LSQ
LEGISLATIVE STUDIES QUARTERLY
Published by the Department of Political Science at Washington University in St. Louis

MICHAEL PERESS
YANGZI ZHAO
Stony Brook University

How Many Seats in Congress Is Control of Redistricting Worth?

How large a benefit is partisan control of the redistricting process? Do legal constraints on redistricting—such as the preclearance requirement of the Voting Rights Act—alter this benefit? Are institutions designed to reduce the benefit to partisan control—such as redistricting commissions—effective? To measure the effects of partisan districting on the electoral fortunes of the parties, we collect data on the partisan composition of state government, House election outcomes, and moderating institutions over an 80-year period. Our results suggest that over time, both parties have benefited from unified control, with the effects largest in states where voters were evenly divided among the parties and smallest in states where the controlling party had a large advantage in the electorate. The effects have changed over time, with both parties having equally benefited from control during the middle of the 20th century, the benefit largely disappearing in the late part of the century, and the Republican Party seeing a moderate advantage from control in the current century. The benefits of partisan control were not diminished in states with redistricting commissions. The preclearance requirement appears to have hurt the Democratic Party except when its vote share was very low. The aggregate effects of partisan redistricting are moderate in magnitude—in the modern period, this effect has typically been less than 10 House seats, with the last election where control of the House would have flipped in expectation occurring in 1954.

Introduction

The Democratic Party was expected to perform poorly in the 2010 election—the president's party typically loses seats in midterm elections, and President Obama's signature achievement was unpopular with the public. In the aftermath of the election, the Republican Party had taken majority control of the House and gained control of 19 state legislative chambers and six governorships, giving the Republican Party complete control in 25 states

DOI: 10.1111/lsq.12268
© 2019 Washington University in St. Louis

(compared to the Democratic Party's 16 states). Democratic politicians and activists feared that the backlash against their party would be felt not just in the midterm, but for the next decade, due to the imminent redistricting. This example illustrates that reactions to one political actor (President Obama) can potentially spill over and affect the electoral fortunes of other political actors in the next election, and even farther in the future. To be sure, it is not the only such mechanism. Presidential coattail theory suggests that a candidate's personal vote may benefit down-ballot candidates (Meredith 2013; Miller 1955). The incumbency advantage means that winning a race in one year will increase a party's chances of winning that race in future years. However, the path from presidential unpopularity to a loss of state control to House losses over the next 10 years postulates a particularly large and long-lasting effect (Kraushaar 2010).

In this article, we seek to quantify the benefits to state control. How large a benefit is partisan control of redistricting? Does partisan control asymmetrically benefit the Republican Party, as Democrat activists have often argued? Has the benefit of control changed over time? Are the benefits to control moderated by institutions, such as the preclearance requirement of the Voting Rights Act and independent and partisan commissions? And how large are the net effects aggregated over the entire country?

To measure the effects of partisan districting on the electoral fortunes of the parties, we collect data on the partisan composition of state government, House election outcomes, and moderating institutions over an 80-year period. Our results suggest that over time, both parties have benefited from unified control, with the effects largest in states where voters were evenly divided among the parties and smallest in states where the controlling party had a large advantage in the electorate. The effects have changed over time, with both parties having equally benefited from control during the middle of the 20th century, the benefit largely disappearing in the late part of the century, and the Republican Party seeing a moderate advantage from control in the current century. One institution designed to lessen the impact of partisan control appears to be ineffective—the benefits of partisan control are not diminished in states with redistricting commissions (which are purportedly designed to take control away from partisan actors). Another institution—the preclearance requirement of the Voting Rights Act—appears to have hurt the Democratic Party under unified control, while under split and unified Republican control,

the preclearance requirement has meant that there is almost no responsiveness to vote share (which consequently has helped the Democratic Party in states where it had few voters and hurt them in states where they had many voters).

The aggregate effects of partisan redistricting are, however, moderate in magnitude. One estimate that we calculate suggests that though the bonus of seats that unified control produces in a state has varied dramatically over time, the net benefit of partisan redistricting across the entire country has typically been less than 10 seats. The last election where control of the House appears to have flipped (in expectation) due to partisan districting occurred in 1954, at a time when the benefit to unified control was much larger than it is today.

Related Work

Over the past six decades, pundits and scholars have noted the declining competition of congressional elections and have often attributed this decline to partisan gerrymandering (Abramowitz, Alexander, and Gunning 2006). Typically, partisan gerrymandering involves the party controlling state government packing supporters of the opposition party into a small number of districts or making each district's demographic composition mirror the statewide composition (Cain 1985). Conventionally, scholars have used the swing ratio as the dependent variable when studying partisan bias in the redistricting process. The swing ratio measures the gain in seat share resulting from a 1 percentage point gain in vote share. Earlier work demonstrated that the swing ratio was typically greater than one (Tufte 1973) and that the swing ratio was generally greater immediately following a redistricting (Gelman and King 1994a). Abramowitz (1983) found that following the 1980 redistricting, the swing ratio was greater in states where the Democratic Party controlled the process, leading to the Democratic Party gaining more seats.

Following Campagna and Grofman's (1990) critique of the use of the swing ratio to diagnose partisan bias, the more recent work of Engstrom (2006) has focused on separately measuring bias and responsiveness under different redistricting regimes. Using data from 1870 to 1900, Engstrom estimated the vote-seat curve at the state level under unified Democratic control, unified Republican control, and split control. In his framework, each vote-seat curve

was characterized by two parameters—a bias parameter and a responsiveness parameter. The bias parameter measured the bonus of seats over 50% that a party would be expected to obtain when its vote share was 50%. He found that relative to split control, the Democratic Party gained 6% of the seats and the Republican Party gained 8% of the seats when they controlled the districting process. He also found that the payoff from partisan control was highest when the two parties were highly polarized and when voters were equally divided among the major parties. Engstrom (2013) expanded the scope of this analysis and presented results on partisan bias from 1789 to 1960, finding that partisan bias continued to be present. Using data from 1946 to 1970, Cox and Katz (2002) found evidence of decreasing pro-Republican bias in nonsouthern states, which they attributed to the increasing involvement of the courts due to the *Baker v. Carr* and *Wesberry v. Sanders* decisions. Using data from 2002 to 2012, McGann et al. (2016) found that pro-Republican bias increased in the 2012 election (relative to the previous decade), which they attributed to the *Vieth v. Jubilerer* decision.[1]

The work of Jowei Chen (Chen and Cottrell 2016; Chen and Rodden 2013) focused on—characterizing the distribution of outcomes under a redistricting process that was blind to partisanship. This work considered randomly drawn districts that were of equal population, contiguous, and relatively compact. The approach characterized expected partisan outcomes using the partisanship of the district, measured using past presidential election results. While Chen and Rodden (2013) focused on Florida, Chen and Cottrell (2016) compared districts drawn following the 2010 census across the entire United States to simulated districts. Their results suggested that while both parties benefited from controlling the districting process (the expected seats under the enacted plan was greater than the expected seats under the simulated plans), the overall expected seat share of each party across the country mirrored what would be expected under random compact districts. In related work, Goedert (2014) has argued that while both parties have benefited from controlling the districting process, recent bipartisan maps have exhibited a pro-Republican bias.

A related literature has focused specifically on the effect of the Voting Right Acts on the districting process. Cameron, Epstein, and O'Halloran (1996) studied whether majority-minority districts maximized the substantive representation of black voters. Their approach calculated the optimal gerrymander and considered whether the optimal gerrymander generated majority-minority districts.

They found that (barely) majority-minority districts were optimal in southern states, provided that there were enough minority voters to make up such a district. Majority-minority districts were not optimal outside the South. Shotts (2001) developed a model of optimal partisan gerrymandering where the mandate for a majority-minority district was a constraint on the process. He found that the imposition of such a mandate led to more Democrats elected in Republican-controlled states and led to fewer Democrats elected in Democratic-controlled states.

Our work differs from much of the existing literature in that we focus squarely on characterizing the bias induced by partisan control of redistricting. Our methodology is most closely related to Engstrom (2006, 2013), but we focus on the modern time period and answer a different set of questions. Our work covers a time period where districts of unequal population were increasingly prevalent,[2] the period of time when the judicial constraints on redistricting were increasingly imposed, and the most recent time period—where it is argued that the political parties have been increasingly bold in violating norms of the redistricting process. Like Engstrom's work, we also seek to measure how large the effects of bias are when aggregated to the entire country. Our work is complementary to Chen and Rodden (2013) and Chen and Cottrell (2016) by using a different benchmark for a process divorced from partisan influence—specifically, while Chen and his coauthors' work compared partisan control to a blind redistricting process, our work compares partisan control to a process where both parties are able to veto outcomes. By providing empirical estimates of the vote-seat curve for states subject to the preclearance requirement of the Voting Rights Act (which arguably mandates racial gerrymandering), our work is complementary to the work of Cameron, Epstein, and O'Halloran (1996) and Shotts (2001), who develop theoretical predictions for racial gerrymandering under unified control. Finally, we study the partisan impact of redistricting commissions, which appears not to have been considered in the academic literature.

Theory

Constraints on Districting

Control of the districting process may proceed under unified Democratic control, unified Republican control, or split control.

The requirements for unified control differ from state to state, but the most typical case requires a party to hold a majority in both state legislative chambers and hold the governorship or hold both chambers of the state legislature with sufficient majorities to override a gubernatorial veto of the districting plan. We assume that Democratic politicians prefer to have their states represented by as many Democratic congressmen as possible, and Republican politicians prefer to have their states represented by as many Republican congressmen as possible. Under any of the three configurations of state control of districting, the relevant political actors operate under a variety of constraints. These constraints come from the legal structure and norms. These norms may be operative because the relevant actors themselves prefer not to violate these norms, because they fear electoral punishment for violating these norms, or because they anticipate worse outcomes under judicial intervention in the event that they violate these norms.

Here, we consider constraints that the political actors face. The districts crafted must be (nearly) equal in population. Since the *Baker v. Carr* Supreme Court decision in 1962, which established that redistricting was justiciable, congressional districts must be nearly equal in population within each state. Prior to this decision being enforced, congressional districts were not always equal in population, typically due to refusal of a state to redistrict following a decennial census. One example comes from the 1963 Supreme Court case *Wesberry v. Sanders*, where the plaintiffs challenged a Georgia district that was more than twice as large as some other congressional districts in the state.

