A Markov Switching Model of Congressional Partisan Regimes

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Abstract

Studies of development and change in partisan fortunes in the US emphasize epochs of partisan stability, separated by critical events or turning points. Yet to date we have no estimates of legislative regimes as they relate to electoral realignments. In this paper we study partisan balances in the US Congress using the method of Markov switching. Our estimates for the House of Representatives are based on election changes from 1854, roughly the date of the establishment of the modern incarnation of the two-party system, to the present. For the Senate, we estimate partisan balance from 1914, the date of popular election of Senators.

We use this method to estimate an underlying unobserved state parameter, 'partisan regime'. Basically a *partisan regime* denotes a built-in congressional electoral advantage that persists through time, and that changes in a disjoint and episodic fashion. The method allows the direct estimation of critical transition points between Republican and Democratic partisan coalitions. Republican regimes characterized House elections during three periods: 1860 through 1872, 1894 through 1906, and 1918 through 1928. A three-state estimate for the House suggested the emergence of a third state in 1994. For the Senate, the two-state model does not fit adequately. We estimate a three-state model in which a Republican regime dominated from 1914 through 1928; a Democratic regime characterized the period 1930-1934, and a Democratic-leaning regime characterized the period 1938 to the present (1936 is a transition year). Combined with existing historical evidence, our analysis isolates four critical congressional elections: 1874; 1894; and 1930, and 1994.

A Markov Switching Model of Congressional Partisan Regimes[1]

1. Introduction

Studies of development and change in partisan fortunes in the US emphasize epochs of partisan stability, separated by critical events or turning points. These "interludes of stability tend to be characterized by the dominance of one party in national elections and by the persistence of its core themes in political discourse (Polsky 2001:3)". Because the realignment literature has been squarely located within electoral studies, the legislative effects of historical election patterns have received little attention. Yet there is no reason to assume an easy translation from presidential elections to legislative results. In particular, presidential elections are more likely to 'deviate' from the underlying partisan regime than legislative elections, where partisan allegiances are likely to be more compelling. Independent study of legislative elections from the perspective of electoral eras is long overdue.

Students of American political development have stressed the existence of long-lasting party systems in which two parties divide the electorate, with an occasional intrusion by a third party (Burnham 1970; Chambers and Burnham 1967). These party systems tend to be dominated by one party or the other, but occasionally a party can be replaced in a particularly disruptive period. While one-party dominance is characteristic, there can be occasional deviations without disrupting the underlying long run partisan regime. In effect, a partisan regime is at equilibrium, with disruptions only destabilizing electoral patterns briefly. In some elections, however, a shift in the parameter underlying the observed electoral patterns can occur. When that happens, electoral scholars refer to a critical election or partisan realignment (Key 1955, Burnham 1970, Campbell, et.al, 1960, 1966). In the 1928-32 period, for example, Democratic electoral regime replaced a Republican regime. A new electoral equilibrium has formed.

In this paper, we introduce a new approach to the study of partisan regimes. We conceive observed party fortunes as resting on an underlying parameter, termed *party regime*. In the pure two-state model, the parameter can take on one of only two values. The political system is either characterized by a Republican partisan regime a Democratic partisan regime. In a modified three-state model, we allow for a third state, as explained shortly.

Basically a *party regime* denotes a built-in congressional electoral advantage that persists through time, and that changes in a disjoint and episodic fashion. Although the typical state of affairs is for the favored party to win elections, the disfavored party can win elections for two reasons. First, national trends do not penetrate uniformly to all congressional districts, so that some seats remain in the control of the minority. Second, the minority party can put forth candidates or issues that temporarily advantage it, as did the Republicans in the Eisenhower years. But the built-in advantage reverts to the 'Normal Vote' when the temporary disturbances are removed (Converse 1966). The episodes dividing party regimes are critical elections in which the relationship between the mass public and the political parties are torn. These changes can be event-driven, as they were in the electoral realignment associated with the Great Depression, or they can be a pure matter of party strategy. Most likely is some confluence of party strategy and exogenous events, as was the case in the realigning Presidential election of 1896 and the struggles over race in the 1960s and 1970s (Carmines and Stimson 1989).

Conceiving the electoral system dichotomously, in one regime state or another, is in keeping with existing theories of political development. As we discuss more fully below, the stability of partisan regimes emerges from the inability of reelection-driven political parties to act in a fully efficient manner. Full efficiency in elections would result in a dynamic equilibrium between the parties, as the 'out' party raised issues that equaled the playing field as new information came into the system. That does not happen for several reasons, the most important of which are partisan identifications by both party activists and the mass public, and the inattentiveness of the public to political issues. The result is a series of punctuated equilibria each characterized by a dominant partisan regime. Because these states are very 'sticky', they require considerable disruption for a change in partisan regime to occur. This does of course not rule out electoral change even within a partisan era—so long as the destabilizations damp out fairly quickly. Nor do these punctuated equilibria in elections necessarily speak to policy results, which can be driven by many other factors than partisan balance. But partisan regimes are a key characteristic of American political history, and as a consequence deserve study in the legislative arena.

We estimate these underlying states from actual legislative election results using the method of Markov switching developed by James Hamilton (1989; an example from political science is Smith, Sola, and Spagnolo 2000). For the US House of Representatives our estimates are based on election data from 1854, roughly the date of the establishment of the modern incarnation of the two-party system, to the present. For the Senate, our estimates are based on the period 1914, when Senators were all directly elected, through 2000.

For each house of congress, we estimate two potential models. The first is a pure party regime model, which assumes that the political system is in a continual out of balance state, but the two parties swap being electorally advantaged. The second model adds a third state to the two one-party regime states of the underlying party regime parameter. This assumes that there is not just a tendency in the American system to a dynamic of dominance-and-replacement, but that there can be a state of approximate party balance, basically an equilibrium in which neither party can gain a strong upper hand. Adding the third state is not constrained at perfect party balance; it is likely that one party enjoys a modest advantage, and that advantage is stable. This is a possibility not entertained by the existing theories, but as we show, characterizes the modern Senate. We treat the state of being in a partisan regime as an unobserved variable to be inferred from data on the actual distribution of seats affected by an election. In the House, this is the same as the distribution of seats, but in the Senate it is not.

2. Background

2.1 The Theory of Partisan Regimes.

The theory of partisan regime formation and change is based in the motives that parties have to gain power and the attention of the voting public to the activities of the parties. On the one hand, losing parties have motive to challenge the in-party with policy proposals and electoral activities. As a consequence, there seem to be forces in play that tend to restore the balance of party competition, at least at the presidential level (Stokes and Iverson 1962). Elections are not random walks, and for the very sensible reason that the losing party has motive to correct course, proposing policies that will act to remedy the electoral failure. On the other hand, voters adopt continuing allegiances with a party, identifying with them cognitively and emotionally. As a consequence, elections are not full-equilibrium systems in which the parties, through their behaviors in office and in campaigns, remove the obvious systematic variance, leaving only random noise variation behind. Elections can be predicted, based on simple measures of economic performance and the popularity of the incumbent (Campbell and Garand 2000; see in particular Norporth 2000). This predictability means that parties and candidates are not able to remove the systematic variance—the bias toward one party or another—in their policy and campaign activities. This later facet of party politics causes an existing party regime to exhibit considerable path dependence. This can occur because parties serve as informational shortcuts for voters (Downs 1957), but the extreme stickiness of electoral regimes and the persistence of party allegiances among voters in the face of changing circumstances suggest more is going on. Without the disruption of a critical election, the system tends to remain in equilibrium.

