Party Polarization: Congressional Divergence on Environmental Policy from 1970-2008
by

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Abstract

We investigate empirically the importance of a conjectured linkage between economic conditions and increasing party divergence with respect to national-level environmental policy in the United States. Using data from 1970-2008, we find that increases in the rate of unemployment are associated with increases in divergence between the two parties with respect to voting on environmental legislation; a result that is consistent for both the House and Senate. We also report evidence of a positive relationship between party divergence on environmental legislation and real per capita income. We fail to observe evidence of a statistically significant relationship between the rate of inflation and divergence on environmental voting.

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LCV	League of Conservation

INTRODUCTION

There is a well-documented trend of increasing party polarization at the national level in the U.S. during the second half of the 20th century and a good bit of scientific literature devoted to explaining this trend. Of course, this long-term trend includes short-term convergence and divergence that deviates from the trend; Lopez and Ramirez (2004, 2008) find that variation within the trend is sensitive to macroeconomic conditions. In a specific policy context, Shipan and Lowry (2001) report increasing party divergence with respect to support for *environmental* legislation over the period 1969-1999. Tanger et al. (2010) report a similar finding, for the period 1970-2008. In part, this divergence, may reflect the previously-noted increasing divergence between the parties with respect to policy generally, that is manifested in numerous specific policy dimensions. Alternatively, or additionally, it may also reflect increasing disagreement between the parties with respect to environmental policy specifically.

Shipan and Lowry (2001) hypothesize that economic conditions influence party divergence with respect to environmental policy. Their conjecture is supported by the work of Lopez and Ramirez (2004, 2008), who find that policy divergence (generally speaking) reflects conditions in the macroeconomy. However, in their empirical analysis Shipan and Lowry (2001) focus exclusively on inflation as their indicator of 'the condition of the economy,' whereas Lopez and Ramirez also identify the unemployment rate as a significant driver of party divergence with respect to policy. This suggests, at a

minimum, that a more nuanced understanding of the impact of macroeconomic conditions on *environmental policy* requires empirical analysis that explores possible impacts across a broader set of macroeconomic explanatory variables.

Building on this established empirical foundation, we seek to refine our understanding of the linkage between economic conditions and party divergence with respect to environmental policy in two respects: (1) we expand the set of economic variables that proxy 'the condition of the economy' to include the rate of inflation, the rate of unemployment, and real per capita income, and (2) we integrate data from 2000-2008 into the time-series analysis.

Using data from 1970-2008, we find that increases in the rate of unemployment are associated with increases in divergence between the two parties with respect to voting on environmental legislation; a result that is consistent for both the House and Senate. We also report evidence of a positive relationship between party divergence with respect to voting on environmental legislation in the House of Representatives and real per capita income. In terms of the impact of the rate of inflation on voting on environmental legislation, our findings are consistent with, and indeed reinforce, the previously-reported findings of Shipan and Lowry - - we observe evidence of a statistically (in)significant relationship between the rate of inflation and divergence on environmental voting in the (House of Representatives) Senate. Moreover, by estimating our enhanced models over a time frame that is almost identical to the time frame explored by Shipan and Lowry, we demonstrate that the differences we report are not merely an artifact of adding 9 years' worth of new observations. We consistently find that the unemployment rate is a

significant driver of party-based divergence with respect to voting on environmental legislation in both the House and Senate and that even with the unemployment rate included as an explanatory variable in models of party-based divergence on environmental voting in the Senate the rate of inflation retains strong predictive ability. These findings reveal a considerably more complex relationship between macroeconomic indicators and congressional voting on environmental policy than heretofore identified. Further, they have strong policy implications that we address in our Discussion section.

In section II, we discuss important considerations relevant to measuring legislative support for environmental policy initiatives over time, present empirical evidence regarding party-based divergence with respect to voting on environmental legislation, and review relevant literature on party divergence in the U.S. In section III, we identify and discuss our methods and data. Our regression estimation results are reported in section IV and discussed in section V. Concluding comments round out the presentation.

LITERATURE REVIEW

Undoubtedly the most commonly-used indicator of political support for environmentally friendly legislation is the LCV's Environmental Scorecard (e.g., Shipan and Lowery, 2001; Nelson, 2002; Riddel, 2003; Hussain and Laband, 2005). This rating, developed ex post for each legislative session, scores each representative and senator according to the percentage of the time they cast votes in accordance with the LCV-supported position on a selected set of environment-relevant bills that advanced to floor votes. Thus, the values range from 0 – 100. The Environmental Scorecard represents "…the consensus of experts from 22 environmental and conservation organizations who selected the key votes on which members of congress were graded."

Every year the League of Conservation Voters (LCV) produces a score rating from 0 (worst) to 100 (best) for Congressmen and Senators, detailing their support or opposition for what is deemed by their organization as environmentally important legislation. This legislation may be quite different from election cycle to election cycle as the constituency changes. While many research articles use the LCV voter score and other interest group scores as an ideology indicator (Levitt 1996; Shipan and Lowry1997), these scores don't necessarily exist in a vacuum (Groseclose 1999). While the composition of bills can change, so to can the environment in which those bills and the representatives proposing and voting on them may find themselves in any given year.

While tastes and preferences of the constituency (via representatives) may represent the agenda and bills proposed and voted on, the economic conditions facing them may indeed represent an aggregate budget constraint on the feasibility of passing such legislation (Lopez and Ramirez 2007). In poor economic times the implied opportunity cost of environmental legislation is higher than in good economic times. In this way it seems that ideology as it is represented by these interest group scores may not be without its ounce of pragmatism.

In fact, the very organization most well associated with scoring congressmen on environmental issues (that being the LCV) believes the economy does act as a constraint on environmental legislation. In June of 2008, in an article titled "Economy cited in lower environment scores for Maryland lawmakers", LCV director of Maryland, Cindy Schwartz was quoted saying "Against the backdrop of an economic downturn, conservation scores dropped across the board" (Associated Press June 12th, 2008). To be clear these comments were made in the context of LCV scores for Maryland state legislators, but the comment has interesting implications at the national level as well. Therefore politicians are faced with providing environmental legislation, but citizens do tend to resist when the economic cost of these policies is too high, a phenomenon found in empirical research (Riddell 2003).

With this example in mind we explore empirically the question of if and why political support for the environment appears to be diverging over time and how that divergence is influenced by measures of macroeconomic performance. We empiricize this question by using League of Conservation Voter (LCV) scores as a barometer of a

Congressman's support for (co-production of) environmentally friendly legislation. Focusing on the time period of 1970-2008, we explore whether or not average LCV scores of United States Senators and members of the House of Representatives are statistically responsive to measures of macroeconomic conditions in the U.S.

In this paper, we use this preexisting knowledge to illustrate that policy makers are faced with macroeconomic constraints that greatly affect how they can impact the environment. Of utmost importance is whether or not and how these policy makers respond to these economic realities and the outcomes generated from making decisions in a constrained world. Our research holds to this same premise. Do macroeconomic constraints hinder the number of and/or level of environmental goods and services elected officials can provide?

Identifying a metric that accurately reflects political support for the environment is challenging, because the production process in politics can be difficult to track accurately. Much of the real action, in terms of support for, or opposition to, a bill takes place behind the generally closed doors of (sub) committee meetings. Moreover, there is a myriad of things a politician can do to benefit the environment - - adding funding riders for environmental interest groups to pursue projects, changes in the tax code that encourage recycling or other environmentally-friendly behaviors, and the like. Tracking all of these possible political activities is sufficiently daunting that, to our knowledge, no one has even attempted it. Moreover, aggregating these activities into a single metric would be additionally problematic, as there is no established methodology for weighting the impacts.

These difficulties notwithstanding, a number of empirical researchers have used the Environmental Scorecard (ES) ratings of Senators and members of the House of Representatives, developed and published annually by the League of Conservation Voters (LCV), as a barometer of their support for the environment (e.g., Nelson 2000; Shipan and Lowery 2001; Riddel 2003; Ringqvist 2004). Scaled between 0 and 100, the score reported for each senator or congressman reflects the percentage time that each senator or congressman voted in accord with the LCV's desired position on a set of bills selected by the LCV that were reported out of committee and came to floor votes. Following in this tradition, we use LCV scores as our measure of politicians' support for the environment.

LCV's ES ratings are available (from their website) for members of the U.S. House of Representatives and U.S. Senate starting in 1970. The ES ratings have been produced annually (i.e., for each legislative session), except in 1987/88 when a single score was reported by the LCV for both legislative sessions. Following Shipan and Lowry, we use the same scores for both years. Because economic statistics are calculated at the state and national level, but not available for congressional districts, our analysis focuses on ES ratings averaged across members of the House and Senate.

We report the time profile of average ES ratings, by party, for the period 1970-2008 in the U.S. Senate and the U.S. House of Representatives. In the Senate (Figure 1), we observe that the average ES score of Democrats consistently has been higher than the average ES score of Republicans. From 1970 until approximately 1988, the gap stayed more or less constant, with some variation from year to year. However, starting in the late 1980s, this gap of about 20 points began to widen very rapidly, with the mean score of Democrats rising and the mean score of Republicans falling. By the mid-1990s the

gap had reached nearly 80 points; Democrats were voting in concert with the LCV position on bills nearly 90 percent of the time, while Republicans were voting in concert with the LCV position on those same bills roughly 10 percent of the time. Since the mid-1990s, the two curves have tended to move in concert, with an approximate gap of 60-70 points. Meanwhile, in the House of Representatives the gap of a little under 30 points that persisted throughout the 1970s started to diverge in both directions - - with average scores of Democrats rising and average scores of Republicans falling. Unlike in the Senate, where the two curves diverged rapidly, then moved in concert, albeit with a large gap, since the mid-1990s, the gap between Democrats and Republicans in the House grew less dramatically, but continued up until the mid-2000s.