Congressional districts are typically contiguous—such a provision exists in many state constitutions, and this principle tends to be followed in other states with a few exceptions. Congressional districts are often expected to be compact, respect certain political boundaries, and respect certain communities of interest. Though each of these are mandated by law in some states, these geographic constraints are difficult to precisely define.

Districts are required to be racially fair. The Voting Rights Act of 1965 prohibits states from using redistricting to dilute the power of minority votes. In addition, Section 5 of the Voting Right Act singles out certain states and counties for preclearance, whereby these states must submit redistricting plans to a federal court or the Department of Justice for review before the plans are implemented. The preclearance requirement was in effect in the most recent redistricting cycle, but due to a Supreme Court case,

future redistricting will not be subject to this more stringent form of judicial review. Partisan fairness could be viewed as an additional constraint. Extreme partisan gerrymanders could attract judicial scrutiny. A recent case required Pennsylvania to abandon a districting plan due to a provision in the Pennsylvania state constitution, but a recent Supreme Court case (*Gill v. Whitford*, 2018) perhaps lessened the threat of judical intervention based on violations of federal law.

A final constraint on the districting process is uncertainty. A party may draw seemingly favorable districts based on previous election results, but a party's reputation may change over time. Districts that were optimal under one set of expectations may lead to poor performance under a large partisan swing. It is worth noting that only two of these constraints—the equal population constraint and the racial fairness constraint—have a legal basis at the federal level. The remaining constraints operate only to the extent that the relevant political actors choose to follow them or (in a few cases) state law mandates them.

The Vote-Seat Curve at the State Level

Consider a redistricting process operating under split control. Approving the districting plan will require the approval of political actors from both political parties. Under our assumption that each party wants to maximize the number of congressional seats their party will hold, redistricting involves a bargaining process between the two parties. This bargaining process occurs under a set of constraints. In a state with five congressional districts where 79% of the voters are Republican, no districting plan will allow the Democratic Party to obtain all five of the congressional seats. At most, the Democratic Party could hold two seats, but this is very unlikely to be the outcome of the bargaining process. It is unlikely that this would be viewed as a fair compromise, and constructing such a plan would likely involve bizarrely shaped districts. Instead, we expect that under split control, the more votes a party has, the more seats that party will gain (on average) as a result of the districting plan. The particular relationship—the vote-seat curve—while monotonic, need not entail a one-to-one relationship. It is quite likely that in our example state, the Republican Party would win all five seats under most compact districting plans. The vote-seat curve may also fail to intersect the point (0.5,0.5), indicating

that a party that receives 50% of the votes may not receive 50% of the seats. Such an asymmetry could result from the asymmetric ways voters are geographically clustered (Chen and Rodden 2013).

Consider a state with unified control. Absent any constraints other than equal population, the party controlling the legislature could win all the seats with slightly more than half of the congressional votes. Such an outcome is unlikely given the constraints placed upon the redistricting process. Achieving such an outcome would require ensuring that the party has a slight majority in every district. Given the distribution of Democratic and Republican voters around the state, doing so will in all likelihood require violating the constraints of compactness, political boundaries, communities of interest, racial fairness, or even contiguity. What we can say is that a party with unified control should be able to do better than it could do under split control, for all possible values of its vote share. A party with unified control can choose a districting plan that pushes against these constraints up until the point where it is likely to face judicial intervention or severe public backlash. Under unified Democratic and unified Republican control, we will have monotonic vote-seat curves at the state level, but these will be offset from the split control vote-seat curve.

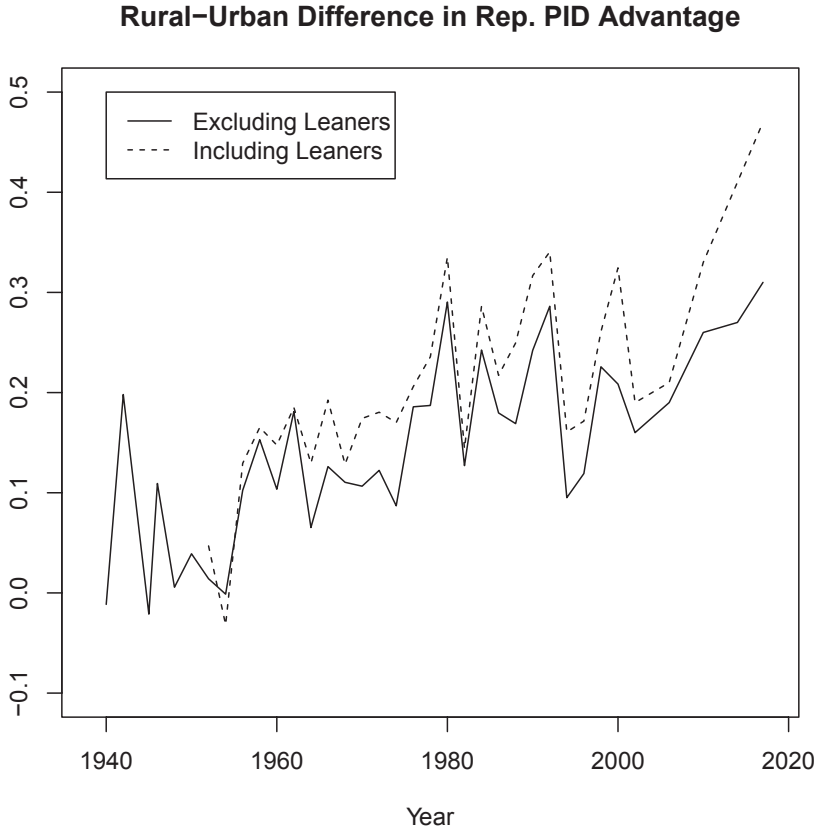
Moderators of the Vote-Seat Curve

The theory lays out a number of interesting avenues for empirical investigation. According to the theoretical framework we laid out, holding constant the configuration of votes for the two parties, states with Democratic control should see a higher share of seats going to the Democratic Party than those with split control, and those with split control should see a higher share of Democratic seats than those with Republican control. The exact magnitude of these effects, however, is not determined by the theory and must be measured empirically. In addition, our theory suggests that as the constraints vary, we should observe variation in the vote-seat curve at the state-year level. A few of the constraints of the districting process will apply differently across time and context.

Prior to the *Baker v. Carr* (1962) decision, the equal population constraint was not binding. Hence, before the decision, we would expect a larger benefit to unified control for each party. The geographic distribution of the parties has also changed over

time. The rural-urban difference in net Republican Party identification is depicted in Figure 1. Though there are considerable year-to-year fluctuations in the early part of the series, prior to 1980, the Republican Party had a small rural relative advantage in party identification. Since 1980, this advantage has grown considerably, where in 2017, the Republican Party does 47 percentage points

FIGURE 1
Geographic Differences in Party Identification Over Time



Note. The figure plots the relative advantage of the Republican Party in rural vs. urban localities, excluding leaners (the solid line) and including leaners (the dashed line). For example, in 2014, in rural localities, 39% identified or leaned as Democrats and 52% identified or leaned as Republicans. In urban localities, 60% identified or leaned as Democrats and 32% identified or leaned as Republican. This leads to a net rural advantage of 13% and a net urban disadvantage of 28% for the Republican Party. Subtracting these, the rural-urban net difference is 41%. Data are from Gallup (1938–50), The American National Election Study (1952–2000), and Pew (2002–17).

better in rural areas (including leaners). The rural configuration of Republican voters may serve as an advantage to the Republican Party in carving out districts that benefit it while remaining compact, respecting political boundaries, and respecting communities of interest. This, in turn, could lead to an increasing advantage for Republicans under unified Republican control, a decreasing advantage for Democrats under unified control, and pro-Republican bias under split control.

As mentioned earlier, certain states have been subject to preclearance in certain years.[3] This process may exert an additional pressure towards racial fairness. This may operate differently in a Democratically controlled state, a Republican-controlled state, and a state with split control. The prohibition of diluting minority votes may moderate the partisan effects of the districting process in two ways. First, the preclearance requirement has encouraged the creation of majority black and majority Hispanic districts. Since both these groups vote largely Democratic, majority-minority districts often have the effect of *packing* Democratic voters. In addition, constructing majority-minority districts has often involved creating districts that are bizarrely shaped and violate the other geographic constraints on districting. This, in turn, may free up political parties to create other bizarrely shaped districts under unified control, leading to increased partisan advantage. The predictions for the effect of preclearance depend on the vote share of each party as well as the regime. Under split control, we might expect preclearance to harm the Democratic Party since the main effect would be to pack Democratic voters. In Republican-controlled states, we would generally expect preclearance to harm the Democratic Party except in states where the Republican Party is strong enough to win most of the congressional seats. In Democratic-controlled states, the two effects work in opposing directions—a majority-minority district may pack Democratic voters, but this may lead to legally required bizarrely shaped districts, which may allow the Democratic Party to propose other bizarrely shaped districts with less fear of judicial scrutiny.

The reasoning we considered above may apply differently to a handful of states where redistricting commissions have been implemented. As of the 2018 election, seven states have used redistricting commissions to draw congressional district boundaries—Arizona, California, Hawaii, Idaho, Montana, New Jersey, and Washington. Redistricting commissions are intended to insulate the redistricting process from partisan considerations. In

many ways, redistricting commissions could be viewed as attempts to institute permanent split-party control on the redistricting process. We previously posited that there were two types of actors—Democrats and Republicans. Most redistricting commission states give some role to the Democratic and Republican parties in selecting members of the commission. For example, in New Jersey, 12 of the 13 members are selected by the Democratic and Republican parties (equally split between the two). In Arizona, four of the five members are Democrats or Republicans (equally split between the parties). To analyze redistricting commissions, we posit the existence of a third type of actor—the nonpartisan. The nonpartisan, instead of being motivated to maximize the number of congressional seats one party holds, is concerned with upholding the various constraints on redistricting (e.g., compactness, preserving communities of interest), as well as, potentially, partisan fairness. Most redistricting commissions posit the existence of such an actor. For example, in New Jersey, the 12 partisan members select the 13th member (or if they don't agree, the 13th member is selected by the state supreme court). In Arizona, one member is required to be an independent.

