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*Credibility and Political Business Cycles**

This paper develops a political business cycle model based on partisanship and credibility arguments that explains the pre-election behavior of inflation, output, and money growth. The approach taken is to introduce elections and a Mundell-Tobin effect into a structure similar to the Barro-Gordon (1983) model of governmental reputation. The model's predictions are similar to those of the simple manipulative models of Nordhaus (1975) and Frey and Schneider (1978), but the predictions do not rely on economic irrationality, myopia, or memory loss.

1. Introduction

There has been a recent revival of interest in political business cycles. The impetus for this revival comes from two sources. First, the theoretical work of Alesina (1987), Rogoff and Siebert (1988), Rogoff (1990), and Terrones (1989) can predict forms of political business cycles without assuming any irrationality, limited memory, or myopia on the part of economic actors. Second, empirical work, particularly by Alesina and Sachs (1988) and Haynes and Stone (1989), indicates that many of the correlations predicted by the theories are present in the data.[1]

The purpose of this paper is to develop a political business cycle model based on partisanship and credibility arguments. We shall demonstrate that the model we construct explains variability in U.S. output, inflation and monetary growth prior to elections, and correctly predicts the correlations between these series. The approach taken is to introduce elections and a Mundell-Tobin effect into a structure similar to the Barro-Gordon (1983) model of governmental reputation. The model's predictions are similar to those of the simple manipulative models of Nordhaus (1975) and Frey and

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[1]See Grier (1987) for a review of other evidence.

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Schneider (1978), but the predictions do not rely on economic irrationality, myopia, or memory loss.

2. A Modified Barro-Gordon Model

The basic structure of the Barro-Gordon model involves government preferences over inflation and unemployment\output growth expressed in the form of a quadratic cost function, and an economy represented by a surprise Phillips curve. To this structure we add two modifications; first we allow for a Mundell-Tobin (see Mundell 1963 and Tobin 1965) effect such that anticipated inflation raises real output growth.[2] Second, we assume that two distinct political parties compete periodically for control of the government. This will imply that agents must form probabilistic expectations about the future monetary regime and inflation rate. The parties' preferences are described, as in Barro-Gordon (1983) and Alesina (1987), by the cost functions

$$\sum_{t=0}^{\infty} q^t \, [(j/2)(\pi_t)^2 - (y_t - \bar{y}_t)] \, , \qquad j = r, d \, ; \tag{1}$$

where π_t is the inflation rate in period t, y_t is the rate of growth of output in t, $\bar{y}$ is the natural rate of output, $q \in [0, 1]$ is a discount factor and $j = r$, d is a coefficient (with obvious allusion to Republicans and Democrats) representing the parties' relative preferences over inflation and output. We assume $d < r$. The monetary growth and inflation rates are assumed identical and to be controlled by the government without error. The economy is described by a simple surprise Phillips curve (for the underlying contracting story see Alesina 1987), to which we add an anticipated inflation term representing a Mundell-Tobin effect (see Fischer 1979 for a similar type of setup)

$$y_t = \bar{y} + \gamma(\pi_t - {}_{t-1}\pi_t^e) + \delta' {}_{t-1}\pi_t^e \, , \tag{2}$$

where ${}_{t-1}\pi_t^e$ is the inflation rate expected for period t conditional on information available in period $t - 1$, and γ, $\delta' > 0$ are coefficients. Combining (1) and (2) and normalizing on γ we obtain

[2]Inflation lowers real interest rates and stimulates capital accumulation. We assume that this requires a one-period lag, so that yesterday's expectation of today's inflation rate determines today's real output. Empirical support for a negative relationship between inflation and real interest rates is presented in Summers (1983).

$$\sum_{t=0}^{\infty} q^t[(i/2)(\pi_t)^2 - (\pi_t - {}_{t-1}\pi_t^e) - \delta_{t-1}\pi_t^e]\,, \qquad i = r, d\,; \tag{3}$$

where $i = j/\gamma$ and $\delta = \delta'/\gamma$. It is assumed that expectations are formed rationally. If each party behaves in a time consistent manner and minimizes its cost function by choosing the monetary growth/inflation rate given expectations of inflation, then this gives the time consistent inflation rates $\pi_t^{i*} = 1/i$.

However, if each could bindingly precommit to monetary growth rate rules each would choose $\pi_t^{ir} = \delta/i$. That neither party would choose a zero monetary growth rate rule follows from the inclusion of the Mundell-Tobin effect. Each party equates at the margin the costs of anticipated inflation to the benefits it provides in increased output growth. However, as Barro and Gordon have shown, in the absence of binding precommitments, the best monetary growth rate rule may not be credible. A government of either party will have an incentive to cheat and play the time consistent inflation rate so as to try to exploit the surprise Phillips curve; a rational public would be aware of this, and so the best rule may not be credibly announced. Following Barro and Gordon we define the temptation to cheat on a rule as the difference in cost between announcing a rule and following it, and announcing the same rule and cheating on it by playing the time consistent inflation rate. From a little algebra we get

$$Temptation = (i/2)[(\pi_t^{ir})^2 - (\pi_t^{i*})^2] + (\pi_t^{i*} - \pi_t^{ir})\,, \tag{4}$$

which is a quadratic with intercept $1/2i$ and slope $i\pi_t^{ir} - 1$, and which has a turning point at the time consistent rate $\pi_t^{ir} = 1/i = \pi_t^{i*}$. Intuitively, the temptation to cheat on a given rule is the benefit arising from the increase in output due to exceeding private sector expectations of the inflation rate, less the cost of the higher realized inflation rate. What may prevent cheating on a rule is a party's loss of reputation. This will take the form of the public expecting the time consistent inflation rate for N periods into the future.[3] If reputation is lost, a party's cost will rise by the discounted

