > (<) 0$ as $E^P_t(\alpha^R_t) < (>) \hat{\alpha}$. Clearly, $U^D = 1 - U^R$. In our model, the winner is unanimous but it is extremely straightforward to extend the analysis to allow q to differ across voters.

We now specify the objective functions of the two political parties. Each party aims to maximize a present-discounted-value functional which depends on (a) their probability of being in office, and (b) the social welfare losses due to suboptimal use of seignorage. The R party's objective function is

$$\Psi^R_t = E_t[x \textstyle\sum^T_{k \in s} \beta^{k-t} U^R_k - (1-x) \sum^T_{k=t} \beta^{k-t} W(\Delta_k)], \tag{11}$$

where S is the set of even-numbered (election) periods, T is the (possibly) infinite time horizon, and x is the weight the party places on being elected; $x \in (0, 1)$. Party D's utility function is identical.[9] Because we have allowed for fairly general U functions, the analysis can readily be generalized to the case where elections are not unanimous, and parties care about their plurality.

Our assumption that the incumbent party places some (possibly very small) weight on social welfare is critical to the analysis below. Signalling is not possible in the extreme case where $x = 1$, since the incumbent political party would always be willing to cause arbitrarily large macroeconomic distortions in order to infinitesimally improve its chances of being re-elected.

Also crucial is our assumption that the policymaker has a temporary information advantage over the public (at least, off the equilibrium path). Note that the representative voter understands the model. However, it is not worth it for him as an individual to monitor the government closely enough to have complete contemporaneous information on how effectively the government is spending his tax dollars. It is certainly reasonable to assume that a voter does not engage in costly information-gathering activities solely to decide his own vote, which has infinitesimal weight. Implicitly, we are assuming that other information which the voter does gather (because it is worthwhile in his production or consumption activities) does not allow him to directly observe α_t (until $t+1$). We are, or course, also assuming that there is no public watch group which can provide free, complete, and unbiased information.

3. NON-REPUTATIONAL EQUILIBRIUM

In this section, we analyse the case where the two political parties have finite time horizons. Because the information asymmetries are temporary, and because the random disturbances are $MA(1)$ processes, each election cycle turns out to be independent of all other election cycles. We are able to show that there exists a unique separating (sequential) equilibrium,[10] in which the incumbent party's action (tax bill) fully reveals its information (competency shock).[11] We then consider some qualitative features of the equilibrium.

If there were full information, so that voters knew the competency shock α_t at election time, then the incumbent party would have no incentive to cheat. For then it could not possibly influence voters' perceptions of its competency. Moreover, by cheating, it would only lower social welfare by increasing seignorage distortions. With asymmetric information, however, the incumbent party may have an incentive to lower taxes in election years to try to exaggerate its competency. We will temporarily posit that voters recognize this incentive and believe that the level of seignorage (cheating) depends on the government's competency shock, α_t. Later, we will verify that if voters have rational expectations, then this supposition is correct. Denote the voters' conjecture of seignorage as a function of α_t by

$$\Delta_t^* = \Delta^*(\alpha_t), \tag{12}$$

where the superscript referring to the political party has been dropped for notational convenience. Of course, voters do not actually observe Δ until after the election; their votes can only be conditioned on the observable variable, τ. Using (12) and the government's production function (1), we can express voters' beliefs about taxes as a function of α by

$$\tau^*(\alpha_t) = g_t - \alpha_t - \Delta^*(\alpha_t), \tag{13}$$

where $g_t \equiv G - \alpha_{t-1}$. We temporarily assume that τ^* is continuous and strictly decreasing. Then τ^* has an inverse function, τ^{*-1}, and the public's time-t expectation of α_t is

$$E_t^P(\alpha_t) = \tau^{*-1}(\tau_t) = \tau^{*-1}(g_t - \alpha_t - \Delta_t). \tag{14}$$

Substituting (14) into (10), and the result into (11) yields the incumbent party's maximization problem

$$\max_\Delta \{xU[\tau^{*-1}(g - \alpha - \Delta)] - (1-x)W(\Delta)\}, \forall \alpha, \tag{15}$$

where the subscript t has been dropped. Given the public's beliefs (12), the incumbent party's choice of Δ affects only current-period elements of its objective function, (11).

[Note that one can trivially rewrite the incumbent's maximization problem in terms of τ using eq. (1).]