While redistricting commissions may strive to create something akin to permanent split-party control, they may fail to achieve this because the mythical nonpartisan may not exist, or the process may not be successful in selecting individuals motivated by partisan fairness rather than helping one of the two parties. In New Jersey, the 12 partisan members may fail to agree on a 13th member, leading the state supreme court to select a nonpartisan who is not actually a nonpartisan. In Arizona, the independent may be registered with neither party, but nonetheless motivated to help one of the two parties. The redistricting commissions may be captured by the party that controls the state in various ways. We have a simple way to test whether redistricting commissions achieve what they are designed to achieve—if redistricting commissions lead to fair partisan outcomes. One way to judge fairness is whether the vote-seat curve for redistricting commissions assigns 50% of the seats when a party wins 50% of the votes. Alternatively, a "fair" outcome may involve the vote-seat curve being offset in favor of one the parties due to political geography. In this case, the vote-seat curve for split control may be helpful in inferring which party likely benefits from political geography. Furthermore, if redistricting commissions are successfully insulated from political considerations, when the vote-seat curve for redistricting

commissions is split up according to the three partisan control regimes, we should see no differences between the curves. Observing otherwise suggests that the parties controlling the state are able to capture the (supposedly nonpartisan) redistricting process.

Data

Our empirical strategy required us to collect data on the partisan composition of state government, the vote shares of candidates for the US House, and various state institutions relating to districting. Our analysis focuses on elections held between 1942 and 2018. To obtain the number of Democrats and Republicans in each of the 99 state legislative chambers, our primary source was Klarner (2013). Additional data were obtained from Burnham (1992) and the National Conference of State Legislatures. We used these data to construct three variables indicating whether the state was under unified Democratic control, unified Republican control, or split control, under the previous redistricting. In order for a state to be in unified Democratic control, the Democratic Party must control both branches of the state legislature (or the one branch in the case of Nebraska), and, in the event that the governor of the state has the ability to veto a redistricting plan, to either control the governorship or have sufficient supermajorities in the state legislature to override the gubernatorial veto. Though the Nebraska Unicameral is formally nonpartisan, making it difficult to collect data on partisan control for this chamber, we used the partisan composition when it was available and otherwise coded majority control based on the party of the Speaker. Additional data on state institutions necessary to code these variables were obtained from the *Book of States*, Squire and Hamm (2005), the National Conference of State Legislatures, and Ballotpedia.

In most cases, the "previous redistricting" would be the redistricting immediately following the previous census. In some cases, redistricting plans were challenged and redrawn by the state legislature. In those cases where the legislature redrew the entire plan in the middle of the decade, control during the previous redistricting would refer to control when the midcensus districting occurred. In instances where the state legislature made minor revisions to a small number of districts or where the courts redrew the districts rather than require the state legislature to redraw the districts, the control variables were coded based on the postcensus composition of state government.

Data on congressional elections were taken from a data set provided by Gary Jacobson, CQ Voting and Elections, and various web sources. The presence of a redistricting commission during the previous redistricting was coded based on the National Conference of State Legislatures. The states subject to the preclearance requirement of the Voting Right Acts were collected from the text of the law.[4]

Methods

Our main goal is to model the vote-seat curve as a function of some conditioning variables. These include the type of state control, the presence of a redistricting commission, the year, and the presence of the preclearance requirement. Theoretically, we must consider the possibility of nonlinear vote-seat cures—since the vote-seat curve must intersect (0,0) and (1,1), linearity requires the vote-seat curve to involve perfect proportionality, which is clearly too restrictive.

In the literature, parametric approaches have generally been used. One common approach is to apply the inverse logistic transformation to both the vote share and the seat share. This leads to the following model for the mean,

$$E[log(\frac{s}{1-s})|v] = \alpha + \beta log(\frac{v}{1-v}), \tag{1}$$

where v is the vote share and s is the seat share. According to this model, the bias when $v = \frac{1}{2}$ is given by $\frac{e^{\alpha}}{1+e^{\alpha}} - \frac{1}{2}$ and β can be interpreted as reflecting responsiveness. This model is typically estimated using ordinary least squares. This approach goes back to the work of Tufte (1973) and is used by Campagna and Grofman (1990). King and Browning (1987) consider a slight variant of this approach, using the same vote-seat curve for the mean, but altering the way the disturbance term is handled. Instead, they solve Equation (1) for the number of seats and treat the number of seats as a binomial variable. Alternatively, Engstrom (2006) uses a single log approach for the mean,

$$E[s|v] = \alpha + \beta log(\frac{v}{1-v}). \tag{2}$$

Engstrom estimates the model as a grouped logit, where the number of seats is the dependent variable. In his approach, $\Lambda(\alpha)$

can be interpreted as the bias when $v = \frac{1}{2}$, where Λ is the logistic CDF.

All of the specifications above generate vote-seat curves that are monotonically increasing, intersect (0,0) and (1,1), and stay within the unit square. Experimenting with various parametric specifications used in the literature suggested that they did not fit the asymmetries we observed in our data. Moreover, fully interpreting the results using parametric approaches required us to plot the vote-seat curve for various moderators. Since presenting the results required us to produce plots and because we found the patterns in these plots were often driven by constraints imposed by the parametric model rather than the underlying data, we present our main results based on nonparametric smoothing.

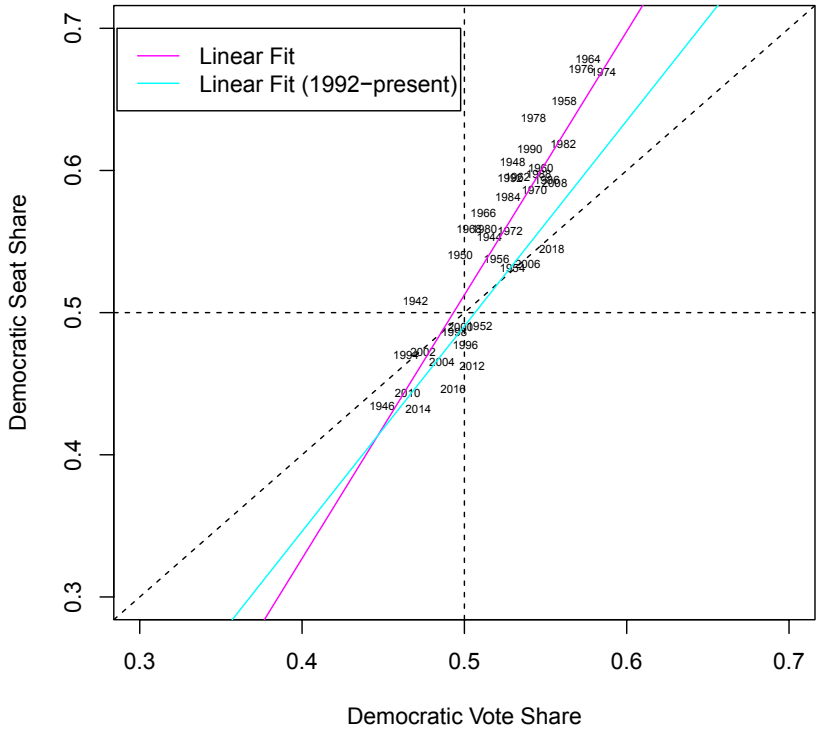
As a robustness check, we also applied two types of parametric models to the same data. We considered Equation (2), but we applied ordinary least squares to estimate the equation. In this case, the α term can be directly interpreted as a measure of bias when $v = \frac{1}{2}$. This approach does necessarily produce vote-seat curves that fall in the unit square, but this is not problematic as we are not interested in the vote-seat curve when v is close to zero or one and extrapolating far away from the data based on a parametric model would be problematic anyway. In addition, we applied Engstrom's (2006) grouped logit approach, which produces vote-seat curves that respect the unit square but requires more work to fully interpret.

Analysis

In Figure 2, we plot the vote-seat curve by year. The result here is similar to results that have been reported in the literature (Tufte 1973). We find evidence of overresponsiveness—the slope of the linear fit is greater than one, indicating that when vote share increases by 1 percentage point, seat share increases by more than 1 percentage point. There appears to be a small amount of pro-Democratic bias—when the Democratic Party has historically won 50% of the votes, it has typically won about 51% of the seats. This trend seems to have changed recently—when we plot the regression line including 1992 to the present, we find a pro-Republican bias of about 1%.

The yearly vote-seat curve reflects districts that are created under a variety of political circumstances. As these decisions are made at the state level, our main analysis considers the vote-seat

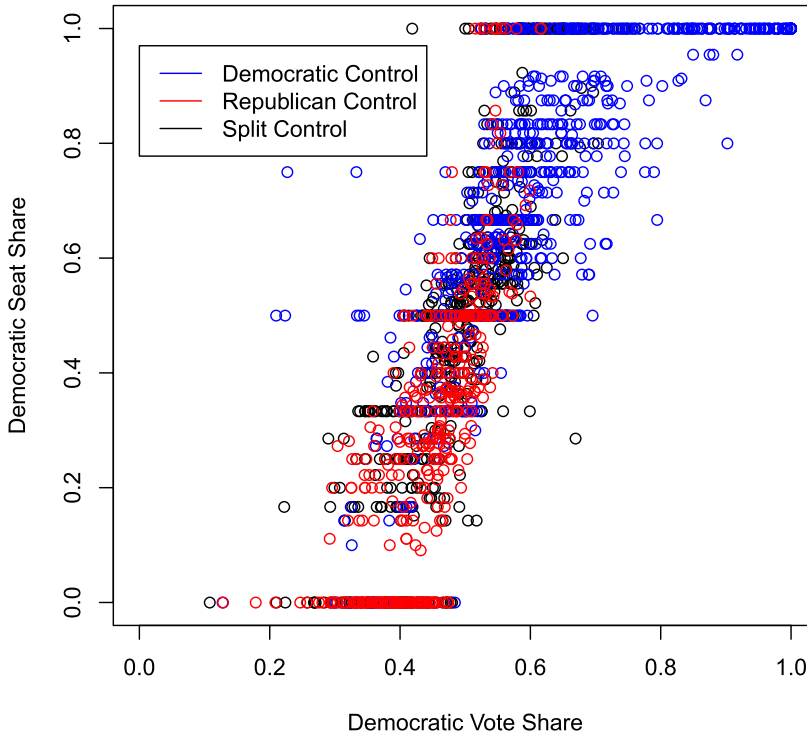
FIGURE 2
Vote-Seat Curve by Year
[Colour figure can be viewed at wileyonlinelibrary.com]



curve at the state level. Figure 3 plots the data we will analyze, with each point denoting a vote share and seat share in a particular election and a particular state. In addition, the figure indicates whether the district was drawn under unified Democratic control, unified Republican control, or split control.