A number of thorny theoretical issues have emerged from considerations of partisan regimes. The first is whether secular realignments are possible (Mayer 1995). A secular realignment would occur if shifts in partisan allegiances occurred gradually rather than suddenly through a critical election. The second concerns the existence of a single national realignment versus ‘rolling realignments’ across regions (Nardulli 1994). That is, the adjustment process to changing circumstances (either new issues or new voters entering the system) may take time, and may take more time in some regions than others. Third, we have almost no work linking partisan regimes to policy choices (Brady 1988 is the exception here.)

Finally, we have scant understanding about how presidential and legislative partisan outcomes might be connected. Most work on this topic has fixated on the issue of presidential ‘coattails’ with little thinking about the relevance of these connections for partisan realignments. We have good reasons for expecting some differences in realignment patterns between a nationally-elected executive and locally chosen legislators. Empirical studies make clear that the drag of partisan identification are more pronounced in legislative elections than in presidential elections. A recent study of the distributions of the party swing ratio (basically election-to-election change in election margins) in House, Senate, and presidential elections, finds more pronounced punctuations in the legislative elections and smoother election-to-election changes in presidential votes (Jones, Sulkin and Larsen 2003). Voter attentiveness is more focused in presidential elections, and because of the stakes parties have strong motive to act strategically in their campaigns.

2.2 Empirical Difficulties in Existing Tests.

A major empirical issue that has plagued the study of American political development is the estimation of the critical moments and durations of these partisan regimes. Scholars have addressed the problem using historical case analysis, with aggregate electoral data, and, for the period since the Second World War, with data from sample surveys. Much progress has been made, but considerable debate continues concerning the duration of partisan regimes.

There are at least three difficulties with current empirical attempts to estimate electoral realignment. First, and particularly disturbing to the theory of partisan regimes, is the difficulty in isolating clear realignment patterns in the modern era (Mayer 1995). Second is the continuing debate about the existence of deviating versus realigning elections. Currently we have no agreed-upon method for distinguishing one from the other, even with historical hindsight. Third, perhaps related to the first two, is the exclusive focus on presidential elections. Most attempt to study realignment patterns have centered on presidential elections (Mayer 1995; Nardulli 1994), yet the strategic actions by candidates can lead to 'deviating elections' in which presidential candidates of the non-dominant party capture the presidency. As a consequence, relying on presidential elections alone to isolate partisan regimes can obscure the underlying patterns. The use of polling data has compounded the problem, both by causing an exclusive focus on in a focus on presidential elections, mostly for practical reasons, and by obscuring regional trends (Nardulli 1994).

To date, we have no comprehensive quantitative examinations of partisan regime switching in Congress. One likely reason is the difficulty of studying congressional elections empirically. Congressional results are a confusing panoply of local and national forces, with legislative elections less nationalized than presidential elections. Nevertheless, underlying partisan patterns should be detectable from aggregate legislative results. While we cannot incorporate the particular electoral balances in the districts into our analysis, we can study changes in the balances in party power in the chamber itself.

3. A Description of Unobserved Markov-Switching Models.

In this section we describe the Markov switching model in some detail; in the next sections we provide estimates of the states of partisan regime parameter for the House and Senate. First-order Markov models have been found to be satisfactory in the econometrics literature for situations, such as the one in hand, where a regime is expected to persist for some time (Nelson and Kim 1999). As we shall see, the Markov method allows us to decompose a time series of electoral results into: a) stable long-term partisan regimes; and b) short-term autocorrelated influences associated with deviating elections. We think of election results as a series of punctuated equilibria whose underpinning is the Normal Vote generated by party allegiances. The empirical appearance of these equilibria are diluted by short-term forces, the most important of which is the political strategy of the out-party. The former of these effects are assessed by the Markov parameters; the latter by standard autocorrelation estimates.

3.1. A state-switching model of party regimes.

In election year *t* let $S_t = 1$ if the Republicans are the dominant national party and let $S_t = 0$ otherwise. S_t is called the "state" and the values of S_t divide the data into two regimes in which electoral behavior may differ. Let Y_t be the fraction of seats in the House of Representatives captured by Republicans in an election. If X_t is a vector of exogenous variables which drive election results, then we can measure the extent to which voter behavior differs in the two regimes by examining the conditional distributions $f\left(Y_t \middle| X_t, S_t = 0\right)$ versus $f\left(Y_t \middle| X_t, S_t = 1\right)$. For illustrative purposes we begin with a simple model in which the Republican party can expect to win the greater fraction of seats. Equation (1) writes the model as a linear regression.

$$\begin{aligned} Y_t &= \mu_{S_t} + \varepsilon_t \\ \mu_{S_t} &= (1 - S_t)\mu_0 + S_t \mu_1 \end{aligned} \tag{1}$$

where presumably $\mu_1 \geq \mu_0$ and where $\varepsilon_t \sim \mathrm{N}\left(0, \sigma^2\right)$.[2]

When the political system is in a Republican regime, the Republicans can expect to win μ_1 seats. When the system is in a Democratic period, the minority Republicans can expect to win only μ_0 seats. The value $\mu_1 - \mu_0$ is the effect of a (Republican) party regime on (Republican) vote shares. The empirical question is whether μ_1 is politically and statistically significantly greater than μ_0.

If we knew *ex ante* the nature of the partisan regime underlying a given election, equation (1) could be estimated by linear regression. In the Markov switching model developed here, S_t is unobserved and is inferred from the data. This approach requires, first, specification of a parsimonious model for the regimes and, second, joint estimation of equation (1) together with the parameters of the regime model.

3.2 The First-Order Markov Model. At time *t*-1the electoral system is characterized either by a Republican ($S_{t-1}=1$) or Democratic ($S_{t-1}=0$) partisan regime. A first-order Markov model specifies that the probability of either party dominating at time *t* depends only on the state of the regime during the previous period, S_{t-1}. The stochastic process describing the dominant party is defined by two "transition probabilities," *p* and *q*. If the system was in a Republican regime last period, then it continues in this period with probability *p*. A "state switch" will occur — that is a Democratic regime will supplant the Republican regime — with probability $1-p$. Formally, $\Pr\left(S_t=1 \middle| S_{t-1}=1\right)=p$ and $\Pr\left(S_t=0 \middle| S_{t-1}=1\right)=1-p$. Analogously, if the system was in a Democratic regime at t-1, then that regime will continue to dominate with probability *q* and a state switch will occur with probability $1-q$; or $\Pr\left(S_t=0 \middle| S_{t-1}=0\right)=q$ and $\Pr\left(S_t=1 \middle| S_{t-1}=0\right)=1-q$. It is frequently convenient to group the transition probabilities in a transition matrix, as illustrated in Table 1.

	$S_t=0$	$S_t=1$
$S_{t-1}=0$	q	$1-q$
$S_{t-1}=1$	$1-p$	p

Table 1: Matrix of Transition Probabilities

Each row in Table 1 describes possible outcomes given that we were in a particular state last period. For example, the first row gives the probabilities of a Republican regime remaining dominant versus a switch occurring from a Republican electoral regime to a Democratic regime. Note that the probabilities sum to unity across each row, as each row gives an exhaustive list of possible outcomes. With a two-state model (two possible partisan regimes) we have four cells in the transition matrix, but only two probability parameters to estimate. In an m-state model (m possible regimes) there would be m^2 cells in the transition matrix and $m(m-1)$ parameters. As a practical matter for estimation to be feasible $m(m-1)$ has to be small compared to the number of data points available, although this isn't much of an issue in U.S. Congressional elections.

The closer the probabilities p and q are to one, the more persistent is the regime of a particular party is likely to be. If $p > \frac{1}{2}$, then once dominant the Republicans are more likely than not to remain dominant (and analogously for q.) If the transition matrix equals $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ then the initially dominant party remains dominant forever. More generally, if the Republicans are dominant today, the probability they will remain dominant for a second period is p, the probability they will remain dominant for a third period is p^2, for a fourth period p^3, and so forth. The expected duration of a Republican regime is $1/(1-p)$ and analogously the expected duration of a Democratic regime is $1/(1-q)$. For example, if $p = q = 0.9$ then the party regime would typically last 10 elections.

