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We develop and test a model of joint determination of economic growth and national election results in the United States. The formal model, which combines developments in the rational choice analysis of the behavior of economic agents and voters, leads to a system of equations in which the dependent variables are the growth rate and the vote shares in presidential and congressional elections. Our estimates support the theoretical claims that growth responds to unanticipated policy shifts and that voters use both on-year and midterm elections to balance the two parties. On the other hand, we find no support for "rational" retrospective voting. We do reconfirm, in a fully simultaneous framework, the "naive" retrospective voting literature's finding that the economy has a strong effect on presidential voting. We find congressional elections unaffected by the economy, except as transmitted by presidential coattails.

The literature on macroeconomic fluctuations and general elections divides into three branches. One studies the impact of economic conditions on voting: economic fluctuations are viewed as predetermined, while electoral results are the endogenous variables (see, e.g., Chappell and Suzuki 1990; Erikson 1989, 1990; Fair 1978, 1982, 1988; Fiorina 1981; Kiewiet 1983; Kramer 1971). A second emphasizes that political parties pursue different policies that result in "partisan effects" on the economy.[1] A third line of research emphasizes the "opportunistic" behavior of politicians who try to manipulate the economy in order to increase their chances of remaining in office (see Alesina, Cohen, and Roubini 1992; Haynes and Stone 1987; Nordhaus 1975, 1989; Tufte 1978).

For the United States in the twentieth century, this literature discloses several regularities:

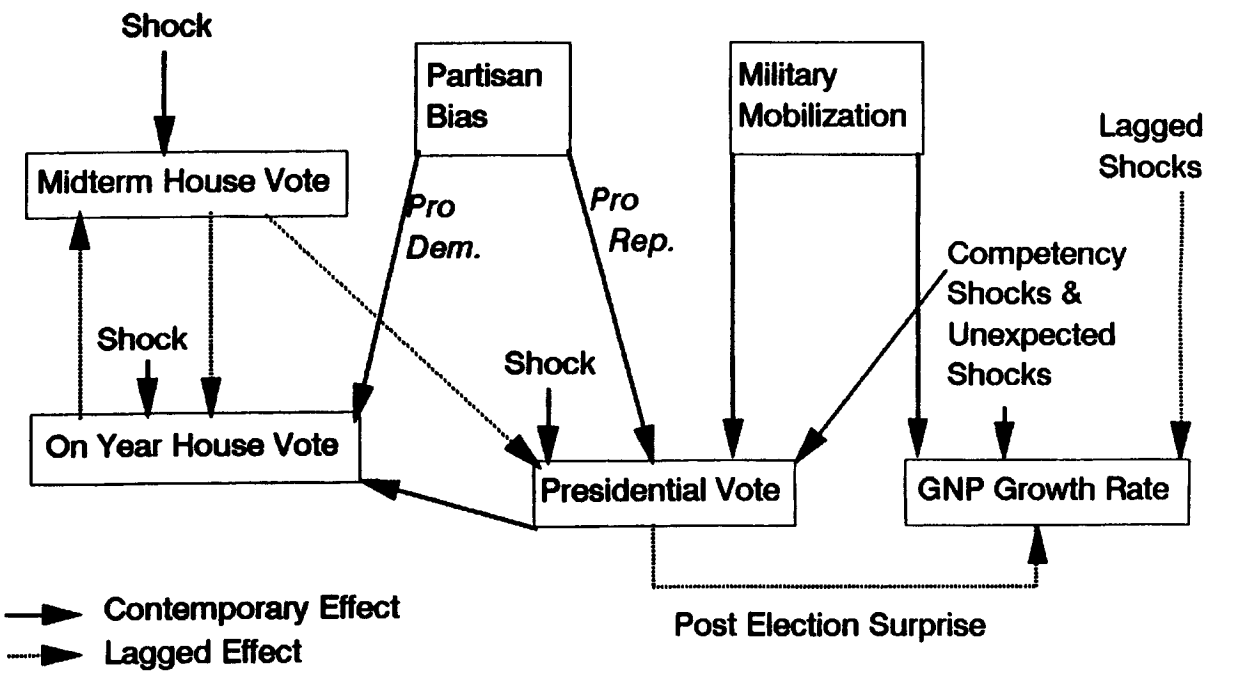
1. Presidential elections are strongly influenced by the business cycle. The vote share of the incumbent president's party's presidential candidate increases with the rate of gross national product (GNP) growth in the election year; other economic variables (e.g., unemployment, inflation) are less significant in explaining presidential results.[2]
2. Congressional vote shares are less sensitive to economic conditions (Alesina and Rosenthal 1989; Chappell and Suzuki 1990; Erikson 1990; Lepper 1974).[3]
3. There is a midterm electoral cycle where the party holding the White House loses plurality in midterm congressional elections (Alesina and Rosenthal 1989; Erikson 1988).
4. Since World War II, in the first half of Republican administrations, economic growth tends to decelerate, reaching its minimum during the second year of each term, while the economy grows more rapidly than average during the first half of Democratic administrations. In the last two years of each term, there are no significant differences between growth rates for Democratic and Republican administrations (Alesina 1988; Alesina and Sachs 1988).[4]
5. The rate of economic growth is not systematically higher than average in election years (see Alesina 1988; Alesina and Roubini 1992; Beck 1992; Golden and Poterba 1980; Hibbs 1987; McCallum 1978).

We construct and test a model consistent with the aforementioned regularities. In this model economic and electoral outcomes are jointly endogenous. The model, which posits rational choice by both voters and economic agents, is based upon four key ideas:

1. The two political parties are "partisan" and polarized. The Republicans, *relative* to the Democrats, are more concerned with containing inflation than with stimulating growth (Hibbs 1977, 1987). The Democrats also favor expansionary monetary and fiscal policies in order to support relatively large government programs.
2. Economic agents form "rational expectations," but wage "stickiness" prevents an immediate adjustment of wages to economic shocks or "news." Because the two parties follow different policies, uncertainty about the outcome of elections engenders uncertainty about postelection policies. Agents are forced to hedge this uncertainty in nominal wage contracts concluded prior to elections remaining in effect after the elections.[5] The actual postelection policies then produce real effects on economic growth. In particular, growth will be relatively high following the election of a Democrat, whereas recessions are most likely after a Republican victory (Alesina 1987).
3. Policy outcomes depend both upon which party holds the presidency and the relative share of seats in Congress. For instance, Democratic control of Congress "pulls" policy outcomes with a Republican president to the left. Voters take advantage of this institutional structure of "checks

FIGURE 1

Schematic Overview of the Model



and balances" to bring about middle-of-the-road, moderate policies (Alesina and Rosenthal 1989, 1991; Fiorina 1988, 1992). The midterm cycle is an instance of this type of moderating behavior.

4. Administrations vary in their degree of "administrative competence." For a given rate of inflation (expected or unexpected), a more competent administration is likely to produce more growth than a less competent one (Persson and Tabellini 1990). Since voters prefer more competence to less, elections will turn on not only partisan preferences but also efficiency arguments. However, a voter cannot observe "competence" directly but only its effect on the economy. Since the economy is also affected by technological innovations, oil price changes, wars, and other matters that have little to do with administrative competence, voters cannot immediately distinguish competence from "luck." A "rational" retrospective voter can only use available information to make a forecast of the incumbent's postelectoral competence. This forecast, as we shall show, leads economic growth to affect electoral results in a manner distinct from "naive" retrospective voting, where no attempt is made to distinguish good luck from good government.[6]

We shall integrate these ideas in a single theoretical model that encompasses both political and economic outcomes. The theory is followed by econometric estimation. Our theoretical model fares well in these tests, which support the theory on several key points including (1) institutional "balancing," manifest in the midterm cycle (the party controlling the White House loses vote share in the midterm elections); (2) the economy has a much greater impact on presidential elections than on congressional elections; and (3) the "partisan" effects on growth appear in the wake of presidential elections. On the other hand, we do not find support for "rational" retrospective voting, a result we shall later discuss at length.

Before embarking on a formal presentation of the model, we use the schematic shown in Figure 1 to provide the reader with a brief overview. The theoretical model leads to four equations in the empirical estimation: the GNP growth rate, the presidential vote, the on-year House vote, and the midterm House vote. Each of these equations has, as is common practice, independent random shocks. The GNP equation reflects the two aforementioned channels of government influence on economic growth. The first is "partisan" politics coupled with electoral uncertainty and nominal wage contracting. The second arises from variations in the competence of different administrations.

The partisan effect, present only at the beginning of each four-year term, arises because agents have to take into account that there are two possible inflation policies that will be pursued *after* the elections: high inflation if a Democrat wins the presidency or low inflation if a Republican wins. Wage contracts signed *before* the elections will be based on the *expected* postelection rate, which, since there is electoral uncertainty, lies in between the high Democratic rate

and the low Republican rate. After the election, there is "unexpected" inflation represented by the difference between this *expected* rate and the *actual* rate implemented by the winner. If the Democrats win, for example, this unexpected "surprise" generates an upsurge in growth. The upsurge lasts, however, only for a couple of years, until new wage contracts have incorporated the higher, now expected, inflation policy. Subsequently, the economy returns to its "normal" rate of growth, implying that there is not a "partisan" influence on the rate of growth in the second half of each term.

The partisan growth model thus implies that the effects of macroeconomic policy on growth are short-lived. In contrast, Hibbs's (1977, 1987) model has persistent partisan effects on the economy. Moreover, in our model, an administration cannot use unexpected inflation to generate an upsurge in growth before elections. In fact, "rational" economic agents would predict such maneuvers and, in so doing, render them ineffective. Therefore, we do not predict a systematic preelectoral burst of growth, as in the Nordhaus (1975) "political business cycle."

In contrast to the partisan effect, the second, competence effect is present in election years and is the key to "rational" retrospective voting. Although we cannot measure "competence" directly, we can test a direct implication of the model. The model predicts that the intertemporal covariation in growth should be *higher* when there is no change in the party holding the White House than when there is one. This is because a change in control leads to a completely new level of competence while with no change the previous level persists. Therefore, the growth equation will be used to provide a very direct test of whether there is a basis for "rational retrospective voting." Indeed, preelectoral economic performance should matter to voters only if there is evidence that the government, as well as outside forces, has an important influence on performance. We will conclude against "rational" retrospective voting: the American electorate pays "too much attention" to the rate of GNP growth in election years.

We estimate both the partisan surprise and competence effects by using an autoregressive moving average representation of GNP growth similar to the unemployment equation in the seminal work of Hibbs (1977). Since we use only a first-order moving average, our representation is simpler than his. On the one hand, this simple representation renders the theoretical model tractable; on the other, statistical tests reject the need for more complexity in the empirical model. The estimation also includes a military mobilization variable as an exogenous measure for the effect of wars.

The presidential vote reflects both the electorate's partisan preferences *and* their evaluation of the incumbent's competence in managing the economy. In a standard "naive" retrospective voting model (e.g., Fair 1988), one would simply enter election-year economic performance as a predictor. But the rational "competency" model says that the voters should focus only on that portion of growth likely to persist after the election. This portion is represented by the shocks directed at growth in Figure 1. In addition to the test for growth, we also test, in the presidential equation, for a "rally 'round the flag" effect from military mobilizations.

The presidential equation and the on-year House equation jointly test the basic idea of institutional balancing. Balancing implies that if one party is advantaged in one institution, its opponent should be stronger in the other. We allow for partisan bias in both on-year voting equations. The on-year House vote further reflects our theoretical framework in allowing for "coattails" from the presidential vote. In contrast, the off-year House elections reflect only the balancing of the midterm cycle, which, as we shall show, is embedded in the lagged effect of the on-year House vote.

Recognizing the overbearing importance of incumbency in American politics, we include the lagged House vote in every voting equation. Indeed, these lagged variables greatly improve the fit. The incumbency advantage is not handled within our formal model for reasons of tractability. To some extent, the lags may proxy for serial correlation in the preferences of the electorate (such as an alleged liberal mood in the 1960s). But the lags have an additional, important role. Being strong in Congress currently facilitates retaining future control of Congress and, to a lesser extent, the presidency. This advantage is offset by the midterm effect, where winning the presidency today causes losses in Congress two years later. In fact, if all exogenous shocks were absent, our estimates show that the lags and the midterm effect would combine to produce a governmental cycle with divided government prevailing over most of the cycle.

THE THEORETICAL MODEL

We simplify the discussion here by treating a "period" as two calendar years. We use t to index periods.