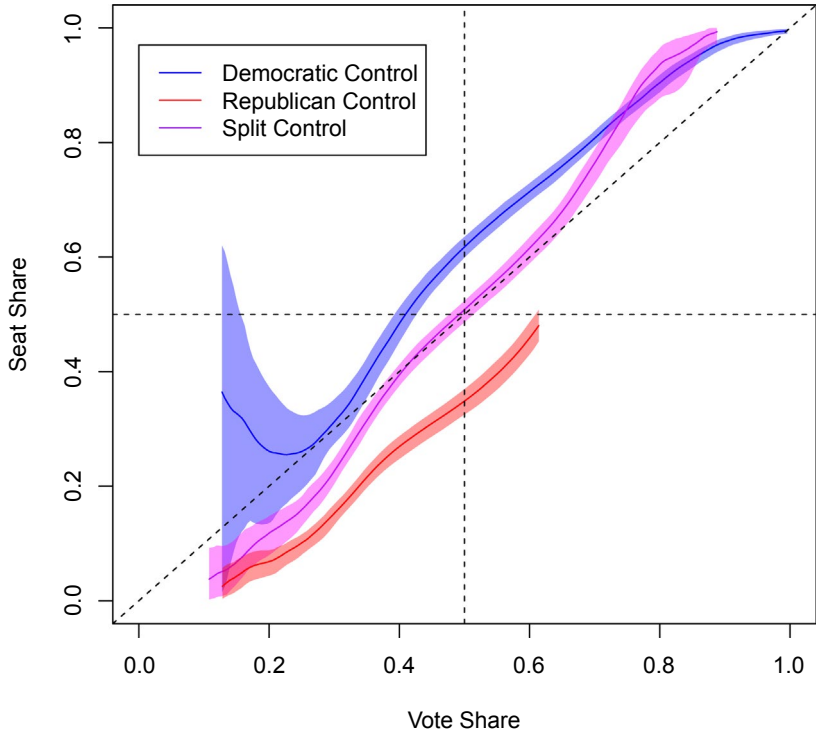
To model these data, we applied locally constant kernel regression to three subsets of the data—units with unified Democratic control, unified Republican control, and split control. These results are reported in Figure 4.[5] We also include 95% confidence bands, estimated using the nonparametric bootstrap. The results indicate that for vote shares ranging between 40% and 60%, control of the districting process is worth about 10% of the seats over split control, with the effect being similar for the Democratic and Republican parties. The three curves appear to move closer together

FIGURE 3
Votes and Seats by State and Year
[Colour figure can be viewed at wileyonlinelibrary.com]



when one party wins a large share of the votes for the House, indicating that control of districting yields the greatest benefit in a state where voters are roughly split between the parties in congressional elections. There are essentially no data for estimating the effect of unified Republican control when Democratic congressional candidates receive more than 65% of the votes, and there are very few data for estimating the effect of unified Democratic control when Republican congressional candidates receive more than 70% of the vote.[6] When the vote share of congressional candidates ranges between 40% and 60%, seat share is very close to vote share in states with split control. The pro-Democratic bias is very small at about 1% and is not statistically distinguishable from zero at the 5% significance level. We observe overresponsiveness when one party receives between 60% and 80% of the vote.

FIGURE 4
Vote-Seat Curve by State and Year
[Colour figure can be viewed at wileyonlinelibrary.com]



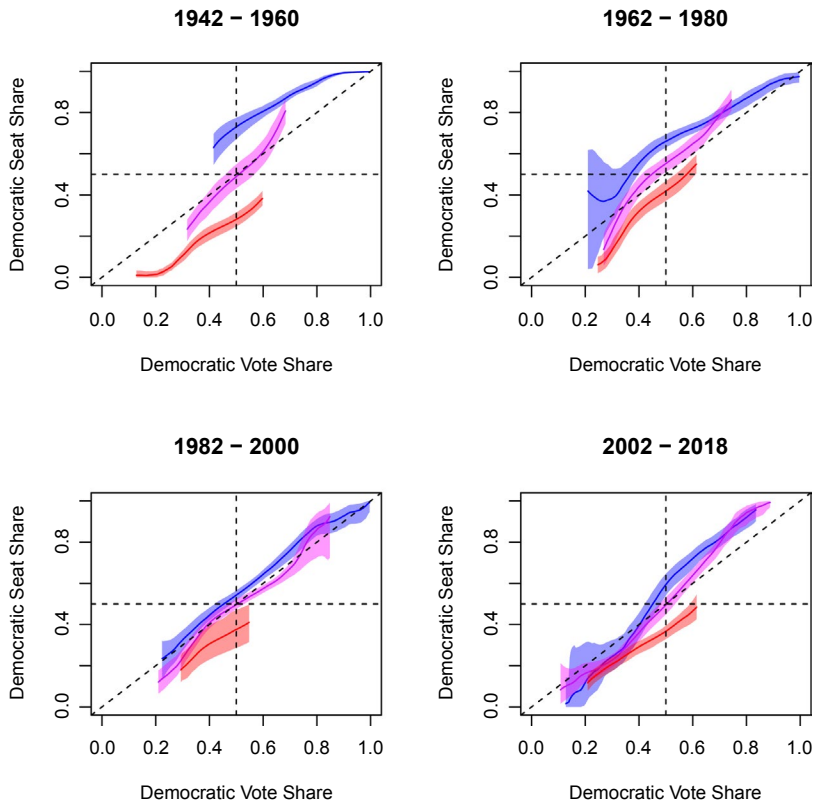
Note. Curves are estimated using locally constant kernel regression. Shaded regions are 95% confidence bands, estimated using the nonparametric bootstrap.

While the above results cover an 80-year period, it is possible (in fact, likely) that there is change over time. Our theory suggests that the benefits of partisan control will vary as the constraints on redistricting vary. We highlighted two important changes. In the earliest part of this 80-year period, the equal population constraint was not as binding, and there was little possibility of judicial intervention in the districting process, leading to a larger benefit from partisan control. The geographic concentration of each party's voters has changed over time—the Republican Party is increasingly concentrated in low-population density areas, making it potentially easier for the Republican Party to draw biased yet compact plans under unified control. We considered a number of

different approaches for dividing the data over time. The precision of our estimates will be roughly proportional to sample size. Our first approach therefore breaks up our 80 years of data into four two-decade periods to achieve approximately equal precision.

In Figure 5, we report the disaggregated results. In the earliest period (1942–60), we observe the largest advantage to unified control, with control of districting worth about 24% to the Democratic Party and 21% to the Republican Party, in states where the congressional parties were near parity. This corresponds to a period of time before the Supreme Court ruled the drawing of congressional districts justiciable and before the Voting Rights Act

FIGURE 5
Vote-Seat Curve by State and Year, Disaggregated by Time Period
[Colour figure can be viewed at wileyonlinelibrary.com]



Note. Curves are estimated using locally constant kernel regression. Shaded regions are 95% confidence bands, estimated using the nonparametric bootstrap.

placed federal constraints on the districting process beyond the cryptic minimal references to redistricting in the US Constitution. During this earlier period, we observe little bias in states with split control.

In the next 20-year period (1962–80), the benefit of state control appears to have diminished considerably. In addition, there appears to be pro-Democratic bias under split control. In the next 20-year period (1982–2000), the benefit of unified control shrinks further (particularly for the Democratic Party, though the vote-seat curve for the Republican Party is imprecisely estimated). In the final period (2002–18), we observe a fairly large benefit to Republican control and a somewhat smaller benefit of Democratic control. The results are consistent with two factors we hypothesized would be at work—in the earliest time period, we observed a larger benefit to partisan control, potentially due to fewer judicial constraints. More recently, we observed patterns consistent with an increased benefit of Republican control due to the increasing concentration of Republican voters in low-population density areas.

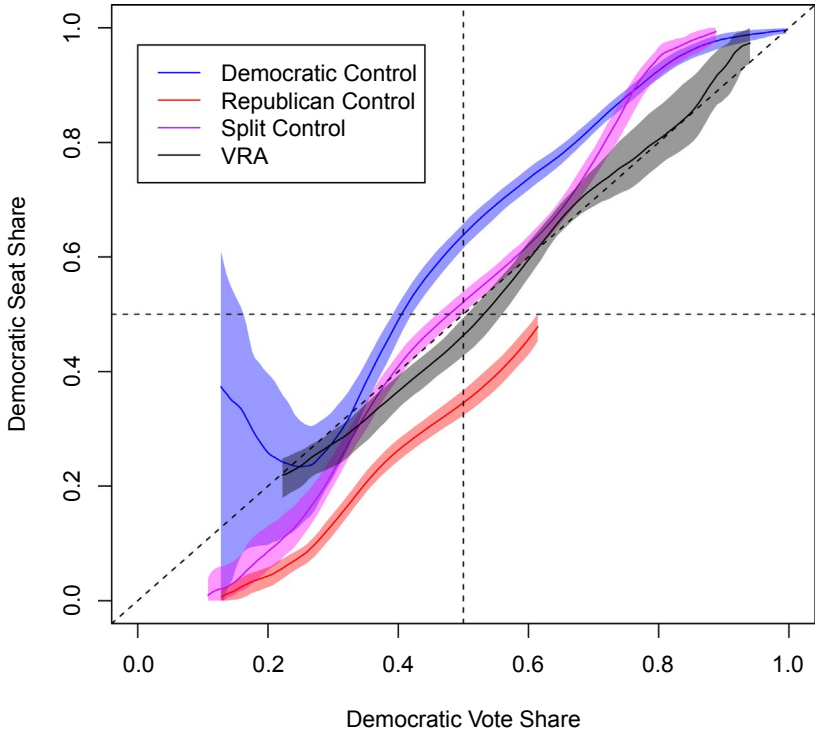
One could argue for alternative ways to divide the data. One alternative approach would be to split the data based on the *Baker v. Carr* decision. A second alternative approach would be to divide the data into decades. In the online supporting information, we report results for districts created before and after the 1970 census, which represents the first census following the *Baker v. Carr* decision (Figure A.5). We also report the results for eight 10-year periods corresponding with elections held after decennial censuses (Figure A.6). In the first of these figures, we continue to find that the Democratic Party's advantage diminished after the *Baker v. Carr* decision, but this result obscures the change in the Republican Party's advantage that occurred in the post-1972 period. In the later figure, we continue to observe the same general patterns, with the advantage of control being largest in the earlier period, the advantage of control diminishing in the later part of the 20th century, and the Republican Party's advantage rebounding since them. Though using smaller aggregations means there is more uncertainty in the estimates, these results suggest that the Democratic Party's benefit from control has also begun to rebound in the most recent elections.