When $p = 1 - q$ we have "independent-switching" rather than "Markov-switching," which means that any particular period's regime does not depend on last period's regime. For example, if $p = 0.9, q = 0.1$, then the probability of a Republican 'regime' is 90 percent without regard to which party was previously dominant. In the special situation when p is close to 0.5, independent switching would characterize an electoral system in dynamic balance—that is, a system that parties compete in a fully efficient manner for electoral advantage and voters are fully attentive and unencumbered by emotional identifications to parties. Clearly the notion of 'partisan regime' ceases to have meaning in such a scenario.

More generally, the probability of, say, a Republican regime equals the probability that the political system was in a Republican regime at the last election times the probability that the system remains in a Republican regime plus the probability that the system was in a Democratic regime at the last election times the probability of a transition away from a Democratic regime. The transition probability equations can be written as

$$\begin{aligned}\Pr\left(S_t=0\right)&=\Pr\left(S_{t-1}=0\right)\cdot\Pr\left(S_t=0\middle|S_{t-1}=0\right)+\Pr\left(S_{t-1}=1\right)\cdot\Pr\left(S_t=0\middle|S_{t-1}=1\right)\\ \Pr\left(S_t=1\right)&=\Pr\left(S_{t-1}=1\right)\cdot\Pr\left(S_t=1\middle|S_{t-1}=1\right)+\Pr\left(S_{t-1}=0\right)\cdot\Pr\left(S_t=1\middle|S_{t-1}=0\right)\end{aligned} \tag{2}$$

or

$$\begin{aligned}\Pr\left(S_t=0\right)&=\Pr\left(S_{t-1}=0\right)\cdot q+\Pr\left(S_{t-1}=1\right)\cdot\left(1-p\right)\\ \Pr\left(S_t=1\right)&=\Pr\left(S_{t-1}=1\right)\cdot p+\Pr\left(S_{t-1}=0\right)\cdot\left(1-q\right)\end{aligned} \tag{3}$$

The unconditional probabilities are found by computing the steady-state of equations (3), where $\Pr\left(S_t=0\right)=\Pr\left(S_{t-1}=0\right)$ and $\Pr\left(S_t=1\right)=\Pr\left(S_{t-1}=1\right)$. The unconditional probability of a Republican regime equals $\frac{1-q}{\left(1-p\right)+\left(1-q\right)}$. If $p=q$ either retime type is equally likely to occur.

3.3 Specifying a Likelihood Function.

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If the states $S_1 \ldots S_T$ were observed, that is if we knew a priori which partisan regime characterized the political system party at each election, then equation (1) could be estimated by least squares and the transition probabilities could be estimated from cell counts of the matrix of observed transitions. Because we are dealing with unobserved states, we instead build up the necessary likelihood function in a series of steps. The derivation is presented in Appendix 1.

With the log likelihood function in hand, we can proceed to obtain parameter estimates and conduct inference by the usual methods of maximum likelihood.[3] While parameter estimates will generally be normally distributed, caution is sometimes required in conducting inference on p and q. Because p and q are bounded by $[0,1]$ the distributions of the estimated p and q are nonstandard close to the edge of the parameter space. For this reason likelihood ratio statistics are sometimes preferred to Wald statistics for formal testing.

4. An Empirical Model

In this section we modify our estimating equation to incorporate aspects of the problem at hand, and then proceed to the estimation of the model.

4.1 Empirical Specification.

The model presented above was simplified to highlight the details of unobserved Markov-switching. In this section we address some specific estimation issues relevant to the data at hand, and then proceed to the empirical results.

In electoral studies, we focus on proportions, as the actual number of votes varies by the size of the electorate. As specified in equation (1) the dependent variable is bounded between zero and one. The assumption of infinitely -tailed normal errors is somewhat problematic in principle. Our data is centered far enough from the boundaries that this issue probably matters little for the problem in hand. Nonetheless we apply an inverse logistic transformation to Y_t and redefine the dependent variable to be

$$y_t = \ln \frac{Y_t}{1 - Y_t} \qquad (4)$$

which maps the fraction of seats held by Republicans to the entire real line.

Figure 1: Republican Percentage of House Seats, 1854-2002

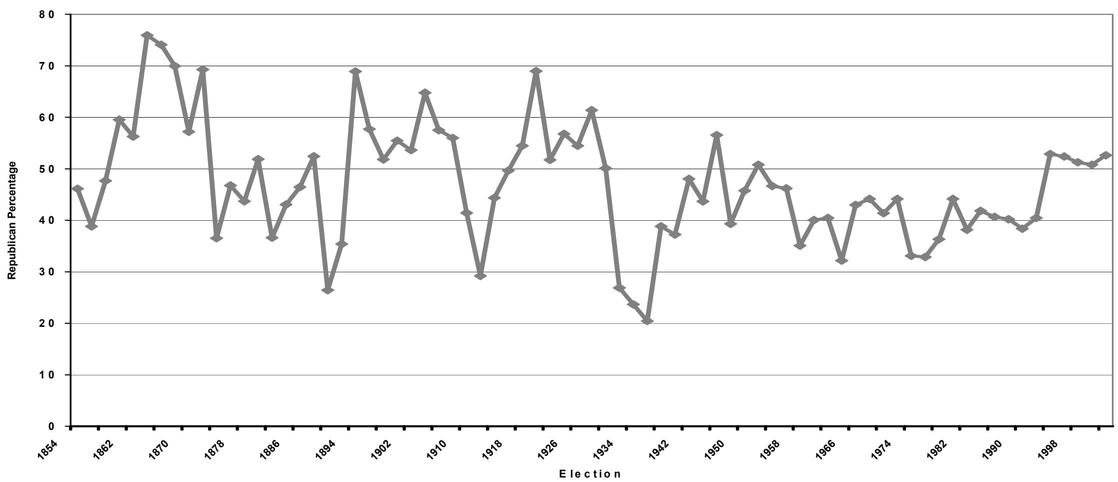


Figure 1 displays the fraction of the U.S. House of Representatives held the Republicans in each Congress. It is evident that the number of seats held by a party tends to persist over time. Indeed, the correlation coefficient between the number of seats held by Republicans at successive elections is 0.57. The first-order Markov state-switching process models a form of nonlinear serial correlation. On the one hand, casual examination of Figure 2 suggests occasional, dramatic, and relative sudden reversals of party fortunes – suggesting that the discrete switching model proposed here is just what is needed. On the other hand, we surely do not want to label any and all serial correlation as evidence in favor of a dominant party theory. For this reason we augment equation (1) to allow for a more standard linear serial correlation as well as Markov switching. This allows us to distinguish persistence in electoral fortunes due to a favorable underlying partisan regime and persistence due to other factors. If the 'other factors' component of the serial correlation were large relative to the partisan regime factor, we would have reason to question the theory. The final empirical specification becomes

$$
\begin{gathered}
y_t = \mu_{s_t} + \varepsilon_t \\
\varepsilon_t = \phi\varepsilon_{t-1} + \omega_t, \omega_t \sim i.i.d.N(0,\sigma^2), \\
\mu_{S_t} = (1-S_t)\mu_0 + S_t\mu_1 \\
\Pr[S_t = 1 \mid S_{t-1} = 1] = p, \Pr[S_t = 0 \mid S_{t-1} = 0] = q
\end{gathered} \tag{5}
$$

Notice that, if $\phi = 0$, we have $\varepsilon_t = \omega_t$ and the model in equation (4.2) collapses to that in equation (3.1). The first two lines in equation (4.2) may be combined into one as follows:

$$
(y_t - \mu_{S_t}) = \phi(y_{t-1} - \mu_{S_{t-1}}) + \omega_t,\ \omega_t \sim i.i.d.N(0,\sigma^2) \tag{6}
$$

Equations (5) can now be estimated by maximum likelihood.[4]

4.2. Data

Our data, pictured in Figure 1 above, consists of the percentage of House seats held by Republicans in the 75 elections from 1854 through 2002. Essentially all the other seats are held by Democrats after 1862, as the number of independent and third party Representatives never reaches five percent in later years. The Republican share ranges from 20 to 76 percent. The mean Republican percentage is 47; the median is 46. Republicans held majorities in 29 of the 73 Congresses. These majorities occurred in eight spans: 4 single election majorities, one three-election span, two seven-election spans, and one eight-election span. Figure 2 presents a histogram of the data and several descriptive statistics.