The Economy

We consider a model in which nominal wage contracts are signed at the end of period t and cannot be revised until the end of period t + 1 (Fischer 1977). Thus, the rate of nominal wage growth equals ex ante expected inflation, since we assume that expected productivity growth is zero. Disregarding capital, a supply function for this economy can be written as follows:

$$g_t = \bar{g} + \gamma(\pi_t - \pi_t^e) + \varepsilon_t, \qquad (1)$$

where g_t is the output growth, $\bar{g}$ is the "natural" rate of growth, π_t is the inflation rate, and $\pi_t^e = E(\pi_t|I_{t-1})$ is the rational expectation of inflation based upon the information available in period $t - 1$.[7]

The error ε_t consists of two components, which

cannot be separately observed by the voters (nor by econometricians):

$$\varepsilon_t = \zeta_t + \eta_t. \quad (2)$$

The transitory shock ζ_t (independently and identically distributed with mean 0 and variance σ_ζ^2) represents unanticipated economic events beyond the scope of government control (e.g., oil price shocks, some technological innovations). The term η_t captures administrative "competence." In fact, *given inflation*, growth is higher, the higher η_t. In this context, competence can be interpreted as the administration's ability to avoid inefficiency and, generally speaking, to create an environment conducive to growth without inflation.

Competence does not disappear overnight. *Within parties*, the competency level exhibits inertia, evolving according to a first-order moving average, or MA(1), process:

$$\eta_t = \mu_t^R + \rho\mu_{t-1}^R \quad \text{if } R \text{ president at } t$$

$$\eta_t = \mu_t^D + \rho\mu_{t-1}^D \quad \text{if } D \text{ president at } t. \quad (3)$$

The disturbances are independently and identically distributed and satisfy

$$E(\mu_t^R) = E(\mu_t^D) = 0$$

$$\text{Var}(\mu_t^R) = \text{Var}(\mu_t^D) = \sigma_\mu^2.$$

This specification implies that we regard parties as ongoing organizations with competence that persists to the same degree whether the incumbent is reelected or a new president from the same party is chosen. The validity of the assumption can be argued by noting the relatively slow turnover of the cadre that forms cabinets. Note also that competence is given, not chosen by an administration. In fact, our model does not even require that the government knows its own competency level!

While for tractability, we do not consider congressional competence, it is reasonable to assume that variations of competence are more important to the presidency, since individual variations in competence are likely to cancel out in a legislative setting with large numbers of decision makers.

In our model, competence shocks persist for one period only, which (as we shall show), suffices to induce rational retrospective voting. Higher-order moving average (MA) processes could be introduced without changing our qualitative results as long as the shocks that precede a presidential election do not influence the competency level of the incumbent's party beyond a single presidential term (see Appendix).

The Two Political Parties

Two parties, D and R, compete for office, with no entry of third parties. All presidential and legislative candidates of a party have identical preferences. These preferences and those of voters are represented by utility functions that are, for tractability, quadratic in the inflation rate and linear[8] in output growth:

$$W^i = \sum_{t=0}^{\infty} \beta^t \left[-\frac{1}{2}(\pi_t - \bar{\pi}^i)^2 + b^i g_t \right] \quad 0 < \beta < 1, \quad (4)$$

where the index i takes on the values D, R for the political parties and generic value i for an individual voter. The parties and voters have a common discount factor β. The following inequalities capture the "partisan" nature of our model:

$$\bar{\pi}^D > \bar{\pi}^R \geq 0; \quad b^D > b^R > 0.$$

While the parties agree that output growth is desirable, they differ both in terms of their most preferred inflation rates ($\bar{\pi}$) and in the trade-off between output and deviations of inflation from its most preferred level (b). Party D is relatively more concerned with growth than with inflation. That the parties prefer positive rates of inflation to zero inflation is motivated by three features of the economy. First, inflation is a tax on nominally denominated assets. To finance public spending, it is optimal to distribute the burden of taxation as widely as possible, including the implicit tax represented by inflation. Second, empirical evidence suggests a negative correlation between *real* interest rates and the inflation rate. Third, Tobin (1972) and many others have argued that moderate inflation facilitates smooth adjustments of prices and wages, particularly (as appears to be the case) if the latter are rigid downward. Thus, the preferences on inflation can be interpreted as a reduced form of underlying preferences on public spending and real interest rates. We assume that the policymakers control the inflation rate directly.[9]

Institutions

The president is elected for two periods by majority rule. The entire legislature is elected each period by strict proportionality.[10] These institutional characteristics, combined with the assumption that the growth shock persists for only one period, greatly facilitate the development of the formal model. Since presidents serve two periods, expectations about the results of midterm elections are relevant to on-year decisions; but voters never need to anticipate the effects of their decisions on the next presidential election. We can thus characterize the voting equilibrium in terms of a game with two moves, the simultaneous election of a president and Congress in on-years and the election of Congress at midterm. Split tickets are permitted on the first move. There is no abstention.

While economic and electoral outcomes will vary as a consequence of the random variables in the model, the equilibrium voting strategies used in each two-move game will be repeated indefinitely. Consequently, we use subscripts 0, 1, and 2 to denote

elections occurring at the end of periods 0 and 1 and economic outcomes occurring in periods 1 and 2.

The Voters

There is a continuum of voters whose preferences are parameterized by $(\bar{\pi}^i, b^i)$. We assume that the distribution of voter preferences is not fully known, by anyone. This realistic feature of the model leaves electoral results uncertain even if the two parties' preferences and policies are common knowledge. Specifically, the inflation ideal points $\bar{\pi}^i$ are uniformly distributed, without loss of generality, on an interval of length 1. Now,

$$\bar{\pi}^i \sim U[\mathbf{a}, 1 + \mathbf{a}], \tag{5}$$

where **a** is a random variable, drawn independently[11] in every period from a uniform distribution on the temporally constant interval $[-w, w]$:[12]

$$\mathbf{a} \sim U[-w, w]. \tag{6}$$

We adopt the simplifying assumption that all voters have the same weight on growth b ($b^i = b$ for all i). In the Appendix, we give conditions where this assumption can be relaxed.

Rational Retrospective Voting and the Competency Model

Since voters benefit from growth (via b), they are inclined to retain in office an incumbent whom they believe to have greater-than-average competence. The key to the Persson and Tabellini (1990) model is that while the voters fully know the model of equations 1–3, they are missing one key piece of information, which is μ_t, the current period's contribution to the MA(1) competence process. They are assumed to know not only g_t, π_t, and π_t^e but also μ_{t-1}, the competency innovation of the previous period. With this information, their optimal forecast of the incumbent's competence in the period after the election is[13]

$$\hat{\eta}_{t+1} = [g_t - \bar{g} - \gamma(\pi_t - \pi_t^e) - \rho\mu_{t-1}]\rho \frac{\sigma_\mu^2}{\sigma_\zeta^2 + \sigma_\mu^2}; \tag{7}$$

that is, a rational retrospective voter's decision will be influenced only by growth net of the terms subtracted (average growth, $\bar{g}$, growth from unexpected inflation, $\gamma(\pi_t - \pi_t^e)$ and the portion of competence that does not carry over to the next term, $\rho\mu_{t-1}$. The term in square brackets is multiplied by ρ, the fraction of μ_t that gets carried over to the next period, and by a term that includes the variances. This last term allows the voter to reduce a forecast of future competence if the role of "luck" (ζ) in the economy is large relative to the role of "competence" (μ). In contrast to the rational retrospective voter, the naive retrospective voter keys on all of g_t.

The Timing of the Model

Schematically, the timing of events in our model is as follows:

Periods t = 0, 2, 4, . . .
Inflation (π_t) is determined by the government; shocks ζ_t, μ_t are assigned by "nature."
Output growth (g_t) is realized.
Binding economic plans (wage contracts) for period $t + 1$ are made by uncoordinated private agents.
The president (who serves in $t + 1$ and $t + 2$) and Congress (which serves in $t + 1$) are elected.

Periods t = 1, 3, 5 . . .
[Identical except that president remains in office and only Congress (which serves in $t + 1$) is elected.]

The Time-consistent Inflation Policies of the two Parties

A time consistency problem (Barro and Gordon 1983; Kydland and Prescott 1977) arises in this model. Each party would be better off if it could credibly commit to implementing, whenever it had control over policy, its inflation bliss point ($\bar{\pi}^D$ or $\bar{\pi}^R$). But a party in power, unable to resist the temptation to stimulate short-run growth through an inflation surprise, inflates up to the point at which the disutility of a surprise increment of inflation just offsets the resulting short-run output stimulation. Substituting equation 1 into equation 4 and taking first-order conditions yields the time-consistent inflation policies:

$$\pi_t^{D^*} = \bar{\pi}^D + \gamma b^D > \pi_t^{R^*} = \bar{\pi}^R + \gamma b^R \quad \forall t. \tag{8}$$

These inflation rates are higher than the corresponding party bliss points. But absent credible commitments to lower inflation rates, economic agents and voters anticipate the time-consistent rates, and parties implement them. Note that if voter i were dictator, his or her time-consistent policy would be

$$\pi_t^{i^*} = \bar{\pi}^i + \gamma b \quad \forall t.$$

The Executive–Legislative Policy Interaction

Postelectoral inflation reflects the time-consistent policies of both parties, since policy is a function of which party holds the presidency and of the composition of Congress. The nature of the policy interaction between the legislature and the executive in practice is, of course, a complex question. We capture this interaction by the following expressions for the actual inflation rate when parties R and D hold the presidency, respectively:

$$\pi_t^R = \alpha\pi^{R^*} + (1 - \alpha)[\pi^{D^*}(1 - V_{t-1}^R) + \pi^{R^*}V_{t-1}^R] \tag{9a}$$

and

$$\pi_t^D = \alpha\pi^{D^*} + (1 - \alpha)[\pi^{D^*}(1 - V_{t-1}^R) + \pi^{R^*}V_{t-1}^R] \tag{9b}$$

where $0 < \alpha < 1$ and V_{t-1}^R is the Republican vote share in the congressional election at the end of

period $t - 1$. These equations imply that the actual policy outcomes (π_t^D and π_t^R) are linear combinations of the president's policy (π^{D^*} or π^{R^*}) and the policy that would be pursued by an all-powerful Congress. The latter (given by the term in square brackets in the equations) is itself a linear combination where each party's time-consistent policy is weighted by its congressional vote share. The parameter α captures the relative weight of the president in policy formation.

Given that both parties are represented in Congress, the actual inflation rate will exceed the time-consistent policy of party R, π^{R^*} and fall short of that of party D, π^{D^*}. Conditional on the party of the president, the rate of inflation is increasing in the vote share for party D. Likewise, holding congressional vote shares constant, inflation is higher with a party D president than with a party R president:

$$\pi_t^D > \pi_t^R.$$

Analysis of the Electoral Model

In standard two-candidate voting models, since voters have only a binary choice, there is a unique voter equilibrium once weakly dominated strategies have been cast aside. In our model, only "extreme" voter types with indirect bliss points less than π^{R^*} (greater than π^{D^*}) have a weakly dominant strategy of always voting for party R (D).[14] More moderate voters do not have weakly dominant strategies. How they vote depends upon their conjectures about the behavior of other voters. Thus, there is a fundamental problem of coordination of voter strategies.

A plausible unique equilibrium can be characterized, however, by adapting the concept of coalition-proof Nash equilibria to this macroeconomic policy context (Bernheim, Peleg, and Whinston 1987).[15] The basic idea is that equilibrium strategies should be robust to "credible" defections of coalitions, as well as of individuals; that is, no "credible" coalition of voters would want to modify the electoral outcome by changing their votes.

