Journal of Political Institutions and Political Economy, 2022, 3: 481–496

Polarization as a Function of Chamber Size

Daniel B. Magleby[1], Gregory Robinson[1], and Matthew Walz[2]

[1] *Binghamton University, SUNY, Binghamton, NY, USA; dmagleby@binghamton.edu, grobinso@binghamton.edu*
[2] *General Mills, Inc. Consumer & Market Intelligence, Minneapolis, MN, USA; mwalz2@binghamton.edu*

ABSTRACT

The size of the House of Representatives has remained fixed at 435 members for more than a century. A static House stands in contrast to the vision of the framers of the Constitution who imagined that the House would grow with the population of the country. In this article we analyze the implications of a static House size on the partisan polarization of its members. Using a series of computer simulations, we imagine a set counter-factual worlds set in a purely hypothetical environment and in the real world to explore the relationship between apportionment and polarization. We find that increasing the number of districts exacerbates polarization, but that each additional seat has a diminishing marginal impact on partisan polarization. Our findings suggest that while increasing the size of the House may have other benefits, it would *not* reduce polarization, though the marginal increase in polarization slows greatly with larger chamber sizes.

Keywords: Polarization; representation; Congress; computational methods

Introduction

The House of Representatives has had 435 for more than 100 years — long enough that political observers and scholars alike take that number for granted. There is reason to believe that the current size of the House and the ratio of representation it implies run counter to the intent of the Framers. Indeed, the

Online Appendix available from:
http://dx.doi.org/10.1561/113.00000069_app
ISSN 2689-4823; DOI 10.1561/113.00000069

current arrangement violates promises made by James Madison and others to constitutional skeptics during the ratification debate. Following the Philadelphia Convention, Madison and others assured those skeptical of the new federal government's power that they would take steps to limit the population of congressional districts. These promises shored up the coalition necessary for the constitution's ratification (see Federalist 55).

Evidence of the Framers' intent to allow the lower chamber of the US national legislature to grow with the country's population abounds (see e.g., Riker, 1991), but their preference for small districts and a large House is perhaps clearest in the first amendment to the constitution passed by both the House and Senate. This *original* first amendment would have capped the population of congressional districts at 50,000 people. In contrast to the amendment providing freedom of speech, assembly, and religion, this earlier amendment dictating a ratio of representation failed to be ratified by the states. Because of this, Congress instead passed a statute that determined the number of House seats and apportioned them every 10 years. Since 1929 (with minor amendments in 1941), those decennial statutes have given way to a fixed House of 435 members[1] with a formula determining how many seats each state will get. District populations have ballooned since, with Congress allowing the typical district population to grow to roughly 760,000 residents following the 2020 Census. At current population trends, most House districts will contain one million people before the end of the 21st Century if the House stays at 435 members.

The purpose of this article is to explore the implications of the choice to keep the House small. Using computational methods we simulate counterfactual worlds where chamber size varies while population remains fixed. In particular, we are interested in the effect of House size on polarization — the ideological distance between Democrats and Republicans in Congress. In a series of simulations, we show that, all else constant, increasing the House size would exacerbate already high levels of polarization.

The article proceeds as follows. In the next section, we present a hypothetical political jurisdiction. We then divide that jurisdiction into more and more (smaller and smaller) districts. Presuming that legislators elected from this purely hypothetical world would behave like existing Members of Congress from similar districts, we show that as the legislature increases in size, we would expect that legislators act in more polarized ways, all else constant. Next, we turn to an illustration with data from the real world, dividing the state of Illinois into a relatively small number of districts and relatively large number of districts. We show that the smaller delegations (elected from larger districts) tend to be less polarized than larger delegations (elected from small

[1] This was so with one brief interlude in the 86th and 87th Congresses when the House temporarily had 437 members to accommodate Alaska and Hawaii, which were added as states between apportionment cycles.

districts) from the same state. After considering a single state, we apply the same method to the full House of representatives. Using the same computer algorithm, we generate 10,000 maps of congressional districts for a small (217 seat), medium (435 seat), and large (871 seat) House of Representatives. Again, we find that increasing House size exacerbates polarization. Finally, we offer some conclusions and specifically consider the importance of the assumption that all else would remain equal and discuss additional avenues of study.

The Number of Districts and Polarization in a Hypothetical Jurisdiction

We begin by analyzing a hypothetical jurisdiction that consists of 40,000 "geographical" units. We populated that grid with 10,000 hypothetical voters that prefer either Democratic or Republican candidates. In this hypothetical setup, we presume that Democrats are more likely to live in a concentrated area towards the middle of the grid. On the other hand, Republicans are more efficiently distributed allowing them to dominate outlying areas. We then divide the jurisdiction into increasingly smaller and smaller districts. For each level, we randomly draw an ensemble of 10,000 districting plans. By comparing the expected level of polarization in each ensemble of maps, we determine how variance in polarization may be conditioned on the number of districts used to elect legislators.