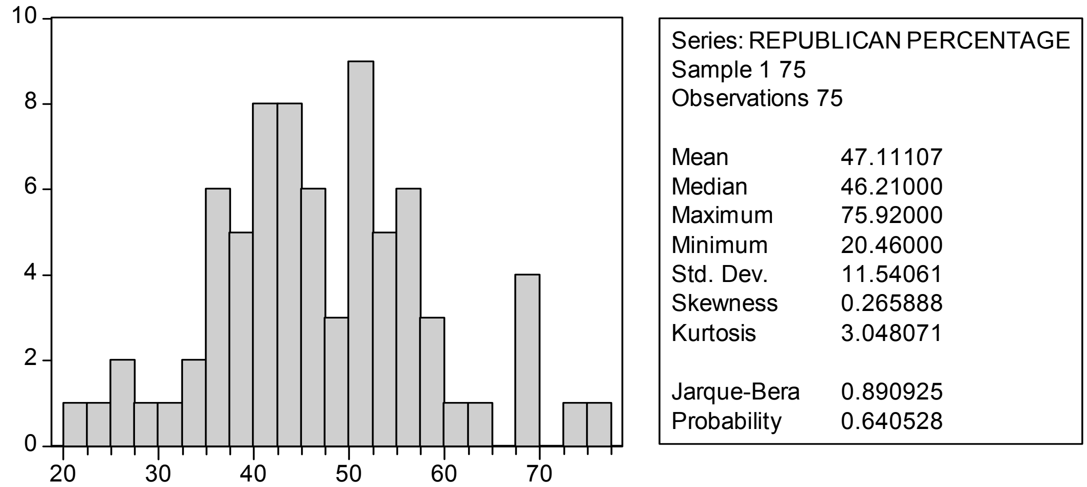


Figure 2: Distribution of Republican Percentage of Seats, 1854-2002

4.3. Results

Table 2 shows the results from estimating equation (5). To compute the magnitude of the dominant party advantage we need to reverse the logistic transformation, computing $\exp(\mu) \big/ 1+\exp(\mu)$[5]. Thus $\mu > 0$ means the party is expected to receive the majority of seats and $\mu < 0$ means the party expects to receive a minority. There is a significant difference between the results for the two parties if $\mu_1 - \mu_0$ is significantly different from zero. The standard error of $\mu_1 - \mu_0$ is 0.158. Since $\mu_1 - \mu_0$ is 4.7 standard errors away from zero, the dominant party advantage is statistically significant at any interesting level. The point estimate for the mean House Republican advantage is 60 percent when the Republicans are dominant and 42 percent when the Democrats are dominant. So the dominant party advantage is politically as well as statistically significant.

We can further test the Markov switching model against the independent switching model. by testing the hypothesis p = 1 – q. Since dynamic partisan equilibrium is modeled by independent switching, and punctuated partisan equilibrium by Markov switching, this is an important test. The t-statistic is 6.3, so independent switching is easily rejected.

Table 2: Two State Parameter Estimates for the House

Parameters	μ_0	μ_1	p	q	ϕ	σ
Estimates	-0.331 (0.125)	0.412 (0.192)	0.854 (0.114)	0.941 (0.045)	0.475 (0.144)	0.335 (0.035)
T = 75; standard errors in parentheses						

The parameters *p* and *q* measure persistence of Republican and Democratic dominant regimes respectively. The average duration of a partisan regime is estimated to be 7 biennial elections for the Republicans [1/(1-p)] and 16 biennial elections for the Democrats [1/(1-q)]. However, since the standard error of $p-q$ equals 0.103, the difference is not statistically significant—that is, the point estimates of duration for the two parties are not statistically different. The parameter ϕ assesses traditional serial correlation that cannot be accounted for by the Markov switching model. The Markov switching model we employ here uses both standard serial correlation and the Markov process to account for correlation across time in the data (see equation 0.11). The estimated ϕ is statistically significant, albeit of moderate magnitude. This indicates that there are other reasons for the observed election-to-election correlation in party seat shares that cannot be reduced to underlying partisan regimes. In effect, short-term deviating factors can influence party fortunes for some number of elections before damping out. Partisan regime theory does a good job of accounting for election-to-election correlations, but it is an incomplete theory of electoral change. Inefficiencies in electoral change are due both to partisan regimes and to the unspecified serial correlation we estimate here.

In addition to parameter estimates, we have "smoothed probabilities" that the Republicans are dominant (see Appendix 1). The probabilities are shown in Figure 3.

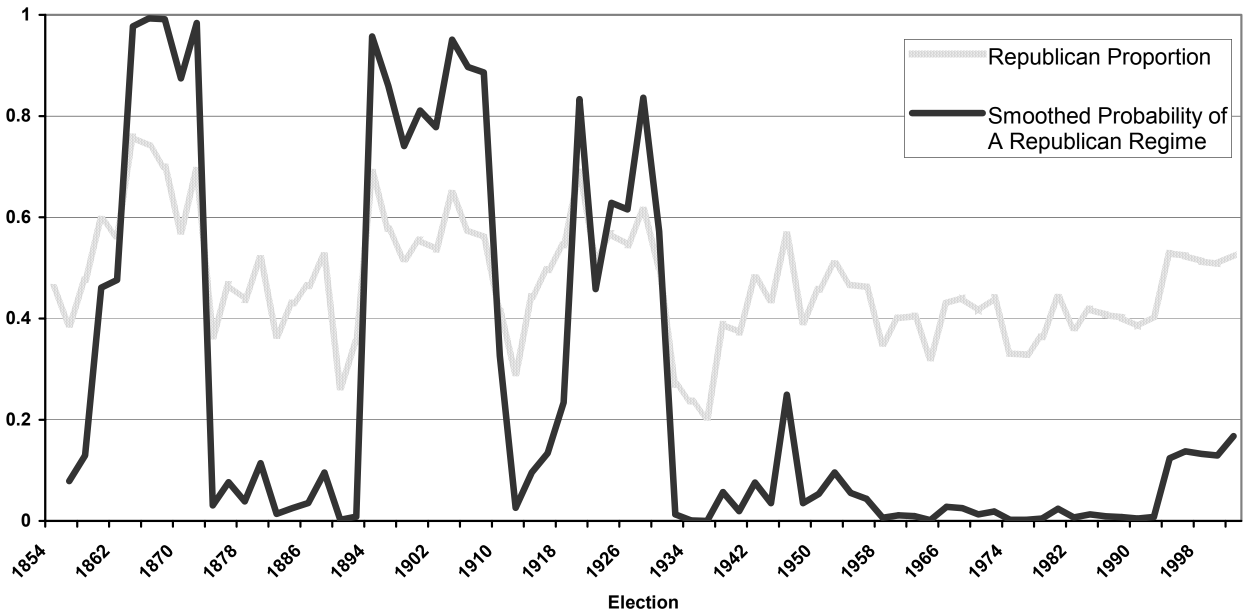


Figure 3: Smoothed Probabilities for Two-State Model for the House

The estimates shown in Figure 3 suggest that a Republican regime likely began in the election of 1858 (Prob=.60) and the GOP was certainly dominant from 1860 through 1872. The Republican regime was displaced by a Democratic one from 1874 through 1892 and then resurfaced starting in 1894. This started a period of Republican domination that lasted through 1906 or 1908 (Pr=.68). The final period of Republican domination began in 1916 (Pr=.51) or 1918 and lasted through 1928.[6] The brevity of the Democratic ascendance in the Taft and Wilson years and the fact that they won because of a severe split in the Republican Party that was healed by 1916 suggests that this best be treated as an interlude in a Republican regime that lasted from 1894 through 1930.