Midterm Elections

At midterm, each voter has a single binary choice—vote D or R for Congress. This makes the equilibrium analysis very simple. With party R holding the presidency, there is a unique pivotal voter ideal point, $\bar{\pi}^{CR}$. Any voter with $\bar{\pi}^i < \bar{\pi}^{CR}$ votes for party R, and those with $\bar{\pi}^i > \bar{\pi}^{CR}$ prefer D. The expected R congressional vote is

$$E(V_1^R) = \bar{\pi}^{CR}. \tag{10}$$

The equilibrium-expected inflation level represents the indirect bliss point of the pivotal voter (Alesina and Rosenthal 1989):

$$E(\pi_2^R) = \bar{\pi}^{CR} + \gamma b. \tag{11}$$

Suppose, to the contrary, that $E(\pi_2^R) < \bar{\pi}^{CR} + \gamma b$. By continuity, voters with ideal points slightly less than $\bar{\pi}^{CR} + \gamma b$ would also find that inflation was too low, and vote D to increase inflation, implying that $\bar{\pi}^{CR}$ did not specify an equilibrium. A similar argument precludes $E(\pi_2^R) > \bar{\pi}^{CR} + \gamma b$. Using equations 9–11, we find

$$\bar{\pi}^{CR} = \frac{\pi^{R^*} - b\gamma + (1-\alpha)(\pi^{D^*} - \pi^{R^*})}{1 + (1-\alpha)(\pi^{D^*} - \pi^{R^*})}. \tag{12}$$

Analogous arguments show that when there is a D president at $t + 1$, there exists another cut-point, $\bar{\pi}^{CD}$, given by

$$\bar{\pi}^{CD} = \frac{\pi^{D^*} - b\gamma}{1 + (1-\alpha)(\pi^{D^*} - \pi^{R^*})}. \tag{13}$$

Equations 12 and 13 imply that the midterm vote for party D is increasing in b (which captures voters' tolerance for higher inflation in exchange for higher growth) regardless of the president's party. However, expected output is unaffected, since at higher values for b, economic agents correctly anticipate the higher inflation that ensues from D's higher congressional vote.

The Two-Period Model: President Unconstrained in Period 1

In the two-period model, each voter simultaneously makes two choices in on-years. Insight into the analysis is provided by decoupling these two choices and assuming, first, that a president unconstrained by Congress is elected in the first period.

For period 1, we now require an additional cut-point $\bar{\pi}^P$. Individuals with indirect bliss points lower than $\bar{\pi}^P$ will vote R for president, while those with higher bliss points will vote D. Thus, the expected vote for the Republican presidential candidate will be

$$E(V_0^{RP}) = \bar{\pi}^P. \tag{14}$$

For an equilibrium to hold, a voter with ideal point $\bar{\pi}^P$ must obtain the same expected utility from an R victory as from a D victory. This means that a voter at $\bar{\pi}^P$ must be indifferent as between the two-period bundle of inflation and growth associated with the election of an R president and the bundle represented by a D president.

We have already computed the inflation outcomes in the bundles, namely

If a D president (unconstrained in period 1):

$$\pi_1^D = \pi^{D^*} \tag{15}$$

$$E(\pi_2^D) = \bar{\pi}^{CD} + \gamma b \tag{16}$$

If an R president (unconstrained in period 1):

$$\pi_1^R = \pi^{R^*} \tag{17}$$

$$E(\pi_2^R) = \bar{\pi}^{CR} + \gamma b \tag{18}$$

We also need to compute the expected growth outcomes in the bundles; in order to do so, we need to evaluate the period 0 rational expectation of inflation in period 1. This requires knowledge of the probability of a D presidential victory, given $\bar{\pi}^P$. This probability, denoted $Q(\bar{\pi}^P)$ can be easily computed, given

the uniform distribution of **a**. The inflation expectation is then evaluated as

$$\pi_1^e = Q(\bar{\pi}^P)\pi^{D^*} + (1 - Q(\bar{\pi}^P))\pi^{R^*} \quad (19)$$

Equation 19 is central to both wage contracting and voting. It underlines that before presidential elections, electoral uncertainty forces agents to "hedge their bets" in forming expectations about future policies. Using 19, we can now compute growth in the two periods. We assume a D president in period 0, the R case being symmetric. Expected growth is[16]

$$\left.\begin{array}{l}\text{if a } D \\ \text{president} \\ \text{at } t = 0\end{array}\right\} \begin{array}{ll} E(g_2^D) = E(g_2^R) = \bar{g} & (20) \\ E(g_1^R) = \bar{g} - Q(\bar{\pi}^{D^*} - \bar{\pi}^{R^*}) & (21) \\ E(g_1^D) = \bar{g} + (1 - Q)(\bar{\pi}^{D^*} - \bar{\pi}^{R^*}) + \hat{\eta}_1. & (22)\end{array}$$

Equation 20 implies that control of the White House will not affect growth in period 2. This result follows because even before the presidential election takes place, the voters know that new wage contracts will be signed at the end of period 1. At that time, there will be no uncertainty about the identity of the president.

Equation 21 gives the expected growth in the first period of an R administration. It is obtained by substituting equations 17 and 19 into equation 1 and by noting that expected competence is at its "normal" value of 0, as R is the challenging party, and so there is no information about its competence. Equation 21 shows that *below*-normal growth is expected at the outset of an R administration. This does not imply that R likes recessions. On the contrary, since $b^R > 0$, party R prefers higher growth to lower growth. The problem is that the possibility of a D electoral victory keeps inflation expectations (see equation 19) *higher* than the low-inflation policy of party R.

Equation 22 represents expected growth in period 1 when party D retains control of the White House. The equation is symmetric to equation 21 in that there is *above* normal growth from surprise inflation. The additional term, $\hat{\eta}_1$, is the expected value of the incumbent party's competence in period 1, from equation 7. (The expectation at $t = 0$ for period 2 is 0 because competence is MA(1).) This is the key to "rational" retrospective voting. Voters will tilt to incumbents with large $\hat{\eta}$s.

With equations 14–22, we have all the necessary information to compute $\bar{\pi}^P$ and $Q(\bar{\pi}^P)$ (see Appendix for details). It should be clear now that there are two influences on presidential voting. The first is how the parties are located relative to the distribution of voter preferences. If R's time-consistent policies are closer to the median indirect bliss point than are D's, R will be favored ($Q < 1/2$). The second is the rate of economic growth in the preelection period, via g's influence on $\hat{\eta}$. We emphasize that the relevant portion of growth reflects only "competence" and "luck" and not the "partisan" inflation policies of the two parties (see equation 7).

The Two-Period Model with Congress Elected in Both Periods

Now we must find one more cut-point $\bar{\pi}^C$, which applies to the on-year congressional elections. Again, voters with indirect bliss points below the cutpoint will vote for R, and those above will vote for D. As in the midterm case, first-period inflation equals, in expectation, the bliss point of the pivotal voter. Applying results from Alesina and Rosenthal (1991), we have

$$\bar{\pi}^C = Q(\bar{\pi}^P)\bar{\pi}^{CD} + (1 - Q(\bar{\pi}^P))\bar{\pi}^{CR}. \quad (23)$$

The first-period congressional cutpoint is a weighted average of the second-period cut-points, with the weights given by the probability of the presidential election outcome. This equation implies that on-year congressional voting responds directly to future partisan effects on economic policy, via $\bar{\pi}^{CD}$ and $\bar{\pi}^{CR}$, but only indirectly to the current state of the economy, via the linkage to presidential voting provided by $Q(\bar{\pi}^P)$. There is no direct response because voters evaluate competence only for the executive.

A "midterm cycle" occurs if and only if $0 < Q(\bar{\pi}^P) < 1$, so that, from equation 23:

$$\bar{\pi}^{CR} < \bar{\pi}^C < \bar{\pi}^{CD}; \quad (24)$$

that is, a midterm cycle results when there is uncertainty about the outcome of the presidential election, leading voters to hedge their bets in on-years. With presidential uncertainty resolved, voters in midterm elections "fully" moderate the presidential winner. For example, consider a voter who desires moderately high inflation, with $\bar{\pi}^i \in (\bar{\pi}^C, \bar{\pi}^{CD})$. If the R presidential candidate were to win, a strong R congressional vote would result in inflation far below the rate favored by voter i. Accordingly, in the on-year, this voter protects against a possible R presidential win by supporting the D congressional delegation. But if party D captures the White House, the risk of a party R win evaporates and at the ensuing midterm election, voter i supports the party R delegation to moderate the D president.

Equation 24 implies that the less unexpected the outcome of presidential elections, the smaller the size of the midterm effect. The amount of uncertainty depends upon $\bar{\pi}^P$, which, in turn, is a function of the parameters of the model. The value of this cut-point can again be obtained by equating the expected utility from an R presidential victory to that from a D victory, this time taking into account the presence of a legislative vote in the first period. One can then compute expectations over growth and, after substitution, the presidential cut-point. The expressions for the presidential and congressional cutpoints generate two equations in two unknowns that are otherwise functions only of the parameters of the model (π^D, π^R, γ, β, ρ, b, w, σ_ξ^2, and σ_μ^2).

Alesina and Rosenthal (1991) show how to solve this problem and demonstrate, for a large set of parameter values, the existence of a unique equilib-

rium (in a different parameterization) characterized by uncertain presidential elections ($0 < Q < 1$) and thus a midterm cycle.

ESTIMATION

The Sample

Our empirical analysis of the joint determination of economic growth and the results of national elections covers 1915–88. We began with 1915 because the previous year, 1914, was the beginning of a new financial regime, marked by the inception of the Federal Reserve and the collapse of the gold standard.[17] Furthermore, economic data before this date are of dubious quality, and the three-party presidential race of 1912 would pose estimation problems. Descriptive statistics and data sources are given in Appendix Table A-1. In the theoretical model, each period represents two calendar years, mimicking the intervals between national elections. The Appendix generalizes the model to permit periods of one year, as in the estimation.

The Growth Equation

The growth equation of our theoretical model reflects two potential channels of political influence on the economy. First, there is "surprise inflation" in the wake of every presidential election. To capture this effect empirically, we construct a "partisan effect" variable, pe_t, set equal to 1 during the second year of a Republican administration, −1 during the second year of a Democratic administration, and 0 otherwise. The coefficient on this variable should be negative. The second channel from politics to growth is the executive branch's competence at promoting economic performance. In the theoretical model, executive competence, which is not directly observable, evolves according to an MA(1) process. This model implies that successive residuals from the growth equation will be less highly correlated when there is a change of administration.

The specification of pe_t has three features deserving explanation. First, the variable is nonzero only in the *second* year of presidential terms. This reflects the view that real effects of monetary policy do not show up in output before 2–4 quarters.[18] Using quarterly data, Alesina (1988) shows that the postelectoral effects on the economy appear no sooner than 2 quarters after a presidential election, peak in about 5–6 quarters, and disappear by 10 quarters. Analogous results for several other countries are reported by Alesina and Roubini (1992). Second, with pe_t, the magnitude of the inflation surprise is equal across parties, whereas in the theory, the surprise (see equations 21–22) is greater for the party with the lower probability of winning.[19] Third, in addition to the presidential inflation surprise captured by pe_t, our theoretical model also allows for surprise inflation from the outcome of congressional elections. However, whereas the presidential outcome is discrete, the impact of congressional elections depends on deviations of V^R from its expected value. These deviations should be roughly of the magnitude of the small forecast errors from our House equations. In addition, presidential influence on policy is likely to exceed that of Congress (Hibbs 1987); that is, α is likely to be large, implying that the impact of congressional surprises is sufficiently small that we can simplify the empirical model by excluding them.

With the term ζ_t in equation 2, we modeled transitory effects on growth as random events. But military activities, especially wars, represent an obvious source of transitory effects that can be included in the analysis.[20] Define m_t to be the number of individuals in military service as of 30 June of year t and POP_t to be the population of the United States for the same year. Then the rate of military mobilization is given by

$$mm_t = (m_t - m_{t-1})/\text{POP}_t.$$

This variable highlights the beginnings and endings of wars, and it scales conflicts relative to one another. Including pe_t and mm_t and substituting into equation 1 from equations 2 and 3, our growth equation is

$$g_t = \gamma_0 + \gamma_1 pe_t + \gamma_2 mm_t + \zeta_t + \mu_t^R + \rho\mu_{t-1}^R \quad \text{if an } R \text{ president}$$

$$g_t = \gamma_0 + \gamma_1 pe_t + \gamma_2 mm_t + \zeta_t + \mu_t^D + \rho\mu_{t-1}^D \quad \text{if a } D \text{ president.} \quad (25)$$

Let θ denote the covariance between the two parties' competency shocks:

$$\theta = \text{Cov}(\mu_t^R, \mu_t^D).$$

In our model, $\theta = 0$, while $\theta = \sigma_\mu^2$ in the standard MA(1) model. The two models are nested in a generalized growth equation with parameters γ_0, γ_1, γ_2, σ_ζ^2, σ_μ^2, ρ, and θ.