The first- and second-order conditions for an interior solution to (15) are

$$-xU'[\tau^{*-1}(g-\alpha-\Delta)]\tau^{*-1\prime}(g-\alpha-\Delta)-(1-x)W'(\Delta)=0, \tag{16}$$

$$xU''[\tau^{*-1}(g-\alpha-\Delta)][\tau^{*-1\prime}(g-\alpha-\Delta)]^2+xU'[\tau^{*-1}(g-\alpha-\Delta)]\tau^{*-1\prime\prime}(g-\alpha-\Delta) -(1-x)W''(\Delta)<0. \tag{17}$$

In a separating equilibrium, voters' conjectures must be consistent, and hence $\Delta^*=\Delta\ \forall\alpha$. Thus, equations (16) and (17) can be rewritten as the interior equilibrium conditions:

$$\Delta'(\alpha)=\frac{xU'(\alpha)}{(1-x)W'[\Delta(\alpha)]}-1, \tag{18}$$

$$\frac{xU''(\alpha)}{[1+\Delta'(\alpha)]^2}-\frac{xU'(\alpha)\Delta''(\alpha)}{[1+\Delta'(\alpha)]^3}-(1-x)W''[\Delta(\alpha)]<0, \tag{19}$$

where we have made use of the fact that $f^{-1\prime}[f(x)]=1/f'(x)$, and $f^{-1\prime\prime}[f(x)]=-f''(x)/[f'(x)]^3$. Note that equation (18) could be rewritten as

$$\tau'(\alpha)=\frac{-xU'(\alpha)}{(1-x)W'[g-\alpha-\tau(\alpha)]} \tag{20}$$

using the public goods production function (1). Inspection of (20) confirms voters' beliefs that the signal τ is continuous and strictly monotonic in α.

The second-order condition (19) allows us to rule out equilibria involving negative Δ:

Proposition 1. *If Δ maximizes (15) and if voters' conjectures are consistent, then $\Delta(\alpha)$ cannot be strictly negative for any α.*

Proof. By (13), $\tau'=-(1+\Delta')$. By (20), $\tau'>(<)0$ for every α if and only if $\Delta<(>)0$ for every α. Differentiating both sides of the equilibrium condition (18) with respect to α gives

$$\Delta''=\frac{(1+\Delta')^2}{xU'}\left[\frac{xU''}{1+\Delta'}-(1-x)W''\Delta'\right]. \tag{21}$$

Substituting (21) into (19) gives the result that the second-order condition holds as long as $W''/(1+\Delta')>0$. ||

Note that the proof of Proposition 1 also establishes that (19) holds for every $\Delta>0$ which solves (18). The proof required $W''>0$, but did not need any restrictions on the sign of U''. In a separating equilibrium, U is not a function of the government's control variable.

Equation (18) is a first-order differential equation with no apparent initial condition. The next proposition provides a boundary condition.

Proposition 2. *A separating sequential equilibrium requires* $\Delta(0)=0$.

Proof. By Proposition 1, $\Delta(0)\geqq 0$. Assume that voters' expectations $\Delta^*(\alpha)$ are governed by (18) with initial condition $\Delta^*(0)=\delta>0$. Define

$$D(\alpha)\equiv xU(0)-(1-x)W(0)-xU(\alpha)+(1-x)W[\Delta^*(\alpha)].$$

Since $U(0)$ is the lower bound on U, $D(\alpha)$ represents the minimum gain to a type α who defects and sets $\Delta=0$ instead of equal to $\Delta^*(\alpha)>0$. Clearly $D(0)>0$. Furthermore, since D is continuous in α, there exists a neighbourhood of zero in R_+ such that $D(\alpha)>0$. ||

It might seem that the "natural" boundary condition would be $\Delta(\bar{\alpha})=0$ rather than $\Delta(0)=0$. The best type cannot gain by posing as a better type. Proposition 2 tells us, however, that it is $\alpha=0$ who gains nothing by cheating *in equilibrium.* As long as other agents are cheating enough so that, by (18), it is not worthwhile for $\alpha=0$ to *raise* Δ above $\Delta^*(0)$, then he might as well not cheat at all. He will be recognized as a zero in equilibrium anyway.

The proof of Proposition 2 relied on the fact that $\tau=g$ is a feasible level of taxes. Suppose there exists some $\tau^{\max}<g$ such that taxes cannot exceed $\tau^{\max}$. (It would be plausible to posit that taxes cannot be raised above $\tau^{\max}$ without fundamental changes in the tax system, and that these changes would take several periods to implement.) Then $\Delta^*(0)=g-\tau^{\max}$ is the only consistent conjecture for voters. The proof is analogous to the proof of Proposition 2.[12]

The incumbent party's maximization problem (15) does not always have an interior solution on all of A. Suppose for example that

$$Q(\alpha)\equiv xU'(\alpha)-(1-x)W'(0) \tag{22}$$

is strictly negative for $\alpha=0$. Then (18) implies that $\Delta'(0)$ is negative, but this possibility is ruled out by Propositions 1 and 2. Since $U''>0$ for $\alpha<\hat{\alpha}$, it is possible that $Q(\alpha)>0$ for some $\alpha>0$. Denote the smallest α such that $Q(\alpha)\geqq 0$ as α_L. (If $Q(\alpha)<0\ \forall\alpha$, let $\alpha_L=\bar{\alpha}$.) Then consider a solution path to (18) initiating at $\Delta(\alpha_L)=0$. It is easy to show that Δ will initially rise from zero, but eventually declines. If $W'(0)>0$, it crosses the α axis from above at some $\alpha_M\in(\hat{\alpha},\infty)$. If $W'(0)=0$, the curve may asymptote to the α axis rather than intersecting it. Furthermore, it must be true that $Q(\alpha)$ is strictly negative for all $\alpha\geqq\alpha_M$ (since $U''<0$ for $\alpha>\hat{\alpha}$). Let $A^0\equiv\{\alpha\in A\,|\,\alpha_M\leqq\alpha \text{ or } \alpha_L\geqq\alpha\}$. We now show that on A^0, an equilibrium has zero seignorage.