Figure 1. LCV scores 1970-2008: U.S. Senate

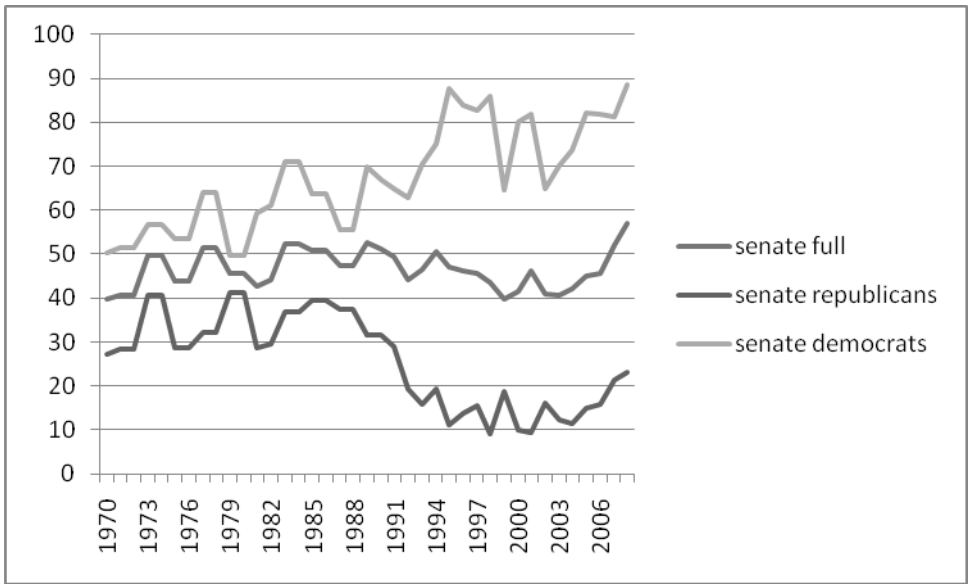


Figure 2. LCV scores 1970-2008: U.S. House of Representatives

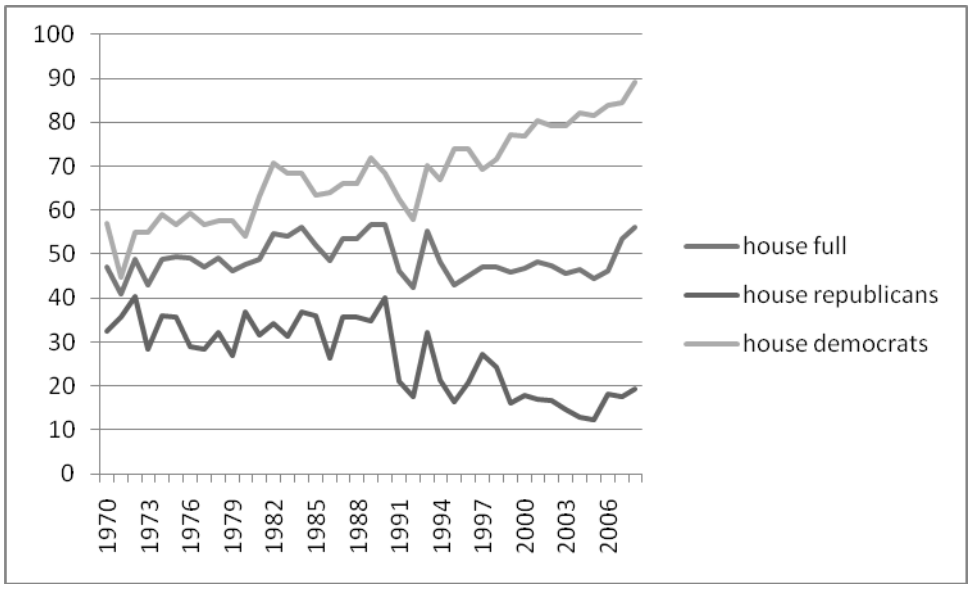


Figure 3. Adjusted LCV scores 1970-2008: U.S. Senate

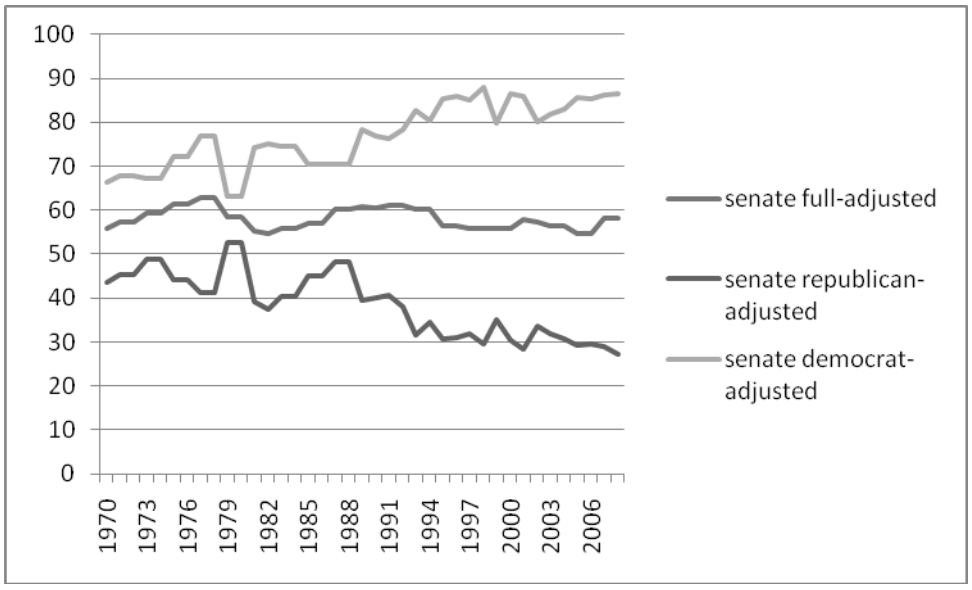
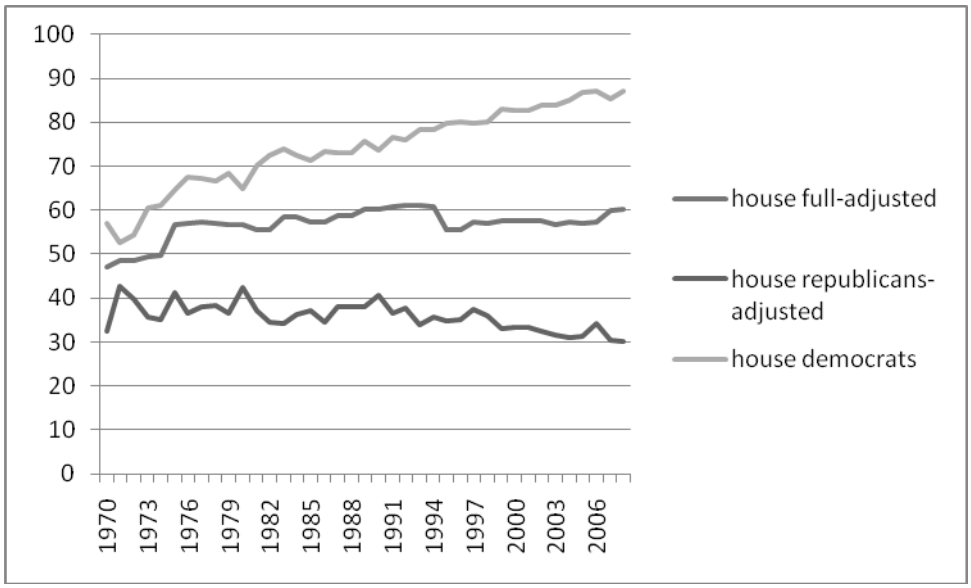


Figure 4. Adjusted LCV scores 1970-2008: U.S. House of Representatives



A particular drawback to LCV scores is that they are available only for individuals who are in a position to influence production of environmental legislation (i.e., incumbent congressmen, not challengers). A second drawback is that they reflect only legislators' behavior with respect to a select set of bills that received floor votes; they do not reflect a more comprehensive spectrum of ways in which an individual can advance (or obstruct) environment-relevant legislation. However, since the scores are constructed from votes on a number of different bills, they arguably reflect each individual's breadth of support for the environment, which may, in turn, be taken as a sign of his/her degree of commitment to environmental protection[1]. Riddel (2003) used E-PAC contributions as an alternative measure of candidate eco-labeling. However, in her analysis of individual donations to U.S. Senate candidates, Riddel looked only at whether or not each of 4 E-PACs donated to each candidate and did not examine the intensity of the signal (the amount donated). One might also use candidates' stated positions on environmental issues as an indicator (Project Vote Smart). But, of course, stated positions do not necessarily imply policy fidelity, so basing empirical analysis on such a variable may be problematic[2] (Ringquist 2004).

Another potential pitfall of using LCV scores as a measure of political support for the environment *across time* is that the metric itself does not stay constant over time. We know, for example, that the number and substance of bills voted on each year that forms the basis for the E.S. ratings changes over time (Groseclose et al. 1999). If the number of bills used to generate the LCV's E.S. differs from year to year, then the resulting scores

[1] Unfortunately, if a Congressman does not vote at all on a bill due to any number of reasons, he/she's vote on that particular bill is counted as a vote against the stated position of the LCV.
[2] The Project Vote Smart sample is truncated as not all incumbents and challengers participate in the political courage test.

are calculated using different weights assigned to the constituent bills that comprise each year's score.[3] The substance of bills introduced and, especially, those permitted to come to a floor vote, surely is affected by policy constraints, such as which party controls legislative outcomes and the robustness of the economy. Finally, with respect to comparisons between the House and Senate, note that a congressman and senator may vote identically on the same set of bills in a given year, but their E.S. ratings may differ by virtue of differences across legislative bodies with respect to the set of bills used by LCV to create the E.S.