Nelson and Plosser (1982) show that the standard MA(1) model where $\theta = \sigma_\mu^2$, and $\sigma_\zeta^2 = 0$ is not rejected in favor of more complicated autoregressive moving average (ARMA) process models.[21] Thus, the standard MA(1) model adequately describes the annual growth series.[22] In contrast, our model implies $\theta = 0$ and does not restrict σ_ζ^2. The model implied by equation 25 is underidentified: we cannot recover ρ, σ_μ^2, σ_ζ^2, and θ without further structure. (See the Appendix for a more detailed discussion of this test.) However, we can estimate $c_0 = \rho\sigma_\mu^2$, and $c_1 = \rho\theta$, enabling us to test both the competency-based model, which implies H_0: $c_0 > c_1 = 0$, and the standard MA(1) model, which implies H_1: $c_0 = c_1$.

Our estimate of c_1 is 10.51, with a standard error of 3.98, leading to rejection of H_0 at all standard levels of significance. Is there evidence that $c_1 < c_0$—as we might see if the competency shocks for the two parties were positively (but imperfectly) correlated? The estimated value of c_0 is 7.85, *less* than c_1, provid-

ing no evidence against H_1 in favor of the alternative that $c_1 < c_0$. We thus *reject* the competence model. This implies that rational voters should not be retrospective—the rate of GNP growth in election years should not affect presidential elections. We return to this point when we discuss the presidential vote results.[23]

Our test of H_1 against the unrestricted model is more favorable, indicating acceptance at all standard significance levels.[24] We thus adopt the standard MA(1) model:

$$g_t = \gamma_0 + \gamma_1 pe_t + \gamma_2 mm_t + \rho\mu_{t-1} + \mu_t. \quad (26)$$

Purely to facilitate estimation of the full model, we allow for heteroscedasticity with separate variances for nonelection years, midterm election years, and years in which there is a presidential election: $\sigma^2_{\mu N}$, $\sigma^2_{\mu M}$, and $\sigma^2_{\mu P}$ respectively.[25] Our estimates do not lead to rejection of the null hypothesis that these variances are equal.

Presidential Elections

For convenience in estimation, we specify, for both presidential and congressional elections, the dependent variables as *shares of the two-party vote for the party of the incumbent president*.

In our theoretical model, voters evaluate both party policies and presidential competence. But since the tests of the growth model provided no evidence that variations in competence are an important factor in growth, any evidence of retrospective voting on the economy will, within the context of our model, constitute a rejection of voter rationality.

Our theoretical model of presidential voting implies a cut-point $\bar{\pi}_P$ that may not be at the expected median. Consequently, one party may have an expected vote share greater than one-half. We capture the embodiment of policy preferences in the cut-point via r_t, which takes on a value of 1 if the incumbent is a Republican, and 0 otherwise.

However, we allow the cut-point implicit in r_t to be "adjusted" via v^{hm}_{t-2}, the share of the popular vote cast for the incumbent president's House delegation during the preceding midterm election. This variable can be proxying for several effects. First, the locations of the parties *relative* to the distribution of the voters may adjust slowly in time, whereas they are assumed to be constant in the theoretical model. Second, the independent preference shocks in the theoretical model are likely to be serially correlated in practice. Third, incumbency advantage in the House may directly improve chances of winning the presidency. None of these mechanisms is included (for reasons of tractability) in our theoretical model, but our results suggest they are empirically relevant.

The presidential voting equation also contains an additional disturbance φ^P_t that is orthogonal to the growth shocks and measures. This incorporates **a** in the theoretical model. "Rally 'round the flag" effects from wars perhaps represent a systematic short-run shift in the distribution of preferences. Consequently, we also include mm_t in the equation.

Last—and certainly not least—is retrospective voting on the economy. We test for this effect by including g_t in the regression. But to pursue our investigation of "rational" versus "naive" voting further, we break g_t into two components: μ_t, the contemporaneous shock, and $\hat{g}_t$, which is the expected growth rate based on the parameters of equation 26 and lagged shock (recall that $pe = 0$ in an election year):

$$\hat{g}_t = \gamma_0 + \gamma_2 mm_t + \rho\mu_{t-1}.$$

Our voting equation is, then,

$$v^p_t = \psi_0 + \psi_1 r_t + \psi_2 v^{hm}_{t-2} + \psi_3 mm_t + \psi_4 \hat{g}_t + \psi_5 \mu_t + \varphi^p_t. \quad (27)$$

Since we rejected the competence model, voter rationality would imply, in this model, that $\psi_4 = \psi_5 = 0$. Purely naive retrospective voting implies $\psi_4 = \psi_5 > 0$; that is, the electorate votes on the basis of GNP growth and does not even attempt to make any distinction between shocks to growth and predictable growth. For a naive voter, growth is growth: its pedigree does not matter.

Note that φ^P_t does not appear in equation 26. Consequently, equations 26–27 represent a recursive system. The recursive structure is preserved when we add congressional voting.[26] We also estimate a restricted presidential equation in which there is no direct "rally 'round the flag" effect:

$$v^p_t = \psi_0 + \psi_1 r_t + \psi_2 v^{hm}_{t-2} + \psi_4 \hat{g}_t + \psi_5 \mu_t + \varphi^p_t. \quad (28)$$

House Elections

For House elections, we distinguish between presidential election years and midterm contests. In both cases we include military mobilization, the lagged House vote, and the incumbent's party affiliation, the latter to allow congressional cut-points to differ from the median.

In presidential years, we allow for coattails (Calvert and Ferejohn 1983; Erikson 1990). Two avenues for coattails need to be considered.[27] First, our formal model includes a random preference shock, **a**, which affects both races and induces positive correlation between the presidential vote and the congressional vote. Following Kramer (1971), we allow for this effect by making the House vote dependent on the presidential vote shock φ^P_t. We expect a coefficient on this variable of less than 1, since the presidential shock may contain candidate-specific effects that are "outside" our formal model. Second, naive retrospective voting may induce positive coattails in congressional elections due to a "feel good" effect: some of the effect of economic performance on the presidential vote carries over to the benefit of the party's congressional delegation (Erikson 1990).

We test for positive or negative coattails based on

TABLE 1

Equation for Annual Growth Rate: Percentage of Real Gross National Product, 1915–1988

VARIABLE	COEFFICIENT	UNRESTRICTED[a]	SYSTEM RESTRICTED[b]
Constant	γ_0	3.254 (.728)	3.214 (.726)
Partisan effect	γ_1	−1.700 (.902)	−1.698 (.887)
Military mobilization	γ_2	3.027 (.516)	3.087 (.447)
Lagged growth shock	ρ	.518 (.101)	.484 (.122)
Type of year			
Nonelection year[c]	$\sigma^2_{\mu N}$	13.503 (3.254)	—
Midterm election year[d]	$\sigma^2_{\mu M}$	21.704 (7.453)	—
Presidential election year[e]	$\sigma^2_{\mu P}$	19.377 (6.336)	—

Note: The restricted estimates are computed using Rothemberg's (1973) optimum minium distance technique, which does not produce fresh σ^2 estimates. Standard errors are in parentheses.
[a]Equation 26, estimated jointly with equations 27, 29, and 31.
[b]Equation 26, estimated jointly with equations 28, 30, and 32.
[c]R^2 = .438.
[d]R^2 = .658.
[e]R^2 = .300.

economic performance by estimating two versions of the presidential year house voting equation. In the first specification, there is no direct effect from the presidential vote. The instrumented growth rate and contemporaneous growth shock enter directly. Coattails arise solely from the shock to presidential voting:

$$v_t^{hp} = \lambda_0 + \lambda_1 r_t + \lambda_2 v_{t-2}^{hm} + \lambda_3 mm_t + \lambda_4 \hat{g}_t + \lambda_5 \mu_t + \lambda_6 \varphi_t^p + \varphi_t^{hp}. \quad (29)$$

In a second specification, neither the economy nor military mobilization nor the president's party affiliation matter once the effects of the shock to presidential preferences have been accounted for:

$$v_t^{hp} = \lambda_0 + \lambda_2 v_{t-2}^{hm} + \lambda_6 \varphi_t^p + \varphi_t^{hp}. \quad (30)$$

As for midterm elections, our theory predicts a consistent midterm backlash against the incumbent president's party as voters seek to moderate the policy impact of the incumbent president; formally, $v_t^{hm} < v_{t-2}^{hp}$. Two specifications are used. In the first, the midterm House vote depends on all variables that appear in the other equations (save for pe_t, which is perfectly collinear with r_t during midterm years):

$$v_t^{hm} = \kappa_0 + \kappa_1 r_t + \kappa_2 v_{t-2}^{hp} + \kappa_3 mm_t + \kappa_4 \hat{g}_t + \kappa_5 \mu_t + \varphi_t^{hm}. \quad (31)$$

A more extreme specification of the midterm cycle is that the seat loss is unaffected by anything other than the previous election's winning margin. This is embodied in our second specification of midterm voting:

$$v_t^{hm} = \kappa_0 + \kappa_2 v_{t-2}^{hp} + \varphi_t^{hm}. \quad (32)$$

Estimation Results

For each of the three voting equations in our model, we have just presented two versions, restricted and unrestricted. First, we jointly estimated the three unrestricted equations and the growth equation via maximum likelihood. The results appear in the first columns of Tables 1–4. We then estimated the restricted version of each voting equation, with the other equations unrestricted. These results are in the second columns of Tables 2–4. Finally, our preferred model, dubbed "system restricted", simultaneously restricts all three equations, with results in the last columns of Tables 1–4.

The estimates of the growth equation appear in Table 1. The partisan effect, the lagged growth shock and military mobilization are all significant at the 5% level. There are no statistically significant differences in the estimated variances, although the estimate for nonelection years is somewhat lower than the estimates for presidential and midterm years.

The estimated partisan effects parameter, γ_1, is of the same magnitude reported by Alesina and Sachs (1988) for a single-equation estimation covering 1948–84. It indicates that growth rates during the second year of Republican administrations with no changes

TABLE 2

Equation for Midterm Popular Vote for House of Representatives: Percentage of Two Party Vote for Incumbent President's Party, 1918–1986

VARIABLE	COEFFICIENT	PARAMETER ESTIMATES		
		UNRESTRICTED[a]	EQUATION RESTRICTED[b]	SYSTEM RESTRICTED[c]
Constant	κ_0	−1.398 (6.771)	−1.422 (6.230)	−1.418 (6.230)
Republican incumbent	κ_1	.240 (1.096)	—	—
Previous House vote	κ_2	.939 (.123)	.950 (.116)	.950 (.116)
Military mobilization	κ_3	−.369 (1.079)	— —	— —
Expected growth, $\hat{g}_t$	κ_4	.090 (.115)	—	—
Current growth shock	κ_5	.181 (.299)	—	—
Residual variance[d]	σ^2_{hm}	4.753 (1.586)	—	—

Note: The restricted estimates are computed using Rothemberg's (1973) optimum minimum distance technique, which does not produce fresh σ^2 estimates. Standard errors are in parentheses.
[a]Equation 31, estimated jointly with equations 26, 27, and 29.
[b]Equation 32, estimated jointly with equations 26, 27, and 29.
[c]Equation 32, estimated jointly with equations 26, 28, and 30.
[d]R^2 = .853.

in the level of the armed forces will average under 2%, while during the corresponding year of a Democratic administration, the economy will typically grow by almost 5%.

As expected, the beginnings and endings of wars overshadow other economic events. We estimate that the economy expands by about 3% for each 1% of the population that is mobilized into military service. When the same 1% are demobilized, the economy contracts, again by approximately 3%.[28]

Our estimate of ρ indicates that the effect of the lagged shock, μ_{t-1}, is approximately half the effect of the current shock, μ_t. This estimate is very similar to Nelson and Plosser's (1982) results.

Estimates for the unrestricted midterm House election equation (equation 31) appear in the first column of Table 2. This equation has an R-squared of .85. However, the predictive power of this equation stems almost entirely from the presence of the lagged House vote among the regressors. While no other explanatory variable is significant at the 10% level, the lagged House vote coefficients "t-ratio" is over 7. Equation 32 therefore imposes the restriction that the midterm House vote is influenced only by the preceding on-year vote. This results in a test statistic of $\chi^2_4 = 1.824$, corresponding to a p-value of .768, a "success" for our theoretical model in which the state of the economy does not affect House elections.