The Markov-switching algorithm easily distinguishes between critical and deviating elections. Figure 3 shows both the smoothed probability and the Republican share of the House. As one might suspect, the two show a broad correspondence. However, the smoothed probabilities discount transitory spikes in the Republican proportion of seats. Republican majorities in 1880, 1888, 1946, and 1952 are all estimated to be aberrations within spans of Democratic domination—that is, they are deviating elections. Moreover, the hair's breadth Republican majority of 1930 is estimated to be the beginning of the Democratic 'Roosevelt' coalition that dominated the House of Representatives at least until 1994. Electoral scholars have debated whether 1932 was a realigning election, or whether the realignment began in 1928 (Mayer 1995). Our finding that the 1930 Congressional election was the watershed event for the Depression-Era realignment suggests that those who argue that 1932 was too late have the upper hand here.

On the other hand, the algorithm indicates that the period of Democratic successes in 1908-1914 were not deviations, but more of a serious interlude. Had the Progressives more substantially swung to the Democrats, this may have been a lasting realignment. That did not happen, and Progressive Republicanism did not die. Finally, the algorithm identifies the five small-majority Republican Congresses starting in 1994 as continuing a period of Democratic domination, which many would regard as problematic. As a consequence of this aberration, we estimated a three-state model.

4.4.1. A Three-State Model for the House. The extension of Markov models to allowing more than two states is straightforward, although the algebra is tedious (Kim and Nelson 1999). In a three-state model the states are S_t^1, S_t^2, and S_t^3, where at a given time one state equals 1 and the other two equal zero. There are now three possible means, $\mu_{S_t} = \mu_1 S_t^1 + \mu_2 S_t^2 + \mu_3 S_t^3$, and six independent transition probabilities.

We hypothesized that a three-state estimate would produce Democratic and Republican regimes, along with a balanced regime emerging in the latter part of the 20th Century. That did not happen; rather our estimate produced a model that distinguished Democratic, Republican, and leaning Republican regimes. Table 3 gives the parameter estimates for the three-state model, and Figure 4 diagrams the model across elections. The estimates for a Republican-leaning regime are not statistically significant from a balanced regime. Given the actual distribution of seats (see Figure 1), it is likely that this results from the shift away from the Democrats in 1994. Note from Figure 4 the movement to a Republican-leaning regime at that election is not well-defined in comparison to earlier periods.

One strong possibility is that the period under study was characterized by one strong regime—Republican dominance between 1864 and 1872, and two partisan-leaning regimes

Table 3: Three State Model for the House of Representatives

Parameters	μ_1	μ_2	μ_3	p_{11}	p_{12}	p_{21}	p_{22}	p_{31}	p_{32}	ϕ	σ
Estimates	0.833 (0.225)	0.186 (0.128)	-0.399 (0.092)	0.786 (0.183)	0.000 (0.000)	0.041 (0.044)	0.850 (0.105)	0. 000 (0.000)	0.091 (0.068)	0.359 (0.150)	0.308 (0.035)
T = 75; Standard Errors in parentheses											

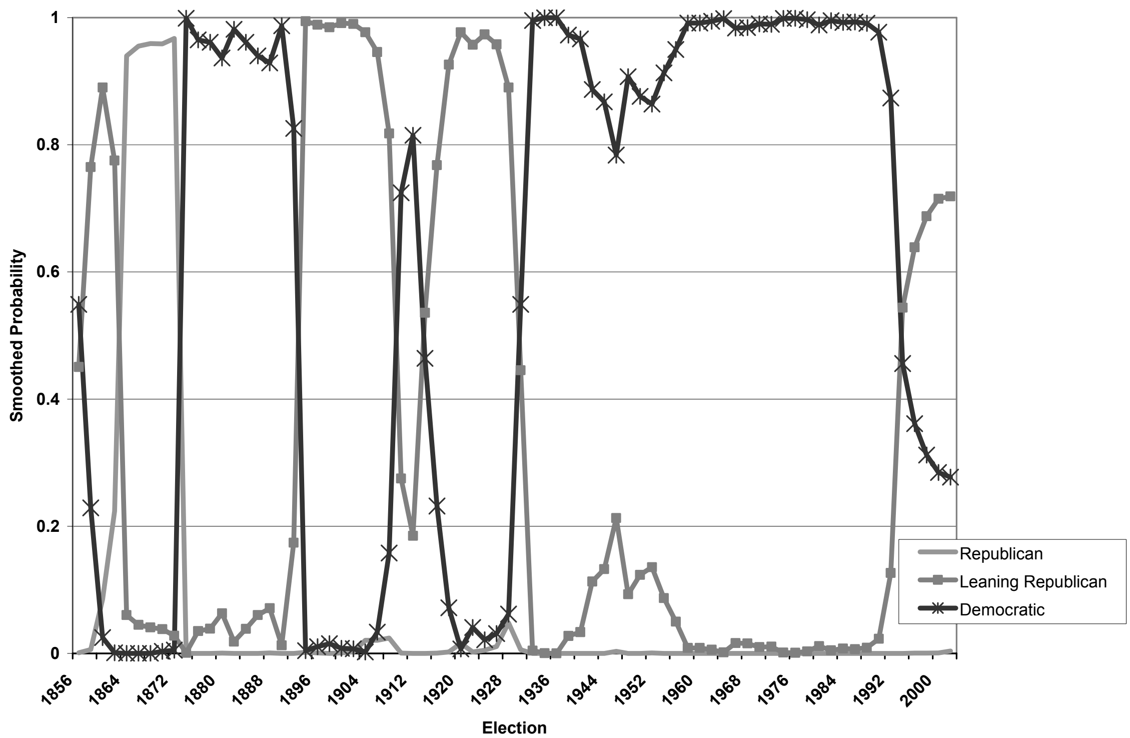


Figure 4: Three State Model for the House of Representatives

4.6 Applying Markov-Switching to the Senate

In order to explore further the robustness of Markov-switching for modeling electoral regimes, we apply the same technique to Senate elections. Data on Senate elections is differs from data on House elections in two important aspects. First, the majority of Senators were first chosen by direct popular election in 1914. As a result, we have only 45 observations. Second, unlike in the House, in the Senate winning a plurality of seats in an election is not equivalent to winning control of the chamber, since Senate membership is a three-election moving average of Senate elections. Partisan regime theory applies to elections, not directly to legislative control.