The results of the 10-year disaggregations in particular highlight some differences between our findings and Cox and Katz's (2002) findings. While we don't dispute that the courts played a

major role in the changing patterns of bias observed in the early 1970s, pro-Republican bias began to decrease in the 1950s, well before *Baker v. Carr* could have had an affect. Our results, therefore, leave more room for geographic explanations of changing bias (Chen and Rodden 2013; Goedert 2014).

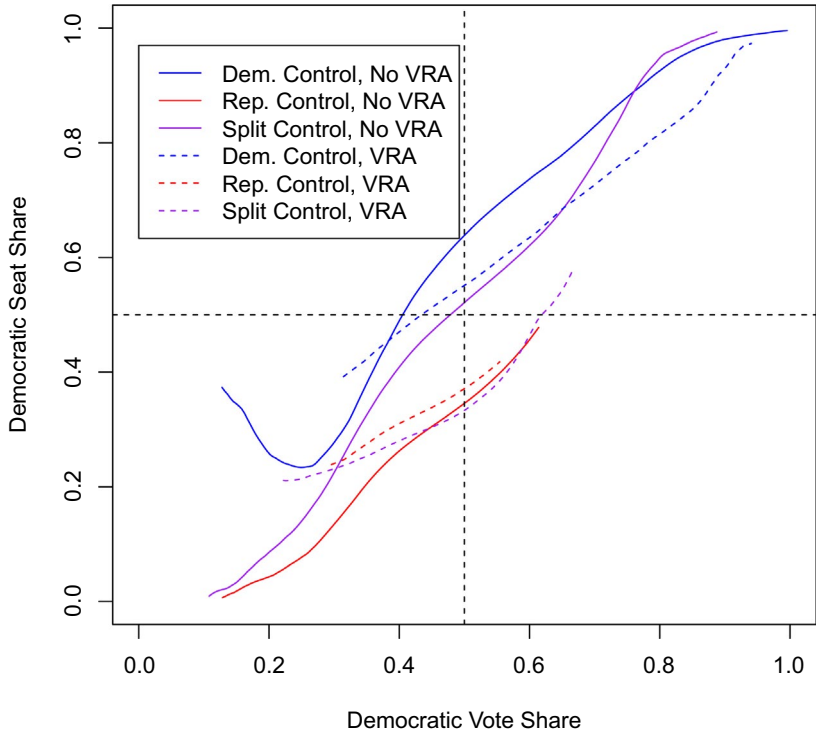
Figures 6 and 7 consider a second moderator that may affect the vote-seat curve—whether the unit was subject to the preclearance requirement of the Voting Rights Act. Figure 6 pools all preclearance states. The Democratic Party tends to do far worse in preclearance states than in those with split control except when Democratic vote share is below 35%. The fact that the Democratic Party does worse may be due to the fact that preclearance states

FIGURE 6
The Vote-Seat Curve and Preclearance
[Colour figure can be viewed at wileyonlinelibrary.com]



Note. Curves are estimated using locally constant kernel regression. Shaded regions are 95% confidence bands, estimated using the nonparametric bootstrap.

FIGURE 7
The Vote-Seat Curve and Preclearance, Disaggregated
[Colour figure can be viewed at wileyonlinelibrary.com]

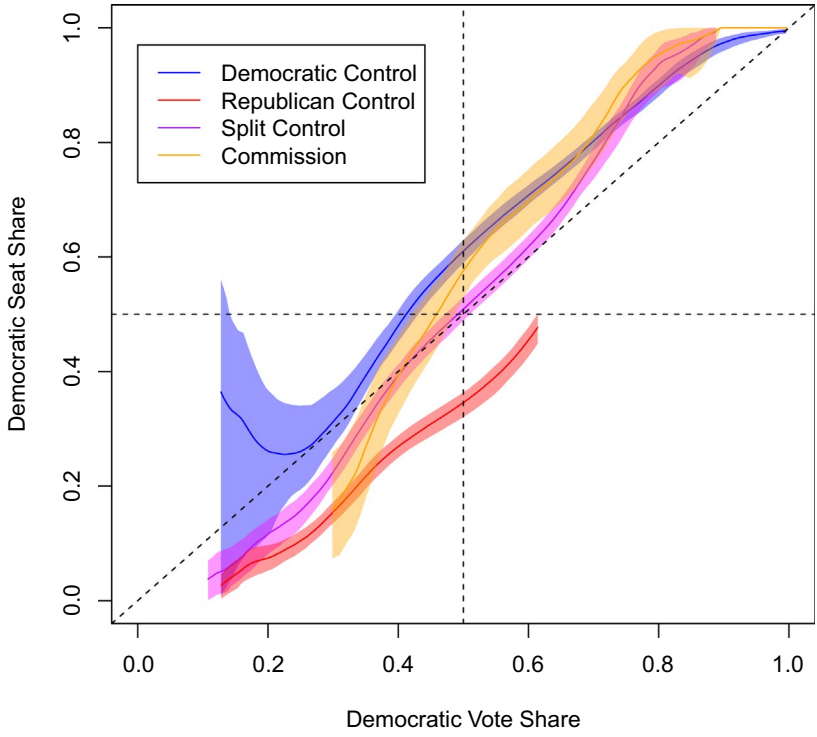


Note. Curves are estimated using locally constant kernel regression.

were more likely to be under Republican control than split control. Figure 7 disaggregates preclearance by state control but omits the confidence intervals to make the figure easier to decipher. Here, the results suggest that the Democratic Party is harmed by the preclearance requirement under Democratic control. Under split control and Republican control, we see very little variation in seat share as a function of vote share. For both split control and Republican control and for Democratic vote shares ranging from 30% to 70%, the Democratic Party wins around 30% of the seats. This is consistent with the preclearance condition forcing states to pack minority voters in majority-minority districts, which benefits the Democratic Party when its vote share is small and harms it when its vote share is high.

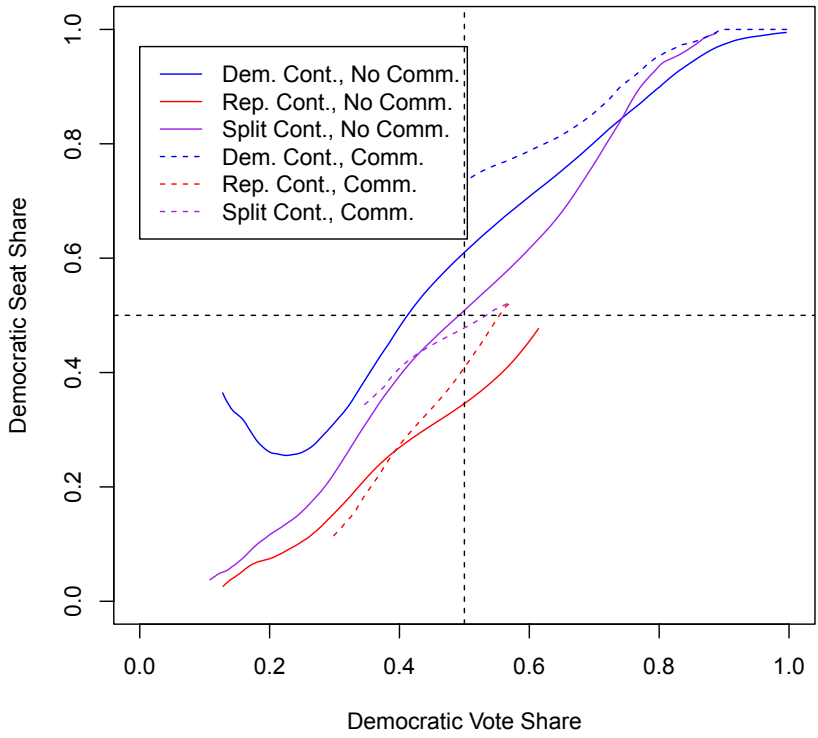
In Figures 8 and 9, we consider a third moderator of the vote-seat curve—whether a state's redistricting process employs a redistricting commission. In states with redistricting commissions, the advantage to controlling state government are as large as they are for states with no redistricting commission. We omit confidence bands from the figure to make it more readable, but the Democratic curve for commissions is distinguishable from the split control and Republican curves for commissions over the entire range. One possible explanation for this result is capture—although the process for selecting the redistricting commission varies from state to state, most attempt to avoid partisan outcomes by including nonpartisan actors on the commission, but these nonpartisan actors may

FIGURE 8
The Vote-Seat Curve and Redistricting Commissions
[Colour figure can be viewed at wileyonlinelibrary.com]



Note. Curves are estimated using locally constant kernel regression. Shaded regions are 95% confidence bands, estimated using the nonparametric bootstrap.