[3]This model is subject to the usual multiple equilibrium problem associated with reputational models. Here there exists a different equilibrium for many values of N. However this is not crucial in this case. The general properties of the model are identical for all values of N. Furthermore, endogenizing N by modeling private sector preferences so that N may be viewed as a trigger strategy adds very little

difference between the cost experienced when a rule may be credibly announced and the cost experienced when the public expects the time consistent inflation rate. This discounted increase in future costs due to the loss of reputation provides the enforcement mechanism which tends to prevent cheating on a rule. If there are no elections we have enforcement as

$$Enforcement = \sum_{t=1}^{N} q^t \left[(i/2)(\pi_t^{i*})^2 - (i/2)(\pi_t^{ir})^2 + \delta(\pi_t^{ir} - \pi_t^{i*})\right], \quad (5)$$

where N represents the length of the enforcement or punishment period.

Enforcement is a quadratic with intercept $\Sigma_t q[(i/2)(\pi_t^{i*})^2 - \delta\pi_t^{i*}]$ and a turning point at δ/i.

To find those policy rules that are credible requires finding a set of inflation rate announcements such that the future cost of cheating on the announcement, that is, enforcement, is at least as large as the contemporaneous cost reduction, that is, temptation. Equating temptation to enforcement and solving the resultant quadratic provides the solution for the credible policy range,

$$Credible\ Policy\ Range = \left[\left(\frac{1 - A + 2\delta A}{(1 + A)i}\right), \frac{1}{i}\right], \quad (6)$$

where $A \equiv \Sigma_{t=1}^{N} q^t$. There are two cases, $A < 1$ and $A > 1$. When $A < 1$, notice that (6) immediately implies that, irrespective of the length of the punishment period, the best rule δ/i will only be credible at $\delta = 1$ (that is, where the credible range is degenerate). When $\delta > 1$ the first term in (6) constitutes the upper boundary of the credible policy range. Simple algebra demonstrates that $\delta/i > [1 - A + 2\delta A]/[1 + A]i$ when $\delta > 1$. Similarly, when $\delta < 1$ the first term in (6) constitutes the lower boundary of the credible policy range, and simple algebra demonstrates that $\delta/i < [1 - A + 2\delta A]/[1 + A]i$. At $\delta = 1$ the best and time consistent rules coincide. When the best rule is not credible then the party will play

(Note cont. from p. 71)
to the model. It might be thought that the private sector could lengthen N as an election approaches; however it can be demonstrated that this would not necessarily be sub-game perfect. For our purposes it is not even necessary that the private sector coordinate on one common N. All the model requires is that the distribution of Ns chosen by the private sector be stationary.

the best credible rule defined by the closest root,[4] which is always defined to be

$$\pi_t^{ir} = \left(\frac{1 - A + 2\delta A}{(1 + A)i}\right). \tag{7}$$

When $A > 1$, Equation (6) implies that, irrespective of the length of the punishment period, the best rule δ/i is always credible. When $\delta > 1$, then $1/i < \delta/i < [1 - A + 2\delta A]/[1 + A]i$. Similarly, when $\delta < 1$, then $[1 - A + 2\delta A]/[1 + A]i < \delta/i < 1/i$. Thus, when $A > 1$, the best rule δ/i always lies within the credible policy range.[5]

The inclusion of the Mundell-Tobin effect has the interesting implication that it is possible for the best inflation rate rule to exceed the credible range. However this requires the somewhat unreasonable assumption that anticipated inflation is more expansionary than unanticipated inflation. Hereafter we shall assume the opposite so that $\delta < 1$ (see Fischer 1979 for a discussion of this assumption). The best credible policy will always be the lower bound of the credible policy range.

If elections are now introduced into the model, enforcement must be rewritten to take into account the fact that loss of reputation can only hurt a party in those periods it holds office.

3. Political Elections

To develop intuition, and for purposes of tractability, we work with the simplest case and introduce one election into the model.[6] The winner of the election then remains in power for all future periods. The probability of the ith party winning the election is assumed exogenous and is denoted by P^i. The introduction of the election will not alter temptation in any period. However, the value

[4] This is easily shown to be the cost minimizing choice.

[5] Both the discount rate for political parties, q, which could be quite low when an election is near and the future is discounted heavily, and the length of the enforcement period, N, are unknown. Therefore whether $A < 1$ or $A > 1$ is also unknown. The simulations performed in the next section allow A to vary between 0.010101 and 6.0

[6] In fact, the one-election model and multiple-election models produce exactly the same results if the economy attains the steady state between elections and remains in this position for at least the enforcement period. Even if the single- and multiple-election models do differ, the difference is only quantitative.

of enforcement in the periods before the election will be affected in two ways: First, if the enforcement period overlaps the election, then the post election component of enforcement will only be incurred with the probability of election victory (it does not matter if your reputation is intact or not if you are out of power). Second, as enforcement varies due to an overlap of the enforcement period with the election this will affect the best credible inflation rate policy, which itself will affect enforcement in earlier periods. Noting that the expected inflation rate must be the probabilistically weighted sum of the two parties' inflation rates and manipulating the resultant expression allows enforcement to be written

$$\sum_{j=t}^{\bar{t}} q^{j-t+1}\,[(i/2)(\pi_j^{i*})^2 - (i/2)(\pi_j^{ir})^2 + \delta(\pi_j^{ir} - \pi_j^{i*})]$$
$$+ \sum_{j=\bar{t}+1}^{t+N} q^{j-t+1}P^i[(i/2)(\pi_j^{i*})^2 - (i/2)(\pi_j^{ir})^2 + \delta(\pi_j^{ir} - \pi_j^{i*})]$$
$$\text{if } t + N \geq \bar{t}\,, \tag{8a}$$

and

$$\sum_{j=t}^{t+N} q^{j-t+1}\,[(i/2)(\pi_j^{i*})^2 - (i/2)(\pi_j^{ir})^2 + \delta(\pi_j^{ir} - \pi_j^{i*})]$$
$$\text{if } t + N < \bar{t}\,, \tag{8b}$$

where $\bar{t}$ is the election period. Enforcement will be either (8a) or (8b) depending on whether or not the enforcement period extends beyond the election date. Temptation will remain as defined by (4).