Estimates of equation 32 appear in the second column of Table 2. Routine calculations show that the predicted vote loss is 3.73% when the president's party won 46% (the sample minimum for victorious presidents) of the on-year House vote and increases to 4.54% at 62% (the sample maximum). Although the estimated intercept is insignificantly different from 0 and the coefficient of the lagged vote is insignificantly different from 1, the predicted vote loss is significant for the range of sample observations. For example, the party of an incumbent president that received 50% of the House vote in the preceding presidential election year is expected to lose 3.93%. The estimated standard deviation of this expected loss is only .65%. This result echoes Erikson (1990), who imposed $\kappa_2 = 1$ and used only postwar data.

To summarize our midterm House estimates, the systematic midterm effect is consistent with our theoretical prediction of a moderation of the president's party. Moreover, the fact that the midterm effect is increasing in the lagged vote for the president's party is consistent with regression to the mean induced by the random shock to preferences, **a**.

The first column of Table 3 displays the unrestricted presidential vote shares equation (equation 27). The economy has a pronounced effect on presidential voting. Both instrumented growth (ψ_4) and the current growth shock (ψ_5) have statistically significant coefficients. As we have discussed, the naive retrospective voting hypothesis has $\psi_4 = \psi_5$. Tests of this hypothesis indicate acceptance, whether one uses the unrestricted or system restricted estimates. In the former case, the asymptotic t-ratio is −.96,

TABLE 3

Equation for Popular Vote for President: Percentage of Two Party Vote for Incumbent President's Party, 1916–1988

VARIABLE	COEFFICIENT	PARAMETER ESTIMATES		
		UNRESTRICTED[a]	EQUATION RESTRICTED[b]	SYSTEM RESTRICTED[c]
Constant	ψ_0	5.622	5.981	12.209
		(10.410)	(10.147)	(9.470)
Republican incumbent	ψ_1	10.365	10.362	8.842
		(1.929)	(1.919)	(1.223)
Previous House vote	ψ_2	.743	.739	.692
		(.194)	(.193)	(.187)
Military mobilization	ψ_3	−.406	—	—
		(2.358)		
Expected growth, $\hat{g}_t$	ψ_4	1.636	1.590	.795
		(.509)	(.405)	(.216)
Current growth shock	ψ_5	1.139	1.140	1.174
		(.208)	(.208)	(.201)
Residual variance[d]	σ_p^2	13.601	—	—
		(4.425)		

Note: The restricted estimates are computed using Rothemberg's (1973) optimum minimum distance technique, which does not produce fresh σ^2 estimates. Standard errors are in parentheses.
[a]Equation 27, estimated jointly with equations 26, 29, and 31.
[b]Equation 28, estimated jointly with equaitons 26, 29, and 31.
[c]Equation 28, estimated jointly with equations 26, 30, and 32.
[d]R^2 = .764.

while in the latter it is 1.32. Both results are consistent with the hypothesis of naive retrospective voting. In fact, since the results show that voters do not treat components of growth differentially (though they might be expected to under rational retrospection), these results provide stronger support for naive retrospection than is available in previous single equation estimates. The effect of growth is substantial; in the system restricted estimation, a 1% increase in the election-year growth rate increases the vote for the incumbent president's party by .795%.[29] Even larger impacts arise in the other specifications.

The insignificant coefficient on the military mobilization variable in equation 27 shows that "rally 'round the flag" effects are manifest only through growth. The beginning and ending of wars, except insofar as they stimulate growth, are neutral for the incumbents' electoral fortunes. Estimates of the other coefficients change little when mm_t is deleted.

The estimated pro-Republican bias of 10% (ψ_1) is only partly counteracted by the effect of the lagged House vote, which favors the Democrats. Ceteris paribus, for a Democratic incumbent president to be more favored than a Republican, the Democrats would have to have done exceptionally well in the preceding midterm election, obtaining almost 57% of the House vote.

While our theoretical model allows for a partisan bias by voters, it requires that there be no bias to the incumbent party in presidential voting. This hypothesis is testable: the predicted Republican presidential vote in an election year with a Republican incumbent and the predicted Democratic presidential vote given a Democratic incumbent—in both cases with the explanatory variables at the sample mean—should sum to 100% of the two-party vote. If the sum is significantly greater, then there is a bias toward incumbents in addition to the pro-Republican bias. We test this in the context of the unrestricted model. The sum of the predicted incumbent totals is 105.59. With respect to the null hypothesis of 100, the t-ratio is 2.12, indicating rejection of the null hypothesis of no bias toward incumbents at the 5% level.

The presidential year House voting results appear in Table 4. As with midterm voting, the party affiliation of the president, military mobilization, and the growth variables have individually insignificant effects. The absence of a significant partisan bias in the congressional races coupled with the significant pro-Republican bias for the presidency shows that the Democrats are relatively more favored in the House than in presidential races, leading, other effects aside, to split-ticket voting.

The absence of a significant effect for growth is consistent with recent work by Erikson (1990), who included both the current presidential vote and the current growth rate on the right-hand side of a House voting equation and found that the coefficient of growth was insignificant. Our analysis confirms this result in a context that is free from the possible simultaneity bias of Erikson's estimator.

The presidential vote *shock* does have a highly

TABLE 4

Equation for Popular Vote for House of Representatives in Presidential Election Years: Percentage of Two Party Vote for Incumbent President's Party, 1916–1988

VARIABLE	COEFFICIENT	PARAMETER ESTIMATES		
		UNRESTRICTED[a]	EQUATION RESTRICTED[b]	SYSTEM RESTRICTED[c]
Constant	λ_0	3.637 (7.424)	7.855 (6.492)	7.809 (6.497)
Republican incumbent	λ_1	1.345 (1.366)	—	—
Previous House vote	λ_2	.886 (.138)	.860 (.131)	.860 (.131)
Military mobilization	λ_3	1.567 (1.688)	—	—
Expected growth, $\hat{g}_t$	λ_4	.554 (.370)	—	—
Current growth shock	λ_5	−.032 (.153)	—	—
Presidential vote shock	λ_6	.547 (.105)	.534 (.065)	.531 (.065)
Residual variance[d]	σ^2_{hp}	2.841 (.937)	—	—

Note: The restricted estimates are computed using Rothemberg's (1973) optimum minimum distance technique, which does not produce fresh σ^2 estimates. Standard errors are in parentheses.
[a]Equation 29, estimated jointly with equations 26, 27, and 31.
[b]Equation 30, estimated jointly with equations 26, 27, and 31.
[c]Equation 30, estimated jointly with equations 26, 28, and 32.
[d]R^2 = .905.

significant effect on the on-year House vote, with a one-percentage-point shock to the presidential vote translating into approximately half an extra percentage point in the popular vote for the president's House delegation. This is consistent with the view that observed coattails result from a shock to preferences that shifts more voters to the same side of *both* the presidential and House voting cut-points.

When the insignificant variables from the on-year House voting equation are simultaneously dropped, the resulting χ^2_4 statistic of 6.63 indicates acceptance at all standard significance levels. The restricted presidential-year and midterm-year House voting equations have very similar structures, save for the effects of the presidential vote shock in the on-year equation. However, while the midterm voting equation reflects a systematic bias against the president's House delegation, we find no evidence of such bias in the on-year House elections. Holding the presidential vote shock equal to zero, and setting all other variables at their sample means, routine calculations reveal a statistically insignificant expected vote *gain* of about 1 percentage point for the president's party in a presidential year House election. The estimates do reveal a slight—but statistically insignificant—tendency toward mean reversion, with an expected vote gain of 2.08 percentage points with the lagged House vote at the sample minimum of 41% and a loss of .29 percentage points with a lagged House vote of 58%, the sample maximum for presidential election years.

Our preferred model consists of the system restricted set of equations—equations 26, 28, 30, and 32—whose jointly estimated values appear in the right-hand columns of Tables 1–4. To explore the dynamics of the system, we use our coefficient estimates to simulate the system in the absence of any random shocks to either growth or voting behavior and with military mobilization set to zero. Regardless of the starting value for the previous House vote, the system converges to an 36-year cycle, with the White House changing hands at regular intervals (see Table 5).

The cycling results from the cumulative effect of midterm losses. Each midterm loss costs the party of the incumbent a larger share of the vote than it wins back through mean reversion in the ensuing presidential election two years later. Indeed, when the president's House delegation is sufficiently large, small additional losses through mean reversion are expected in the on-year election. The longer a party retains control of the White House, the greater the cumulative erosion of its congressional delegation. Because the presidential vote is an increasing function of the lagged House vote, erosion of support for the incumbent's House delegation reduces its presidential vote. This process eventually costs the incumbent's party the White House.

The marked partisan bias toward Republican presidential candidates (which we have discussed) results in the Republican party's retaining control of the

TABLE 5

Long-Run Stable Cycle for the System

YEAR	GROWTH RATE	VOTE FOR INC. PRES. PARTY		ELECTION WINNER	
		PRESIDENT	HOUSE	PRESIDENT	HOUSE
1	3.214	—	—	—	—
2	4.912	—	55.08	—	D
3	3.214	—	—	—	—
4	3.214	52.88	55.18	D	D
5	3.214	—	—	—	—
6	4.912	—	51.00	—	D
7	3.214	—	—	—	—
8	3.214	50.06	51.67	D	D
9	3.214	—	—	—	—
10	4.912	—	47.67	—	R
11	3.214	—	—	—	—
12	3.214	47.75	48.81	R	R
13	3.214	—	—	—	—
14	1.516	—	47.22	—	D
15	3.214	—	—	—	—
16	3.214	56.28	48.41	R	D
17	3.214	—	—	—	—
18	1.516	—	44.58	—	D
19	3.214	—	—	—	—
20	3.214	54.45	46.14	R	D
21	3.214	—	—	—	—
22	1.516	—	42.42	—	D
23	3.214	—	—	—	—
24	3.214	52.96	44.29	R	D
25	3.214	—	—	—	—
26	1.516	—	40.66	—	D
27	3.214	—	—	—	—
28	3.214	51.74	42.77	R	D
29	3.214	—	—	—	—
30	1.516	—	39.22	—	D
31	3.214	—	—	—	—
32	3.214	50.74	41.54	R	D
33	3.214	—	—	—	—
34	1.516	—	38.04	—	D
35	3.214	—	—	—	—
36	3.214	49.93	40.52	D	D

Note: The system simulated is

$$g_t = 3.214 - 1.698pe_t \qquad t = 0, 1, 2, 3, 4, \ldots$$
$$V_t^p = 12.209 + 8.842r_t + .692V_{t-2}^{hm} + .795g_t \qquad t = 2, 6, 10, 14, \ldots$$
$$V_t^{hp} = 7.809 + .860V_{t-2}^{hm} \qquad t = 2, 6, 10, 14, \ldots$$
$$V_t^{hm} = -1.418 + .950V_{t-2}^{hp} \qquad t = 0, 4, 8, 12, \ldots$$

Starting values must be assigned to r_t and V_{t-2}^{hp}. The steady state is reached from all starting values assigned. See Table A-1 and text for definitions of variables.

White House for 24 of the 36 years of the cycle. However, Republican control of the White House typically occurs with a divided government. There is unified Republican control of the executive and legislative branches for only 2 of the 36 years. Although the Democratic party only controls the White House for 12 years of the cycle, it receives a majority of the House vote during 10 of these years. Thus, to the extent that unified government is important to policy initiatives, the Democrats may actually have more opportunities to implement new policies than the Republicans.

The pattern of divided government, with Republicans occupying the White House and Democrats entrenched in Congress, is similar to actual post–World War II experience. However, it does not resemble the political climate of the 1930s, which was dominated by the "shock" of the Great Depression.

CONCLUSION

We have tested, in a fully simultaneous estimation, a macro model of economic growth and national elections. This model incorporates (1–2) the "rational partisan model" of growth; (3) voters' moderating

behavior, which counterbalances the president via the congressional vote both in on-years via split tickets and in midterm elections; and (4) the "competency" model of rational retrospective voting. We found strong support for features 1–2 and 3 and rejected feature 4. Rather than summarizing these results in detail, we conclude by highlighting some open issues.

There are two inherent limitations to our enterprise. On the theoretical side, formulating a tractable model has forced us to limit dynamic considerations to the anticipation of midterm elections in years when the presidency is at stake; that is, with respect to the strategies pursued by political and economic agents, "the world starts over" every four years. Our finding of a bias in favor of presidential incumbents suggests an interest in developing a model with a longer time horizon, where voters are risk-averse with regard to the growth rate. On the empirical side, data are thin. In the model, only presidential elections have an important impact on the economy; and they occur only every four years. While output is produced continuously, persistence in the time series limits the information available for testing. In addition, the presence of only seven shifts in party control of the presidency since 1915 makes it difficult to distinguish persistence in administrative competence from other forms of persistence in the economy.