FIGURE 9
The Vote-Seat Curve and Redistricting Commissions, Disaggregated
[Colour figure can be viewed at wileyonlinelibrary.com]



Note. Curves are estimated using locally constant kernel regression.

in fact be undercover partisans, or the process of selecting them may ultimately be influenced by partisan actors. An alternative explanation is that the members of the commissions are influenced by norms and that there is a norm that the party that controls state government deserves a more favorable vote-seat curve. We cannot be certain about which of these explanations is correct, but our data suggest patterns that are clearly at odds with claims of proponents of redistricting commissions. In the online supporting information, we demonstrate similar findings using two parametric specifications.

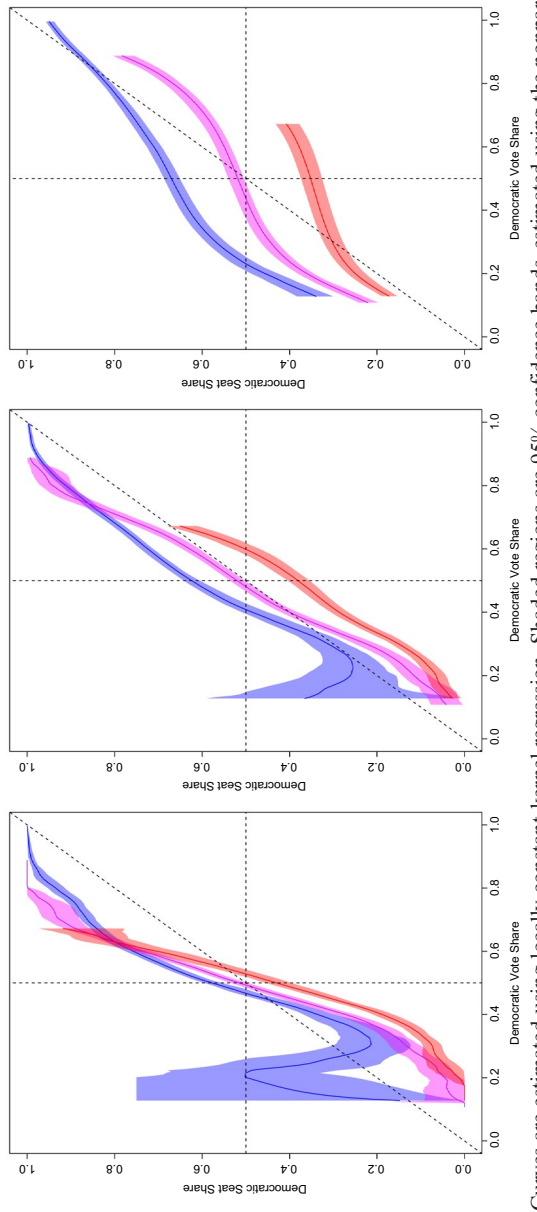
We briefly highlight a number of concerns the reader may have with the analysis above. Our analysis pooled results from

states with a number of congressional districts ranging from 2 to 53. We might expect that outcomes will vary with the number of congressional districts. In a state with two congressional districts, one could reasonably expect one party to win 100% of the seats. For a state with 20 or more seats, it would be extremely unlikely for one party to win all of the seats. In principle, the vote-seat curve (which represents the *expected* number of seats as a function of vote share) could be the same for small and large states, but it might not be. If the vote-seat curve differed dramatically with the number of congressional districts in a state, some of the results we report could be misleading. In Figure A.7 in the online supporting information, we report the vote-seat curve by regime, disaggregated by the number of congressional districts in the state. The vote-seat curves are remarkably similar in large and small states. There is perhaps a tendency for the Democratic Party to do better under split control in very small and very large states, but these differences are not statistically significant. However, we do find evidence for greater responsiveness in states with fewer congressional districts.

Related to this, in the main analysis, each redistricting plan was treated as a unique data point. An alternative approach would treat each congressional seat as a unique data point. In our framework, we can achieve this by weighting the results by the number of congressional seats. To the extent that Figure A.7 in the online supporting information suggests that the shape of the vote-seat curve depends on the number of congressional seats, weighted results could potentially lead to different conclusions. We report weighted results in Figures A.8 and A.9 in the online supporting information. We arrive as similar conclusions about the benefits of partisan control over time. The slope of the vote-seat curve under split control becomes flatter when the results are weighted. This is consistent with expectations based on the patterns in Figure A.7—while bias does not depend much on the number of congressional districts, the vote-seat curve under split control is more responsive in states with a larger number of congressional districts.

The bandwidth of the kernel reflects the degree of smoothing, which in turn affects the bias and variance of the estimator—large bandwidths lead to less variance (by pooling more data points) but more bias towards a flat curve. Smaller bandwidths lead to less bias, but greater variance. In Figure 10, we report results for alternative bandwidths. A larger bandwidth than we use (as seen in the left-most panel of Figure 10) is clearly too large. Pooling

FIGURE 10
Vote-Seat Curve, Alternative Bandwidths
[Colour figure can be viewed at wileyonlinelibrary.com]



Note. Curves are estimated using locally constant kernel regression. Shaded regions are 95% confidence bands, estimated using the nonparametric bootstrap.

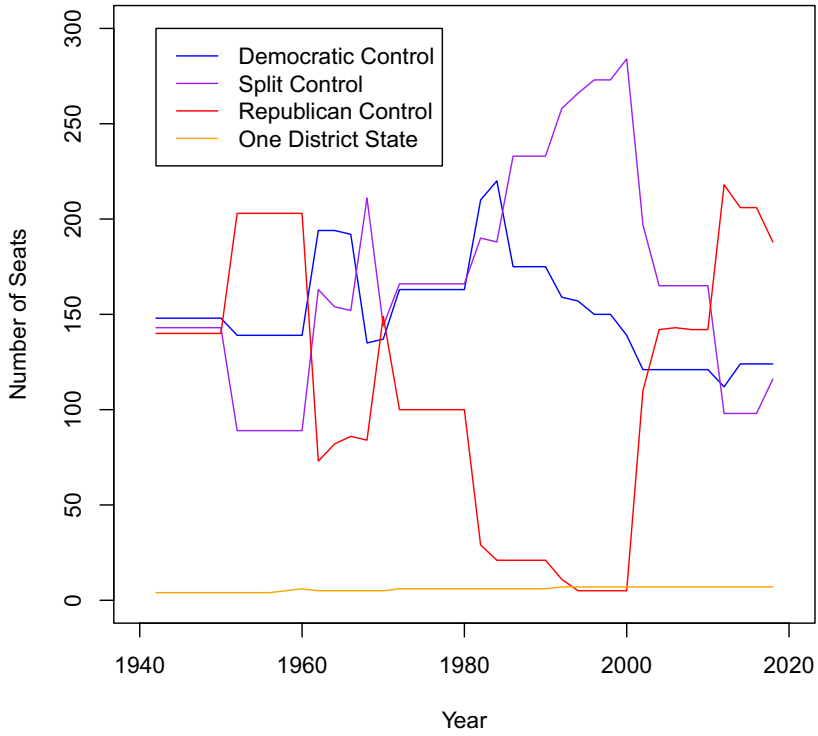
far-away points in the vote-share curve biases the results towards finding very large differences between partisan control regimes. The smaller bandwidth could be used to argue that our estimates may somewhat overstate the benefits to control of districting.

The confidence bands we reported were based on bootstrapped samples where individual data points were sampled with replacement. Observations within the same state-decade may be correlated because they (typically) represent outcomes from the same legislative plan. This clustering will not effect the consistency of the kernel regression estimates, but may cause the bootstrapped confidence bands to understate uncertainty. To address this, we altered to bootstrap to sample state-decades with replacement, where a decade was a span of consecutive elections ranging from a year ending with a 2 to a year ending with a 0. These results are reported in Figure A.10 in the online supporting information. As can be seen, the confidence bands become somewhat larger, but not dramatically so. In particular, we retain our ability to reject the null that the vote-seat curves for different control regimes are equal.

How Many Seats Is Control Worth

To calculate the aggregated benefits to control of state government, it is necessary to account for a few different things. First, the vote-seat curve for the different regimes is necessary. The results below rely on calculations from Figure 5. We must account for how many seats are districted under each regime. This is reported in Figure 11, considered more fully below. In addition, we need a benchmark to compare against. This benchmark should represent how many seats a party would be expected to gain under neutral conditions. One possibility is to use proportional allocation as the benchmark. When we examine the vote-seat curve at the state level (e.g., Figure 4), we observe considerable overresponsiveness under split control. This is arguably a natural result of fair districting and obtaining proportional results in states where one party holds 70% of the votes may be difficult to obtain without bizarrely shaped districts. In the work of Chen and his coauthors (Chen and Cottrell 2016; Chen and Rodden 2013), randomly simulated compact districts are used as a benchmark. This approach is in many ways attractive, but difficult to apply over a long time period.[7] Instead, the benchmark we will use is the number of seats

FIGURE 11
Number of Districts Under Each Control Regime
[Colour figure can be viewed at wileyonlinelibrary.com]



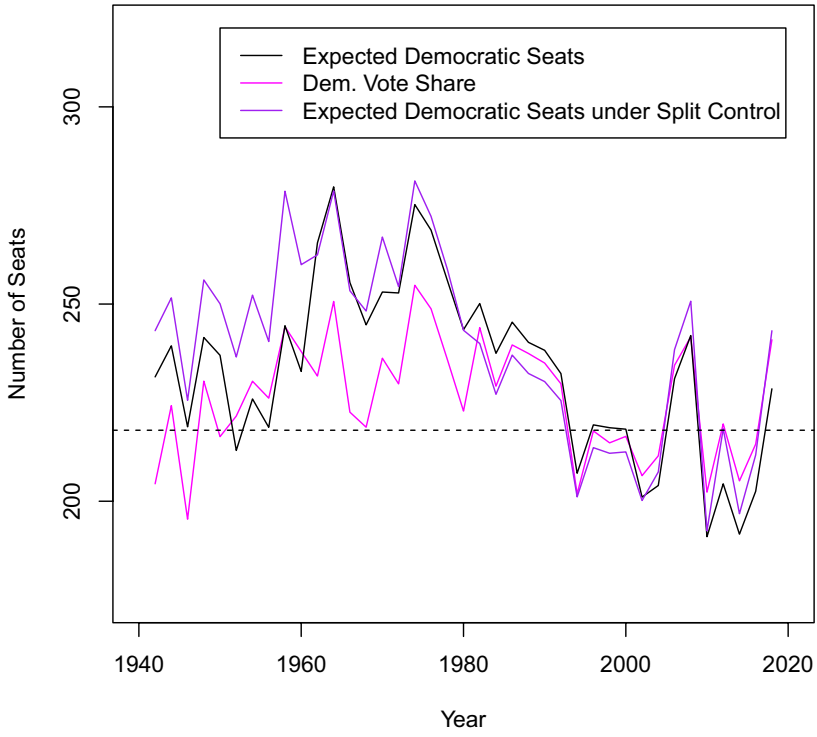
that a party would expect to gain under a split regime in every state. We believe that this does a good job of approximating the outcomes a neutral districting system would generate. In particular, it generates a benchmark where parties win about 50% of the seats when they win 50% of the vote, but they win more than 70% of the seats when they win 70% of the vote.