To solve the model we adopt the following procedure. First we compute the post election credible policy range. If the best rule is credible we set all post election inflation rates at this level. If the best rule is not credible we set the post election inflation rates at the value of the best credible rule. The value thus selected for the steady state post election inflation rate provides an endpoint condition from which we may solve the model recursively. To obtain the solution for the inflation rate in the election period we use (4) and (8b), given $t = \bar{t}$ to obtain the credible policy range, then select as the inflation rate either the best rule, if credible, or otherwise the best credible rule. The procedure is then repeated for $t - 1$, $t - 2$ and so on. Algebraically this recursive solution tech-

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$$- (i/2)(\pi_j^{ir})^2 + \delta(\pi_j^{ir} - \pi_j^{i*})]$$

$$)^2 - (i/2)(\pi_j^{ir})^2 + \delta(\pi_j^{ir} - \pi_j^{i*})]$$

$$N \geq \bar{t}\,, \qquad (8a)$$

$$- (i/2)(\pi_j^{ir})^2 + \delta(\pi_j^{ir} - \pi_j^{i*})]$$

$$N < \bar{t}\,, \qquad (8b)$$

Enforcement will be either (8a) or
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nique becomes intractable after only a few iterations.[7] However, numerical solutions are easily obtained by simulating time paths for inflation over a range of reasonable parameter values. The simulations can then be used to examine the properties of the theoretical model.

4. Time Paths for Inflation and Output

As we indicated in Section 3, inflation at any point in time can take one of two forms. If the best rule is not in the interior of the credible range, then inflation equals the best credible rule as defined by the boundary of the credible range closest to the best rule. If the best rule does lie in the interior of the credible range, then it is chosen and inflation equals δ/i. To explain the possible time paths for inflation—and hence output growth—we need to explain the conditions in which inflation is determined by each of these values, and when it switches between them.

These questions are answered largely by means of numerical simulations (for details see the appendix). There are in fact only three types of time path that can arise. These are illustrated in Figure 1. Time path *A* gives an example of when the best credible rule occurs in every time period and where it exceeds the best rule. Temptation and enforcement loci for this type of outcome are illustrated in Figure 2a. Inspection of Equation (8a) immediately reveals that enforcement will be lower in time periods when the punishment period overlaps the election. It then follows that if the economy achieves a best credible rule inflation rate in any period, it will do so for all following periods. Time path *B* illustrates when the best rule is always credible. Temptation and enforcement loci for this case are provided in Figure 2b. Finally, time path *C* illustrates how the best rule may initially be credible but ceases to be so as the election approaches and enforcement falls. The time path is initially best rule and then switches to best credible rule. Figure 2c provides temptation and enforcement loci for this case.

The time paths of inflation can be understood quite easily. In each case, as the election date approaches, more of the enforcement periods fall after the election and the enforcement locus shifts downward.[8] The range of credible policies contracts with both end-

[7]The model is an *N*th-order non-linear difference equation, so general analytical solutions for the time path are unavailable.

[8]Inspection of the enforcement Equation (8a) or (8b) reveals that the induced changes in the inflation rate reinforce this effect.

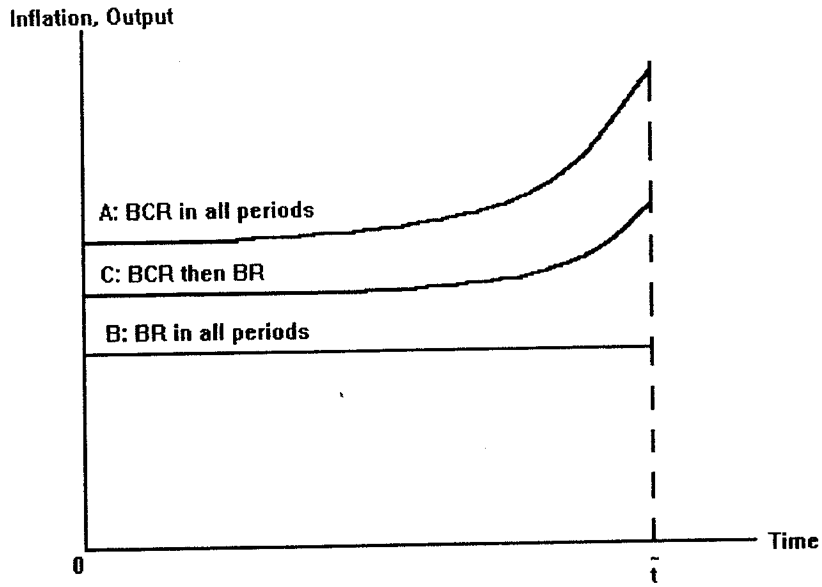
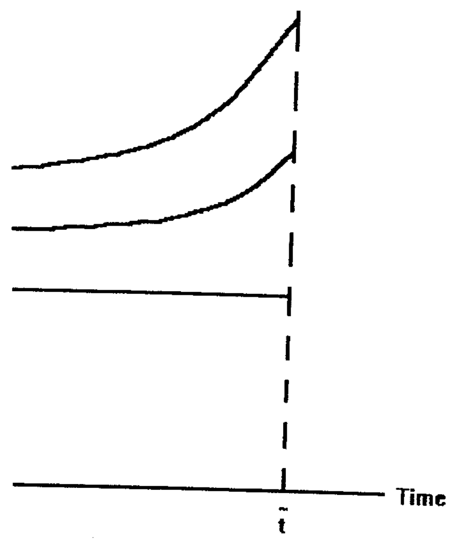