To make the voter scores more comparable over time and across chamber, we employ a linear transformation introduced by Groseclose et al. (1999) - - see Appendix. If the *i*-th member in chamber *k* has LCV score $y_{k,i,t}$ in period t, then the transformed score is $\hat{y}_{k,i,t} = \frac{y_{k,i,t} - \hat{a}_{k,t}}{\hat{b}_{k,t}}$, where the values $\hat{a}_{k,t}$ and $\hat{b}_{k,t}$ for each chamber-year are maximum likelihood parameter estimates of movements in the policy space. This adjusted score isolates the individual legislator's position from general trends in the congressional chamber, e.g. changes in majority party leadership that would alter the types or number of bills introduced (Lopez and Ramirez 2008).[4]

[3] In 1975, for example, the Environmental Scorecard percentages were based on analysis of roll call votes on 21 (31) bills in the House (Senate). In 2006, the Environmental Scorecard percentages were based on analysis of roll call votes on 12 (7) bills in the House (Senate).

[4] Groseclose et al. (1999) argue that the adjusted scores more accurately represent a politician's position on legislation the actual scores presume to reflect. Indeed, they find that the adjustment results in substantive changes to the conclusions of previous research (e.g., Levitt 1996), reduces the standard error of the estimates in most cases, reduces the sensitivity of empirical findings to the particular modeling assumptions, and improves the performance of the model on specification tests.

With respect to our analysis of LCV scores, implementing the Groseclose adjustment had the particular effect of resulting in adjusted scores that exceeded 100 for a number of individuals, in all cases Democrats, especially in the last decade.[5]

Although the trends documented in Figures 1 and 2 may suggest that Democrats are becoming more environmentally friendly over time while Republicans are becoming less environmentally friendly, the time-pattern of index-adjusted LCV scores we present (Figures 3 and 4) indicate that this conclusion is premature. In fact, Democrats are becoming more environmentally friendly, at least in terms of adjusted LCV scores, but Republican support for pro-environment policies has not eroded nearly as much as the nominal LCV scores suggest, especially in the House. This finding is consistent with Brewer et al. (2002), who argue that Democrats are driving the divergence between the two parties[6]. For much of the 1970s and 1980s, the average adjusted LCV score among Republican Senators stayed roughly in the mid-40s, and then declined in the 1990s to around 30, where it has remained throughout the 2000s. Meanwhile, in the House, the mean adjusted LCV score among Republicans declined from the upper 30s to the lower 30s. Further, it is quite apparent that the nominal LCV scores understate the support for pro-environment policy initiatives by members of *both* parties, as the adjusted scores are higher for both Democrats and Republicans. Indeed, the mean adjusted LCV score in both the Senate and House ranged between roughly 55 and 60 over the time period under

[5] Dr. Groseclose indicated (personal correspondence) that he and his coauthors found a similar result. Specifically they found that adjusted scores for several Senators and House members were above 100 for the ideological ratings (Americans for Democratic Action and Americans for Constitutional Action) they worked with. In our analysis this result was much more pronounced.

[6] Though Brewer et al. use ADA scores as their dependent variable this indicates that party divergence with respect to general policy positions is trending in a consistent manner with environmental policy specifically.

consideration, as compared to average nominal LCV scores in both chambers that, for the most part, ranged between 40 and 50.

Still, in either nominal or adjusted terms, there has been increasing divergence between Democrats and Republicans, with respect to the LCV's Environmental Scorecard ratings of House and Senate members.

Both Poole and Rosenthal (1984) and Lowry and Shipan (2002), show that the gap in aggregate party voting patterns was narrowing from the ADA's inception (1947) until the early 1970's. These findings are consistent with Downs' (1957) median voter theorem as applied to political actors; assuming that candidates or parties are motivated purely by winning elections and that candidates have the same information about voters' preferences, then, in one dimension, both candidates will converge fully to the same policies. A well known result of Downs' (1957) model under two-party competition is that the parties' platforms tend to converge when the information sets they have about constituents is the same. However, this implies that party platforms would tend to diverge when their information sets are different (Lopez and Ramirez 2004).

In contrast to theories of partisan convergence, some models of electoral behavior suggest that political parties stake out distinctly different positions on high-salience issues (Spiliotes and Vavreck 2002)[7]. Formal models show that parties may actually diverge in order to maintain distinct policy positions and to preclude third party challenges (Austen-Smith 1987; Morton 1987). Poole and Rosenthal (1984, 1997, 1998) and Groseclose, Levitt, and Snyder (1999) show evidence of increasing polarization between the parties along ideological lines since 1970. Numerous other scholars have

[7] Although according to Guber (2001), the environment is considered to be a low salience issue.

described the increasing polarization as well (Coleman 1996; Jacobson 2000; Lowry and Shipan 2002).

Lowry and Shipan (2002, p. 35) propose an empirical framework to "systematically explain the variance over time in the behavioral gap between the two major American political parties on a liberal-conservative dimension." They identify a multivariate statistical model that they posit should be applicable to any empirical study on divergence between the parties in the aggregate.

To our knowledge, only Shipan and Lowry (2001) have attempted to explain the cause of this widening gap with respect to environmental voting. They argue (p. 255) that economic conditions affect party divergence on environmental policy:

> "When the economy is bad, either of two things may happen that can reduce divergence between the parties on environmental issues. First, the Democratic party, traditionally the party pushing more environmental legislation, may be reluctant to endorse any dramatic changes. Second, both the Republican and Democratic parties will be more likely to focus their attention on economic issues than on other social issues, such as the environment, that can drive an ideological wedge between them."

Shipan and Lowry use the rate of inflation as their indicator of the "condition of the economy"; in their empirical analysis of party-based divergence in adjusted LCV scores over the period 1969-1999, they find that as inflation increases, divergence with respect to adjusted LCV scores decreases significantly in the U.S. Senate, but not in the U.S. House of Representatives. We note that Lowry and Shipan (2001) do not offer any theoretical guidance with respect to why this specific economic indicator (inflation) should make Democrats less likely to endorse dramatic changes in environmental policy or why inflation will focus the attention of both Republicans and Democrats on economic

policy rather than environmental policy[8]. However, Lopez and Ramirez (2004) do provide theoretical justification for why both inflation *and* unemployment should influence party-based divergence *with respect to policy issues generally*. They argue (p. 415) that:

> "Both inflation and unemployment affect different citizens in different ways. For example, an increase in inflation undoubtedly affects everyone in some respect. However, it tends to affect wealthier individuals more than it does the poor since inflation represents a tax on wealth. An increase in unemployment tends to also affect citizens differently – those at the poorer end of the income spectrum tend to become unemployed at a higher rate than others. Thus, when unemployment increases, it disproportionately affects the poor. As a result of these fluctuations, parties' information sets about voters tend to differ over the business cycle. This, in turn, generates differences in spending priorities, which end up affecting the degree of party polarization.
>
> However, the degree of polarization would differ between the one generated by inflation, and the one generated by unemployment. Democrats (who are typically seen as representing the poor as well as advocating more government spending) would see the increase in unemployment as affecting their constituents more than Republicans would. In view of the increase in unemployment, they would defend more vigorously expenditures in government programs to help their constituents. Hence, it would be expected that the parties' policy agendas become more polarized. An increase in inflation, however, may lead to less polarization instead. Although inflation, in theory, tends to affect the rich more than the poor, there tends to be more agreement among policymakers as to how to combat it. With more agreement, of course, there is more convergence."

Following this general line of reasoning, we present the following 3 hypotheses:

(1) *increasing unemployment leads to increasing divergence between Democrats and*

[8] However, the authors (p.47) offer economic reasoning for including inflation as an economic driver in their 2002 analysis of general party divergence: "To measure economic conditions, we use the rate of inflation. We use this for a simple reason. Inflation affects everyone in the economy directly, whereas other measures, such as poverty level or unemployment, have greater direct effects on certain segments of the public." However, Alesina and Rosenthal (1995) have established that conservative policymakers tend to care more about inflation and less about unemployment than liberal policymakers do. In the United States, Republicans are typically seen as being 'harder' on inflation and 'softer' on unemployment than Democrats. (Lopez and Ramirez 2004). To the extent that these differences in preferences exist, we should expect to see measures of relative policy preferences change with business cycle conditions.

Republicans with respect to environmental policy.

There are at least two rationale for this hypothesis:

First, Democrats' tendency to '…defend more vigorously expenditures in government programs to help their constituents…" arguably will be accompanied by complementary efforts to not alienate another important constituency for the Democratic Party - - environmentalists. That is, Democrats cannot be perceived as favoring certain constituencies over others in their political base. Thus, we believe that more vigorous defense of spending on programs that help alleviate unemployment among the poor will be accompanied by more vigorous efforts to pursue pro-environment policies or, at a minimum, to not give ground on environmental policy. Second, this effect will be exacerbated by efforts of Republicans to use spikes in unemployment as political cover for opposing new environmental regulations and/or attempting to roll-back previously enacted environmental regulations.

(2) *increasing inflation has no effect on divergence between Democrats and Republicans*

with respect to environmental policy.

Because "….an increase in inflation undoubtedly affects everyone in some respect…" but "…tends to affect wealthier individuals more than it does the poor….," Democrats have little reason to be either more or less vigorous in their support of environmental policy during periods characterized by relatively high rates of inflation. Likewise, it is difficult to link an implicit tax on wealth to increased efforts by

Republicans to oppose new environmental regulations and/or to undo, or reduce the impact of, previously-enacted environmental policy.

(3) *increasing per capita income (in real terms) leads to increasing divergence between*

Democrats and Republicans with respect to environmental policy.

We interpret the Lopez and Ramirez claim that Democrats are advocates of "… more government spending…" as linking to income growth and applying more narrowly to politically-important constituent groups. That is, with real growth in income, Democrats advocate more government spending on programs and policies that differentially benefit their core political base, which includes environmentalists. Republicans, of course, have spending and policy priorities that differ from those of Democrats. Thus, other things equal, increases in real income will lead to increasing divergence with respect to voting on environmental policy.

So we ask the simple question. Is production of environmental policy affected significantly by economic considerations/conditions? Is it affected by economic forces? Is environmental voting ideological or does Congress not only responds to constituent's demands? Are those demands met when the larger economy is undergoing changes in the form of economic indicators?