Figure 5: Republican Percentage of Seats Captured , 1914-2000

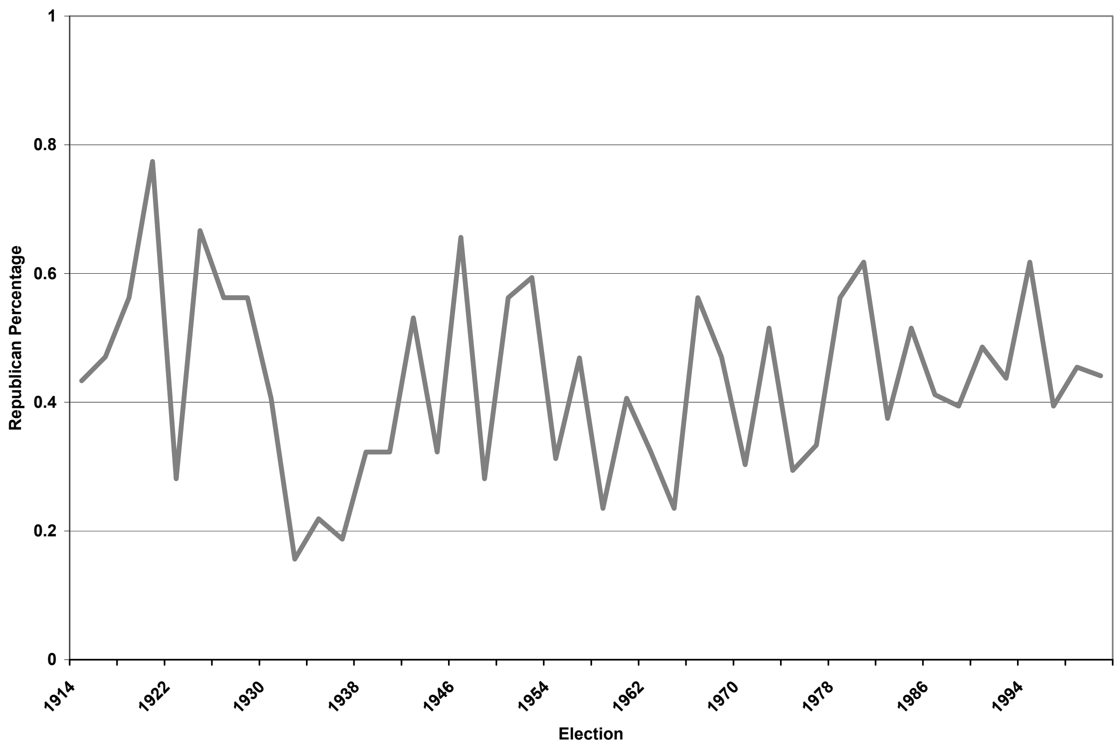


Figure 5 shows the outcomes of popular elections to the Senate. A two-state Markov switching model allows for two regimes, each regime having a separate mean outcome, with fluctuations occurring around each of the regime means. Nothing in the statistics requires that the mean of one regime be above 50 percent while the other lies below 50 percent. In other words, nothing forces the algorithm to say that the two interesting regimes are Republican versus Democratic. Indeed, when we estimate a two-state model on the data shown in Figure 5, we find that the two states are a strongly Democratic regime during the Great Depression and Democratic-leaning regimes at all other times (Table 4 presents the parameter estimates). The obvious difficulties with this fit suggest that we are attempting to fit the data with too few parameters.

Table 4: Two State Model for the Senate

Parameters	μ_0	μ_1	***p***	***q***	ϕ	σ
Estimates	-1.174 (0.409)	-0.171 (0.100)	0.957 (0.056)	0.674 (0.238)	-0.202 (0.166)	0.525 (0.064)
T = 44; standard errors in parentheses						

It is likely that a two-state model is inadequate to characterize the history of Senate elections, so we extend the model to allow the party regime parameter to assume three states. Table 5 presents the three-state parameter estimates, and Figure 6 shows the probabilities that the system is in each of the three states. The three-state model provides a more sensible fit to the data. There is good evidence of a Republican regime through 1928 followed by a strong Democratic regime in the elections of 1930 through 1934. For the 1936 election, the algorithm assigns rough equal weights to the probability of strong versus Democratic leaning regimes. Thereafter, the probability of a Democratic leaning regime remains above 90 percent.

Table 5: Three State Model for the Senate

Parameters	μ_1	μ_2	μ_3	p_{11}	p_{12}	p_{21}	p_{22}	p_{31}	p_{32}	ϕ	σ
Estimates	0.160 (0.152)	-0.286 (0.068)	-1.336 (0.291)	0.945 (0.082)	0.000 (0.000)	0.024 (0.027)	0.976 (0.027)	0.000 (0.001)	0.273 (0.235)	-0.336 (0.149)	0.486 (0.054)
T = 44; standard errors in parentheses											

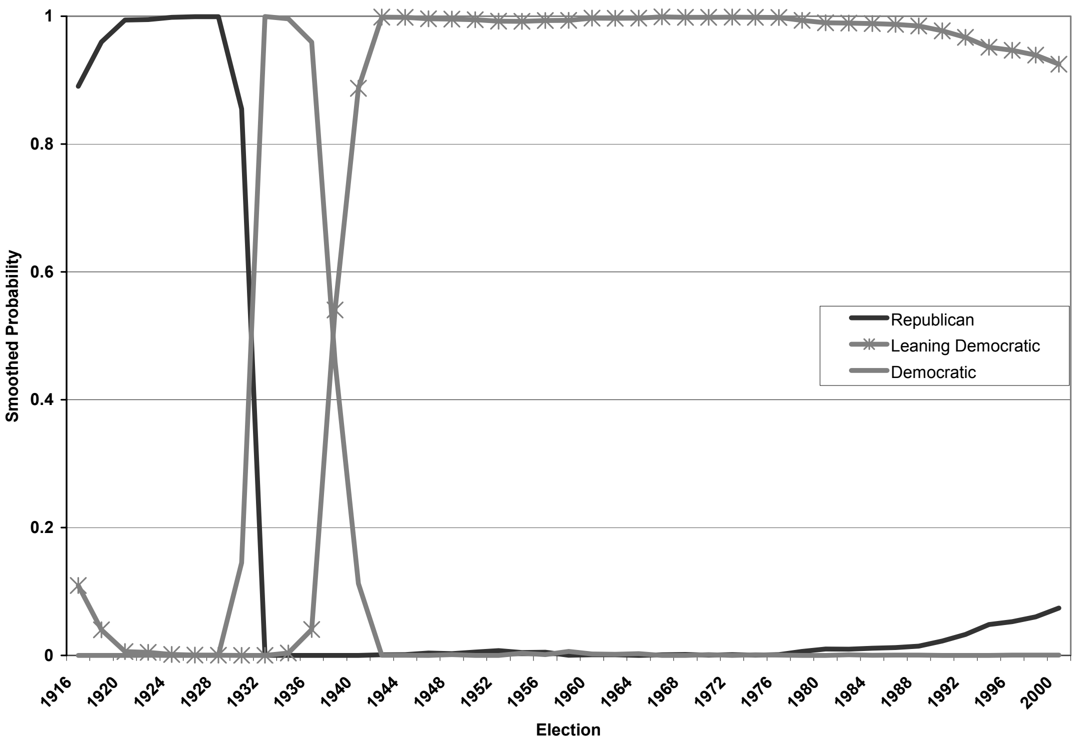


Figure 6: Three State Model for the Senate

Parameter estimates translate into expected Republican wins of 54 percent when the system is in a Republican regime, 43 percent when it is in a Democratic-leaning regime, and 21 percent when the Democrats are strongly dominant. Note in particular that the value of wins under the Republican regime is only modestly well identified, which is to be expected given the moderate magnitude of the Republican advantage and the small number of elections characterized by a Republican regime. In contrast, the data better identifies the Democratic regimes extent of dominance, because the magnitude of Democratic dominance is quite large during the Depression and since there are many more data points associated with the Democratic-leaning regime.

We can interpret these results in a slightly different but very instructive manner. What we call a regime is to some extent arbitrary. We could be observing two regimes of moderation (a Republican-leaning regime yielding an expected electoral return of 54% of the seats and a Democratic-leaning regime yielding an expected electoral return of 57% of the seats). Dividing these two regimes was a brief period of a strong partisan regime—the Democratic regime of 1930-1934, which yielded an expected electoral return of 79% for the Democrats.