A handful of states only have one congressional district. In these states, control of the districting process is irrelevant for congressional outcomes. For the remaining states, the fortunes of the two major parties in state government have varied dramatically (see Figure 11). The Republican Party did fairly well after the 1952 redistricting, but it fared poorer after the 1962 redistricting. The Republican Party then did considerably worse over time,

reaching its low point in 1996, where only a handful of districts were drawn under unified Republican control. During this same period, districts drawn under split control accounted for a majority of congressional districts. Since 2000, the number of districts drawn under Republican control increased by about 200, with the number of districts drawn under Democratic control being relatively flat and the number of districts drawn under split control dropping substantially.

In Figure 12, we report the aggregate House vote share of the Democratic Party, the expected seats under the observed configuration of control, and the expected seats under split control in every state. The reported vote share is the raw data. We calculate expected seats using the vote-seat curve estimated from Figure 5. For example, to calculate the expected seats for a state

FIGURE 12
The Aggregate Effects of Control of Redistricting
[Colour figure can be viewed at wileyonlinelibrary.com]



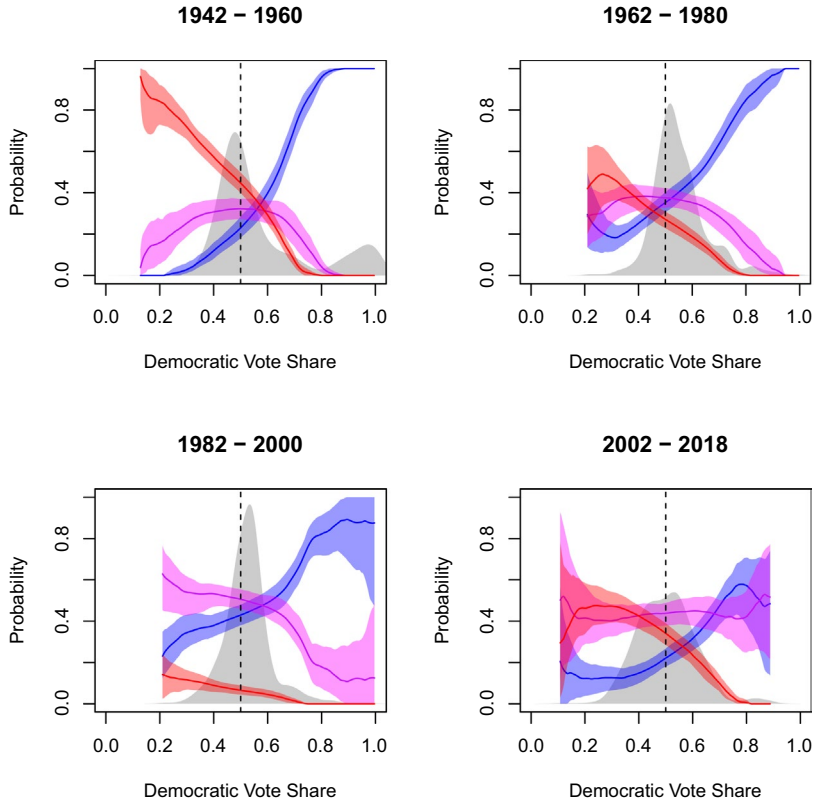
under Republican control in 2000 where the Democratic vote share was 40%, we would look at the red curve in the lower-right panel of Figure 5, finding that we would expect the Democratic Party to receive around 25% of the seats. If the particular state had eight congressional districts, we would add two to the Democratic Party's seat total. We would perform a similar calculation for every state in that year, adding up the number of Democratic seats, to obtain the black curve in Figure 12. To calculate the expected seat share under split control for the observation, we would look at the purple curve in the lower-right panel of Figure 5, finding that the Democratic Party would expect to receive 35% of the seats. We would again add up the number of Democratic seats to obtain the purple curve in the figure.

In the figure, expected seats and expected seats under split control (the black and purple curves) appear to follow each other very closely. We rarely see a difference of more than 10 seats. The biggest difference is in 1960, where the Democratic Party would have gained about 25 seats under split control in every state. Interestingly, vote share and expected seats depart from each other dramatically during the 1958–76 period. It is during this period that unified Democratic control led to a large advantage, and there was substantial pro-Democratic bias under split control. In more recent years, the effect has been muted. In 2000, the Republican Party controlled almost no seats in the districting process, yet it was not punished relative to split control because in this period, we found that the Democratic Party did not benefit from unified control. Later, the Republican Party gained control of districting for about 200 seats but enjoyed a relatively small benefit of about 10 seats relative to split control in every state.

To understand why the benefit was so small, Figure 13 plots the probability of each control regime as a function of vote share. The Republican Party was relatively successful in winning unified control in Republican-leaning states. However, in these states, Figure 5 suggests that there was little benefit to unified Republican control over split control, explaining the small benefit.

Figure 14 expands on these results by calculating the expected seats under unified Democratic and unified Republican control in every state. Here, the hypothetical benefit of control is very large—it ranges from almost 175 seats prior to the *Baker v. Carr* decision to just over 60 seats in the early 1980s, with the current difference being about 75 seats. These extreme magnitudes will never be observed for a few reasons—the benefit of control of districting is

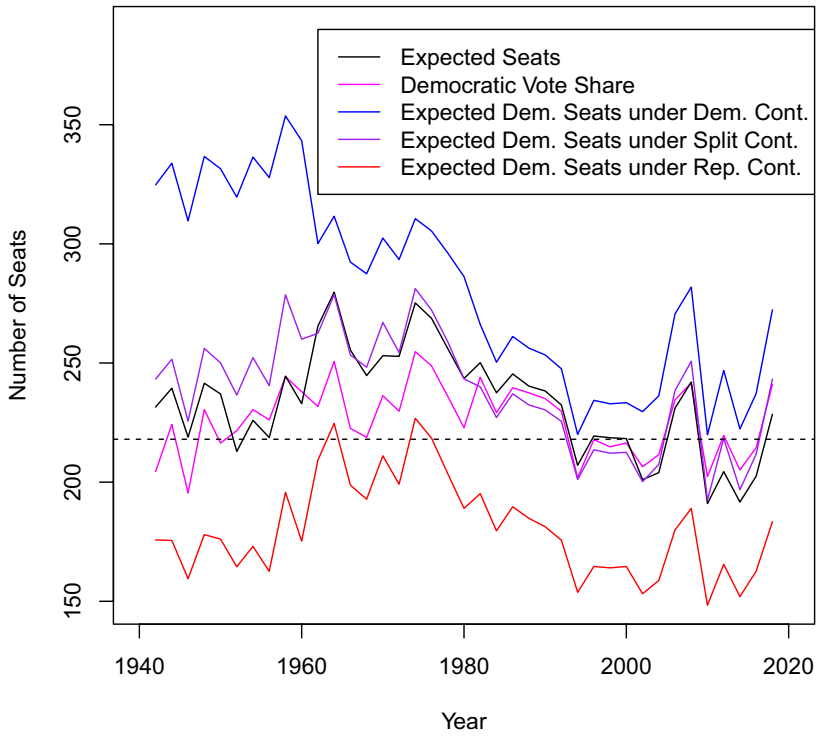
FIGURE 13
Probability of Redistricting Regime
[Colour figure can be viewed at wileyonlinelibrary.com]



Note. The blue line indicates the probability of unified Democratic control, the red line indicates the probability of unified Republican control, and the purple line indicates the probability of split control, as a function of the Democratic Party's vote share in House elections. The gray shaded region is the density of the Democratic Party's vote share in House elections. The blue, red, and purple shaded areas represent 95% confidence bands for their respective curves.

largest in states that are evenly divided among the parties, but it is rare for one party to have a large advantage among evenly divided states. This only seems to have occurred in the 1978–96 period, where the effects of control were at their lowest point. The benefits of control are greatest in states were the other party is strong, but we rarely observe a party controlling state government when its House vote share is low. Even in the modern period (the lower-right

FIGURE 14
The Aggregate Effects of Control of Redistricting Relative to Complete Control
[Colour figure can be viewed at wileyonlinelibrary.com]



panel of Figure 13), the Republican Party essentially never wins unified control in strong Democratic states, and the Democratic Party rarely wins unified control in strong Republican states.

Conclusion

In this article, we estimated the benefits to partisan control of the districting process. Our results suggest a benefit to both parties that has changed over time. In the earliest time period we study (prior to court decisions ruling that redistricting was justiciable), we found that the benefit of state control exceeded 20% of the seats for either party in closely contested states. This benefit

almost completely disappeared in the 1980s and 1990s, but has since increased for the Republican Party. In the modern period, the Democratic Party received less benefit from controlling the districting process (relative to split control). In all time periods, the benefit of control was lessened in states that were not closely contested. One institution was found to moderate the benefit of state control—the preclearance requirement of the Voting Rights Act harmed the Democratic Party in all cases except when it had a very little support among the voters. A second institution—redistricting commissions—was found to have little effect on the vote-seat curve and was found to preserve partisan bias in the districting process.