Patterns of Spatial Sorting

To generate hypothetical distributions of voters, we populate a 200×200 grid with 5,000 Republican and 5,000 Democrat voters.[2] Each position may be occupied by one and only one voter. We represent the resulting grid in Figure 1. We assign Republican voters a position in the grid according to a uniform probability distribution. Likewise, we distribute half the Democrats according to a uniform probability distribution. We assign the remaining Democrats a position according to a distribution that makes it more likely that they fall closer to the middle of the grid than further away.

For our purposes, the imaginary jurisdiction allows us to determine the influence of an increased number of single-member districts while holding constant the distribution and behavior of hypothetical voters. Observe that we restrict the proportion of voters belonging to either party to 0.50 of the total population, so neither group exhibits an advantage ex-ante. We allow a concession to the real-world residential patterns of Republican and Democratic voters; however, their distribution in geographic space remains constant in

[2]For the sake of realism, it may help to think of each voter in the simulation as representing 10, or 100, or 1,000 voters of the same political persuasion. The conclusions we would reach should be the same regardless.

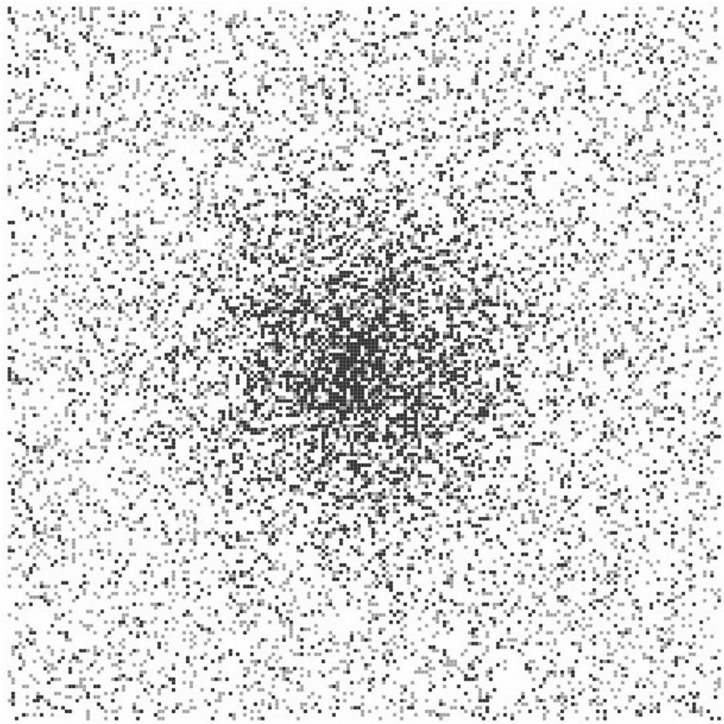

Figure 1: A hypothetical political jursidiction consisting of 40,000 geographical units and populated by 5,000 Republicans (light grey dots) and 5,000 Democrats (dark grey dots). Republicans are uniformly distributed in space while Democrats are concentrated towards the center of the grid.

all simulations. All that differs between ensembles of maps is the number of districts into which we divide voters.

Dividing the Grid into Districts

We use an algorithm proposed by Magleby and Mosesson to divide the hypothetical grid into the requisite number of districts (2018). The algorithm we use has the advantage of being extremely efficient, allowing us to draw a large number of hypothetical maps. In addition to being fast, Magleby and Mosesson, 2018 assert that their algorithm draws maps without "indication of bias" (2018, 147). Others have expressed skepticism that any algorithm can draw maps in an unbiased way (Altman *et al.*, 2004; Altman *et al.*, 2015; Altman and McDonald, 2011). We may set aside this debate for the purposes of our analysis because what matters is that the method of districting remains constant as we increase the number of districts. Even if the algorithm did exhibit bias, our findings will be dispositive if the amount of polarization present varies with the number of districts. We provide a technical description of the algorithm in the Online Appendix B.

We use the algorithm to divide the population represented in Figure 1 into maps of 2, 5, 11, 25, 50, 100, 200, and 400 districts. For each of these districting scenarios, we generate 10,000 unique districting plans using the Magleby and Mosesson algorithm. In all, we analyze 80,000 unique maps that divide the hypothetical grids of voters into various numbers of districts. Figure 1 provides a representation of the districts that the algorithm produces. Observe that the districts are relatively compact and the shape of the districts is not "bizarre." Since the population is sorted in a way that concentrates population towards the middle of the grid, districts formed in the center of the grid tend to be smaller (consisting of fewer geographic units) than districts towards the outside of the grid.