Figure 1.
Potential Inflation/Output Time Paths

points shifting towards $1/i$. If the best policy lies outside the credible policy range, then its left-hand boundary determines the best credible policy. Thus inflation increases as the election approaches. If the best rule is initially inside the credible range it may remain so, or, become unenforceable as the election comes nearer, with inflation initially constant but then rising with the best credible policy.

The frequencies with which the best credible rule and best rule solutions arose over the parameter ranges in the simulations are provided in Table 1. The table indicates that, as the election date approaches, the percentage of best credible rule increases, and the percentage of best rule decreases. Overall, for enforcement periods of 3 and 6, respectively, 57.1% and 57.1% are determined by the best credible rule for all periods, 24.5% and 20.5% are initially best rule but switch to best credible rule as the election approaches, 18.4% and 22.4% are best rule for all periods.[9] A division

[9]That the two enforcement periods yield the same initial percentages is an artifact of the discreteness of the simulation; for simulations where the distance between the parameter values was reduced the longer enforcement period produced a greater percentage of best rules.



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n/Output Time Paths

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TABLE 1.

Time period	BCR-3	BCR-6	BR-3	BR-6	SW-3	SW-6
$\tilde{t}$-24	0.571	0.571	0.429	0.429	0.000	0.000
$\tilde{t}$-4	0.571	0.571	0.429	0.429	0.000	0.000
$\tilde{t}$-3	0.592	0.592	0.408	0.408	0.021	0.021
$\tilde{t}$-2	0.612	0.612	0.388	0.388	0.020	0.020
$\tilde{t}$-1	0.694	0.673	0.306	0.327	0.082	0.061
$\tilde{t}$	0.816	0.776	0.184	0.224	0.122	0.103

NOTE: BCR and BR indicate best credible rule and best rule solutions, respectively. SW indicates the percentage that switched from best rule to best credible rule. Appended numbers, for example, BR-3, indicate the length of the enforcement period.

of the parameter space is provided in Figure 3. In Figures 3a and 3b enforcement is for three and six periods respectively. The dashed lines on the diagrams reveal $\{P^i, q\}$ combinations for which the best rule and best credible rule are coincident in each period. The areas above the dashed lines are parameter combinations for which the best rule is enforceable. The areas below it are the parameter ranges over which the best rule is unenforceable and the inflation rate is determined by the best credible rule. Note that the best credible rule solutions occur with greater frequency (a) the lower is the probability of election, P^i, (b) the lower is the discount factor, q, and (c) the smaller is the enforcement period, N.[10]

In each of the time path types, inflation and output growth are non-decreasing as the election approaches. Thus, the model produces a political business cycle. Whenever inflation is determined by the best credible rule—as in 81.6% and 77.6% at the end of our simulation runs—inflation and output rise at an increasing rate.

5. Comparative Dynamics

The results of the preceding section demonstrate that a credibility model can generate a political business cycle. In this section we analyze the model's comparative dynamic properties.

[10]In the simulations, whether a time path was best rule, best credible rule or a mix of the two was not affected by changes in i or δ. While this property held for all parameter values tried—including some very extreme values—it is doubtful that it is a global result. Instead, it reflects the fact that changes in i and δ cause the endpoint of the credible range and the best rule move in the same direction and by very similar magnitudes.