DATA AND METHODS

To test these hypotheses, we estimated alternative specifications of the following time series model, adapted from both Shipan and Lowry (2001) and Lopez and Ramirez (2004):

$$(1) \quad \text{LCV DIFF}_t = \alpha_0 + \alpha_1 \text{PCI}_t + \alpha_2 \text{UE}_t + \alpha_3 \text{Inflation}_t + \alpha_4 \text{SouthDems}_t + \alpha_5 \text{ADADiff}_t + \alpha_6 \text{NewMembers}_t + \varepsilon_t$$

where,

LCV DIFF_t = the average *adjusted* LCV score of Democrats minus the average *adjusted* LCV score of Republicans in the U.S. House of Representatives/Senate in year t,

PCI_t = per capita income in chained (2000) dollars,

UE_t = the percentage of the total labor force in year t that was unemployed but actively seeking employment and willing to work,

Inflation_t = the annual average rate of inflation in year t,

SouthDems_t = the share of seats in the House/Senate held by Democrats from southern states in year t,[9]

[9] Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas, Virginia.

$ADADiff_t$ = the average Americans for Democratic Action[10] (ADA) score of Democrats

minus the average ADA score of Republicans in the U.S. House of Representatives/Senate in year t,

$NewMembers_t$ = the number of new members elected to the House/Senate in the most recent

election to year t, and

ε_t = the error term.

For the reasons indicated previously, we expect party-based divergence with respect to voting on environmental legislation to increase with rising real per capita income and with rising unemployment, but to be unaffected by the rate of inflation. Following Shipan and Lowry (2001), we include as an explanatory variable the percent of southern Democrats, who tend to be conservative (and vote consistently with Republicans) on a range of issues; the larger the percent of southern Democrats, the less Democrats as a whole will diverge from Republicans. Also following the model structure suggested by Shipan and Lowry (2001), we control for the extent of policy divergence generally between Democrats and Republicans, by including a term that measures average divergence in their respective mean ADA scores. We expect party-based

[10] The mission statement of Americans for Democratic Action states that: "Americans for Democratic Action has and will continue to be a forthright liberal voice of this nation. We work to advocate progressive stances on civil rights and liberties, social and economic justice, sensible foreign policy, and sustainable environmental policy." (Taken from: http://www.adaction.org/pages/about.php, accessed March 18, 2010). Like the League of Conservation Voters, ADA develops an annual rating of U.S. Congressmen and Senators, based on the percentage of time each politician votes consistently with the ADA position on a wide-ranging set of bills. Because the substance of these bills reflects a wide range of policy issues (spending, military, environmental, social, economic), the ADA ratings provide a barometer of party-based differences across the policy spectrum.

divergence with respect to environmental policy to reflect, at least partially, more general party-based divergence. Thus, we expect the estimated coefficient of ADADiff to be positive.

In many cases, turnover in either legislative chamber implies that party-based differences with respect to average LCV scores will decline. Admittedly, turnover that involves a seat being filled by someone from the same party as the previous holder may result in little change in LCV scores. However, given the well-documented difference between Republicans and Democrats with respect to average LCV scores, seat turnover that involves party change arguably will be associated with policy convergence, as each party backs moderate candidates in order to pick-off vulnerable incumbents or win open-seat races.

Our sample necessarily was limited to those candidates who received environmental voting scores from the League of Conservation Voters, which required that they served during the 91^{st}-110^{th} Congresses. Although the E.S. ratings for the House/Senate were calculated as the average of the individual members' scores, in any given year there typically were fewer than 435 (100) observations from Congressmen (Senators). There were deletions from each year's sample for a number of reasons (e.g., prolonged sickness, death, retirement/resignation, expulsion, and entry by means of a special election in mid-term) that resulted in members who only served a partial term. The minimum number of observations for any one year was 370 congressmen and 81 senators. Our annual samples did not include the Speaker of the House, since the LCV does not include a score for this individual, noting that the Speaker votes at his own discretion.

Sample statistics for the Senate (House of Representatives) are reported in Table 1a (b). Over the 39-year period in question (1970-2008), the difference in mean adjusted LCV scores was slightly higher in the House (37.86) than the Senate (35.91), which is consistent with the fact that mean ADA scores were higher in the House (54.57) than in the Senate (50.75). The share of southern Democrats averaged just over 20 percent in both chambers. Likewise, the percentage of new members in each legislative body was quite similar - - approximately 7-8 percent per year, on average.

Table 1. Sample statistics

Variable	Mean	Std. Dev.	Minimum	Maximum	Cases
Senate					
LCVDiff	35.91	14.63	10.17	57.27	39
New Members	0.07	0.08	0.00	0.30	38
ADADiff	50.75	13.15	25.92	68.30	39
SOUDEMS	20.53	4.68	10.20	26.79	39
House of Representatives					
LCVDiff	37.86	10.87	12.68	59.13	39
New Members	0.08	0.08	0.00	0.25	38
ADADiff	54.57	13.22	31.22	70.89	39
SOUDEMS	21.96	3.45	14.56	27.27	39
Economic variables					
PCI	27.83	6.18	18.39	38.40	39
UE	6.12	1.36	3.97	9.71	39
INFLATIO	4.68	2.90	1.55	13.58	39

Once the LCV scores were adjusted, we estimated models based on equation (1) to determine if there were any statistically significant linkages between indicators of economic well-being and divergence in aggregate party level political support for environment policy, as reflected in the adjusted LCV scores. Because we employed time-series data for our empirical analysis, we investigated the time-series properties of the data for the variables in our model. We tested various models to assess whether they met the required stationarity requirements for time-series estimation.[11] All variables, individually, met the requirements of stationarity and randomly-distributed residuals according to Augmented Dickey-Fuller (ADF) stationarity tests, indicating that Ordinary Least Squares (OLS) regression estimation was appropriate.[12] This result is consistent with Shipan and Lowry (2001), an analysis similar to ours in topic and design. However, when using OLS to estimate several of the model specifications (for the Senate, not the House), we found that the Durbin-Watson statistic still indicated the presence of autocorrelation. While this was not true in all cases, on the chance that autocorrelation was present in any of the models we used the Prais-Winsten Feasible Generalized Least Squares (FGLS) regression estimation technique, which corrects for first order

[11] The typical issue in time series estimation is that variables are not normally distributed, thus the coefficient estimates generated by Ordinary Least Squares (OLS) regression are characterized by understated standard errors. If theory suggests x_t should affect y_t and both have trends, they will be correlated and coefficients will appear significant when in reality the explanatory power of x_t is overstated. The residual error term ε_t in an OLS model should be distributed randomly (colloquially described as white noise –WN). An OLS regression with non-stationary variables is characterized by autocorrelation (ε_t, ε_{t-1}) in the residual series ε_t. Autocorrelation implies there is useful information in the residual ε_t relative to predicting y_t. Obtaining this information requires either a different model or transformed variables (Enders 1995).

[12] If the gamma coefficient in the ADF test is negative and significant then the variable is stationary (Enders 1995).

autocorrelation in the error terms. This procedure mirrors that of Shipan and Lowry (2001) and Lopez and Ramirez (2004).[13]

[13] In addition to the AR(1) Prais-Winston estimation results that we present, we also estimated our models using the Newey-West HAC (heteroskedasticity- and autocorrelation consistent) adjustment. These results are available upon request. In almost all cases the House results were consistent regardless of procedure. The Senate results indicated that some correction was necessary. As to whether to use Newey-West or FGLS there appears to be little specific guidance. Woolridge (2006, chapter 12, sections 2 and 3) argues that if the explanatory variables are completely exogenous FGLS is preferred. But our colleagues familiar with time-series econometrics argued that the Newey-West HAC estimation procedure also is considered appropriate when the error terms are correlated.

RESULTS

Tables 2 and 3 display the FGLS regression estimation results for the U.S. Senate and U.S. House of Representatives, respectively. The Durbin-Watson statistics for all models are sufficiently close to 2 that we are confident that autocorrelation is not a serious problem. The specific results that we focus on for the moment are those in the fourth column of each table - - the models looking at divergence in adjusted LCV scores over the period 1970-2008.

Turning immediately to the economic variables of interest, we find, as expected, a positive and statistically significant relationship between the rate of unemployment and the extent of party-based divergence with respect to LCV scores, in both the House and Senate. Over the 39-year period analyzed, we estimate that a 1-point increase (decrease) in the unemployment rate was associated with a 1.4 (1.9) point increase (decrease) in divergence of mean adjusted LCV scores between Democrats and Republicans in the House of Representatives (Senate). We also find, as expected, no evidence of a statistically significant relationship between the rate of inflation and party-based divergence in mean adjusted LCV scores in the House of Representatives but a statistically significant inverse relationship between the rate of inflation and party-based divergence in mean adjusted LCV scores for the Senate. This is perfectly consistent with the findings of Shipan and Lowry (2001). Finally, as expected, we report a positive and statistically significant relationship between real per capita income and party-based

divergence in LCV scores in the House, but we fail to find evidence of such a relationship in the Senate.

With respect to the other control variables in the model, we report:

A. Evidence of a positive (as expected) and statistically significant relationship between party-based divergence in ADA scores and party-based divergence in LCV scores in both legislative bodies,

B. Evidence of a negative (as expected) and statistically significant relationship between the percent of southern Democrats in each chamber and party-based divergence in LCV scores, and

C. Evidence of a positive (unexpected) relationship between the number of new members in the Senate and party-based divergence in LCV scores, but no evidence of a statistically significant impact of new members in the House of Representatives. Our estimated models of party-based divergence in LCV scores explain over 91 and 79 percent of the annual variation for the House of Representatives and Senate, respectively.