For our analysis, we draw 10,000 maps of each level of apportionment. Each map included in our analysis contains contiguous districts that are also balanced in terms of population. If a system of districts is perfectly balanced, then each district contains *exactly* the same number of people. In practice, we consider a map's districts to be balanced if no district's population deviates by more than $\pm 1\%$ of the perfectly balanced ideal. Observe that balance varies from districting scenario to districting scenario. For example, in a map that divides a population of 10,000 into ten districts, we would consider a map with a district containing 1,009 people to be balanced. By contrast, a map that divides a population of 10,000 into 100 districts that contained a district with a population of 109 would be out of balance. Thus, we restrict maps with more districts to maximum deviation of two voters from ideal balance.

Calculating Polarization

We presume that a legislator's behavior is determined, at least in part, by their electoral environment (Mayhew, 1974; Fenno, 1978). Recent work by McCarty *et al.* maintains that the relationship between elections and representation is discernible (2009, 672). We draw these assumptions from existing literature, particularly the work of (McCarty *et al.*, 2009, p. 674). McCarty *et al.*'s work is often cited as a definitive dismissal of gerrymandering as a cause of polarization. Our intention in this article is to extend the logic of the 2009 piece beyond redistricting to another question of institutional design, the number of districts used to generate a representative assembly.

Following McCarty *et al.* we estimate legislators' ideological position by regressing their Congress-by-Congress first dimension DW-NOMINATE score on the the proportion of the two-party vote they received in the previous election and their partisan affiliation (2009, 674). Given that polarization

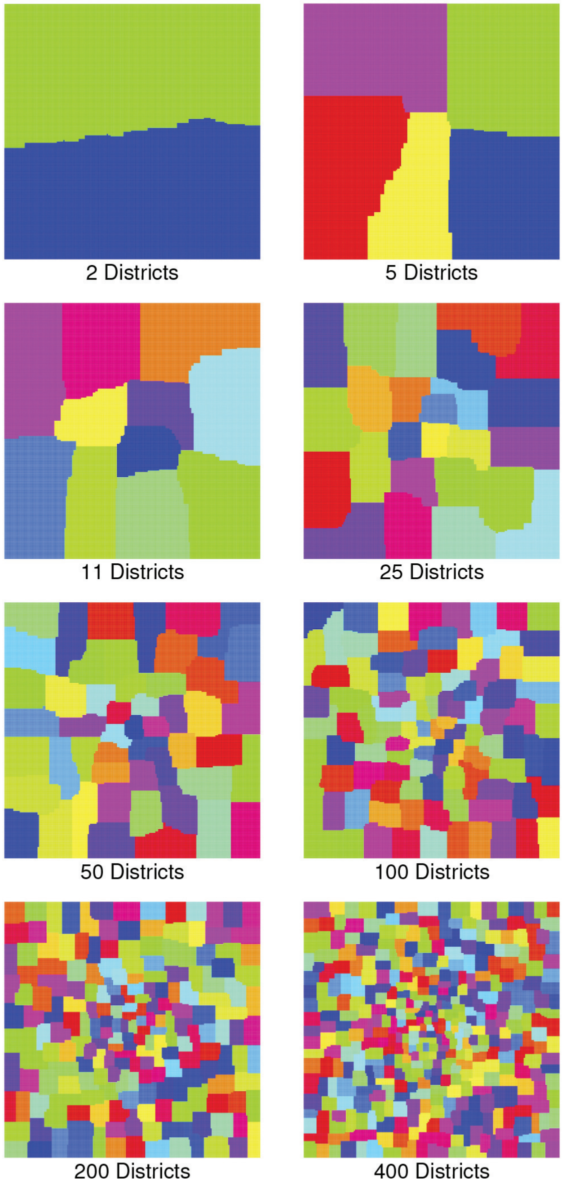

Figure 2: Examples of districts drawn by the Magleby-Mosesson redistricting algorithm. Each map is one example from a set of 10,000 unique maps each of which contains districts that are balance to between ±1% of exact population parity between districts in the map. Because the population is relatively concentrated in the middle of the graph, districts in that region are smaller in terms of the space they include. Districts in more sparsely populated outlying areas are relatively larger.

exhibits a secular increase in the post-World War II period, we estimate these models for three overlapping periods — 1947 to 2004, 1974 to 2004, and 1994 to 2004. We condition House members' first dimension DW-NOMINATE score on their partisanship and the Democratic share of the two-party vote in his or her district in the previous election.We represent the results of these estimates as the following equations.