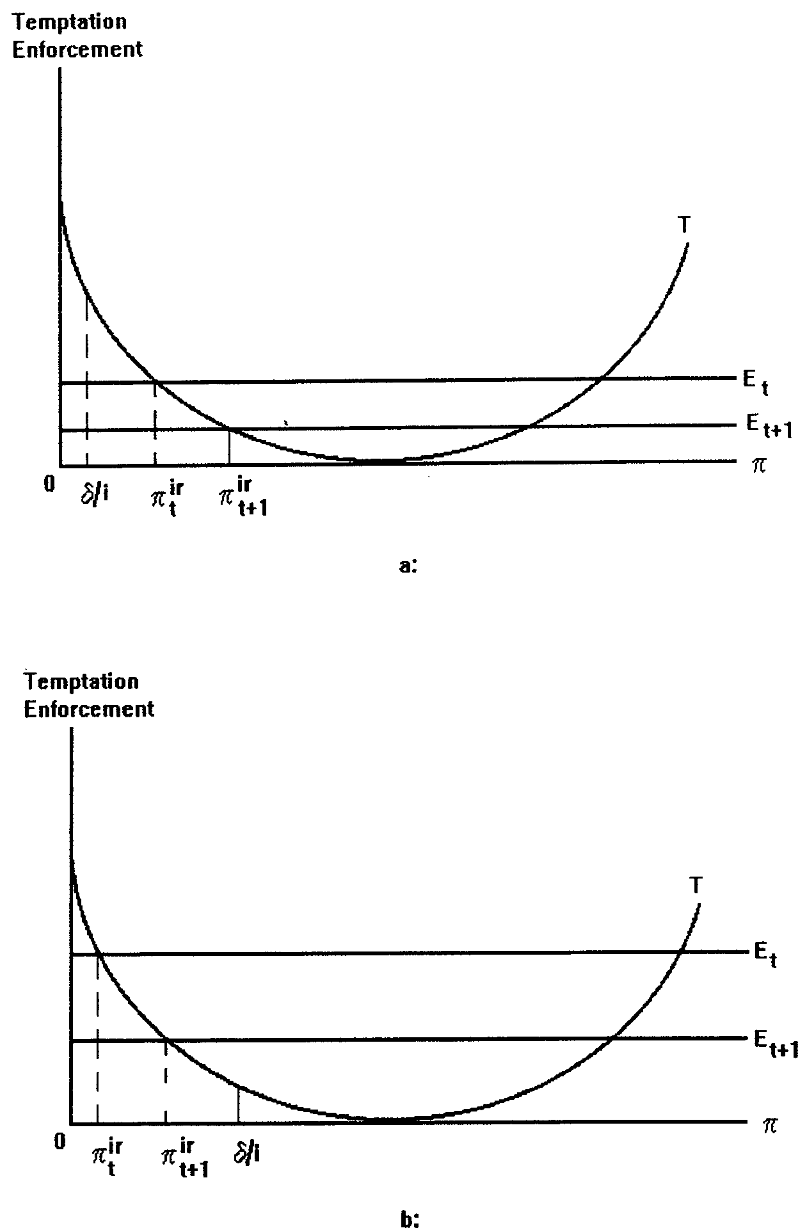
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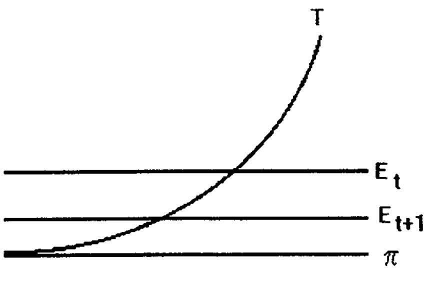
Figure 2.



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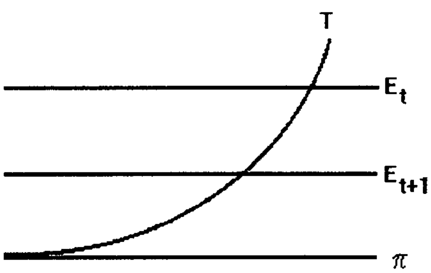

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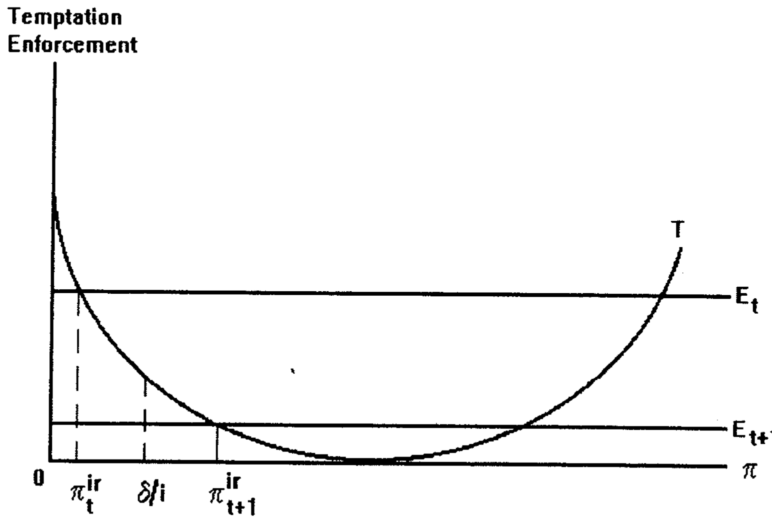
Figure 2.

(Figure 2 cont.)



c:

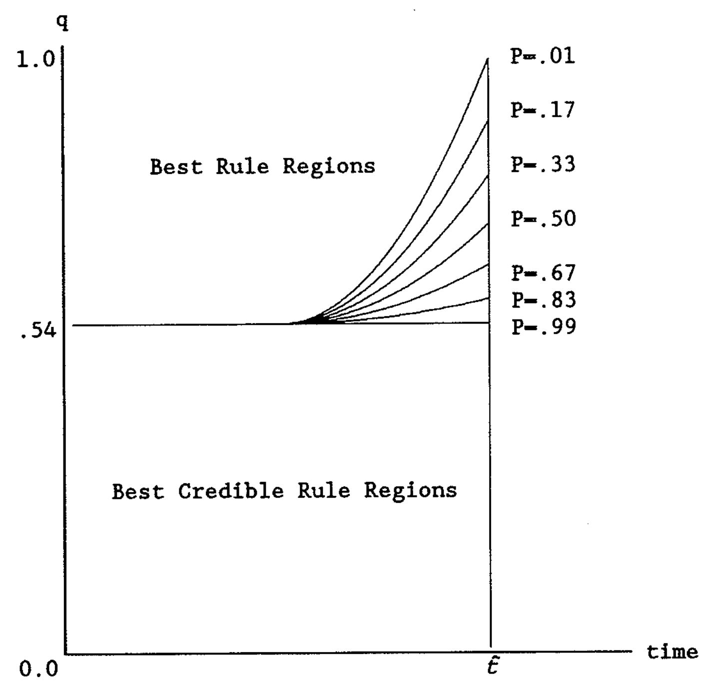
The exogenous parameters in the model are the probability of reelection (P^i), the discount factor (q), the relative effect of anticipated inflation (δ), and the relative weight placed on inflation in the cost function (i). For the best rule sections of any time path we can obtain analytical solutions for the comparative dynamics; these are reported in Table 2. As the table demonstrates, changes in P^i and q do not affect the best rule sections of the time paths. Increases in P^i and q both increase enforcement extending the credible range, but, since δ/i is already in the interior of the credible range, it must be unaffected. Decreases in P^i and q reduce the credible range and may cause the solution to switch from best rule to best credible rule in some time periods—as Table 1 demonstrates. An increase in δ or a reduction in i raises the best rule in every period. An increase in δ means that any anticipated inflation rate will have a larger effect on output growth, a reduction in i means that the policymaker is more willing at the margin to trade off inflation for output growth.