Proposition 3. $\Delta=0$ *on* A^0.

Proof. Suppose voters' beliefs are given by $\Delta^*(\alpha)=0, \forall\alpha\in A^0$. Then

$$\tau^{*-1}(g-\alpha-\Delta)=g-(g-\alpha-\Delta)=\alpha+\Delta,\quad \forall\alpha\in A^0. \tag{23}$$

Then the party's objective function is

$$xU(\alpha+\Delta)-(1-x)W(\Delta).$$

The first derivative of the objective function evaluated at $\Delta=0$ is negative for every $\alpha\in A^0$. Hence, $\Delta=0\ \forall\alpha\in A^0$ solves the party's optimization problem. ||

Definition 1. *A separating equilibrium* is a continuous function $\Delta^s: A\to[0,\Delta)$ such that

(i) $\Delta^s=0$ if $\alpha\in A^0$.
(ii) Δ^s satisfies (18) otherwise.

Theorem 1. *A unique separating equilibrium exists.*

Proof. See Appendix. ‖

The solid line in Figure 1 is a graph of the equilibrium Δ^s function, drawn for the case $W'(0)=0$. (There can be more than one turning point.) Figure 2 is the same curve translated into (α, τ) space; $\tau^s(\alpha)=g-\alpha-\Delta^s(\alpha)$. The negatively sloped straight line in Figure 2 is the full information level of taxes, $\tau=g-\alpha$. Note that by Theorem 1, τ^s must

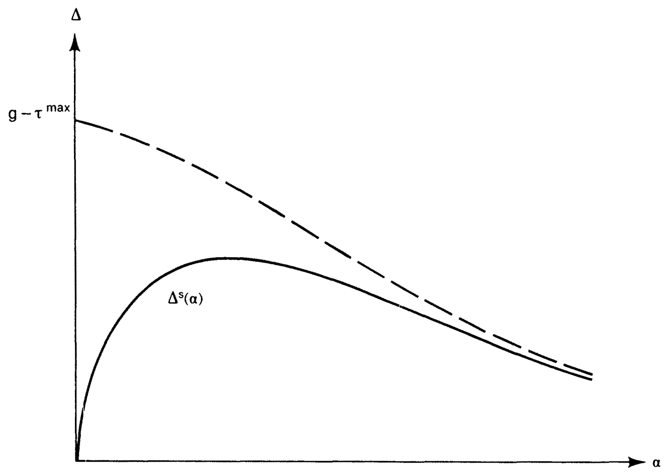

FIGURE 1

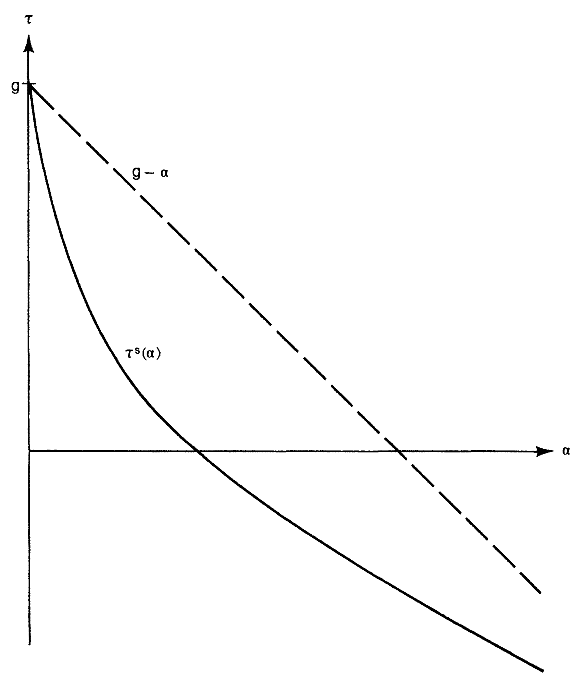

FIGURE 2

be monotonic so that voters are indeed able to separate types according to their tax bills. Correspondingly, the slope of $\Delta^s(\alpha)$ in Figure 1 is always greater than minus one. Also note that τ is permitted to take on negative values. Otherwise a fully separating equilibrium would not always exist. However, it seems very plausible to us that lump-sum taxes can be transfers.