If this is correct, it may indicate that there may be some forces in Senate elections that push outcomes toward moderation. We speculate that this is a result of a 'mixed model' of the theory of punctuated partisan regimes and the theory of dynamic equilibria. That is, because of the higher visibility of Senate elections, and the ability of Senators to distance themselves from their partisan affiliations, Senate elections are more likely to deviate consistently from that expected from the existing underlying partisan regime. Because these results don't 'damp out' as predicted by the pure two-state regime theory, they constitute a separate state of the system.

5. Conclusions

Electoral theory points to a historical process that adjusts to changing circumstances, but which is not in simple dynamic equilibrium. The minority party has electoral incentive to propose policies that undermine the dominant party's governing status. Yet voters identify cognitively and emotionally with their parties, and pay only sporadic attention to politics. This 'stickiness' in party allegiances implies that the dynamic adjustment pattern over time will be disjoint and episodic.

In this paper we extend the empirical estimates of partisan regimes to legislative coalitions. We define a *partisan regime* as a period characterized by a persistent advantage in elections by one of the parties, a persistence that collapses in a regime shift rather than gradually dying away. The election-to-election struggles for advantage may either dampen or acerbate the underlying advantage, but do not eliminate it. In order to estimate partisan regimes, we introduce a new method for election studies, a state-switching Markov model, and apply it to election changes in the US Congress. We tried two-state and three-state models for both houses. In the Senate, a three-state model is clearly necessary. For the House, a two-state model is sufficient, but taking both models together suggests the emergence of a new balanced partisan regime in 1994.

For the House of Representatives we detect a Republican electoral regime from 1858 through 1874; a Democratic regime from 1874 through 1894, a Republican period from 1894 through 1928, and a Democratic regime from 1928 to the present. It would seem that the brief period of Democratic ascendancy in the early part of the 20^{th} Century was a serious interlude, more than a deviation, but not a lasting realignment. The period is very short, and the probabilities of Democratic dominance are smaller than in the other periods. The dominant party advantage in the House of Representatives is very large, perhaps surprisingly so. Roughly speaking, when the Republicans constitute the dominant partisan coalition, they can expect to capture 60 percent of House seats in any given election. The Democrats can expect 58 percent when dominant.

A major problem with the two-state model for the House was the placement of the period since 1994 within the Democratic regime, albeit with declining probabilities. The method 'force fits' data into the regime structure, so basically it had to choose between Republican and Democratic options. We fit a three-state model, but the results were somewhat confusing. The three regimes emerging from this analysis were Democratic, Republican, and Republican-leaning. Historical context and recent electoral studies should be used in interpreting these results. There is little use in distinguishing Republican from Republican-leaning regimes prior to 1930; indeed we believe that this may be an artifact of the algorithm used in estimating the three-state model. The emergence of the third state in 1994, however, is important. We suspect that if the balanced regime emerging in 1994 were to continue for a few more elections, the algorithm could distinguish between the stronger Republican regimes prior to 1930 and the weaker one of the modern era.

In the Senate, a three-parameter approach is clearly necessary. We interpret the results as supporting the existence of two moderate partisan regimes and one more typical partisan regime. We detect a Republican-leaning regime from 1914 through 1928 (with an expected electoral return of 54% of the seats up for election), followed by a brief period of a strong Democratic regime in the three elections 1930, 1932, and 1934 (with an expected electoral return of 79% of the seats). The election of 1936 is a Senate turning point, with a long period of a Democratic-leaning regime following (with an expected return of 57% of the seats up for election).

Most probably Democrats enjoyed a national majority after 1928, engendered by a shift in the underlying partisan allegiances of voters, but they could not dominate in Senate the same manner that they did in the House of Representatives. This could well be because of the heightened visibility of Senate elections, allowing voters to judge on candidates and issues as well as on party affiliation. If so, this suggests that Senate elections allow the existence of a 'moderate regime', a regime capable of limiting majoritarianism in a way not anticipated by institutional analyses. The Senate results are not due to deviating elections from a pattern of party dominance; rather moderation is an underlying parameter of the historical development of the system. The House and Senate differ in more ways than political scientists perhaps realize.

The results from this study are in line with historical studies of elections, but they also add to our understanding of the process of shifts in partisan control. In an important instance, our approach points to the Democratic control of the House in the 1880s as a dominant period for that party, with the estimated probabilities leaving little question on this issue. The mix of a Democratic House and a Republican president foreshadows the more recent period of 1968-1992.

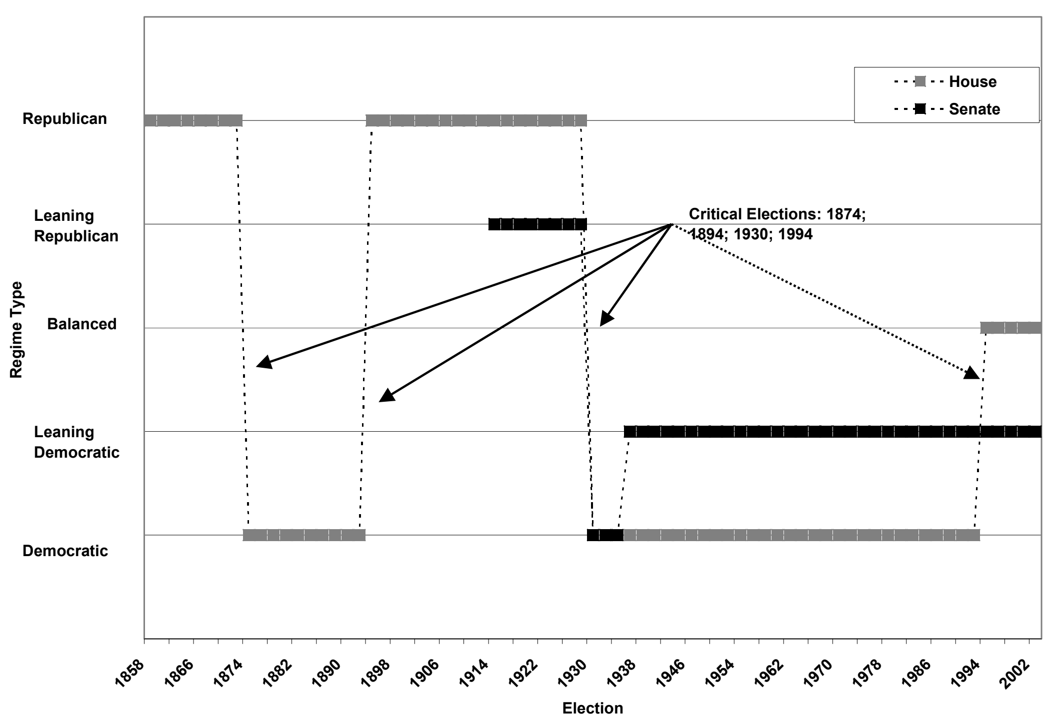
Our analysis provides clear evidence that the major realignment in American politics—that associated with the Great Depression, occurred in 1930. We do not question the notion that 1928 foreshadowed the great 1930 realignment, but the effects were not strong enough to produce a regime shift. On the other hand, it is quite clear that the regime shift had already occurred before 1932. The House and the Senate analyses agree entirely on this point. The isolation of 1930 as the critical realigning election of the period is a major finding that could not have been detected by either a focus only on presidential elections or by 'eyeballing' election results. The rigor of the Markov switching method lays to rest this long-running debate in American political development.

Figure 7 is a generalized schematic of what we have learned. There we plot the type of regime, allowing a distinction between strong and moderate partisan regimes for the Senate. We treat the period of Democratic ascendancy in the early part of the 20th Century as an important temporary interlude associated with Progressivism rather than a legislative realignment. In this scenario, critical elections emerge in 1874, 1894, and 1930. Interestingly, each of these occurs in an off-year election.