$$\begin{aligned}\text{DW-NOMINATE} &= (-0.0021 \times \text{Democratic Vote Share}) \\ &\quad + (-0.5931 \times \text{Democrat}) + 0.3931 \qquad (1)\\ \text{DW-NOMINATE} &= (-0.0031 \times \text{Democratic Vote Share}) \\ &\quad + (-0.6022 \times \text{Democrat}) + 0.4677 \qquad (2)\\ \text{DW-NOMINATE} &= (-0.0038 \times \text{Democratic Vote Share}) \\ &\quad + (-0.6623 \times \text{Democrat}) + 0.5445 \qquad (3)\end{aligned}$$

Equation 1 corresponds to estimates derived from the period beginning in 1947 and ending in 2004, Equation 2 corresponds to estimates derived from the period beginning in 1974 and ending in 2004, and Equation 3 corresponds to estimates derived from the period beginning in 1994 and ending in 2004. NOMINATE space extends from -1 to 1. Relatively liberal legislators' DW-NOMINATE scores typically fall towards the lower end of the scale and more conservative legislators' scores are situated towards the higher end of the scale. In every period we analyze, the mean difference between Democrats and Republicans is significant. On average Democrats' DW-NOMINATE score is 0.5931 lower than Republicans when we estimate the model using data from 1947 to 2004, 0.6022 lower when we use the 1974 to 2004 data, and 0.6623 when we estimate the relationship using 1994 to 2004 data. We also find that increases in Democratic share of the vote resulted in a downward shift of -0.0021, -0.0031, and -0.0038 depending on whether we used data starting in 1947 (Equation 1), 1974 (Equation 2), or 1994 (Equation 3).

We calculate the polarization of the legislature elected from each hypothetical map. First, we find the mean DW-NOMINATE score for districts carried by Democrats in the map. Next we do the same for Republicans. We calculate *polarization* for each map as the difference in the mean Democratic and mean Republican DW-NOMINATE score. Once we have calculated polarization for each map, we then compare the distributions of polarization in hypothetical maps for each level of apportionment.

Findings from a Hypothetical Jurisdiction

We present the results of our simulations of changing levels of apportionment in this hypothetical jurisdiction in Figure 3. Each point represents the average difference in mean DW-NOMINATE scores between districts carried by

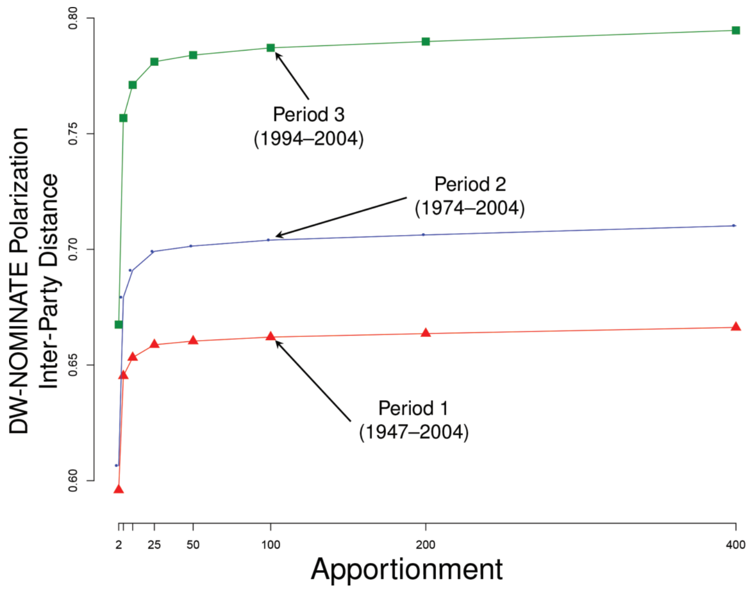

Figure 3: The relationship between apportionment (the number of districts assigned a political jurisdiction) and polarization. On the x-axis, we provide the level of apportionment ranging from 2 districts to 400. On the y-axis, we provide the degree of polarization which we take as the difference between the average estimated DW-NOMINATE score of the Democratic and Republican caucus elected by a particular map. Each point corresponds to 10,000 hypothetical maps drawn by the Magleby-Mosesson redistricting algorithm. We estimate expected DW-NOMINATE scores using data from three overlapping periods, 1947 to 2004 (triangles), 1974 to 2004 (circles), 1994 to 2004 (squares).

Democrats and districts carried by Republicans in 10,000, unique maps drawn with the corresponding number of districts. We do not include confidence levels because, given our large sample size, standard errors are so small they would be covered by the points in the graph. We represent the estimates using the overlapping periods using different shaped points – triangles for the period beginning in 1947, circles for the period beginning in 1974, and squares for the period beginning in 1994.