To better understand Figures 1 and 2, it is helpful to consider two closely neighbouring realizations of the competency shock, α_2 and α_1, $\alpha_2 > \alpha_1$. Suppose both α types are thought to cheat by the same amount, $\Delta^*(\alpha_2) = \Delta^*(\alpha_1)$. Then when the incumbent party draws α_1, it would have to set $\Delta = \Delta^*(\alpha_1) + \alpha_2 - \alpha_1$ in order to convince the public it had drawn α_2. In deciding to pose as a more competent type, the incumbent would compare the increased expectation of winning with the marginal social welfare cost of distortions. If U' is high, and if W' is low, then an α_1's temptation to defect is great. To discourage an α_1 type from trying to imitate an α_2, it may be necessary to have $\Delta^s(\alpha_2) > \Delta^s(\alpha_1)$. Good types must "run away" from bad types. As Δ rises, W' rises and the temptation to cheat falls. Since U' begins to fall at $\hat{\alpha}$, Δ^s must eventually begin to fall. The dashed line in Figure 1 is a graph of Δ^s for the case where a type zero is forced to use seignorage since $g - \tau^{\max} > 0$. In this case, the level of seignorage may be strictly decreasing in α. It is simple to prove that $\Delta^s(\alpha)$ is nondecreasing in $g - \tau^{\max}$ [13]

Thus far, we have not considered the possibility that there may exist pooling equilibria, in which a range of α types all set the same level of taxes, τ. One possible pooling equilibrium would be for all types to set the same level of taxes (say, $\tau = g - \bar{\alpha}$), in which case the incumbent is always thought to have the average level of competency, $\hat{\alpha}$. For some parameter values, such an equilibrium might be supported by the off-the-equilibrium path beliefs that any other level of taxes indicates that the incumbent is a type zero. Of course, this specification of beliefs is not very plausible, since it is hard to see why the public should interpret a level of taxes below $g - \bar{\alpha}$ as evidence of a type $\alpha = 0$. But sequential equilibrium does not place restrictions on agents' off-the-equilibrium path beliefs (other than they support the equilibrium). It is essentially for this reason that, in general, one cannot rule out pooling equilibria here (in pure or mixed strategies) without applying a more restrictive equilibrium concept. Banks and Sobel (1987), and Cho and Kreps (1987) have proposed refinements of sequential equilibrium which place restrictions on agents' off-the-equilibrium path beliefs. Rogoff (1987*b*) formally applies Cho and Kreps "intuitive" criterion to rule out all pooling equilibria in a two-type version of the present model (i.e. α can take on only two values). This analysis can be extended to rule out pooling equilibria for any finite number of types. However, a number of technical issues arise in the limiting continuum-of-types case, which we are not able to resolve here. Instead we simply make the ad-hoc restriction that $\tau^*(\alpha)$ must be a differentiable, weakly monotonic function. Under this (plausible) restriction on beliefs, pooling equilibria cannot arise.

We now turn to establishing some comparative statics properties of the model. Define $\Delta(\alpha; x)$ as an equilibrium path for a given value of x, the weight the two parties place on votes. (For the remainder of this section, we omit the "s" superscript.)

Proposition 4. $\partial\Delta(\alpha; x)/\partial x \geqq 0\ \forall\alpha$, *with strict inequality if* $\Delta > 0$ *and* $\alpha > 0$.

Proof. Consider first the case $\alpha_L = 0$. Then by (18), for $\alpha \leqq \alpha_M$,

$$\frac{\partial\Delta'(\alpha; x)}{\partial x} = \frac{U'(\alpha)}{(1-x)^2 W'[\Delta(\alpha; x)]} - \frac{xU'(\alpha)W''[\Delta(\alpha; x)]}{(1-x)W'[\Delta(\alpha; x)]^2} \cdot \frac{\partial\Delta(\alpha; x)}{\partial x}. \tag{24}$$

Evaluating (24) at $\alpha=0$ we get

$$\frac{\partial\Delta'(0;x)}{\partial x}=\frac{U'(0)}{(1-x)^2W'(0)}>0$$

because $\Delta(0,x)=0\,\forall x$ implies $\partial\Delta(0;x)/\partial x=0$. The function $\partial\Delta/\partial x$ is continuous in α. This follows from Ross, Theorem 10.4. Hence there exists a deleted R.H.S.-neighbourhood N of zero where $\partial\Delta(\alpha;x)/\partial x>0, \forall\alpha\in N$. Now suppose there exists an $\alpha>0$ such that $\partial\Delta(\alpha;x)/\partial x<0$. Then it must be the case that there exists an $\alpha^0>0$ such that $\partial\Delta(\alpha^0;x)/\partial x=0$, and $\partial\Delta'(\alpha;x)/\partial x<0$, within a R.H.S.-neighbourhood of α^0. But by (24),

$$\frac{\partial\Delta'(\alpha^0;x)}{\partial x}=\frac{U'(\alpha^0)}{(1-x)^2W'[\Delta(\alpha^0;x)]}>0.$$

Hence $\partial\Delta'(\alpha^0;x)/\partial x>0$ within a R.H.S.-neighbourhood of α^0. And this is a contradiction.