Even with these limitations in mind, our results are not good news for the attempt to explain retrospective voting on the economy via rational choice models. Shocks to the economy appear to be short-lived and unlinked to changes in partisan control of the White House. The analysis of growth gives no evidence that voters *should* use information about aggregate growth to learn about competence. Nevertheless, the effects of the economy on voting are consistent with naive retrospective voting.

A further challenge to rational choice models might result if we were to include measures of the probability of victory in our econometric model. While elections that are several months distant may always appear uncertain to economic agents, many postwar elections were known landslides on election eve. In such cases, we should not, according to our theoretical model, observe a midterm effect. But the midterm cycle is uniformly present. Discriminating true failures of the model from changes in preferences is, of course, difficult. While Nixon's 1972 election may have been "certain," Watergate intervened to produce a pro-Democratic shift at midterm. Even if it were possible to measure either probabilities or preference shifts, an expansion of the econometric model would further tax degrees of freedom. Nonetheless, the pervasiveness of the midterm cycle may attest to voters treating probabilities differently than in standard rational choice models.[30] Consequently, an explicit treatment of voter expectations just prior to voting is a strong candidate for future research.

In short, we have presented a unified rational choice model of national elections and the macroeconomy. The empirical tests of the model led to rejection of rational retrospective voting but to strengthened support for rational responses to electoral uncertainty via both the midterm electoral cycle and the partisan business cycle. To reconcile these contrasting results on rationality would be an excellent aim for future theoretical and empirical research.

APPENDIX

Heterogeneity in b

Alesina and Rosenthal (1991) characterized the Coalition Proof Nash (CPN) equilibria in a general one-dimensional voting model with two polarized parties and the same institutional structure used herein. With a common b to all voters, our model here is also one-dimensional. It is straightforward to redefine variables and apply the results in Alesina and Rosenthal 1991. The indirect bliss points given in the text play the role of the one-dimensional bliss points in Alesina and Rosenthal 1991. The additional technical problem introduced herein is provided by the second dimension of preference parameters represented by b^i.

Equilibrium at $t = 1$ with heterogeneous b. Alesina and Rosenthal (1991) showed that the midterm equilibrium characterized by equations 12 and 13 not only is CPN but also Strong Nash. Here, we show how to generalize this result when the b^i differ across voters. Using equations 1 and 4 in the text, voter i maximizes:

$$E\left(-\frac{1}{2}(\pi_2 - \tilde{\pi}_i)^2 + b^i[\tilde{g} + \gamma(\pi_2 - \pi_2^e) + \varepsilon_t]\right).$$

While the party of the president for the second period is known at the midterm elections, second-period inflation is treated as a random variable by the voters, since actual inflation will reflect the outcome of the midterm elections. We use the notation $\pi_2(V_1^D)$ to express this dependence, where $V_1^D = 1 - V_1^R$. The growth shock ε, long-term growth parameter $\tilde{g}$, and expected inflation rate π_2^e are all unaffected by the voting decisions. Consequently, maximization of expected utility is equivalent to maximization of

$$W^{*i} = -\frac{1}{2}E[(\pi_2(V_1^D) - \tilde{\pi}_i)^2] + b^i\gamma E[\pi_2(V_1^D)].$$

Without loss of generality, we assume an R president, the D president case being symmetric. We also assume the following:

ASSUMPTION 1. $b_i \sim f(b_i)$, $E(b_i) = b$, $\tilde{\pi}^i | b_i \sim U[\mathbf{a}, 1 + \mathbf{a}]$.

In other words, for every b^i, voter preferences on inflation have the same uniform distribution. (The marginal density of b^i is unrestricted.)

Using equation 8, we write,

$$\pi_2^R = \pi^{R^*} + KV_1^D; \quad K = (1 - \alpha)(\pi^{D^*} - \pi^{R^*}).$$

After substitution and some algebra, we have

TABLE A-1

Descriptive Statistics, 1915–88

VARIABLE	MEAN	S.D.	N
Growth rate of real GNP (g)	3.062	5.981	74
Nonelection year growth rate	3.610	4.967	37
Midterm year growth rate	1.528	8.192	18
Presidental year growth rate	3.447	5.404	19
Party (D = 0, R = 1) of president (r)	.486	.503	74
Presidential vote for incumbent's party (V^p)	53.053	7.805	19
On-year House vote for incumbent's party (V^{hp})	49.907	5.610	19
Lagged House vote (on-year)	49.279	4.790	19
Midterm House vote for incumbent's party (V^{hm})	49.220	4.922	18
Lagged House vote (at midterm)	53.320	4.551	18
Partisan effect (pe) in 2d year of term	.000	1.029	18
Military mobilization (mm)	.010	1.007	74

Sources: Voting data from U.S. Bureau of the Census, *Historical Statistics of the United States, Colonial Times to 1970 Bicentennial edition, part 2 (Washington: GPO, 1975); idem, Statistical Abstract of the United States 1990,* 110th ed. (Washington: GPO, 1990). Erikson 1989, 1990; Real GNP data from Balke and Gordon 1989 and CITIBASE. The Balke and Gordon series is similar to that of Romer (1989).

$$W^{*i} = -\frac{1}{2}K^2[E(V_1^D)]^2 + (\bar{\pi}^i + b^i\gamma - \pi^{R^*})KE(V_1^D) + K^2\mathrm{Var}(V_1^D) + \text{constants}.$$

The assumption in n. 14 guarantees that $\mathrm{Var}(V_1^D)$ is constant for all voter strategies and thus for all $E(V_1^D)$ (see Alesina and Rosenthal 1991, Prop. 6, Proof). It follows, using the first-order condition, that there is a unique value of $E(V_1^D)$ that maximizes expected utility given by

$$E(V_1^D)^{*i} = \frac{\bar{\pi}^i + b^i\gamma - \pi^{R^*}}{K}.$$

Using equation 8, we can verify that the maximizing expected vote level leads to expected inflation equal to the time-consistent inflation policy that would be pursued by a voter–dictator:

$$E(\pi_2^R)^{*i} = \bar{\pi}^i + b^i\gamma.$$

It can also be seen that there is a linear $(\bar{\pi}_i, b_i)$ locus that describes voters with identical preferences. Assume that a voter with preferences $\bar{\pi}^{CR} + b\gamma$ is at his or her maximum. Then, Strong Nash implies that voters with "lower" indirect preferences vote R and voters with "higher" preferences vote *D* (Alesina and Rosenthal 1991). Consequently, voter types with growth preference b^i vote *D* with probability $1 + \mathbf{a} - \bar{\pi}^{CR} - b\gamma + b^i\gamma$. We thus have

$$V_1^D = \int_{b_L}^{b_U}(1 + \mathbf{a} - \bar{\pi}^{CR} - b\gamma + b^i\gamma)f(b^i)db^i = 1 + \mathbf{a} - \bar{\pi}^{CR}, \quad \text{where } E(V_1^D) = 1 - \bar{\pi}^{CR}. \tag{A-1}$$

More generally, assume that $(\bar{\pi}^i, b^i)$ are drawn from some density $f(\bar{\pi}^i, b^i)$, such that the marginal density of $\bar{\pi}^i$ is uniform. If a voter with preferences $\bar{\pi}^{CR} + b\gamma$—where b need not equal $E(b^i)$—is at his or her maximum, then we assume the following:

ASSUMPTION 2. $V_1^D = \int_{\mathbf{a}}^{1+\mathbf{a}} \int_{\frac{\bar{\pi}^{CR} + b\gamma - \bar{\pi}^i}{\gamma}}^{b^U} f(b^i \mid \bar{\pi}^i)db^i d\bar{\pi}^i$

and $V_1^D = 1 + \mathbf{a} - \bar{\pi}^{CR}$ *if*

$$\int_{\mathbf{a}}^{\bar{\pi}^{CR}} \int_{\frac{\bar{\pi}^{CR} + b\gamma - \bar{\pi}^i}{\gamma}}^{b_U} f(b^i \mid \bar{\pi}^i)db^i d\bar{\pi}^i = \int_{\bar{\pi}^{CR}}^{1+\mathbf{a}} \int_{b_L}^{\frac{\bar{\pi}^{CR} + b\gamma - \bar{\pi}^i}{\gamma}} f(b^i \mid \bar{\pi}^i)db^i d\bar{\pi}^i$$

Assumption 2 says that voters with $\bar{\pi}^i > \bar{\pi}^{CR}$ who vote *R* are exactly offset by voters with $\bar{\pi}^i < \bar{\pi}^{CR}$ who vote *D*. (This is similar to conditions of radial symmetry or median in all directions that appear in spatial voting theory [Enelow and Hinich 1984].) The assumption is different from these conditions in that it applies to a pivotal voter type, rather than a median. It is also weaker in that it applies, through integration, only to an aggregated property of the distribution of voter types. Assumption 1 implies Assumption 2. The assumption in n. 14 guarantees that if Assumption 2 holds for any **a**, it holds for all **a**. Thus, if we find that there exists a $\bar{\pi}^{CR}$ such that equation 12 holds and Assumption 2 is valid at $\bar{\pi}^{CR}$, then equation A-1 holds. Thus, independence is sufficient, but not necessary, for equation A-1.

Equation A-1 can also hold when, rather than having a conditional density given $\bar{\pi}^i$, b^i is functionally dependent on $\bar{\pi}^i$. Assume that a voter with preferences $\bar{\pi}^{CR} + b^i(\bar{\pi}^{CR})\gamma$ is at his or her maximum. This leads directly to the following assumption:

ASSUMPTION 3.

If $\bar{\pi}^i > \bar{\pi}^{CR}$, $\bar{\pi}^i + b^i(\bar{\pi}^i)\gamma > \bar{\pi}^{CR} + b^i(\bar{\pi}^{CR})\gamma$

and if $\bar{\pi}^i < \bar{\pi}^{CR}$, $\bar{\pi}^i + b^i(\bar{\pi}^i)\gamma < \bar{\pi}^{CR} + b^i(\bar{\pi}^{CR})\gamma$.

Assumption 3 holds when b_i is a strictly increasing function of $\bar{\pi}_i$. Therefore, equation A-1 holds for two polar cases of heterogeneity of b_i: independence and perfect correlation. Showing that equation 12 in the main text defines a Strong Nash equilibrium follows (with appropriate redefinition of variables) from the proof in Alesina and Rosenthal 1991.

The Two-Period Voting Equilibrium with Heterogeneous b^i and President Unconstrained in Period 1. Assume that analogs to Assumption 2 or 3 also hold, with $\bar{\pi}^P$ substituted for $\bar{\pi}^{CR}$. The two-period indifference conditions in Alesina and Rosenthal 1991 can be used to find the indifference condition for a voter type $\bar{\pi}^i$, b^i. (See also equation A-4.) As with *equilibrium at $t = 1$ with heterogeneous b*, the locus of indifferent types is linear. The remainder of the development follows the previous section.

The Full Model with Heterogeneous Growth Preferences. The setup again directly parallels that of *equilibrium at $t = 1$ with heterogeneous b*. It is straightforward to show that the relevant loci are again linear.

A General Annualized Model

We shall recast the model as an annual model with elections occurring only at the end of even periods, with on-year elections in periods 0, 4, etc. and midterm elections in periods 2, 6, etc. The policy π depends only upon the identity of the president and the vote in the previous congressional election. Thus, the policy is constant for two periods. We use the notation $\pi^J_{12}(V^D_0)$ to denote the policy for the first two periods when party J won the presidential election in period 0 and the congressional vote for D was V^D_0. Similarly, $\pi^J_{34}(V^D_2)$ gives the policy for periods 3 and 4. Except where noted, the specification of the model is unchanged from the text. The generalization of the model assumes that the competency shock follows an MA(4) process:

$$\eta_t = \mu_t + \sum_{k=1}^{4} \rho_k \mu_{t-k}$$

$$0 \le \rho_k \le 1; \quad \begin{matrix}\mu_t \text{ is independently and} \\ \text{identically distributed}\end{matrix}; \quad E(\mu_t) = 0$$

$$\mu_t \begin{cases} \mu^D_t & \text{if } D \text{ president at } t \\ \mu^R_t & \text{if } R \text{ president at } t \end{cases} \qquad \textbf{(A-2)}$$

By equation A-2, any competency shocks that arrive in a four-year presidential term will not carry over beyond the next term. In addition, Congress is entirely elected every two years. Consequently, we can analyze the model as a four-period model where elections occur at the ends of periods 0 and 2 and realizations to utility occur in periods 1, 2, 3, and 4.