The data represented in Figure 3 exhibit a clear positive relationship between polarization and the number of districts. More specifically, as the number of districts increases, the amount of polarization increases. The pattern is monotonic, but it is far from linear. Rather, the relationship shows diminishing marginal impact of a seat increase on the amount of polarization. For example, using data from the period beginning in 1994, we find that polarization increases about 0.1 (roughly 5% of the NOMINATE scale) when the number of seats increases from 2 to 5. On the other hand, doubling the number of districts from 200 to 400 results in roughly a 0.01 increase in polarization. In sum, changes in polarization conditional on size will be most pronounced when the chamber (or delegation) is small. Once the chamber (or delegation) is large, even large changes in the number of districts have little impact on the polarization of the chamber.

Of course, these findings are based on a highly "controlled" set of data. That is, we have carefully crafted a simulation in which one and only one party concentrates into a single cluster. If we were to relax our assumptions patterns of clustering our findings might change. For example, suppose one concentrated itself in two clusters as opposed to one cluster, we would expect the outcome of similar simulations to depart from those reported in Figure 3. Likewise, if we observed two clusters, one Democratic on Republican, the patterns of polarization would again be slightly different from what we report in Figure 3. Real political geography is much messier than this purely hypothtical setup, but even in those messier settings, we an increase in polarization the number of districts increases, *ceteris paribus*. In the next section we turn to a messier, real world environment to see if these patterns hold.

Apportionment and Polarization in the "Real" World

In this section we turn to real world jurisdictions. Our analysis will proceed as it did in the previous section; however, rather than a hypothetical grid, we will use real geography and votes cast in actual elections. We first consider a single state, Illinois, and analyze the expected polarization of that state's congressional delegation if it were electing representatives to a small (217 member), medium (435), large (871), and extra-large (1743) House. After that, we extend the analysis to all states, and consider how polarization varies with apportionment in a small, medium, and large House.

Apportionment and Polarization in One State

We have shown how apportionment conditions patterns of polarization in a hypothetical setting. In this section we demonstrate how apportionment may distort representation in an actual political jurisdiction, Illinois. Illinois is an interesting case because of its size and the geographic distribution of partisan voters. Clearly, we cannot manipulate Illinois electoral geography, but in what follows, we consider three levels of apportionment, 9 districts, 18 districts, 36 districts, and 72 districts. Using current apportionment methods, these levels of apportionment correspond to the representation afforded Illinois if the size of the House was set at 217, 435, 871, or 1743 seats. As with the hypothetical grid, we find that polarization increases in Illinois as the number of representatives increases, but we also find that there is a diminishing marginal impact of increasing the number of representatives.

Like the grid of hypothetical voters we presented in the previous section, voters of a particular type, Democrats in this case, are relatively concentrated in Illinois. Likewise, voters of a different type, Republicans, are more evenly distributed throughout the state. Much like the stylized grid, the concentrated group is collected into essentially one clump in and around Chicago. As in our hypothetical grid, Chicago is overwhelmingly Democratic while the suburbs around the city are more evenly divided between Democrats and Republicans, with Republicans dominating the more sparsely populated areas.

We draw a set of 10,000 maps with 9 districts, a set of 10,000 maps with 18 districts, a set of 10,000 maps with 36 districts, and a set of 10,000 maps with 72 districts. We measure polarization in the hypothetical maps as the difference in the mean estimated DW-NOMINATE score for legislators using votes cast for president in the 2016 election as a proxy for party support. To draw the maps, we again use the Magleby-Mosesson algorithm. We utilize shapefiles of voter tabulation districts provided by the U.S. Census Bureau, and estimates of Democratic two-party voter share of the presidential vote share in the 2016 election at the VTD-level provided by Wolf (2014). We represent the differences in the distributions of each set of maps in Figure 4.

The maps in Figure 4 are examples of the districts drawn by the Magleby-Mosesson algorithm in Illinois. Map A in Figure 4 has 9 districts, map B has 18 districts, map C has 36 districgts, and map D has 72 districts. Observe that the districts drawn by the algorithm are similar to what we might expect a human mapmaker to draw. The districts are relatively compact and do not take a bizarre shape. Like the hypothetical grid with its single cluster of population, population is concentrated in a single area in Illinois. By contrast, however, Illinois's population is clustered in Chicago in the northeast corner of the state. Since the population of that region is concentrated in a small area, the algorithm draws many districts that are geographically smaller than districts located in downstate regions. Even so, the population of each district drawn by the algorithm deviates by less than $\pm 1\%$ from the perfectly balanced ideal.