Measuring the aggregate consequences of control of districting required accounting for many factors. In the modern period, the benefit that a party gained over split control in every state rarely exceeded 10 House seats. This limited effect was a consequence of the fact that the benefit to each party in states they controlled partially canceled out and closely contested states—where the benefit of control was largest—were mostly likely to fall under split control.

Perhaps our most surprising finding is support for overtime changes in the benefit to control of redistricting, which has been hypothesized by various political activists, but which we develop empirical support for. In particular, we identify a growing Republican advantage and a diminishing Democratic advantage. We hypothesized that this is the result of geography. We provided some evidence for the plausibility of this claim—the Republican Party's rural advantage has risen dramatically in recent years. Obtaining more direct evidence that the Democratic Party is at an increasing geographic disadvantage is an avenue for future work and could potentially be investigated by applying Chen and Cottrell's (2016) approach over a long period of time.

Michael Peress <michael.peress@stonybrook.edu> is an Associate Professor of Political Science at SUNY-Stony Brook. His work has appeared in American Political Science Review, Journal of the American Statistical Association, Legislative Studies Quarterly, and Journal of Politics. Yangzi Zhao <yangzi.zhao@stonybrook.edu> is a Ph.D. student studying Political Science at SUNY-Stony Brook.

NOTES

1. McGann et al. (2016) used a measure of partisan bias developed in Gelman and King (1994b).

2. Engstrom (2013) overlaps with this time period, but his analysis aggregates over a longer period of time.

3. The states subject to preclearance are Alabama, Alaska, Arizona, Georgia, Louisiana, Mississippi, South Carolina, Texas, and Virginia. A large number of counties and townships in New Hampshire and North Carolina were subject to preclearance. A number of additional states had a small number of counties subject to preclearance.

4. We coded states where a large number of counties or townships were subject to preclearance (New Hampshire and North Carolina) as subject to preclearance. States where only a handful of counties were subject to preclearance (e.g., Michigan) were coded as not subject to preclearance. In Figure A.1 in the online supporting information, we demonstrate that our conclusions would have been similar had we coded New Hampshire and North Carolina as not subject to preclearance.

5. We applied an Epanechnikov kernel with a bandwidth of 0.2 throughout the article.

6. The bootstrap confidence bands, as well as the distribution of House Democratic vote share by regime (reported in Figures A.2, A.3, and A.4 of the online supporting information) can be used to determine where the vote-seat curves can be measured with relative precision.

7. Chen and Rodden (2013) simulate districts in a single state and a single year, and Chen and Cottrell (2016) simulate districts across the entire United States in a single year. Repeating their analysis over our 80-year time period would require collecting presidential election results at a disaggregated level for a large number of elections, which would be a massive undertaking.

REFERENCES

Abramowitz, Alan I. 1983. "Partisan Redistricting and the 1982 Congressional Elections." *Journal of Politics* 45: 767–70.

Abramowitz, Alan I., Brad Alexander, and Matthew Gunning. 2006. "Incumbency, Redistricting, and the Decline of Competition in U.S. House Elections." *Journal of Politics* 68: 75–88.

Burnham, W. Dean. 1992. *Partisan Division of American State Governments, 1834–1985*. Ann Arbor, MI: Inter-University Consortium for Political and Social Research. https://doi.org/10.3886/ICPSR00016.v1

Cain, Bruce E. 1985. "Assessing the Partisan Effects of Redistricting." *American Political Science Review* 79: 320–33.

Cameron, Charles, David Epstein, and Sharyn O'Halloran. 1996. "Do Majority-Minority Districts Maximize Substantive Black Representation in Congress?" *American Political Science Review* 90: 794–812.

Campagna, Janet, and Bernard Grofman. 1990. "Party Control and Partisan Bias in 1980s Congressional Redistricting." *Journal of Politics* 52: 1242–57.

Chen, Jowei, and David Cottrell. 2016. "Evaluating Partisan Gains from Congressional Gerrymandering: Using Computer Simulations to Estimate the Effect of Gerrymandering in the U.S. House." *Electoral Studies* 44: 329–40.

Chen, Jowie, and Jonathan Rodden. 2013. "Unintentional Gerrymandering: Political Geography and Electoral Bias in Legislatures." *Quarterly Journal of Political Science* 8: 239–69.

Cox, Gary W., and Jonathan N. Katz. 2002. *Elbridge Gerry's Salamander: The Electoral Consequences of the Reapportionment Revolution*. Cambridge: Cambridge University Press.

Engstrom, Erik J. 2006. "Stacking the States, Stacking the House: The Politics of Congressional Redistricting in the 19th Century." *American Political Science Review* 100: 419–28.

Engstrom, Erik J. 2013. *Partisan Gerrymandering and the Construction of American Democracy*. Ann Arbor, MI: University of Michigan Press.

Gelman, Andrew, and Gary King. 1994a. "Enhancing Democracy Through Legislative Redistricting." *American Political Science Review* 88: 541–59.

Gelman, Andrew, and Gary King. 1994b. "A Unified Method of Evaluating Electoral Systems and Redistricting Plans." *American Journal of Political Science* 38: 514–54.

Goedert, Nicholas. 2014. "Gerrymandering or Geography? How Democrats Won the Popular Vote but Lost the Congress in 2012." *Research and Politics* 1: 1–8.

King, Gary, and Robert X. Browning. 1987. "Democratic Representation and Partisan Bias in Congressional Elections." *American Political Science Review* 81: 1251–73.

Klarner Carl. 2013. "State Partisan Balance Data, 1937–2011." *IQSS Dataverse Network*. http://hdl.handle.net/1902.1/20403

Kraushaar Josh. 2010. "Democrats' Losses Could Grow in 2012." *National Journal*. https://web.archive.org/web/20101116002651/ http://nationaljournal.com:80/columns/against-the-grain/democrats-losses-could-grow-in-2012-20101110?print=true

McGann, Anthony J., Charles Anthony Smith, Michael Latner, and Alex Keena. 2016. *Gerrymandering in America: The House of Representatives, the Supreme Court, and the Future of Popular Sovereignty*. New York: Cambridge University Press.

Meredith, Marc. 2013. "Exploiting Friends-and-Neighbors to Estimate Coattail Effects." *American Political Science Review* 107: 743–65.

Miller, Warren E. 1955. "Presidential Coattails: A Study in Political Myth and Methodology." *Public Opinion Quarterly* 19: 353–68.

Shotts, Kenneth W. 2001. "The Effect of Majority-Minority Mandates on Partisan Gerrymandering." *American Journal of Political Science* 45: 120–35.

Squire, Peverill, and Keith E. Hamm. 2005. *101 Chambers: Congress, State Legislatures, and the Future of Legislative Studies*. Columbus, OH: Ohio State University Press.

Tufte, Edward R. 1973. "The Relationship Between Seats and Votes in Two-Party Systems." *American Political Science Review* 67: 540–54.

Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's web site:

Additional analyses to accompany "How Many Seats in Congress is Control of Redistricting Worth."

Figure A.1: The Vote-Seat Curve and Preclearance, Alternative Coding of Preclearance States
Note. Curves are estimated using locally constant kernel regression. Shaded regions are 95% confidence bands, estimated using the non-parametric bootstrap. In the left panel, New Hampshire and North Carolina—partially covered states with many counties subject to preclearance—were coded as preclearance states. In the right panel, New Hampshire and North Carolina were not coded as preclearance states.
Figure A.2: Density of House Democratic Vote Share by Regime
Note. Curves are estimated using kernel density estimation.
Figure A.3: Vote-Seat Curve and Density of House Democratic Vote Share by Regime
Note. Solid curves (representing the vote-seat curve by regime) are estimated using kernel density estimation and dashed curves (representing the density of House Democratic vote share by regime) are estimated using kernel density estimation.
Figure A.4: Density of House Democratic Vote Share by Regime, Disaggregated by Time Period *Note*. Curves are estimated using kernel density estimation.
Figure A.5: Vote-Seat Curve by State and Year, Disaggregated by Time Period (pre and post the effect of *Baker v. Carr*)
Note. Curves are estimated using locally constant Kernel regression. Shaded regions are 95% confidence bands, estimated using the non-parametric bootstrap.
Figure A.6: Vote-Seat Curve by State and Year, Disaggregated by Time Period (time periods between decennial censuses)

Note. Curves are estimated using locally constant kernel regression. Shaded regions are 95% confidence bands, estimated using the non-parametric bootstrap.

Figure A.7: Vote-Seat Curve by State and Year, Disaggregated by Number of Congressional Districts

Note. Curves are estimated using locally constant kernel regression. Shaded regions are 95% confidence bands, estimated using the non-parametric bootstrap.

Figure A.8: Vote-Seat Curve by State and Year, Unweighted vs. Weighted

Note. Curves are estimated using locally constant kernel regression. Shaded regions are 95% confidence bands, estimated using the non-parametric bootstrap.

Figure A.9: Vote-Seat Curve by State and Year, Disaggregated by Time Period and Weighted by Number of Congressional Districts

Note. Curves are estimated using locally constant kernel regression. Shaded regions are 95% confidence bands, estimated using the non-parametric bootstrap.

Figure A.10: Vote-Seat Curve, Regular vs. Clustered Confidence Bands

Note. Curves are estimated using locally constant kernel regression. Shaded regions are 95% confidence bands, estimated using the non-parametric bootstrap. In the left panel, the bootstrap sampled individual data points with replacement. If the right panel, the bootstrap sampled state-decades (running from a year ending in 2 through a year ending in 0) with replacement.

Table A1: Effect of Control of Redistricting on Vote Seat Curve, Basic Model

Note. Heteroskedasticity-robust standard errors in parentheses. + $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$.

Table A2: Effect of Control of Redistricting on Vote Seat Curve, Additional Interactions

Note. Heteroskedasticity-robust standard errors in parentheses. + $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$.

Table A3: Effect of Control of Redistricting on Vote Seat Curve, Basic Model

Note. Heteroskedasticity-robust standard errors in parentheses. + $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$.

Table A4: Effect of Control of Redistricting on Vote Seat Curve, Additional Interactions

Note. Heteroskedasticity-robust standard errors in parentheses. + $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$.