Table 2. OLS Regression Estimation Results for Party Divergence in Average Environmental Scorecard Ratings – U.S. Senate

	Shipan/Lowry 1970-1999 Adjusted LCV	Shipan/Lowry 1970-2008 Adjusted LCV	Tanger/Laband 1970-1999 Adjusted LCV	Tanger/Laband 1970-2008 Adjusted LCV	Tanger/Laband 1970-2008 Unadjusted LCV
Intercept	45.3650**	33.6164**	16.4935	16.2665	52.4330*
	(20.8829)	(16.0803)	(22.3258)	(21.6996)	(29.1940)
Real per capita income			1.1590	0.3901	-0.3762
			(1.0231)	(0.7102)	(1.0079)
Unemployment (%)			3.2219***	1.8832*	0.1957
			(1.2214)	(1.1633)	(1.6242)
Inflation (%)	-1.5480**	-1.3889**	-1.3480**	-1.3903**	-1.6930*
	(0.7048)	(0.6344)	(0.6440)	(0.6275)	(0.9034)
% Southern Democrat	-1.4088**	-1.0567**	-1.8992***	-1.1511**	-1.9040***
	(0.6695)	(0.4226)	(0.5752)	(0.4788)	(0.6511)
ADA Divergence	0.4116**	0.4979***	0.1306	0.4084	0.7729*
	(0.1934)	(0.1668)	(0.3582)	(0.2790)	(0.4105)
New Members in previous election	0.5129	0.4570	0.6946*	0.5882*	0.5914)
	(0.3834)	(0.3561)	(0.3656)	(0.3626)	(0.5304)
Rho	0.4755***	0.4082***	0.2562	0.3645**	0.2285
	(0.1634)	(0.1481)	(0.1795)	(0.1511)	(0.1579)
adjusted R2	0.6929	0.7795	0.7706	0.7933	0.7750
Durbin-Watson statistic	1.8777	1.8925	1.9410	1.9210	1.9877
N	30	39	30	39	39

*** (**) Estimated coefficient is statistically significant at the 0.01 (0.05) level.

Table 3. OLS Regression Estimation Results for Party Divergence in Average Environmental Scorecard Ratings – U.S. House of Representatives

	Shipan/Lowry 1970-1999 Adjusted LCV	Shipan/Lowry 1970-2008 Adjusted LCV	Tanger/Laband 1970-1999 Adjusted LCV	Tanger/Laband 1970-2008 Adjusted LCV	Tanger/Laband 1970-2008 Unadjusted LCV
Intercept	18.3215*	19.3738**	1.7805	-7.1642	-5.2160
	(10.1049)	(8.5923)	(12.8945)	(10.8844)	(22.0330)
Real per capita income			0.6107	1.1022***	1.4605*
			(0.5681)	(0.3872)	(0.7795)
Unemployment (%)			1.1972**	1.3728***	0.3394
			(0.5629)	(0.4781)	(1.0772)
Inflation (%)	-0.0973	-0.0400	-0.0809	-0.0308	-0.2956
	(0.3207)	(0.3232)	(0.2824)	(0.2546)	(0.5636)
% Southern Democrat	-0.5963**	-0.7039***	-0.4905*	-0.3853*	-0.7387*
	(0.2895)	(0.2066)	(0.2986)	(0.2274)	(0.4354)
ADA Divergence	0.6027***	0.6571***	0.4217**	0.2752*	0.4083
	(0.0819)	(0.0775)	(0.2162)	(0.1584)	(0.3164)
New Members in previous election	-0.0088	-0.0267	-0.0104	-0.0079	-0.0188
	(0.0340)	(0.0320)	(0.0321)	(0.0286)	(0.0633)
Rho	0.0806	0.1781	-0.1194	-0.0780	0.2444
	(0.1851)	(0.1596)	(0.1844)	(0.1617)	(0.1573)
adjusted R2	0.8404	0.9043	0.8201	0.9120	0.8743
Durbin-Watson statistic	1.8474	1.6405	1.9220	1.9391	1.8049
N	30	39	30	39	39

*** (**) Estimated coefficient is statistically significant at the 0.01 (0.05) level.

CONCLUSIONS & DISCUSSION

Not surprisingly, divergence between Democrats and Republicans with respect to their political support for the environment appears to be, in part, a reflection of more general (i.e. issue-encompassing) divergence between the two parties. We find this to be true in both legislative chambers; Shipan and Lowry (2001) find statistically significant evidence of this in the House, but not the Senate. However, it also is clear that party-based divergence with respect to environmental policy is influenced significantly by factors other than general party-relevant ideology. Specifically, such divergence, in both the House and Senate, seems clearly to be affected positively by the rate of unemployment. Our conclusion in this regard is consistent with the finding by Lopez and Ramirez (2004) of a positive relationship between the rate of unemployment and party-based divergence in ADA scores. Further, it advances our understanding of the factors that influence divergence on environmental policy, as Shipan and Lowry (2001) only considered the possible impact of inflation. Our finding of no significant impact of inflation on environmental policy divergence in the House but a significant impact in the Senate not only is consistent with Shipan and Lowry (2001) it also is, upon reflection, quite plausible. To the extent there is a political response to the rate of inflation, we would expect such an effect to be more likely/apparent/sizable in the Senate than the House since the corrosive effects of inflation are cumulative over several years. With only 2-year terms, House members' voting behavior is likely to be influenced more by short-

term economic conditions (e.g., the unemployment rate) than by longer-term economic conditions (e.g., inflation). In contrast, by virtue of their 6-year terms the voting behavior of U.S. Senators is more likely to be influenced by longer-term economic conditions. Regarding the impact of new members on environmental policy divergence, we find evidence of a statistically significant positive relationship in the Senate, with an estimated impact (coefficient estimate = 0.58) that is virtually identical to the effect reported by Shipan and Lowry (0.56). However, we fail to find evidence of a statistically significant impact, either positive or negative, of new members on environmental policy divergence in the House.

Our finding of a strong, inverse relationship between the percentage of southern Democrats and divergence in party-based LCV scores in each chamber is consistent with the estimate by Shipan and Lowry for the Senate, but not for the House (for which they report a positive but statistically insignificant coefficient estimate on % southern Democrat). However, the same authors (Lowry and Shipan 2002) contend that this inverse relationship should be stronger in the Senate than in the House, which is consistent with our findings.

Finally, we also find evidence of a positive and highly significant relationship, in the House of Representatives but not the Senate, between real per capita income and party-based divergence with respect to LCV scores. This creates a bit of a conundrum: why would members of the House of Representatives but not the Senate be sensitive to changes in real per capita income in regards to voting on environmental policy, while at the same time legislators in both chambers exhibit sensitivity to changes in the rate of

unemployment? Apparently, the former is not driven by the 2-year versus 6-year election cycles in the House and Senate, respectively, as one might equally expect such a driver to affect how changes in the rate of unemployment influence voting on environmental policy. So this finding awaits additional interpretation and understanding that we are unable to provide at the present time.

In an attempt to parse out the extent to which the noted differences between our findings and those of Shipan and Lowry may derive from the different time periods under consideration, we estimated a simplified version of the Shipan/Lowry model for data that almost exactly duplicates their original time period (we use 1970-1999; they used 1969-1999) and then re-estimated the model for data covering our time period (1970-2008).[14] We also estimated our own model for these two different time periods.[15] These results also are shown in Tables 2 and 3.

Quite clearly, the estimation results are sensitive, in certain respects, to the time period under consideration. Comparing the two time periods using the simplified Shipan/Lowry model, we observe in the U.S. Senate (U.S. House of Representatives) that the adjusted R^2 value of the model based on the 1970-2008 data is approximately 12.5 (7.6) percent greater than for the model based on the 1970-1999 data. The sizes of the estimated coefficients of the explanatory variables in the model differ also, although the principal conclusions remain unaltered - - party divergence with respect to adjusted LCV scores is influenced significantly by the percentage of Southern Democrats and general policy divergence between the parties, as reflected in the ADA Divergence variable, in

[14] Our simplified version of the Shipan/Lowry model does not include their salience or interest group variables.

[15] We appreciate this suggestion made by an anonymous referee.

both the Senate and House, and influenced significantly by the rate of inflation in the Senate but not the House.

Comparing the Tanger/Laband model across the two time periods, we observe even greater evidence that the findings may be period-sensitive. While the unemployment rate exerts a statistically significant impact on divergence in adjusted LCV scores in both chambers, the size of the estimated effect in the Senate is only a little more than half as large for the 1970-2008 period (estimated coefficient = 1.8832) as it is for the 1970-1999 period (estimated coefficient = 3.2219). By contrast, the estimated impact in the House is higher for the 1970-2008 period (estimated coefficient = 1.3728) than for the 1970-1999 period (estimated coefficient = 1.1972). In the House, the estimated impact of real per capita income is statistically insignificant in the 1970-1999 period, but highly significant in the 1970-2008 period.

Finally, in the last column of Tables 2 and 3, we report estimation results for our model using *unadjusted* LCV scores to calculate party divergence on environmental voting. Across both chambers, the percentage of Southern Democrats is a statistically significant predictor of divergence. In the Senate (House of Representatives), the rate of inflation (unemployment rate) is an economic indicator that significantly predicts divergence.

Notwithstanding this apparent sensitivity of results to the time-frame under scrutiny, we believe that the evidence strongly suggests that party divergence with respect to voting on environmental legislation in both chambers is affected by conditions in the macro-economy, particularly the unemployment rate. There is some evidence to suggest that party-based divergence on environmental voting in the House of

Representatives also is affected by the level of real per capita income and in the Senate by the rate of inflation.

Our findings are important because they shed empirical light on an issue of great importance with respect to environmental policy - - as put to us by an anonymous reviewer: "Can we really expect that as economic conditions falter, the two parties will pursue radically different agendas on environmental policy?" We believe that the answer to this question, as revealed by our findings, is 'yes,' and we suggest that this year's congressional battle over 'cap and trade' was an illustrative case in point. By all accounts, most congressional Democrats were strongly in favor of 'cap and trade' notwithstanding the fact that the national unemployment rate in the U.S. exceeded 10 percent, an extraordinarily high rate for the U.S. in historic terms. In contrast, Republicans were solidly opposed.