We summarize our findings in Illinois in Table 1. As in the purely hypothetical jurisdiction, we calculate the expected DW-NOMINATE score for each district in each map using Equations 1, 2, and 3. We then take polarization of each map as the difference in the average DW-NOMINATE score for Republicans and Democrats elected in that hypothetical map. Regardless of the data we use to estimate legislator ideology, polarization increases in delegation size in the simulations of electoral maps in Illinois. Consider the estimate of polarization summarized using data from period 3 (1994 to 2004). We report these findings in the bottom panel of Table 1. We estimate polarization of the Illinois delegation to be a little more than 0.77 on average when the state elects nine representatives. By contrast, we expect the distance between Democrats and Republicans polarization will be roughly 0.78 if the state elected 72 rep-

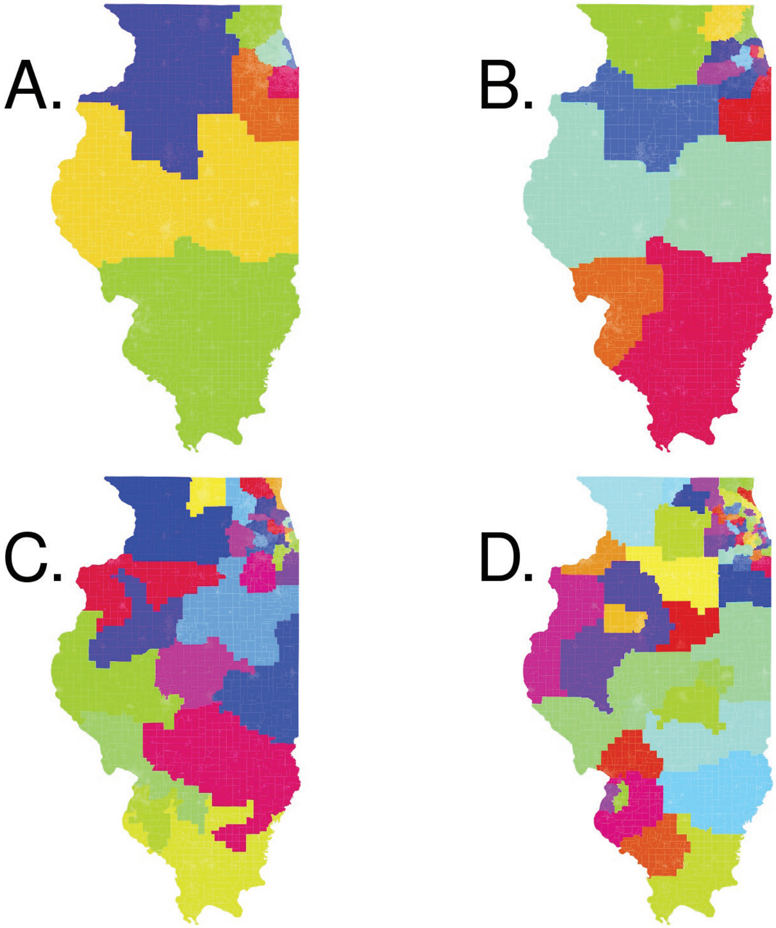

Figure 4: Examples of hypothetical maps of congressional districts in Illinois for various levels of apportionment. Districts were drawn using the Magleby-Mosesson algorithm from geographic shapefiles and population data provided by the U.S. Census bureau. The population of each district deviates by less than 1% perfectly balanced for each level of apportionment.

resentatives. We also report the 99% confidence interval for each of these estimates, and they do not overlap. In short, increasing apportionment leads to a statistically discernible increase in polarization. Even so, an increase of just 0.01 units of NOMINATE space, is a fairly modest increase in polarization for an 8-fold increase in the size of the delegation.

Table 1: Estimated polarization in 10,000 maps of 9, 18, 36, and 72 congressional districts in Illinois.

Small (9 Districts)	Medium (18 Districts)	Large (36 Districts)	XL (72 Districts)
DW-NOMINATE Polarization Period 1 (1947–2004)			
0.65349	0.65385	0.65492	0.65849
(0.65346, 0.65353)	(0.65383, 0.65387)	(0.65489, 0.65494)	(0.65848, 0.65851)
DW-NOMINATE Polarization Period 2 (1974–2004)			
0.69135	0.69187	0.69345	0.69873
(0.69131, 0.6914)	(0.69184, 0.69190)	(0.69342, 0.69348)	(0.69871, 0.69876)
DW-NOMINATE Polarization Period 3 (1994–2004)			
0.77158	0.77222	0.77416	0.78063
(0.77153, 0.77164)	(0.77219, 0.77226)	(0.77412, 0.77419)	(0.78060, 0.78066)

Notes: Polarization is calculated as the difference between the mean estimated DW-NOMINATE score for the Democratic and Republican legislators elected in each hypothetical map where 2016 presidential vote at the VTD-level is used as proxy for partisan support. Below each estimate of the expected level of polarization we include a 99% confidence interval.