TABLE 2.

	dP^i	dq	$d\delta$	di
$d\pi_t$ and dy_t	0	0	+	−

When the time paths of inflation and output growth are determined by the best credible rule, analytical solutions for the comparative dynamics are not possible and we must rely on numerical methods. Differentiating (7) and reexpressing the result in terms of elasticities demonstrates that, in the post election period, increases in i produce equi-proportionate decreases in inflation. The simulations reveal that this relationship of elasticity -1 is also present in the pre-election period.[11] In Table 3 we report log derivatives (elasticities) for changes in δ, P^i, and q. The numbers 3 and 6 denoting the columns indicate the number of periods for which reputation will be lost if the party does not play its announced policy.

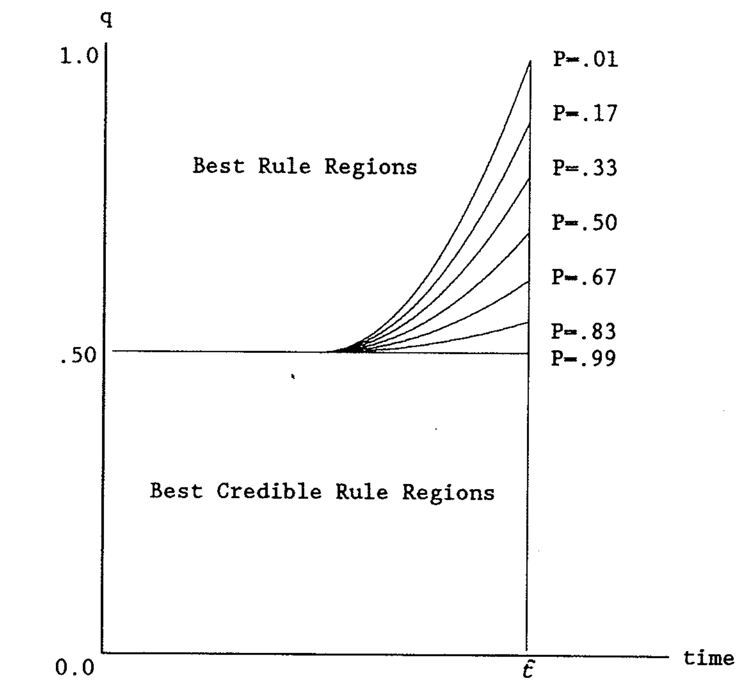
[11]We do not dwell on this result as it is an artifact of the functional forms.



(a) Three Period Enforcement

Figure 3.
Division of the Parameter Space

(Figure 3 cont.)



(b) Six Period Enforcement

These results are averages taken across all the simulation runs where the inflation rate is determined by the best credible rule solution.[12]

The numerics produce a very clear picture. For enforcement periods of both 3 and 6, increases in δ, decreases in P^i, and decreases in q each raise the inflation rate in every time period. This is entirely intuitive; higher values of δ raise the marginal effect on output of an increase in anticipated inflation. The cost to the party of having to play its time consistent inflation rate is thus reduced. Enforcement must fall and inflation and output growth rates must rise. A decrease in P^i lowers the probability of election success, and consequently the probability of the party being fully punished if it

[12]In our simulations we never observed a sign reversal in the derivatives, although this technique by its nature does not allow us to categorically rule out this possibility.

TABLE 3. *Numerical Derivatives*

	D3	D6	P3	P6	Q3	Q6
1	3.2561	3.7339	−0.274E-08	−0.905E-08	−0.69733	−0.97292
2	3.2561	3.7339	−0.573E-08	−0.185E-07	−0.69733	−0.97292
3	3.2561	3.7339	−0.120E-07	−0.379E-07	−0.69733	−0.97292
4	3.2561	3.7339	−0.254E-07	−0.777E-07	−0.69733	−0.97292
5	3.2561	3.7339	−0.537E-07	−0.160E-06	−0.69733	−0.97292
6	3.2561	3.7339	−0.114E-06	−0.328E-06	−0.69733	−0.97292
7	3.2561	3.7339	−0.243E-06	−0.677E-06	−0.69733	−0.97292
8	3.2561	3.7339	−0.520E-06	−0.140E-05	−0.69733	−0.97292
9	3.2561	3.7339	−0.112E-05	−0.295E-05	−0.69733	−0.97293
10	3.2561	3.7339	−0.242E-05	−0.632E-05	−0.69733	−0.97293
11	3.2561	3.7339	−0.527E-05	−0.141E-04	−0.69733	−0.97293
12	3.2561	3.7338	−0.116E-04	−0.335E-04	−0.69734	−0.97294
13	3.2561	3.7334	−0.259E-04	−0.871E-04	−0.69735	−0.97292
14	3.2561	3.7318	−0.591E-04	−0.247E-03	−0.69737	−0.97282
15	3.2561	3.7263	−0.139E-03	−0.736E-03	−0.69742	−0.97238
16	3.2557	3.7098	−0.341E-03	−0.213E-02	−0.69747	−0.97072
17	3.2541	3.6713	−0.888E-03	−0.535E-02	−0.69742	−0.96563
18	3.2481	3.6074	−0.243E-02	−0.110E-01	−0.69674	−0.95265
19	3.2299	3.5161	−0.648E-02	−0.185E-01	−0.69317	−0.91671
20	3.1912	3.4155	−0.152E-01	−0.285E-01	−0.68153	−0.86511
21	3.1230	3.2978	−0.292E-01	−0.414E-01	−0.65305	−0.79558
22	2.9623	3.1342	−0.456E-01	−0.566E-01	−0.58176	−0.70727
23	2.7114	2.8780	−0.609E-01	−0.709E-01	−0.49463	−0.60209
24	2.3415	2.4920	−0.689E-01	−0.777E-01	−0.39863	−0.48633