We offer a simple, yet we believe powerful, explanation that identifies a linkage between economic conditions and party-based divergence on environmental policy that is quite specific. Politically, it would be simply disastrous for the Democrats to simultaneously anger the portion of their base that is interested in economic issues and anger the portion of their base that is interested in environmental issues. That is, Democrats can't politically afford to look incompetent across the policy spectrum of interest to their base - - they must not be bad at *everything*. Consequently, if poor economic conditions can plausibly be tied to policies pursued (or not pursued) by Democrats, this implicitly ramps up the political pressure on Democrats to be seen by other critical components of their base, such as environmentalists, as performing well. Arguably, then, adverse economic circumstances will lead directly to environmental

policy divergence between the major political parties as Democrats push hard for policy successes on other margins to sell to their base while Republicans unite in opposition. While we have focused on Democrats with respect to presenting this argument, the logic generalizes to Republicans.

In addition to divergence between the two parties, the changing party-specific mean E.S. levels over time are of interest. With respect to the nominal E.S. levels reported in Figures 1 and 2, neither party started out as either a consistent supporter or consistent opponent of the environmental legislation tracked by the League of Conservation Voters. For example, throughout the 1970s and 1980s, Republicans in both the Senate and House supported roughly one-third of the environmental legislation that formed the basis for the E.S. ratings. During the 1970s, Democratic support for environmental legislation rarely touched the 60 percent level. So during this period, at least, congressional Democrats were not die-hard environmentalists. However, by 2006 the support level for environmental legislation by Democrats (Republicans) in both the House and Senate had risen (fallen) to 90 (10-20) percent. What would explain such large changes over time? Have Democratic politicians really become more 'green' over time? Are Republicans really 'anti-green'? If so, why? One plausible explanation is that relatively high-impact, low-cost policy measures were brought to the table early-on and attracted a high degree of bipartisan support. But as the years passed and policy measures had reduced impacts (the law of diminishing returns) and/or higher costs, bi-partisan support steadily eroded away.

We close by re-focusing our attention on the graphs presented in figures 3 and 4. There are, in our opinion, at least two interesting features of these graphs that command

the attention of future researchers. First, there appears to be considerably greater year-to-year variation in the adjusted mean scores of each party in the Senate than in the House, especially among Democrats. Second, while the mean adjusted LCV scores of Senate Democrats (Republicans) have climbed (fallen) in roughly equal measure, in the House of Representatives the mean adjusted LCV scores of Republicans have remained essentially constant for nearly 40 years. This means that increasing divergence between Democrats and Republicans over time with respect to voting on environmental policy in the House is due to increasing support among Democrats. Why is the time-pattern of support for environmental legislation by Republicans different in the House than in the Senate?

More fundamentally, if there are political rents associated with voting on environmental policy, why do we observe divergence rather than convergence? There aren't many satisfactory answers to this question. If support for the environment by the hypothetical median voter at any given point in time falls somewhere between the mean adjusted LCV scores of the two parties, then convergence by the two parties clearly would be predicted by a Downsian median-voter model, but we don't observe such convergence. Perhaps there is something about environmental policy - - e.g., that it is of relatively low salience (Guber 2001) that renders application of the median voter paradigm unsuitable. However, if median-voter support for the environment is either consistent with or more extreme than the mean adjusted LCV scores of one party or the other, we are left begging for an explanation of why the elected members of the other party not only have consistently ignored the median voter, they have moved away from that median voter over time.

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APPENDIX A

We follow the method proposed by Groseclose, Levitt, and Snyder (1999, American Political Science Review, 33–50) to adjust time-series scores assigned to legislators by the group Americans for Democratic Action (ADA); we adjust time-series scores assigned to legislators by the League of Conservation Voters. Denote the LCV score for member *i* in chamber c in year *t* by y_{cit}. The observable data are the collection of LCV scores $\{y_{cit}$; c = H or S; $i \in$ I; $t \in$ T$\}$, where *c* is either House or Senate, I is the collection of all members, and T is the collection of all years when LCV scores are available. We assume that each member *i* in chamber *c* has an unobservable intrinsic score, denoted by x_{ci}, which only depends on the member himself and does not change over time. However, because the chamber members and bills vary across years, the observed LCV score y_{cit} is thus affected and usually different from the intrinsic score x_{ci}. Here we assume that y_{cit} is determined from the intrinsic score x_{ci} by shifting and scaling. More formally, assume that

$$y_{cit} = a_{ct} + b_{ct} x_{ci} + \varepsilon_{cit}$$

where a_{ct} and b_{ct} are shifting and scaling parameters for chamber *c* in year *t* and ε_{cit} is a random error following $N(0, \sigma^2)$. The parameters a_{ct} and b_{ct} only depend on chamber and year, and are independent of members. Hence they can be regarded as characterizations of chamber *c* in year *t*. In this model, only y_{cit} are observed, and parameters $\{a_{ct}, b_{ct}, x_{ci,} \sigma\}$ are to be estimated from y_{cit}. After a_{ct} and b_{ct} are calculated, the adjusted score of member *i* in year *t* is

$$\hat{y}_{cit} = \frac{y_{cit} - a_{ct}}{b_{ct}}$$

The parameters $\{a_{ct}, b_{ct}, x_{ci,} \sigma\}$ are estimated using maximum likelihood method. They are the values that maximize the log-likelihood function

$$\ell(a,b,x,\sigma) = \sum_{t \in T} \sum_{c \in \{H,S\}} \sum_{i \in I_{ct}} [-\frac{1}{2} \log 2\pi\sigma^2 - \frac{1}{2\sigma^2} (y_{cit} - a_{ct} - b_{ct} x_{ci})^2]$$

where T is the set of all years in the sample, I_{ct} is the set of all members serving in chamber c during year *t*. Setting the derivative of $\ell(a, b, x, \sigma)$ with respect to $a_{ct}, b_{ct}, x_{ci,} \sigma$ to 0, we obtain the following equations:

$$\frac{\partial \ell}{\partial a_{ct}} = -\frac{1}{2\sigma^2}\sum_{i\in I_{ct}}(y_{cit} - a_{ct} - b_{ct}x_{ci}) = 0 \quad (1)$$

$$\frac{\partial \ell}{\partial b_{ct}} = -\frac{1}{2\sigma^2}\sum_{i\in I_{ct}}(y_{cit} - a_{ct} - b_{ct}x_{ci})x_{ci} = 0 \quad (2)$$

$$\frac{\partial \ell}{\partial x_{ci}} = -\frac{1}{2\sigma^2}\sum_{t\in T}(y_{cit} - a_{ct} - b_{ct}x_{ci})b_{ct} = 0 \quad (3)$$

$$\frac{\partial \ell}{\partial \sigma^2} = \sum_{t\in T}\sum_{c\in\{H,S\}}\sum_{i\in I_{ct}}[-\frac{1}{2\sigma^2} + \frac{1}{2\sigma^4}(y_{cit} - a_{ct} - b_{ct}x_{ci})^2] = 0 \quad (4)$$

The estimates of $\{a_{ct}, b_{ct}, x_{ci,}\sigma\}$ satisfy equations (1)--(4). However, it is complicated to solve them directly. Instead, we use an iterative algorithm to calculate the estimates. Starting from an initial value $a_{ct} = 0$ and $b_{ct} = 1$, we calculate x_{ci} from equation (3) as

$$x_{ci} = \frac{\sum_{t\in T}(y_{cit} - a_{ct})}{\sum_{t\in T} b_{ct}b_{ct}}$$

then update the value a_{ct} from equation (1) by

$$a_{ct} = \frac{\sum_{i\in I_t^c}(y_{cit} - b_{ct}x_{ci})}{\sum_{i\in I_{ct}} 1}$$

then update the value b_{ct} from equation (2) by

$$b_t^c = \frac{\sum_{i\in I_{ct}} x_{ci}(y_{cit} - a_{ct})}{\sum_{i\in I_{ct}} x_{ci}x_{ci}}$$

We keep updating the values of x_{ci}, a_{ct}, and b_{ct} using the above expressions sequentially until they do not change much. The final values of $\{a_{ct}, b_{ct}, x_{ci}\}$ are the estimates we need. The estimate of σ can be calculated from equation (4).

APPENDIX B

Initially our attempts were to calculate the importance of several macroeconomic variables influence on divergence between the two political parties over the period that the LCV had conducted its environmental scoring record. The following two models represent what came out of the regressions run with an AR(1) process that gave us satisfactory autocorrelation results according to our D-W statistic.

First I include several models which examine the House of Representatives. The first model is the last one that was settled on for the final models.
Model number 4 is the one I focus on in the appendix as it represents the model I was attempting to estimate originally and the others were conducted for comparisons with prior research. Also, I conducted several lag structures to determine the proper lag structure if any was needed.

FGLS Regression Estimation Results for Party Divergence in Average Environmental Scorecard Ratings – U.S. House of Representatives

	Shipan/Lowry 1970-1999 Adjusted LCV	Shipan/Lowry 1970-2008 Adjusted LCV	Tanger/Laband 1970-1999 Adjusted LCV	Tanger/Laband 1970-2008 Adjusted LCV	Tanger/Laband 1970-2008 Unadjusted LCV
Intercept				-7.1642	-5.2160
				(10.8844)	(22.0330)
Real per capita income				1.1022***	1.4605*
				(0.3872)	(0.7795)
Unemployment (%)				1.3728***	0.3394
				(0.4781)	(1.0772)
Inflation (%)				-0.0308	-0.2956
				(0.2546)	(0.5636)
% Southern Democrat				-0.3853*	-0.7387*
				(0.2274)	(0.4354)
ADA Divergence				0.2752*	0.4083
				(0.1584)	(0.3164)
New Members in previous election				-0.0079	-0.0188
				(0.0286)	(0.0633)
Rho				-0.0780	0.2444
				(0.1617)	(0.1573)
adjusted R2				0.9120	0.8743
Durbin-Watson statistic				1.9391	1.8049
N				39	39

*** (**) Estimated coefficient is statistically significant at the 0.01 (0.05) level.

Notes:

All regressions are estimated using the Prais-Winsten general least squares procedure to correct for serial correlation. “rho” is the estimated serial correlation parameter. Standard errors are reported in parentheses.