If $\alpha_L=\tilde{\alpha}>0$, then clearly $\partial\Delta(\tilde{\alpha})/\partial x>0$ and otherwise the proof is the same as when $\alpha_L=0$. ||

As x rises, the incentive to cheat rises. Thus to separate themselves, "good" types must cheat more *relative* to "bad" types. Since by Proposition 2, $\Delta(0)=0$, then Δ must rise for all $\alpha>0$. The same result obtains if $\Delta(0)=g-\tau^{\max}$.

Now suppose that voters like the incumbent party for observable "noneconomic" reasons, indexed by the parameter ν. In particular, suppose we modify equation (9) so that the incumbent party wins if

$$\nu_t+E_t^P(\alpha_t)-\hat{\alpha}+q_t\geqq 0. \tag{25}$$

ν_t is observed by both voters and the incumbent at the beginning of period t, before τ_t is set. In order to maintain our assumption that $E_t^P(\Delta_{t+2})$ is the same for both parties, we will assume that the popularity disturbance is transitory, affecting only the current election. Then the first-order condition (18) can be rewritten as

$$\Delta'(\alpha)=\frac{xU'(\alpha+\nu)}{(1-x)W'(\Delta)}-1. \tag{26}$$

Define $\Delta(\alpha;\nu)$ as an equilibrium Δ function for a given value of ν.

Proposition 5. $\partial\Delta(\alpha;\nu)/\partial\nu\geqq 0$ *for* $\alpha+\nu<\hat{\alpha}$, *with strict inequality if* $\alpha>\alpha_L$.

Proof. The proof is analogous to the proof of Proposition 4. ||

Proposition 5 contradicts the conventional notion that more popular incumbents are less likely to engage in a political business cycle.[14] If the incumbent party draws a low α, then a rise in its popularity *increases* its temptation to cheat. As $\alpha+\nu$ rises from zero to $\hat{\alpha}$, a small amount of cheating yields larger and larger benefits in terms of increased probability of election. Only for $\alpha+\nu>\hat{\alpha}$, so that $U''<0$, can an increase in popularity lead to a lower level of cheating. Proposition 5 has a second important interpretation. The shift parameter ν may be viewed as an *observable* component of the incumbent's competency shock. We illustrate Proposition 5 in Figure 3.

Proposition 5 does not tell us whether *expected* seignorage

$$E(\Delta\,|\,\nu)=\int_0^{\bar{\alpha}}\Delta(\alpha;\nu)f(\alpha)d\alpha$$

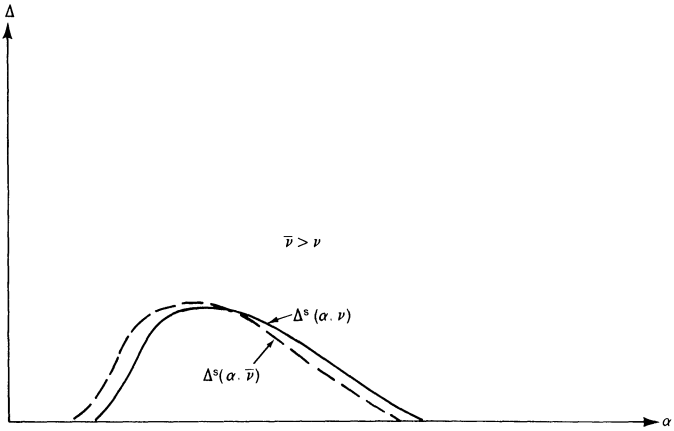

FIGURE 3

is increasing or decreasing in ν, where $f(\alpha)$ is the probability density function of α; note that $E(\Delta|\nu)$ is conditional on the popularity shock ν, but not on the realization of α. Numerical simulations indicate that $\partial E(\Delta|\nu)/\partial\nu$ may be positive or negative, depending on the shape of $f(\alpha)$.

Thus far, we have only analyzed the government's behaviour during even (election) periods. But clearly, there is no gain to cheating in off-election years, since the public will have observed α_{t+1} by period $t+2$. This supports our assumption in Section 2 that expected seignorage is the same regardless of which party wins the election. Of course, if the ε's followed a higher-order MA process, then expected seignorage in $t+2$ (conditional on t information) would not necessarily be the same for both parties (by Proposition 5). The fact that the parties tend to move in and out of power (depending on competency shocks and voter preference shifts) does not complicate our analysis because we assume that the public directly observes α_t in period $t+1$. If voters were only able to observe $\varepsilon_t = \alpha_t + \alpha_{t-1}$, then there would be a "start-up" problem whenever a new party moves into office. (The public doesn't know α_{t-1} and therefore can't sort out α_{t-1} and α_t.) This case is more complicated.

It should be emphasized that elections are not necessarily a bad thing, just because they result in excessive inflation or a suboptimal distribution of tax distortions over time. By holding elections, the public gets a more competent government, on average. One can, in principle, use a model such as the present one (but with a more general stochastic structure) to analyse the optimal frequency of elections.