Apportionment and Polarization Nationwide

We repeat the analysis we conducted in Illinois for every state in the U.S. Using the algorithm we draw 10,000 unique maps of each state's congressional districts for a small, medium and large House of Representatives. For each chamber size, we use the Huntington-Hill method of assigning representation to states according to their populations. In the Online Appendix A, we show the calculations we use to establish each state's representation in a smaller or larger House. As in our analysis fo Illinois, we use the Magleby-Mosesson algorithm, shapefiles of voter tabulation districts (VTDs) provided by the U.S. Census Bureau, and estimates of Democratic two-party voter share of the presidential vote share in the 2008, 2012, and 2016 elections at the VTD-level provided by Wolf (2014). We represent the differences in the distributions of each set of maps in Figure 4.

We report the results of our simulations in Table 2. The patterns we observed in other simulations are borne out in this larger simulation. Focusing on the last line of results in Table 2, it is clear that as we increase House size from 217 to 435, polarization increases by roughly .01 units of NOMINATE space. A similar increase is evident when we double the size of the House from its current 435 to a hypothetical House with 871 representatives. Note that the differences are statistically significant, but that the change in representation is logarithmic with each simulation doubling the next smallest simulation's House

Table 2: Estimated polarization in 10,000 maps of 9, 18, 36, and 72 congressional districts in Illinois. We use Democratic share of the two-party vote during the 2008, 2012, and 2016 presidential elections in each hypothetical district to calculate the expected DW-NOMINATE score for legislators for each district. We then calculate polarization as the difference between the mean estimated DW-NOMINATE score for the Democratic and Republican legislators elected in each hypothetical map. Below each estimate of the expected level of polarization we include a 99% confidence interval.

	DW-NOMINATE Polarization Period 1 (1947–2004)		
Election	SMALL (217 Seats)	MEDIUM (435 Seats)	LARGE (817 Seats)
2008	0.63271	0.63688	0.64085
	(0.63270, 0.63272)	(0.63687, 0.63689)	(0.64084, 0.64086)
2012	0.63616	0.64107	0.64492
	(0.63615, 0.63617)	(0.64106 0.64108)	(0.64491, 0.64493)
2016	0.64314	0.64850	0.65296
	(0.64313, 0.64315)	(0.648493, 0.64852)	(0.65295, 0.65297)
	DW-NOMINATE Polarization Period 2 (1974–2004)		
2008	0.66068	0.66683	0.67268
	(0.66066, 0.66069)	(0.66681, 0.66684)	(0.67267, 0.67269)
2012	0.66577	0.67301	0.67869
	(0.66575, 0.66579)	(0.67299, 0.67302)	(0.67868, 0.67870)
2016	0.67607	0.68399	0.69057
	(0.67605, 0.67609)	(0.68397, 0.68400)	(0.69055, 0.69058)
	DW-NOMINATE Polarization Period 3 (1994–2004)		
2008	0.73398	0.74152	0.74870
	(0.73396, 0.73400)	(0.74150, 0.74153)	(0.74868, 0.74871)
2012	0.81035	0.82722	0.84046
	(0.81031, 0.81039)	(0.82718, 0.82725)	(0.84043, 0.84048)
2016	0.75285	0.76255	0.77062
	(0.75284, 0.75287)	(0.76253, 0.76257)	(0.77060, 0.770632)

size. Thus we observe decreasing marginal impact of additional apportionment on polarization, the same pattern we observed in each of the simulations reported here.

Conclusion

The size of a legislative body has many consequences. Larger legislatures have been shown to affect the level of government spending, though different analyses have shown the effect to be positive (Gilligan and Matsusaka, 1995; Gilligan and Matsusaka, 2001; Primo and Snyder Jr., 2008) and negative (Höhmann, 2017; Pettersson-Lidbom, 2012). At the same time larger legislatures—or more precisely, smaller constituent to representative ratios—seem to produce more approval from the public (Binder *et al.*, 1998; Oppenheimer, 1996).

This second strand of research is more directly related to this article. The problem we wrestle with can be phrased in a number of ways: It is a legislative assembly that has too few members, or a single-member district electoral system that has too few districts, or districts that have too many constituents. Related work has shown that the district-based partisan bias of legislative elections can be exacerbated when districts/members are too few and constituents are too many Magleby and Robinson 2019. But how does it work for polarization?

In the analysis summarized in this article, we show that polarization is a function of legislature size. In particular we show that polarization increases as the number of representatives increases, ceteris paribus. That pattern was evident in our analysis of a hypothetical jurisdiction, in a focused analysis of a single state's delegation, and in an analysis of counterfactual Houses of Representatives that are both smaller and larger than the actual House of Representatives.