FGLS Regression Estimation Results for Party Divergence in Average Environmental Scorecard Ratings – U.S. House of Representatives No lags

	Shipan/Lowry 1970-1999 Adjusted LCV	Shipan/Lowry 1970-2008 Adjusted LCV	Tanger/Laband 1970-1999 Adjusted LCV	Tanger/Laband 1970-2008 Adjusted LCV	Tanger/Laband 1970-2008 Unadjusted LCV
Intercept				-5.9548 (10.83)	
Real per capita income				1.2437 (0.3862)	
Unemployment (%)				0.9924 (0.5269)	
Inflation (%)				-0.0348 (0.2605)	
% Southern Democrat				-0.2423 (0.2603)	
FullD				-2.4600 (1.5185)	
FullR				-1.8441 (1.6568)	
ADA Divergence				-0.1875 (0.1624)	
Net House Democrats gain				-0.4523 (1.2732)	
Rho				-0.0851 (0.1616)	
adjusted R2				0.9509	
Durbin-Watson statistic				1.9051	
N				39	

*** (**) Estimated coefficient is statistically significant at the 0.01 (0.05) level.

Notes:

All regressions are estimated using the Prais-Winsten general least squares procedure to correct for serial correlation. “rho” is the estimated serial correlation parameter. Standard errors are reported in parentheses.

FGLS Regression Estimation Results for Party Divergence in Average Environmental Scorecard Ratings – U.S. House of Representatives
Lag 1

	Shipan/Lowry 1970-1999 Adjusted LCV	Shipan/Lowry 1970-2008 Adjusted LCV	Tanger/Laband 1970-1999 Adjusted LCV	Tanger/Laband 1970-2008 Adjusted LCV	Tanger/Laband 1970-2008 Unadjusted LCV
Intercept				-29.4051	
				(9.5081)	
Real per capita income $_{t-1}$				2.2972	
				(0.3559)	
Unemployment (%) $_{t-1}$				1.8986	
				(0.4192)	
Inflation (%) $_{t-1}$				-0.0136	
				(0.2534)	
% Southern Democrat $_{t-1}$				0.1838	
				(0.2123)	
FullD $_{t-1}$				-2.9488	
				(0.9932)	
FullR $_{t-1}$				-1.2857	
				(0.9007)	
ADA Divergence $_{t-1}$				-0.1856	
				(0.1624)	
Net House Democrats gain $_{t-1}$				-0.7485	
				(0.9692)	
Rho				0. 07678	
				(0.1617)	
adjusted R2				0.9356	
Durbin-Watson statistic				1.9051	
N				39	

*** (**) Estimated coefficient is statistically significant at the 0.01 (0.05) level.
Notes:
All regressions are estimated using the Prais-Winsten general least squares procedure to correct for serial correlation. “rho” is the estimated serial correlation parameter. Standard errors are reported in parentheses.

FGLS Regression Estimation Results for Party Divergence in Average Environmental Scorecard Ratings – U.S. House of Representatives
Lag 2

	Shipan/Lowry 1970-1999 Adjusted LCV	Shipan/Lowry 1970-2008 Adjusted LCV	Tanger/Laband 1970-1999 Adjusted LCV	Tanger/Laband 1970-2008 Adjusted LCV	Tanger/Laband 1970-2008 Unadjusted LCV
Intercept				-12.8115	
				(9.5081)	
Real per capita income $_{t-2}$				1.7993	
				(0.3559)	
Unemployment (%) $_{t-2}$				1.0171	
				(0.4895)	
Inflation (%) $_{t-2}$				0.4496	
				(0.2738)	
% Southern Democrat $_{t-2}$				-0.1659	
				(0.2783)	
FullD $_{t-2}$				-2.3168	
				(1.3180)	
FullR $_{t-2}$				-0.9372	
				(1.2752)	
ADA Divergence $_{t-2}$				-0.0148	
				(0.1906)	
Net House Democrats gain $_{t-2}$				0.0024	
				(0.0521)	
Rho				-0. 0491	
				(0.1620)	
adjusted R2				0.9293	
Durbin-Watson statistic				2.0788	
N				39	

*** (**) Estimated coefficient is statistically significant at the 0.01 (0.05) level.
Notes:
All regressions are estimated using the Prais-Winsten general least squares procedure to correct for serial correlation. “rho” is the estimated serial correlation parameter. Standard errors are reported in parentheses.

FGLS Regression Estimation Results for Party Divergence in Average Environmental Scorecard Ratings – U.S. House of Representatives
Lag 3

	Shipan/Lowry 1970-1999 Adjusted LCV	Shipan/Lowry 1970-2008 Adjusted LCV	Tanger/Laband 1970-1999 Adjusted LCV	Tanger/Laband 1970-2008 Adjusted LCV	Tanger/Laband 1970-2008 Unadjusted LCV
Intercept				-13.2303	
				(9.5081)	
Real per capita income $_{t-3}$				1.5227	
				(0.4740)	
Unemployment (%) $_{t-3}$				0.1472	
				(0.4406)	
Inflation (%) $_{t-3}$				0.6020	
				(0.2738)	
% Southern Democrat $_{t-3}$				0.1347	
				(0.2592)	
FullD $_{t-3}$				-1.7302	
				(1.1842)	
FullR $_{t-3}$				-0.0375	
				(1.1566)	
ADA Divergence $_{t-3}$				-0.0148	
				(0.1906)	
Net House Democrats gain $_{t-3}$				0.0100	
				(0.0479)	
Rho				-0.1220	
				(0.1610)	
adjusted R2				0.9358	
Durbin-Watson statistic				2.2069	
N				39	

*** (**) Estimated coefficient is statistically significant at the 0.01 (0.05) level.
Notes:
All regressions are estimated using the Prais-Winsten general least squares procedure to correct for serial correlation. “rho” is the estimated serial correlation parameter. Standard errors are reported in parentheses.

As the reader may notice there are some chamber (house and senate) composition variables included in these models (in the appendix) that do not appear in the final models reported. We tried several types of variables to capture this idea of composition (turnover, how strongly controlled by one party the legislature may be by year, etc.)

I also originally used Newey-West estimators originally but due to reviewer comments settled on the more widely accepted AR(1) process. Here the reader can see the differences between the two methods. Newey-West estimators are considered a legitimate for correcting both autocorrelation in time series data and heteroskedasticity in the error terms of models calculated.

Newey-West Regression Estimation Results for Party Divergence in Average Environmental Scorecard Ratings – U.S. House of Representatives
No lag

	Shipan/Lowry 1970-1999 Adjusted LCV	Shipan/Lowry 1970-2008 Adjusted LCV	Tanger/Laband 1970-1999 Adjusted LCV	Tanger/Laband 1970-2008 Adjusted LCV	Tanger/Laband 1970-2008 Unadjusted LCV
Intercept				16.3895 (7.3524)	
Real per capita income					
Unemployment (%)					
Inflation (%)				0.0448 (0.3329)	
% Southern Democrat				-0.3726 (0.1596)	
ADA Divergence				0.6822 (0.0808)	
Net House Democrats gain					
adjusted R2				0.9043	
Durbin-Watson statistic				1.6404	
N				39	

*** (**) Estimated coefficient is statistically significant at the 0.01 (0.05) level.
Notes:
All regressions are estimated using the Newey-West general least squares procedure to correct for serial correlation. “rho” is not reported in the computation of these models.
Standard errors are reported in parentheses.

Newey-West Regression Estimation Results for Party Divergence in Average Environmental Scorecard Ratings – U.S. House of Representatives
No lag

	Shipan/Lowry 1970-1999 Adjusted LCV	Shipan/Lowry 1970-2008 Adjusted LCV	Tanger/Laband 1970-1999 Adjusted LCV	Tanger/Laband 1970-2008 Adjusted LCV	Tanger/Laband 1970-2008 Unadjusted LCV
Intercept				-7.0052	-13.3825
				(9.0866)	(13.7763)
Real per capita income				1.0823	2.0524
				(0.3402)	(0.4680)
Unemployment (%)				1.2744	0.8131
				(0.5049)	(0.7317)
Inflation (%)				-0.0339	-0.2127
				(0.3325)	(0.4064)
% Southern Democrat				-0.3726	-0.7478
				(0.1596)	(0.3434)
ADA Divergence				0.2834	0.1681
				(0.1575)	(0.2044)
Net House Democrats gain				-0.0237	0.0772
				(0.0720)	(0.0997)
All Dem				-1.1639	-1.1639
				(1.0285)	(1.0285)
adjusted R2				0.9258	
Durbin-Watson statistic				2.1496	
N				39	

*** (**) Estimated coefficient is statistically significant at the 0.01 (0.05) level.

Notes:

All regressions are estimated using the Newey-West general least squares procedure to correct for serial correlation. “rho” is not reported in the computation of these models. Standard errors are reported in parentheses.

Newey-West Regression Estimation Results for Party Divergence in Average Environmental Scorecard Ratings – U.S. House of Representatives
No lag

	Shipan/Lowry 1970-1999 Adjusted LCV	Shipan/Lowry 1970-2008 Adjusted LCV	Tanger/Laband 1970-1999 Adjusted LCV	Tanger/Laband 1970-2008 Adjusted LCV	Tanger/Laband 1970-2008 Unadjusted LCV
Intercept				16.3895	-8.0794
				(7.3524)	(5.0951)
Real per capita income					
Unemployment (%)					
Inflation (%)				0.0448	0.7567
				(0.3329)	(0.3097)
% Southern Democrat				-0.3726	-0.8684
				(0.1596)	(0.3307)
ADA Divergence				0.6822	1.1955
				(0.0808)	(0.0827)
New Members				-0.0842	-0.0921
				(0.0745)	(0.0920)
adjusted R2				0.9043	0.7599
Durbin-Watson statistic				1.6404	1.7074
N				39	39

*** (**) Estimated coefficient is statistically significant at the 0.01 (0.05) level.
Notes:
All regressions are estimated using the Newey-West general least squares procedure to correct for serial correlation. “rho” is not reported in the computation of these models. Standard errors are reported in parentheses.