4. REPUTATIONAL EQUILIBRIA

If the time horizons of the two political parties extend indefinitely far into the future, there can exist "reputational" or "trigger-strategy" equilibria (Friedman (1971)) which Pareto-dominate the "nonreputational" equilibrium of Section 3.[15] If voters and political parties place a large weight on the future, it may even be possible to support the optimal outcome, in which the distorting seignorage tax is never used. We are not going to formally consider reputational equilibria here, since the extension is rather straightforward. Also, as we argue below, reputational factors may not be very important in the present context.

One reason is that elections are typically spaced many years apart. If politicians significantly discount the future, and if there is substantial exogenous uncertainty about future elections (e.g. if the variance of the q shock is large), then the best attainable trigger-strategy equilibrium will not be too different from the non-reputational equilibrium, anyway. Though formally the trigger-strategy mechanisms alluded to here are similar to the ones used in the study of duopolies, the time scale is entirely different. A dupolist's prices can be reset almost continuously so that punishments can swiftly follow defections. Here, the punishment does not come until the next election many years hence. A second issue is that a significant degree of coordination would be required to focus the beliefs of a large and diverse number of voters on an optimal trigger-strategy equilibrium.[16]

Although we have presented some reasons for not devoting much attention to reputational equilibria, we recognize that there may be applications of the present model in which reputational equilibria are of considerable importance.

5. CONCLUSIONS

Our analysis illustrates the essential role of temporary information asymmetries in explaining electoral cycles in macroeconomic policy variables. Much of the extant empirical evidence on political business cycles deals with national elections in the U.S. and Germany. Our model is broadly consistent with this evidence. However, the general framework we develop can also be used to examine other types of electoral policy cycles, such as those associated with state and local elections.

The results here can be generalized in a number of dimensions. Rogoff (1987*b*) presents a multi-dimensional signalling model in which both government consumption spending and government investment are allowed to vary. Voters observe taxes and government consumption spending prior to voting, but only observe government investment with a one-period lag. (There is no seignorage in this variant, so it is more directly applicable to state and local elections.) A limitation in applying our model to some other countries is that is does not allow for endogenous timing of elections. Nevertheless, if there is a sufficient lag between the time when elections are called and the time they are held, the general notion that the incumbent will try to look good should remain relevant. It would also be of interest to allow for more differences across the two parties, along the lines of Alesina (1987).

APPENDIX

Proof of Theorem 1. The proof below requires the additional assumption that W''/W' is uniformly bounded on $[c, \bar{\Delta})$ for $c>0$.

Suppose that $xU'(0)>(1-x)W'(0)$ and let $c>0$ be such that $xU'(0)>(1-x)W'(c)$. Define $\tilde{W}:(-\bar{\Delta}, \bar{\Delta})\to R$ by

$$\tilde{W}(\Delta)\equiv\begin{cases} W(\Delta) & \text{if } \Delta\in[c,\bar{\Delta}) \\ W(c)-(1-e^{\Delta-c})W'(c) & \text{if } \Delta\in(-\bar{\Delta}, c)\end{cases}$$

and $Y:R\to R_+$ by

$$Y(\alpha)\equiv\begin{cases} U'(\alpha) & \text{if } \alpha\geqq 0 \\ U'(-\alpha) & \text{if } \alpha<0.\end{cases}$$

Let

$$z(\alpha,\Delta)\equiv\frac{xY(\alpha)}{(1-x)\tilde{W}'(\Delta)}-1.$$

We now show that the initial-value problem

$$\Delta'(\alpha) = z(\alpha, \Delta),$$
$$\Delta(0) = c \tag{A1}$$

has a unique solution on A. We first prove a lemma.

Lemma. *If a solution,* $\tilde{\Delta}$, *to* (A1) *exists, then there exists a constant* $\Delta_U < \bar{\Delta}$ *such that* $\tilde{\Delta}(\alpha) < \Delta_U \ \forall \alpha \in A$.

Proof. Let $\Delta_U < \bar{\Delta}$ be such that $xY(\hat{\alpha}) < (1-x)\tilde{W}'(\Delta_U)$. Such a Δ_U exists because $Y(\hat{\alpha}) < \infty$ and $W \to \infty$ as $\Delta \to \bar{\Delta}$. Suppose $\exists$ an α^0 such that $\tilde{\Delta}(\alpha^0) > \Delta_U$.

$$\Delta'(\alpha^0) = \frac{xY(\alpha^0)}{(1-x)\tilde{W}'(\Delta)} - 1 < 0.$$

because $Y(\alpha) < Y(\hat{\alpha}), \forall \alpha \in A$ and $\tilde{W}'' > 0$. This is a contradiction. ||

Clearly z is continuous in α on $D \equiv R \times (-\bar{\Delta}, \bar{\Delta})$. $|z_2(\alpha, \Delta)|$ is unformly bounded on D, and hence z satisfies a Lipschitz condition with respect to Δ on D. Thus all the hypotheses of Theorem 10.1 in Ross (1965) are satisfied, and there exists a unique solution, $\tilde{\Delta}$, on $(-h, h)$, where

$$h \equiv \frac{\bar{\Delta} - \Delta_U}{\max_D |z|} > 0.$$

Likewise the problem

$$\Delta'(\alpha) = z(\alpha, \Delta),$$
$$\Delta(h) = \tilde{\Delta}(h)$$

has a unique solution on $(0, 2h)$. Continuing in this manner we see that (A1) has a unique solution on A.