In midterm elections, therefore, utility-maximizing voters care only about the effect of their vote on the $t = 3$ and $t = 4$ components of their additive utility functions. Hence, the relevant objective function becomes

$$W^{*i} = -\frac{1}{2}(1+\beta)(E[(\pi^J_{34}(V^D_2) - \bar{\pi}_i)^2] + b^i \gamma E[\pi^J_{34}(V^D_2)]) \qquad \textbf{(A-3)}$$

Using equation A-3, it is straightforward to show that equations 12 and 13 continue to give the equilibrium for midterm elections.

We now turn to the on-year elections. Without loss of generality, assume there is a party D president in period 0. The indifference condition for presidential voting is

$$-\frac{1}{2}(1+\beta)(\pi^{D^*} - \bar{\pi}^P)^2 - \frac{\beta^2}{2}(1+\beta) \cdot [\mathrm{Var}(\pi^D_{34}) + (\bar{\pi}^{CD} + \gamma b - \bar{\pi}^P)^2] + \gamma b(\sum_{k=1}^{4} \beta^{k-1} E(g^D_k)) = -\frac{1}{2}(1+\beta)(\pi^{R^*} - \bar{\pi}^P)^2 - \frac{\beta^2}{2}(1+\beta) \cdot [\mathrm{Var}(\pi^R_{34}) + (\pi^{CR} + \gamma b - \bar{\pi}^P)^2] + \gamma b(\sum_{k=1}^{4} \beta^{k-1} E(g^R_k)). \qquad \textbf{(A-4)}$$

The growth expectations are given by

$$E(g^D_4) = \bar{g} + \rho^*_4 \mu^*_0$$

$$E(g^D_3) = \bar{g} + \rho^*_3 \mu^*_0 + \rho_4 \mu_{-1}$$

$$E(g^R_t) = \bar{g} \qquad t \in \{3, 4\}$$

$$E(g^D_2) = \bar{g} + (1-Q)(\bar{\pi}^{D^*} - \bar{\pi}^{R^*}) + \rho^*_2 \mu^*_0 + \rho_3 \mu_{-1} + \rho_4 \mu_{-2}$$

$$E(g^D_1) = \bar{g} + (1-Q)(\bar{\pi}^{D^*} - \bar{\pi}^{R^*}) + \rho^*_1 \mu^*_0 + \rho_2 \mu_{-1} + \rho_3 \mu_{-2} + \rho_4 \mu_{-3}$$

$$E(g^R_t) = \bar{g} + Q(\bar{\pi}^{D^*} - \bar{\pi}^{R^*}) \qquad t \in \{1, 2\},$$

where

$$\rho^*_k = \rho_k \frac{\sigma^2_\mu}{\sigma^2_\mu + \sigma^2_\zeta}.$$

Solving for the presidential cutpoint yields

$$\bar{\pi}^P = \{((\pi^{D^*})^2 - (\pi^{R^*})^2) + \beta^2((\bar{\pi}^{CD} + \gamma b)^2 - (\bar{\pi}^{CR} + \gamma b)^2) - \gamma b(2(\pi^{D^*} - \pi^{R^*}) + (1+\beta)\vartheta)\}/\{2(\pi^{D^*} - \pi^{R^*}) + 2\beta^2(\bar{\pi}^{CD} - \bar{\pi}^{CR})\}$$

where

$$\vartheta = \sum_{k=1}^{4} \beta^{k-1} \rho^*_k \mu^*_0 + \sum_{k=2}^{4} \beta^{k-2} \rho_k \mu_{-1} + \sum_{k=3}^{4} \beta^{k-3} \rho_k \mu_{-2} + \rho_4 \mu_{-3}.$$

TABLE A-2

Single Equation Estimates of Annual Growth Rate (%) of Real GNP

VARIABLE	COEFFICIENT	NESTED MODELS: UNRESTRICTED (1)	$v_0 = v_1$ (2)	$c_0 = c_1$ AND $v_0 = v_1$ (3)
Constant	γ_0	3.100	3.081	3.047
		(.700)	(.705)	(.709)
Partisan effect	γ_1	−1.806	−1.862	−1.900
		(.851)	(.875)	(.850)
Military mobilization	γ_2	3.147	3.136	3.090
		(.506)	(.502)	(.489)
Same party variance	v_0	20.046	20.825	20.981
		(4.171)	(3.825)	(3.870)
Turnover variance	v_1	11.761	—	—
		(3.832)		
Same party covariance	c_0	8.356	7.853	8.260
		(2.504)	(2.230)	(2.276)
Turnover covariance	c_1	8.301	10.512	—
		(2.789)	(3.981)	
log likelihood		−208.139	−209.673	−209.874

Note: Standard errors are in parentheses.

This equation shows that the qualitative conclusions of the model are maintained. First, the incumbent's vote is nondecreasing in any competency shock the incumbent receives throughout his tenure. Second, the incumbent's vote is nondecreasing in the growth rate for the election year.

The model also continues to hold in the case where the president and the Congress are both elected in the first period. Because (1) growth shocks are unaffected by the outcome of congressional elections and (2) the policy π will be constant in periods 1 and 2, equation 23 continues to hold, and a presidential cutpoint equation can then be developed that is qualitatively similar to the equation for the MA(1) model.

Estimation

We shall offer further details of our test of the competency-based model. In addition, we shall allow for the possibility that the degree of persistence of competency shocks is different when there is a change of administrations, so that $\eta_t = \zeta_t + \mu_t^j + \rho_1 \mu_{t-1}^j$, with j designating the party of the new administration and where ρ_1 may differ from ρ. This leads us to a stand-alone growth model that depends on eight parameters: γ_0, γ_1, γ_2, σ_ζ^2, σ_μ^2, ρ, ρ_1, and θ. The model still suffers from underidentification: we can recover seven parameters: γ_0, γ_1, γ_2, v_0, v_1, c_0, and c_1. The parameters v_0, c_0, and c_1 are as defined in the text, while $v_1 = \sigma_\zeta^2 + \sigma_\mu^2 + \rho_1\sigma_\mu^2$. Estimates of this seven-parameter growth model appear in column 1 of Table A-2.

To test whether $\rho_1 = \rho$, it is sufficient to test H_2: $v_0 = v_1$. When we impose the restriction that $v_0 = v_1$, we obtain the estimates appearing in column 2 of Table A-2. This leads to a likelihood ratio test statistic of 3.07 (which is asymptotically distributed as χ_1^2), below the $\alpha = .05$ critical value of 3.84; thus, we accept H_2. In both columns 1 and 2, the coefficient of c_1 is positive and significant at all standard significance levels, leading to rejection of the competency model, which implies $c_1 = 0$.

The MA(1) model implies H_1: $v_0 = v_1$, $c_0 = c_1$. Parameter estimates obtained imposing this restriction appear in column 3 of Table A-2. The implied likelihood ratio statistic of 3.47 (which is asymptotically distributed as χ_2^2) is well below the $\alpha = .05$ critical value of 5.99. We thus conclude that there is no empirical basis for Persson–Tabellini rational retrospection, while we find no evidence against the standard MA(1) model in favor of a model with $\theta < 1$. Partisan differences in competence do not significantly affect economic growth.

Note that the coefficient estimates in column 3 for the partisan effects variable and for military mobilization differ slightly from those reported in Table 2. This difference arises not only from the simultaneous estimation but also from allowing separate residual variances for growth in years with elections. As indicated in the text, we cannot reject the hypothesis that the variances are the same. However, allowing them to differ makes simultaneous estimation of the growth and voting equations substantially more straightforward.

Maximum Likelihood Estimation of the Model

First, it is convenient to develop the following notation. We let $\mathcal{P}$ signify the set of all presidential

election years in our sample, $\mathcal{M}$ the set of all midterm election years, and $\mathcal{N}$ the set of nonelection years: $\mathcal{P} = \{1916, 1920, \ldots, 1988\}$, $\mathcal{M} = \{1918, 1922, \ldots, 1986\}$, and $\mathcal{N} = \{1915, 1917, 1919, \ldots, 1987\}$. Let P = the number of elements in $\mathcal{P}$, M = the number of elements in $\mathcal{M}$, and N = the number of elements in $\mathcal{N}$, while T = P + M + N. We let h_t denote the set of errors and the explanatory variables realized before year t: $h_t \equiv \{\mu_s, \varepsilon_s^p, \varepsilon_s^{hp}, \varepsilon_s^{hm}, mm_s, v_{1914}^{hm}, r_{1914} | s < t\}$. Denote by v the vector of all shocks in our model: $\{\mu_t\}_{t=1915}^{1988}, \{\varepsilon_t^p\}_{t\in\mathcal{P}}, \{\varepsilon^{hp}\}_{t\in\mathcal{P}}, \{\varepsilon^{hm}\}_{t\in\mathcal{M}}$. The shocks are independently normally distributed with joint density $f(v)$. Using repeated application of Bayes' Rule, we can rewrite this joint density as

$$f(v) = g_p(\mu_{1988}, \varepsilon_{1988}^p, \varepsilon_{1988}^{hp} | h_{1988}) \cdot g_n(\mu_{1987} | h_{1987}) \cdot g_m(\mu_{1986}, \varepsilon_{1986} | h_{1986}) \cdot \ldots \cdot g_n(\mu_{1915} | h_{1915}).$$

Taking logs, we obtain

$$ln(f(v)) = \sum_{t\in\mathcal{P}} g_p^*(\mu_t, \varepsilon_t^p, \varepsilon_t^{hp} | h_t) + \sum_{t\in\mathcal{N}} g_n^*(\mu_t | h_t) + \sum_{t\in\mathcal{M}} g_m^*(\mu_t, \varepsilon_t | h_t),$$

where

$$g_n^*(\mu_t | h_t) = -\frac{1}{2} ln(2\pi) - \frac{1}{2} ln(\sigma_{\mu\mathcal{N}}^2) - \frac{\mu_t^2}{2\sigma_{\mu\mathcal{N}}^2}$$

$$g_m^*(\mu_t, \varepsilon_t^{hm} | h_t) = -ln(2\pi) - \frac{1}{2} ln \begin{vmatrix} \sigma_{\eta\mathcal{M}}^2 & 0 \\ 0 & \sigma_{hm}^2 \end{vmatrix} - \frac{1}{2} [\mu_t, \varepsilon_t^{hm}] \begin{bmatrix} \sigma_{\mu\mathcal{M}}^2 & 0 \\ 0 & \sigma_{hm}^2 \end{bmatrix}^{-1} \begin{bmatrix} \mu_t \\ \varepsilon_t^{hm} \end{bmatrix}$$

$$= -\frac{1}{2} ln(2\pi) - \frac{1}{2} ln(\sigma_{\mu\mathcal{M}}^2) - \frac{\mu_t^2}{2\sigma_{\mu\mathcal{M}}^2} - \frac{1}{2} ln(2\pi) - \frac{1}{2} ln(\sigma_{hm}^2) - \frac{(\varepsilon_t^{hm})^2}{2\sigma_{hm}^2}$$

$$g_p^*(\mu_t, \varepsilon_t^p, \varepsilon_t^{hp} | h_t) = -\frac{3}{2} ln(2\pi) - \frac{1}{2} ln \begin{vmatrix} \sigma_{\mu\mathcal{P}}^2 & 0 & 0 \\ 0 & \sigma_p^2 & 0 \\ 0 & 0 & \sigma_{hp}^2 \end{vmatrix} - \frac{1}{2} [\mu_t, \varepsilon_t^p, \varepsilon_t^{hp}] \begin{bmatrix} \sigma_{\mu\mathcal{P}}^2 & 0 & 0 \\ 0 & \sigma_p^2 & 0 \\ 0 & 0 & \sigma_{hp}^2 \end{bmatrix}^{-1} \begin{bmatrix} \mu_t \\ \varepsilon_t^p \\ \varepsilon_t^{hp} \end{bmatrix}$$

$$= -\frac{1}{2} ln(2\pi) - \frac{1}{2} ln(\sigma_{\mu\mathcal{P}}^2) - \frac{\mu_t^2}{2\sigma_{\mu\mathcal{P}}^2} - \frac{1}{2} ln(2\pi) - \frac{1}{2} ln(\sigma_p^2) - \frac{(\varepsilon_t^p)^2}{2\sigma_p^2} - \frac{1}{2} ln(2\pi) - \frac{1}{2} ln(\sigma_{hp}^2) - \frac{(\varepsilon_t^{hp})^2}{2\sigma_{hp}^2}.$$