The following models are variations on the senate models I ran including both adjusted and unadjusted LCV scores and both AR (1) and Newey-West estimators.
FGLS Regression Estimation Results for Party Divergence in Average Environmental Scorecard Ratings – U.S. Senate

	Shipan/Lowry 1970-1999 Adjusted LCV	Shipan/Lowry 1970-2008 Adjusted LCV	Tanger/Laband 1970-1999 Adjusted LCV	Tanger/Laband 1970-2008 Adjusted LCV	Tanger/Laband 1970-2008 Unadjusted LCV
Intercept				16.2665	52.4330*
				(21.6996)	(29.1940)
Real per capita income				0.3901	-0.3762
				(0.7102)	(1.0079)
Unemployment (%)				1.8832*	0.1957
				(1.1633)	(1.6242)
Inflation (%)				-1.3903**	-1.6930*
				(0.6275)	(0.9034)
% Southern Democrat				-1.1511**	-1.9040***
				(0.4788)	(0.6511)
ADA Divergence				0.4084	0.7729*
				(0.2790)	(0.4105)
New Members				0.5882*	0.5914)
in previous election				(0.3626)	(0.5304)
Rho				0.3645**	0.2285
				(0.1511)	(0.1579)
adjusted R2				0.7933	0.7750
Durbin-Watson statistic				1.9210	1.9877
N				39	39

*** (**) Estimated coefficient is statistically significant at the 0.01 (0.05) level.

FGLS Regression Estimation Results for Party Divergence in Average Environmental Scorecard Ratings – U.S. Senate

	Shipan/Lowry 1970-1999 Adjusted LCV	Shipan/Lowry 1970-2008 Adjusted LCV	Tanger/Laband 1970-1999 Adjusted LCV	Tanger/Laband 1970-2008 Adjusted LCV	Tanger/Laband 1970-2008 Unadjusted LCV
Intercept				17.2598 (24.8107)	
Real per capita income				0.6413 (0.7668)	
Unemployment (%)				1.3845 (1.3067)	
Inflation (%)				-1.2320 (0.6674)	
% Southern Democrat				-0.8320 (0.8320)	
ADA Divergence				0.2264 (0.2976)	
New Members in previous election				0.5596 (0.3718)	
fullD				-5.4948 (4.4122)	
fullR				-0.1560 (3.7378)	
Rho				0.5090 (0.1396)	
adjusted R2				0.8289	
Durbin-Watson statistic				1.9217	
N				39	

*** (**) Estimated coefficient is statistically significant at the 0.01 (0.05) level.

FGLS Regression Estimation Results for Party Divergence in Average Environmental Scorecard Ratings – U.S. Senate
Lag 1

	Shipan/Lowry 1970-1999 Adjusted LCV	Shipan/Lowry 1970-2008 Adjusted LCV	Tanger/Laband 1970-1999 Adjusted LCV	Tanger/Laband 1970-2008 Adjusted LCV	Tanger/Laband 1970-2008 Unadjusted LCV
Intercept				30.0329 (20.7419)	
Real per capita income $_{t-1}$				0.1422 (0.6585)	
Unemployment (%) $_{t-1}$				0.2384 (0.7821)	
Inflation (%) $_{t-1}$				-0.3830 (0.5903)	
% Southern Democrat $_{t-1}$				-0.8320 (0.8320)	
ADA Divergence $_{t-1}$				0.3781 (0.3302)	
New Members in previous election $_{t-1}$				0.2713 (0.3783)	
FullD $_{t-1}$				-8.9886 (4.7796)	
FullR $_{t-1}$				-1.2361 (4.0683)	
Rho				0.5615 (0.1342)	
adjusted R2				0.7365	
Durbin-Watson statistic				1.8283	
N				39	

*** (**) Estimated coefficient is statistically significant at the 0.01 (0.05) level.

FGLS Regression Estimation Results for Party Divergence in Average Environmental Scorecard Ratings – U.S. Senate
Lag 2

	Shipan/Lowry 1970-1999 Adjusted LCV	Shipan/Lowry 1970-2008 Adjusted LCV	Tanger/Laband 1970-1999 Adjusted LCV	Tanger/Laband 1970-2008 Adjusted LCV	Tanger/Laband 1970-2008 Unadjusted LCV
Intercept				24.3221 (20.0536)	
Real per capita income $_{t-2}$				0.3059 (0.5925)	
Unemployment (%) $_{t-2}$				- 0.6266 (0.7138)	
Inflation (%) $_{t-2}$				0.3191 (0.5808)	
% Southern Democrat $_{t-2}$				-0.6785 (0.5935)	
ADA Divergence $_{t-2}$				0.4079 (0.2800)	
New Members in previous election $_{t-2}$				0.2246 (0.3561)	
FullD $_{t-2}$				-7.2077 (4.7254)	
FullR $_{t-2}$				0.0047 (4.0184)	
Rho				0.5179 (0.1388)	
adjusted R2				0.7365	
Durbin-Watson statistic				1.8025	
N				39	

*** (**) Estimated coefficient is statistically significant at the 0.01 (0.05) level.

FGLS Regression Estimation Results for Party Divergence in Average Environmental Scorecard Ratings – U.S. Senate
Lag 3

	Shipan/Lowry 1970-1999 Adjusted LCV	Shipan/Lowry 1970-2008 Adjusted LCV	Tanger/Laband 1970-1999 Adjusted LCV	Tanger/Laband 1970-2008 Adjusted LCV	Tanger/Laband 1970-2008 Unadjusted LCV
Intercept				20.6901 (20.2205)	
Real per capita income $_{t-3}$				0.7961 (0.5538)	
Unemployment (%) $_{t-3}$				-1.3083 (0.6708)	
Inflation (%) $_{t-3}$				0.5010 (0.5464)	
% Southern Democrat $_{t-3}$				-0.5538 (0.5662)	
ADA Divergence $_{t-3}$				0.2569 (0.2831)	
New Members in previous election $_{t-3}$				0.1918 (0.3444)	
FullD t-3				-8.6294 (4.3998)	
FullR t-3				0.0047 (4.0184)	
Rho				0.5431 (0.1362)	
adjusted R2				0.8213	
Durbin-Watson statistic				1.9377	
N				39	

*** (**) Estimated coefficient is statistically significant at the 0.01 (0.05) level

Newey-West Regression Estimation Results for Party Divergence in Average Environmental Scorecard Ratings – U.S. House of Representatives
No lag

	Shipan/Lowry 1970-1999 Adjusted LCV	Shipan/Lowry 1970-2008 Adjusted LCV	Tanger/Laband 1970-1999 Adjusted LCV	Tanger/Laband 1970-2008 Adjusted LCV	Tanger/Laband 1970-2008 Unadjusted LCV
Intercept				24.7166	
				(14.5574)	
Real per capita income				-0.1175	
				(0.5890)	
Unemployment (%)				1.5956	
				(0.8128)	
Inflation (%)				-0.7814	
				(0.5484)	
% Southern Democrat				-1.2288	
				(0.4049)	
ADA Divergence				0.6595	
				(0.2708)	
Net Senate Democrats gain				0.0153	
				(0.0747)	
adjusted R2				0.7753	
Durbin-Watson statistic				1.38	
N				39	

*** (**) Estimated coefficient is statistically significant at the 0.01 (0.05) level.

Notes:
All regressions are estimated using the Newey-West general least squares procedure to correct for serial correlation. “rho” is not reported in the computation of these models.
Standard errors are reported in parentheses.

Newey-West Regression Estimation Results for Party Divergence in Average Environmental Scorecard Ratings – U.S. Senate
No lag

	Shipan/Lowry 1970-1999 Adjusted LCV	Shipan/Lowry 1970-2008 Adjusted LCV	Tanger/Laband 1970-1999 Adjusted LCV	Tanger/Laband 1970-2008 Adjusted LCV	Tanger/Laband 1970-2008 Unadjusted LCV
Intercept				28.2916	
				(14.7765)	
Real per capita income					
Unemployment (%)					
Inflation (%)				-0.7326	
				(0.5612)	
% Southern Democrat				-0.9658	
				(0.4139)	
ADA Divergence				0.6080	
				(0.1554)	
Net House Democrats gain					
adjusted R2				0.7708	
Durbin-Watson statistic				1.2639	
N				39	

*** (**) Estimated coefficient is statistically significant at the 0.01 (0.05) level.
Notes:

All regressions are estimated using the Newey-West general least squares procedure to correct for serial correlation. “rho” is not reported in the computation of these models. Standard errors are reported in parentheses.

Newey-West Regression Estimation Results for Party Divergence in Average Environmental Scorecard Ratings – U.S. Senate
No lag

	Shipan/Lowry 1970-1999 Adjusted LCV	Shipan/Lowry 1970-2008 Adjusted LCV	Tanger/Laband 1970-1999 Adjusted LCV	Tanger/Laband 1970-2008 Adjusted LCV	Tanger/Laband 1970-2008 Unadjusted LCV
Intercept				24.7166 (14.5574)	
Real per capita income				-0.1175 (0.5890)	
Unemployment (%)				1.5956 (0.8128)	
Inflation (%)				-0.7814 (0.5484)	
% Southern Democrat				-1.2288 (0.4049)	
ADA Divergence				0.6595 (0.2708)	
Net Senate Democrats gain				0.0153 (0.0747)	
adjusted R2				0.7753	
Durbin-Watson statistic				1.38	
N				39	

*** (**) Estimated coefficient is statistically significant at the 0.01 (0.05) level.
Notes:
All regressions are estimated using the Newey-West general least squares procedure to correct for serial correlation. “rho” is not reported in the computation of these models. Standard errors are reported in parentheses.