11	3.2561	3.7339	−0.527E-05	−0.141E-04	−0.69733	−0.97293
12	3.2561	3.7338	−0.116E-04	−0.335E-04	−0.69734	−0.97294
13	3.2561	3.7334	−0.259E-04	−0.871E-04	−0.69735	−0.97292
14	3.2561	3.7318	−0.591E-04	−0.247E-03	−0.69737	−0.97282
15	3.2561	3.7263	−0.139E-03	−0.736E-03	−0.69742	−0.97238
16	3.2557	3.7098	−0.341E-03	−0.213E-02	−0.69747	−0.97072
17	3.2541	3.6713	−0.888E-03	−0.535E-02	−0.69742	−0.96563
18	3.2481	3.6074	−0.243E-02	−0.110E-01	−0.69674	−0.95265
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cheats on its announced rule. Enforcement must therefore fall and inflation and output growth rates must rise. A decrease in q means that the party cares less about the future. This is when the punishment for cheating occurs. So again enforcement declines, but the inflation and output growth rates both rise.

Table 3 also reveals that the magnitude of the elasticities is always larger for the longer enforcement period. This follows from the discussion of the effects of changes in δ, P^i and q given above. In each of these cases the comparative dynamics are explained by a change in per period enforcement; these effects are naturally larger when they accumulate for more periods.

The results in Table 3 also show that the effects on inflation of changes in δ, P^i, and q vary systematically (almost monotonically) from period to period. A unit increase in δ produces a proportionately smaller increase in inflation in each successive period closer to the election. We know that an increase in δ raises inflation by reducing enforcement per period. The closer is the election the smaller will be this effect because, for all post election periods, it will reduce enforcement only with the probability of election victory. An identical argument holds for the effect on inflation of a change in q, which tends to fall in absolute value as the election approaches. A rise in P^i raises enforcement and lowers inflation by a proportionately greater amount in periods closer to the election. This follows because, closer to the election, P^i effects enforcement in more periods, and so has a greater cumulative effect.

Frey and Schneider's (1988) survey presents considerable evidence that parties follow more expansionary policies the lower are their election prospects; that is, the lower is P^i. They explain this fact by suggesting that the parties are both partisan and election motivated, so a party will try to "purchase" popularity when it is unpopular by following an expansionary policy. Our explanation is very different and has the advantage of being presented in the context of a formal model. Lower levels of popularity reduce enforcement which leads to higher best credible inflation rates and higher levels of output.

The results of the theoretical model obtained from both analytical techniques and simulation of the model can be summarized as follows:

1. For any government inflation and output growth rates accelerate as the next election date approaches.
2. Governments that care relatively more about inflation experience lower inflation and output growth rates.

3. An increase in the relative magnitude of the Mundell-Tobin effect raises output growth and inflation rates in every period for both types of government.
4. The more a government cares about the future the lower will be the inflation and output growth rates in each period, provided that the best rule is not credible.
5. The effect on inflation and output growth of a change in the discount factor will be absolutely smaller in periods closer to the election.
6. For any government an increase in the probability of reelection lowers the rates of inflation and output growth.
7. An increase in the reelection probability has an absolutely larger effect on inflation and output growth rates in periods closer to the election.

Results 1, 2, and 6 are the key empirical predictions of our model.[13] We now turn to an examination of the consistency of these results with the empirical evidence.

6. Some Empirical Evidence

The empirical evidence concerning result 1 comes from work that attempts to assess the electoral model of Nordhaus (1975) (which is similar to earlier work by Kalecki 1937 and Schumpeter 1939). In this model the incumbent party manipulates the economy to improve the chance of reelection. This manipulation produces, theoretically, cyclical behavior in economic aggregates. Tests of this model by McCallum (1978), Hibbs and Fassbender (1981), and Beck (1982a, 1982b) are not supportive. However, more recent work by Haynes and Stone (1989, 1990) has shown that these early dismissals of the electoral model may have been premature. They argue that earlier work was overly restrictive in its maintained hypotheses and show

[13]Results 3, 4, and 5 are concerned with the effects of changes in the parameter measuring the response of output to changes in anticipated money and changes in the government's discount rate. The value of the parameter measuring the effects of anticipated money is a highly contentious issue. Identifying the effects of changes in this parameter would be even more difficult. Thus it is doubtful that attempts to test result 3 would be successful. The unavailability of data on the government's discount rate makes it difficult to subject results 4 and 5 to direct empirical tests. Tests of 7 would involve comparing how the same change in the reelection probability affects inflation and output growth in different time periods before an election. This too would be a difficult empirical task.