Polarization has been blamed for many problems in American politics, and our analysis suggests that increasing the size of the House would tend to exacerbate those problems, all else equal. However, it is far from clear that all else will actually remain equal if the size of the House increases. Recall that our analysis, reported in Equations 1, 2, and 3, suggests that electoral politics only explains a tiny fraction of the variance in legislator ideology. We are not the first to make this observation (see e.g., McCarty *et al.* 2009). Polarization, it seems, is primarily driven by forces other than electoral dynamics. While increasing the size of the House will not solve the problem of polarization, it might address other issues in American politics. For example, increasing chamber size can diminish the amount of bias in the translation of votes into seats in electoral settings like the U.S (see Magleby and Robinson, 2019). Likewise, increases in the number of seats might serve to diminish the responsiveness of American elections and may lead to fewer unstable majorities which Lee argues is the driving force in behavior that manifests itself as polarization (2016). Given the modest normatively negative implications of increasing apportionment with respect to polarization, and the potential that a larger House has for solving some persistent problems in American politics, it may be time to revisit the framers vision of an appropriately sized House of Representatives.

The findings herein are very much a first approximation. Are voters in every geographical unit that is to be carved up into districts distributed precisely the way our hypothetical assumes? No, obviously not. Would the model that maps district political characteristics onto members' roll call voting in the late 20th and early 21st century House of Representatives hold for a radically restructured electoral and legislative environment that would result from substantially increasing the number of districts? Very likely not.

In some ways what we have presented is a stress test. Increasing the size of the House is an idea that occasionally occurs to reformers and provoked the one substantive contribution that George Washington made during the drafting of the US Constitution. But what would be the effect of a larger House, and in the general case, what is the effect of a larger legislature all else equal? What are its potential benefits and what are its possible detriments? In this particular case, a larger legislative assembly could increase polarization, but not by much.

References

Altman, M., B. Amos, M. P. McDonald, and D. A. Smith. 2015. "Revealing Preferences: Why Gerrymanders are Hard to Prove, and What to Do about It". *Available at SSRN 2583528*.

Altman, M., J. Gill, and M. P. McDonald. 2004. *Numerical Issues in Statistical Computing for the Social Scientist*. Vol. 508. John Wiley & Sons.

Altman, M. and M. P. McDonald. 2011. "BARD: Better Automated Redistricting". *Journal of Statistical Software*. 42(4): 1–28.

Binder, S., F. Maltzman, and L. Sigelman. 1998. "Senators' Home-State Reputations: Why Do Constituents Love a Bill Cohen So Much More Than an Al D'Amato?" *Legislative Studies Quarterly*: 545–560.

Fenno, R. F. 1978. *Home Style: House Members in their Districts*. Harper-Collins.

Gilligan, T. W. and J. G. Matsusaka. 1995. "Deviations from Constituent Interests: The Role of Legislative Structure and Political Parties in the States". *Economic inquiry*. (3): 383–401.

Gilligan, T. W. and J. G. Matsusaka. 2001. "Fiscal Policy, Legislature Size, and Political Parties: Evidence from State and Local Governments in the First Half of the 20th Century". *National Tax Journal*. 54(1): 57–82.

Hamilton, A. 2012. *The Federalist Papers*. New York, NY: Dutton/Signet.

Höhmann, D. 2017. "The Effect of Legislature Size on Public Spending: Evidence from a Regression Discontinuity Design". *Public Choice*. 173(3): 345–367.

Lee, F. E. 2016. *Insecure Majorities: Congress and the Perpetual Campaign*. University of Chicago Press.

Magleby, D. B. and D. B. Mosesson. 2018. "A New Approach for Developing Neutral Redistricting Plans". *Political Analysis*. 26(2): 147–167.

Magleby, D. B. and G. Robinson. 2019. "The Zeroeth Amendment: Apportionment and the Perpetuation of Partisan Bias". Working paper.

Mayhew, D. R. 1974. *Congress: The Electoral Connection*. Vol. 26. Yale University Press.

McCarty, N., K. T. Poole, and H. Rosenthal. 2009. "Does Gerrymandering Cause Polarization?" *American Journal of Political Science*. 53(3): 666–680.

Oppenheimer, B. I. 1996. "The Representational Experience: The Effect of State Population on Senator-constituency Linkages". *American Journal of Political Science*: 1280–1299.

Pettersson-Lidbom, P. 2012. "Does the Size of the Legislature Affect the Size of Government? Evidence from Two Natural Experiments". *Journal of Public Economics*. 96(3–4): 269–278.

Primo, D. M. and J. M. Snyder Jr. 2008. "Distributive Politics and the Law of 1/n". *The Journal of Politics*. 70(2): 477–486.

Riker, W. H. 1991. "Why Negative Campaigning is Rational: The Rhetoric of the Ratification Campaign of 1787–1788". *Studies in American Political Development*. 5(2): 224–283.

Wolf, S. 2014. "DRA Update: 2012 President & Downballot Election Results Estimates Display Table Template". In: *The Daily Kos*. (accessed on 7/24/2017). URL: http://www.dailykos.com/stories/2014/8/4/1318876/-DRA-Update-2012-President-Downballot-Election-Results-Estimates-Display-Table-Template.