The error terms in this model have a recursive structure. The growth errors are temporally recursive:

$$\mu_t = g_t - \gamma_0 - \gamma_1 pe_t - \gamma_2 mm_t - \rho\mu_{t-1}.$$

Here we assume that $\mu_{1914} = 0$, enabling us to construct the sequence of μ_t's conditional on γ_0, γ_1, γ_2, the sequence of mm_t values, and the sequence of realizations of pe_t. While r_t and pe_t depend on the latest realizations of V_s^p, $s < t$, they are predetermined as of t. Given the contemporaneous growth error, we can calculate the midterm House voting error and the on-year presidential election error, namely,

$$\varepsilon_t^{hm} = v_t^{hm} - \kappa_0 - \kappa_1 r_t - \kappa_2 v_{t-2}^{hp} - \kappa_3 mm_t - \kappa_4 g_t - (\kappa_5 - \kappa_4)\mu_t$$

$$\varepsilon_t^p = v_t^p - \psi_0 - \psi_1 r_t - \psi_2 v_{t-2}^{hm} - \psi_3 mm_t - \psi_4 g_t - (\psi_5 - \psi_4)\mu_t;$$

and given the on-year presidential voting error, we can calculate the on-year House voting error, namely,

$$\varepsilon_t^{hp} = v_t^{hp} - \lambda_0 - \lambda_1 r_t - \lambda_2 v_{t-2}^{hm} - \lambda_3 mm_t - \lambda_4 g_t - (\lambda_5 - \lambda_4)\mu_t - \lambda_6 \varepsilon_t^p.$$

We adopt the following notation:

$\gamma = (\gamma_0, \gamma_1, \gamma_2, \rho, \sigma_{\mu\mathcal{N}}, \sigma_{\mu\mathcal{M}}, \sigma_{\mu\mathcal{P}})$
$\psi = (\psi_0, \psi_1, \psi_2, \psi_3, \psi_4, \psi_5, \sigma_{\varphi p})$
$\lambda = (\lambda_0, \lambda_1, \lambda_2, \lambda_3, \lambda_4, \lambda_5, \lambda_6, \sigma_{hp})$
$\kappa = (\kappa_0, \kappa_1, \kappa_2, \kappa_3, \kappa_4, \kappa_5, \sigma_{hm})$.

We can rewrite the likelihood function as

$$\ell(\gamma, \psi, \lambda, \kappa) = \ell^g(\gamma) + \ell^p(\psi | \gamma, \mu_t) + \ell^{hp}(\lambda | \psi, \gamma, \mu_t, \varepsilon_t^p) + \ell^{hm}(\kappa | \gamma, \mu_t),$$

where

$$\ell^g(\gamma) = -\frac{T}{2} ln(2\pi) - \frac{N}{2} ln(\sigma_{\mu\mathcal{N}}^2) - \frac{M}{2} ln(\sigma_{\mu\mathcal{M}}^2) - \frac{P}{2} ln(\sigma_{\mu\mathcal{P}}^2) - \sum_{t\in\mathcal{N}} \frac{\mu_t^2}{2\sigma_{\mu\mathcal{M}}^2} - \sum_{t\in\mathcal{M}} \frac{\mu_t^2}{2\sigma_{\mu\mathcal{M}}^2} - \sum_{t\in\mathcal{P}} \frac{\mu_t^2}{2\sigma_{\mu\mathcal{P}}^2}$$

$$\ell^p(\psi | \gamma, \mu_t) = -\frac{P}{2} ln(2\pi) - \frac{P}{2} ln(\sigma_p^2) - \sum_{t\in\mathcal{P}} \frac{(\varepsilon_t^p)^2}{2\sigma_p^2}$$

$$\ell^{hm}(\kappa | \gamma, \mu_t) = -\frac{M}{2} ln(2\pi) - \frac{M}{2} ln(\sigma_{hm}^2) - \sum_{t\in\mathcal{M}} \frac{(\varepsilon_t^{hm})^2}{2\sigma_{hm}^2}$$

$$\ell^{hp}(\psi | \gamma, \mu_t, \varepsilon_t^p) = -\frac{P}{2} ln(2\pi) - \frac{P}{2} ln(\sigma_{hp}^2) - \sum_{t\in\mathcal{P}} \frac{(\varepsilon_t^{hp})^2}{2\sigma_{hp}^2}.$$

Parameter estimates are obtained via maximum likelihood. We obtain starting values for the coefficients of directly observed variables by first estimating each equation by ordinary least squares. Starting values for the coefficients of the shock terms and for the variances of the shocks are recovered from the

covariance structure of the ordinary least squares errors.

Testing the restrictions embodied in equations 28, 30, and 32 could in principle be accomplished by a likelihood ratio test. This would require reestimating the entire model by maximum likelihood, a nontrivial task. We instead adopt Rothemberg's (1973) method, a more manageable, asymptotically equivalent procedure.

Notes

This paper was initiated while Alesina was an Olin Fellow at the National Bureau of Economic Research (NBER), Londregan a faculty member at Carnegie Mellon, and Rosenthal a visiting professor of economics at the Massachusetts Institute of Technology. Alesina thanks the Olin and Sloan foundations for financial support. Alesina and Rosenthal acknowledge financial support from National Science Foundation Grant No. SES-8821441. The paper was revised while Rosenthal was a fellow at the Center for Advanced Study in the Behavioral Sciences (CASBS). He is grateful for financial support provided by National Science Foundation Grant No. BNS-870864 during his stay at CASBS. Very useful comments were provided by Gregory Hess, Susanne Lohmann, and our university colleagues; participants in seminars at Houston, the Institute of International Economics in Stockholm, NBER, Princeton, Rochester, and Stanford; participants in panels at the 1991 meetings of the Midwest Political Science Association and American Political Science Association; and participants in conferences sponsored by Washington University in St. Louis in 1991 and the European Science Foundation in Sesimbra, Portugal, in 1992.

1. The seminal work in this area is by Hibbs (1977, 1987). See also Alesina 1988; Alesina and Roubini 1992; Alesina and Sachs 1988; Chappell and Keech 1988. Beck (1982) suggests that in addition to partisan effects, there are important administration specific effects, as well.

2. But Kiewiet and Udell (1991) find that Kramer's (1971) initial results change when recently improved historical data series are used in place of his original data.

3. See Jacobson 1990 for a contrasting view.

4. Similar partisan effects are observed in many other industrial democracies; see Alesina and Roubini 1992 and the references cited therein.

5. Most wage contracts last one to three years (Taylor 1980).

6. Our formulation of the competence model closely follows Persson and Tabellini 1990. This model, applied to a different economic problem, was originally proposed by Rogoff and Sibert (1988). Related results are in Cukierman and Meltzer 1986.

7. Allowing for persistence in output growth in equation 1 would not change our qualitative conclusions, given the functional forms used in the model.

8. Results would go through even if utility were also quadratic in growth. See Alesina and Sachs 1988.

9. The model can easily be generalized, without changes in the results, to one in which the government controls the money supply, rather than inflation. See Alesina 1988.

10. This is a very rough characterization of the American electoral system. We ignore the electoral college, the bicameral legislature based on geographic constituencies, and the presence of staggered terms in the Senate.

11. The qualitative results of the model would be preserved if there were serial dependence in **a**.

12. It is natural to think of the inflation rate, π, as a percentage. In this context, it may seem strained to think of the desired rate as having a range of only 1% and, for $\mathbf{a} < 0$, to include desired deflation. Equations 5 and 6, however, are arbitrary scaling used to simplify the algebra. The analysis would not be changed by allowing for a wider uniform support limited to positive ideal points.

13. Equation 7 uses standard results in signal extraction theory presented in Cukierman 1984.

14. To guarantee that the pivotal voter's own ideal point is uninformative about the realization of the random variable **a**, we further assume that $0 < w < \min\{\bar{\pi}^{R^*} - \gamma b, 1 - \bar{\pi}^{D^*} + \gamma b\}$. This guarantees that the fraction of the electorate without weakly dominant strategies of voting is uniformly distributed over the interval $(\bar{\pi}^{D^*}, \bar{\pi}^{R^*})$ for *any* realization of **a**.

15. See Alesina and Rosenthal 1991 for technical derivations. Since we have a continuum of voters, the coalition-proof Nash concept is implemented by using recent results of Greenberg 1989.

16. Note that voter expectations depend upon the election forecasts, represented by Q, of the agents in the economy. Say that the agents in the economy had some forecast $\hat{Q}$. It might be thought that $\bar{\pi}^P$ depended on $\hat{Q}$, so we would require $\bar{\pi}^P(\hat{Q})$; and at the wage-setting stage, wages would be set taking into account the "reaction function" of the electorate. However, the functional forms in our model imply that $\bar{\pi}^P$ is independent of the electoral forecasts of the agents in the economy. The basic intuition is that increasing $\hat{Q}$ makes for a larger recession in the case of an R victory but at the same time results in a smaller expansion if D wins. The *difference* in growth rates offered by the parties remains constant as $\hat{Q}$ varies. Thus, there is a single value of $\bar{\pi}^P$.

17. Mankiw, Miron, and Weil (1987) provide empirical evidence of an important regime shift in 1914.

18. For a recent discussion and survey, see Romer and Romer 1989.

19. We did experiment with a specification that allowed for a constant Q different from 1/2. This entailed estimating separate impacts for Democrats and Republicans. We were not able to reject the null hypothesis of equal coefficients (Q = 1/2), a not-surprising result given our small sample size.

20. The price of oil represents an additional source of transitory shocks. As adding a measure of oil prices to our growth equation leaves results (available on request) virtually unchanged and uses degrees of freedom, we have chosen not to use this variable.

21. Note however that the GNP growth series can be well described by either an MA(1) or an AR(1) process. Our choice of the MA(1) representation was driven by the tractability of the theoretical model in this case. See Christiano and Eichenbaum 1989 and Campbell and Mankiw 1987 on the difficulty of discriminating among ARMA models of GNP growth.

22. This model, in which growth is MA(1), implies that transitory shocks to growth have permanent effects on the level of output. The alternative hypothesis that the economy reverts to its long-term trend level is tested and rejected by Campbell and Mankiw (1987), in favor of the hypothesis that growth shocks have permanent effects. See also Christiano and Eichenbaum 1989.

23. Note that we assume that the impact of competence is immediate, whereas the inflationary surprise occurs only in the second year of each administration. If there were a similar gestation lag between the implementation of policies related to the competency dimension of the executive and their effects, retrospection would be of no use in assisting rational voters' inferences about an incumbent candidate's postelection effectiveness. Moreover, we found that the standard MA(1) model could not be rejected in favor of a model of growth with lagged competency. Results are available on request.

24. Under H_1, the likelihood ratio test statistic of .402 is drawn from a χ_1^2 distribution, yielding a p-value of .53.

25. We also make the simplifying assumption that $\mu_{1914} = 0$.

26. Many analysts (see Erikson 1989) include a direct measure of the incumbent president's popularity on "noneconomic" dimensions. This is typically constructed from opinion poll data collected a few months prior to the election or immediately after the election. In our model "personality" effects are incorporated in the error term φ_t^p, while the lagged

House vote tracks evolving differences between the parties' ideal points and those of the voters. While measures of individual candidate effects would be desirable, the standard measures are subject, as Fair (1978) pointed out, to simultaneity bias (leaving aside questions of data availability prior to 1948). Consequently, we do not include survey-based measures in our specification.

27. If, following our formal model, there were competency-based voting in presidential, but not congressional, elections, it would be possible to have a negative coattails effect, also. The probability of reelecting the incumbent would increase with greater competence, reducing, via equation 24, the vote for the incumbent's congressional party.

28. It is important to control for demobilization, as well as mobilization, in evaluating the partisan surprise to the economy. In particular, the massive demobilization following World War II picks up the recession of 1946, the second year of a Democratic watch.

29. This estimate is within one standard deviation of Fair's (1988) estimate that an extra 1% of growth corresponds to an additional 1.01% of the incumbent growth share.

30. See Popkin 1991, pp. 91–92, for discussion of this point.

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