that unrestricted estimates of electoral patterns produce highly significant four-year cycles in inflation, output, and unemployment.[14]

The alignment of the electoral patterns estimated by Haynes and Stone support result 1, which states that inflation and output will accelerate as the date of an election is approached. For example, the cyclical component of GNP that Haynes and Stone estimate increases for two years prior to the election and peaks the quarter of the election, unemployment decreases for two years and troughs the quarter after the election, and inflation troughs three quarters prior to the election and peaks five quarters after the election, just as result 1 predicts.[15]

Empirical work on result 2 has come mainly from tests of the Partisan model of Hibbs (1977) where policies differ by political party. In recent applications (Alesina and Sachs 1987), uncertainty over election outcomes induces surprises in policy when the election is over and these surprises, which are dependent upon the party elected, induce fluctuations in inflation and real output. Alesina and Sachs show that in the first two years of an electoral term, output is higher for Democrats than for Republicans, and that in the second two years of the term there is no significant difference. Haynes and Stone report similar results for real output, though when both electoral and partisan variables as well as their interaction are included in the output regressions, the differences between the first and second half of the term disappear. Haynes and Stone also examine unemployment and inflation and find that unemployment is lower and inflation higher for Democratic administrations. Thus, our result 2, that parties that care relatively more about inflation, usually identified as the Republican party, will experience lower inflation and output growth, is supported by the evidence.[16]

[14]They also duplicate the negative results obtained from the more restrictive approach taken in earlier work.

[15]Inflation seems somewhat out of alignment with our predictions. However, the alignment of these cycles is quite consistent with what would be expected if money is driving the cycles and if standard lag structures between impulses and responses are assumed (see Haynes and Stone 1989). In our model, there is no lag between a monetary impulse and shocks to inflation and output (for simplicity) so that the misalignment above is to be expected.

[16]Haynes and Stone's (1990) evidence suggests that Democrats have higher levels of output growth and inflation than Republicans in every period, but that Republicans induce a cycle of greater amplitude. This accords exactly with a combination of our analysis and the post election effects demonstrated by Alesina (1987).

Finally, we discuss the empirical evidence on result 6. If it is accepted that actual voting behavior is a good proxy for the probability of reelection then the results of Fair (1987) are relevant.[17] Fair finds that voting behavior responds to both inflation and real output, and the response is greater for real output. Thus, Fair establishes a correlation between the probability of reelection (voting behavior) and inflation and real output. Result 6 predicts such a correlation but the direction of causality is the reverse of that assumed by Fair. In Fair's econometric model the probability of reelection is caused by inflation and real output. In our model it is the change in the probability of reelection that causes a change in inflation and real output. That is, an increase in the probability of reelection increases the likelihood of incurring enforcement in the post election period. This induces the government to choose a lower rate of inflation, which in turn brings about a lower rate of real output growth. Since the direction of causality between voting behavior and economic events has not been clearly established, Fair's work, which establishes correlations amongst these variables, supports result 6.

7. Summary and Conclusions

This paper develops a credibility model that explains many aspects of the political business cycle. In this analysis changes in the best credible inflation rate occur due to an increase in the number of enforcement periods that overlap an election date. With a fixed total number of enforcement periods this implies that inflation increases as the election date approaches. Since economic agents are rational the increase in inflation is anticipated. The model incorporates a Mundell-Tobin effect so that the increases in anticipated inflation translate into increases in real output growth. This political business cycle model explains pre-election movements in inflation and output growth; the post election behavior of the economy involves standard partisan surprises as discussed in Alesina (1987). The model also has empirical support, the theory's predictions are very close to the evidence presented by Haynes and Stone (1990).

We stress that these results are generated in a model where all agents are fully rational, and where there is no myopia or limit

[17]See also Fair (1978, 1982, 1987, 1988), Hibbs and Fassbender (1981), and Frey and Schneider (1988).

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to memory. There are several avenues for extension. In this paper we present no explanation for voting behavior (see Fair 1987). However, if the labor market of the economy is characterized by hiring by seniority as in Ellis (1991), then it may be possible to incorporate endogenous voting based on expected partisan effects into the structure developed above. Furthermore, this model explains the political business cycle in economies with fixed electoral terms (see Ellis and Thoma 1991 for a model with variable electoral terms, and Balke 1990 for some related empirical findings); extensions to the variable electoral term case would also seem to be potentially important.

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Appendix

Simulation Mechanics

To simulate the model we followed the recursive solution procedure outlined in the text. The simulation requires that we specify initial values for the parameters γ, δ, i, q, P^i and N. We begin by setting $\gamma = 1$; this amounts to no more than a normalization (the relative importance of surprise and anticipated inflation in output determination is given by δ, the relative weight of inflation as opposed to output growth in party preferences is given by i). The parameters P^i, q, and d are allowed to take seven parameter values 0.01, 0.17, 0.33, 0.50, 0.67, 0.83 and 1.0. The parameter i is allowed to take on seven values 0.50, 0.67, 0.83, 1.0, 1.17, 1.33, and 1.50. These parameter ranges were chosen on a priori grounds and because they both generated reasonable values for the inflation rate and exhibit a wide variety of time paths (considerable experimentation was carried out for values outside the reported parameter range, but this revealed no new information). Finally N, the enforcement period, was allowed to take values of 3 and 6 (again further variations in the N were tried but revealed no further information). The results reported below are based on a total of 4,802 simulation runs using the parameter ranges specified above. Each of these runs consisted of calculating the inflation rates for 24 periods prior to the election. In every run, inflation obtained a steady state (working backwards) before the 24th period.