Let $\Delta_c : A \to R_+$ be given by $\Delta_c(\alpha) \equiv \max\{\tilde{\Delta}(\alpha), c\}$. For every $\alpha \in A, \Delta_c(\alpha)$ is non-increasing in c and bounded from below by zero. Hence, $\Delta_0(\alpha) = \lim_{c\to 0} \Delta_c(\alpha)$ exists and is unique. We now show that Δ_0 is continuous in α. For every $\tilde{\alpha} > 0$, $\{\Delta_c\}$ converges unformly to Δ_0. This follows from Struble (1962), Theorem 3, and the Cauchy condition for uniform convergence. Thus, the limit function is continuous on $[\tilde{\alpha}, \bar{\alpha})$, for every $\tilde{\alpha} > 0$. Moreover, as $\tilde{\alpha}$ goes to zero, the limit function goes to zero, which is equal to $\Delta_0(0)$. Hence, the limit function is continuous on A.

The limit function is now shown to be the unique solution of the initial value problem for $c = 0$. We need only show this is true on some $[0, \delta]$, $\delta > 0$. Suppose not. Then there exist two differentiable functions Δ and ψ such that $\Delta > \psi$ on some interval $(0, \delta^0)$. But by (A1), $\Delta' < \psi'$ on $(0, \delta^0)$. Hence, by the generalized mean value theorem, this is a contradiction.

We have considered only the case where $xU'(0) > (1-x)W'(0)$, but clearly the other case is a trivial extension. ||

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NOTES

1. There continues to be a significant amount of empirical work on the topic. See, for example, Kirchgässner (1985), Hibbs (1985), Jonung (1985), or Alesina and Sachs (1986).

2. McCallum (1978) makes this point. The conventional rationale for political business cycles is also questioned by Stigler (1973). Nordhaus (1975) notes that the cycle will disappear in his model, once voters understand the process.

3. Cukierman and Meltzer (1986) have independently developed a related line of research, though their approach is very different from ours. Backus and Driffill (1985), in their application of Kreps and Wilson's (1982) model of reputation note a different rationale for political business cycles. In their model, the probability the incumbent will inflate increases towards the end of his final term in office. He inflates precisely because he is not worried about the future, and has no incentive to maintain his reputation as an inflation fighter. By inflating (more than anticipated), the benevolent and rational elected official is able to temporarily reduce the effect of distortions which keep employment below its socially optimal value. This repeated game "reputational"

model of political business cycles seem at odds with Tufte's (1978) evidence that the political business cycle is more pronounced when the incumbent is up for re-election.

4. McCallum (1978), and Golden and Poterba (1980), find little evidence of a political business cycle in employment. The evidence of a political business cycle in variables such as transfers and money supply growth is stronger (see Tufte (1978), or the Hibbs and Fassbender (1981) volume.)

5. There is a close formal analogy between the separating equilibrium analyzed here and the one studied by Milgrom and Roberts (1982) in their work on limit pricing.

6. More generally, Δ can be thought of as any distortionary tax (which is directly observed by the public with a lag.) Alternatively, it should be possible to extend the analysis to allow for deficit financing along the lines of Barro (1979). If taxes are distortionary, then there is an optimal distribution of taxes over time, and Δ can represent deviations from this optimal distribution.

7. For a fully-specified equilibrium macroeconomic model which yields a reduced form isomorphic to the present model, see Rogoff (1987*b*).

8. In (2), the representative voter is risk-neutral with respect to τ. If the public were risk averse, then the fact that it knows more about the incumbent's competency than about the opposition's would make the incumbent's reelection more likely. Allowing for this possibility does not alter the general nature of the results.

9. The analysis can readily be generalized to allow the two parties to place different weights on social welfare (different x's). However, it would then no longer be the case that expected period $t+2$ social welfare is the same for both parties; see Proposition 4 below. Also, the analysis would have to be modified slightly if parties cared about the competency of the government; see Rogoff (1987*b*).

10. See Kreps and Wilson (1982).

11. All the results below can be extended to the case where the incumbent's party has only a forecast of α_t at the time it must set taxes. In a separating equilibrium, voters are able to perfectly infer this forecast.

12. If $g-\tau^{\max}=\Delta^*(0)$, then a type zero agent will not (cannot) defect by setting Δ lower. (He is so incompetent that he cannot make ends meet without relying on seignorage.)