This immediately raises the question of whether the off-year election of 1994 was a realigning election. We cannot answer this with any certainty. The three-state estimate produced somewhat confusing results. Moreover, unlike the 1896 and 1932 presidential elections, in 1996 the party wining the off-year critical election failed to capture the presidency and failed to continue to gain seats. For the Senate, the subtle shift from a Democratic leaning regime to a more balanced regime, given the paucity of data points, is just more than the method can do. For the House, our analysis suggests that it is quite possible that the system has moved into a three-state system in 1994.

There are, naturally, issues that need to be addressed in adapting this type of analysis to the study of electoral history. We do not examine electoral margins for members; neither do we examine Presidential totals, nor the partisan allegiances of the electorate from polling data. The method requires substantial data for stable estimates to emerge. In any case, we can envision a multifaceted attack on the issue of historical change in patterns of party dominance, with a Markov switching model as a major component of the analyst's toolbox.

Figure 7: Congressional Partisan Regimes: A Graphical Summary



Appendix 1: The Likelihood Function[7]

If the states were observed, then the log likelihood function for equation (1) would be

$$
\begin{aligned}
\ln L &= \sum_{t=1}^{T} \ln f\left(Y_t \middle| S_t\right) \\
f\left(Y_t \middle| S_t\right) &= \frac{1}{\sqrt{2\pi\sigma^2}} \exp\left(-\frac{\left(Y_t - \mu_{S_t}\right)}{2\sigma^2}\right)
\end{aligned}
\tag{7}
$$

Since the states are not observed, we build up the contribution to the likelihood function in a series of steps. The contribution of an individual observation to the likelihood function is the density of Y_t conditional on available information through time t-1, ψ_{t-1}, $f\left(Y_t \middle| \psi_{t-1}\right)$. We write this density by integrating the joint density of Y_t and S_t over values of S_t and then writing the joint density as the product of a conditional density and a marginal density, as in equation (8).

$$
\begin{aligned}
f\left(Y_t \middle| \psi_{t-1}\right) &= f\left(Y_t, S_t = 0 \middle| \psi_{t-1}\right) + f\left(Y_t, S_t = 1 \middle| \psi_{t-1}\right) \\
&= f\left(Y_t \middle| S_t = 0, \psi_{t-1}\right) f\left(S_t = 0 \middle| \psi_{t-1}\right) + f\left(Y_t \middle| S_t = 1, \psi_{t-1}\right) f\left(S_t = 1 \middle| \psi_{t-1}\right)
\end{aligned}
\tag{8}
$$

Recognizing that the density of S_t is discrete, we rewrite the contribution to the likelihood function in (9).

$$
\begin{aligned}
f\left(Y_t \middle| \psi_{t-1}\right) &= \frac{1}{\sqrt{2\pi\sigma^2}} \exp\left(-\frac{\left(Y_t - \mu_0\right)}{2\sigma^2}\right) \cdot \Pr\left(S_t = 0 \middle| \psi_{t-1}\right) \\
&\quad + \frac{1}{\sqrt{2\pi\sigma^2}} \exp\left(-\frac{\left(Y_t - \mu_1\right)}{2\sigma^2}\right) \cdot \Pr\left(S_t = 1 \middle| \psi_{t-1}\right)
\end{aligned}
\tag{9}
$$

The log likelihood function is given then by

$$
\ln L = \sum_{t=1}^{T} \ln f\left(Y_t \middle| \psi_{t-1}\right) \tag{10}
$$

The remaining issue is the computation of $\Pr\left(S_t = j \middle| \psi_{t-1}\right)$. We take advantage of the fact that in a first-order Markov process S_{t-1} contains all information about S_t. The computation is carried out by creating an iterative formula for $\Pr\left(S_t \middle| \psi_{t-1}\right)$ in terms of $\Pr\left(S_{t-1} \middle| \psi_{t-1}\right)$ by integrating over the joint density of S_t and S_{t-1} and then rewriting the joint in terms of the product of the conditional and marginal densities.

$$\begin{aligned}\Pr\left(S_t = j \middle| \psi_{t-1}\right) &= \Pr\left(S_t = j, S_{t-1} = 0 \middle| \psi_{t-1}\right) + \Pr\left(S_t = j, S_{t-1} = 1 \middle| \psi_{t-1}\right) \\ &= \Pr\left(S_t = j \middle| S_{t-1} = 0\right) \cdot \Pr\left(S_{t-1} = 0 \middle| \psi_{t-1}\right) + \Pr\left(S_t = j \middle| S_{t-1} = 1\right) \cdot \Pr\left(S_{t-1} = 1 \middle| \psi_{t-1}\right)\end{aligned} \tag{11}$$

where $\Pr\left(S_t = j \middle| S_{t-1} = i\right)$ is *p, q,* 1-*p,* or 1-*q* accordingly To fill in the final piece of the puzzle, note that the only new information that becomes available at time *t* is Y_t, so $\psi_{t-1} = \left\{\psi_{t-2}, Y_{t-1}\right\}$. We can substitute in (11)

$$\begin{aligned}&\Pr\left(S_{t-1} = i \middle| \psi_{t-1}\right) = \Pr\left(S_{t-1} = i \middle| \psi_{t-2}, Y_{t-1}\right) = \frac{f\left(S_{t-1} = i, Y_{t-1} \middle| \psi_{t-2}\right)}{f\left(Y_{t-1} \middle| \psi_{t-2}\right)} \\ &= \frac{f\left(Y_{t-1} \middle| S_{t-1} = i, \psi_{t-2}\right) \Pr\left(S_{t-1} = i \middle| \psi_{t-2}\right)}{f\left(Y_{t-1} \middle| S_{t-1} = 0, \psi_{t-2}\right) \Pr\left(S_{t-1} = 0 \middle| \psi_{t-2}\right) + f\left(Y_{t-1} \middle| S_{t-1} = 1, \psi_{t-2}\right) \Pr\left(S_{t-1} = 1 \middle| \psi_{t-2}\right)}\end{aligned} \tag{12}$$

Equations (11) and (12) can be solved iteratively to get $\Pr\left(S_t = j \middle| \psi_{t-1}\right), t = 1, 2 \ldots T$, using the unconditional state probabilities to initialize $\Pr\left(S_0 = j \middle| \psi_0\right)$. Thus, for a given set of parameters $\{\sigma, \mu_0, \mu_1\}$, we can evaluate the log likelihood function in (3.4). We find the maximum likelihood estimates by maximizing that log likelihood function using numerical optimization.

Once the parameters of the model are estimated via the likelihood function, we can calculate state probabilities conditional on those parameter estimates. For example, $\Pr\left(S_t = j \middle| \psi_{t-1}\right)$, called the "filtered probability," is of inherent interest in that it provides an estimated probability of party regime conditional on information already available before decisions made at time *t*. $\Pr\left(S_t = j \middle| \psi_T\right)$, called the "smoothed probability," provides an estimated probability of party regimes using all historical information.[8]

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Notes

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[2] The model we actually estimate, described below, is somewhat more sophisticated. For ease of exposition we delay introducing what are for the moment unnecessary complications.

[3] As a practical matter, one maximizes an approximation to the likelihood function derived in Kim (1994).

[4] With suitable modifications to the filter described in (11) and (12) to reflect the addition of serial correlation. See Nelson and Kim, section 4.2.

[5] In general, a nonlinear transformation of an estimated parameter does not give an unbiased estimate of the transformed parameter. However, the estimates of μ_0 and μ_1 are sufficiently precise that the effect of the nonlinearity is negligible.

[6] Note that the estimates reflect the strong Democratic control of the House through most of the second half of the 20th century. Results based on Presidential or other elections might look quite different.

[7] We follow here the presentation in Chapter 4 of Kim and Nelson (1999).

[8] Details of the computation of smoothed probabilities are given in Kim and Nelson (1999), section 4.3.1.