13. It is also straightforward to examine the case where there is some maximum level of cheating, $\Delta^{\max}$. Δ may have a maximum if, for example, there is a limit to how much seignorage can be extracted from money holders. Suppose $\Delta^{\max}$ exists, and the solution to (18) reaches $\Delta^{\max}$ at some α_z. Then there is an equilibrium where Δ remains at $\Delta^{\max}$ for $\alpha>\alpha_z$ until the lowest α such that $xU'(\alpha)\leqq(1-x)W'(\Delta^{\max})$. Denote this α as α_χ. For $\alpha\geqq\alpha_\chi$, the equilibrium path is again governed by (18), and Δ begins to decline. The proof is analogous to the proof of Proposition 3.

14. See, for example, Frey and Schneider (1978). There are several other empirical studies which also attempt to relate presidential popularity to the severity of the political business cycle. Golden and Poterba (1980) find no evidence of such a relationship.

15. See Ferejohn (1986) and Alesina (1987) for analyses of reputational equilibria in models with (infinitely) repeated elections. For a more extended analysis of reputational equilibria in the present model, the reader is referred to an earlier version of the present paper, NBER Working Paper No. 1838, February 1986.

16. Again, see Ferejohn (1986). Rogoff (1987*a*) discusses the coordination problem in a related macroeconomic context.

REFERENCES

ALESINA, A. (1987), "Macroeconomic Policy in a Two-Party System as a Repeated Game", *Quarterly Journal of Economics* (forthcoming).

ALESINA, A. and SACHS, J. (1986), "Political Parties and the Business Cycle in the United States, 1948–1984" (mimeo).

BACKUS, D. and DRIFFILL, J. (1985), "Inflation and Reputation", *American Economic Review*, **75**, 530–538.

BANKS, J. S. and SOBEL, J. (1987), "Equilibrium Selection in Signaling Games", *Econometrica*, **55**, 647–661.

BARRO, R. J. (1979), "On the Determination of Public Debt", *Journal of Political Economy*, **87**, 940–971.

CHO, I. and KREPS, D. M. (1987), "Signaling Games and Stable Equilibria", *Quarterly Journal of Economics*, **102**, 179–221.

CUKIERMAN, A. and MELTZER, A. H. (1986), "A Positive Theory of Discretionary Policy, the Cost of Democratic Government, and the Benefits of a Constitution", *Economic Inquiry*, **24**, 367–88.

FEREJOHN, J. A. (1986), "Incumbent Performance and Electoral Control", *Public Choice*, **50**, 5–25.

FREY, B. and SCHNEIDER, F. (1978), "An Empirical Study of Politico-Economic Interaction", *Review of Economics and Statistics*, **60**, 174–183.

FRIEDMAN, J. W. (1971), "A Non-cooperative Equilibrium for Supergames", *Review of Economic Studies*, **28**, 1–12.

GOLDEN, D. G. and POTERBA, J. M. (1980), "The Price of Popularity: The Political Business Cycle Reexamined", *American Journal of Political Science*, **24**, 696–714.

HIBBS, D. A. (1985), "Inflation, Political Support, and Macroeconomic Policy", in Lindberg, L. N. and Maier, C. S. (eds.) *The Politics of Inflation and Economic Stagnation* (Washington: The Brookings Institution).

HIBBS, D. A. and FASSBENDER, H. (eds.), (1981) *Contemporary Political Economy* (New York: North Holland Publishing Co.).

JONUNG, L. (1985), "Business Cycles and Political Changes in Sweden", *Skandinaviska Enskilda Banken Quarterly Review*, **2**, 26–39.

KIRCHGÄSSNER, G. (1985), "Rationality, Causality and the Relation Between Economic Conditions and the Popularity of Parties: An Empirical Investigation for the Federal Republic of Germany, 1971-1982", *European Economic Review*, **28**, 243-268.

KREPS, D. M. and WILSON, R. (1982), "Reputation and Imperfect Information", *Journal of Economic Theory*, **27**, 253-279.

MCCALLUM, B. T. (1978), "The Political Business Cycle: An Empirical Test", *Southern Economic Journal*, **44**, 504-515.

MCRAE, D. (1977), "A Political Model of the Business Cycle", *Journal of Political Economy*, **85**, 239-263.

MILGROM, P. and ROBERTS, J. (1982), "Limit Pricing and Entry under Incomplete Information: An Equilibrium Analysis", *Econometrica*, **50**, 443-459.

NORDHAUS, W. D. (1975), "The Political Business Cycle", *Review of Economic Studies*, **42**, 169-190.

ROGOFF, K. (1987*a*), "Reputation, Coordination and Monetary Policy", in Barro, R. J. (ed.) *Handbook of Modern Business Cycle Theory* (New York: John Wiley Press) forthcoming.

ROGOFF, K. (1987*b*), "Equilibrium Political Budget Cycles" (mimeo).

ROSS, S. L. (1965) *Differential Equations* (New York: Blaisdell Publishing Co.).

STIGLER, G. (1973), "General Economic Conditions and National Elections", *American Economic Review*, **62**, 160-167.

STRUBLE, R. A. (1962) *Nonlinear Differential Equations* (New York: McGraw-Hill).

TUFTE, E. R. (1978) *Political Control of the Economy* (Princeton: Princeton University Press).