

# An Evaluation of the Partisan Fairness of Kansas's Enacted Congressional Plan

Christopher Warshaw\*

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\*Associate Professor, Department of Political Science, George Washington University. [warshaw@gwu.edu](mailto:warshaw@gwu.edu). Note that the analyses and views in this report are my own, and do not represent the views of George Washington University.

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# 1 Introduction

My name is Christopher Warshaw. I am an Associate Professor of Political Science at George Washington University. Previously, I was an Associate Professor at the Massachusetts Institute of Technology from July 2016 - July 2017, and an Assistant Professor at MIT from July 2012 - July 2016.

I have been asked by Counsel to analyze relevant data and provide my expert opinions about the Ad Astra 2 congressional plan. In particular, I have been asked to evaluate whether the plan provides a disproportionate advantage to any political party based on generally accepted measures of partisan fairness. I have also been asked to evaluate alternative plans proposed over the past few months.

# 2 Qualifications and Publications

My Ph.D. is in Political Science, from Stanford University, where my graduate training included courses in political science and statistics. I also have a J.D. from Stanford Law School. My academic research focuses on public opinion, representation, elections, and polarization in American Politics. I have written over 20 peer reviewed papers on these topics. Moreover, I have written multiple papers that focus on elections and two articles that focus specifically on redistricting. I also have a forthcoming book that includes an extensive analysis on the causes and consequences of partisan gerrymandering in state governments.

My curriculum vitae is attached to this report. All publications that I have authored and published appear in my curriculum vitae. My work is published or forthcoming in peer-reviewed journals such as: the *American Political Science Review*, the *American Journal of Political Science*, the *Journal of Politics*, *Political Analysis*, *Political Science Research and Methods*, the *British Journal of Political Science*, the *Annual Review of Political Science*, *Political Behavior*, *Legislative Studies Quarterly*, *Science Advances*, the *Election Law Journal*, *Nature Energy*, *Public Choice*, and edited volumes from Cambridge University Press and Oxford University Press. My book entitled *Dynamic Democracy in the American States* is forthcoming from the University of Chicago Press. My non-academic writing has been published in the *New York Times* and the *Washington Post*. My work has also been discussed in the *Economist* and many other prominent media outlets.

My opinions in this case are based on the knowledge I have amassed over my education, training and experience, including a detailed review of the relevant academic literature.

They also follow from statistical analysis of the following data:

- In order to calculate partisan bias in congressional elections on the Ad Astra 2 plan in Kansas, I examined:
  - GIS Files with the 2012-2020 Kansas congressional plan and the proposed 2022-30 plan): I obtained the Ad Astra 2 plan and other plans considered in 2021-2022 from the Kansas Legislative Research Service. I obtained the 2012-2020 plan from the Census website.
  - Precinct-level data on recent statewide Kansas elections: I use shapefiles of precinct-level results in Kansas in 2012 and 2016-2020 from the Voting and Election Science Team (University of Florida, Wichita State University). I obtained these data from the Harvard Dataverse.<sup>1</sup>
  - Estimates of the partisan bias in previous congressional elections: As part of my peer reviewed academic research, I have estimated the partisan bias of districting plans used in previous congressional elections around the country from 1972-2020 (Stephanopoulos and Warshaw 2020).

I have previously provided expert reports in seven redistricting-related cases:

- Between 2017 and 2019, I provided reports for *League of Women Voters of Pennsylvania v. Commonwealth of Pennsylvania*, No. 159 MM 2017, *League of Women Voters of Michigan v. Johnson*, 17-14148 (E.D. Mich), and *APRI et al. v. Smith et al.*, No. 18-cv-357 (S.D. Ohio). My expert testimony was found to be admissible and credible in each of these cases and was extensively cited by the judges in their decisions.
- In the current redistricting cycle, I have provided reports in *League of Women Voters v. Ohio Redistricting Commission*, No. 2021-1193, *League of Women Voters v. Kent County Apportionment Commission*, *League of Women Voters of Ohio v. Ohio Redistricting Commission*, No. 2021-1449, and *League of Women Voters of Michigan v. Michigan Independent Citizens Redistricting Commission*.

I also recently provided testimony to Pennsylvania's Bipartisan Reapportionment Commission about the partisan fairness of its proposed State House plan. In addition, I have provided expert testimony and reports in several cases related to the U.S. Census: *State of New York et al. v. United States Department of Commerce*, 18-cv-2921

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1. See <https://dataverse.harvard.edu/dataverse/electionscience>.

(S.D.N.Y.), *New York v. Trump*; *Common Cause v. Trump*, 20-cv-2023 (D.D.C.), and *La Union Del Pueblo Entero (LUPE) v. Trump*, 19-2710 (D. Md.).

I am being compensated at a rate of \$375 per hour. The opinions in this report are my own, and do not represent the views of George Washington University.

### 3 Summary

The relationship between the distribution of partisan support in the electorate and the partisan composition of the government—what Powell (2004) calls “vote–seat representation”—is a critical link in the longer representational chain between citizens’ preferences and governments’ policies. If the relationship between votes and seats systematically advantages one party over another, then some citizens will enjoy more influence—more “voice”—over elections and political outcomes than others (Caughey, Tausanovitch, and Warshaw 2017).

In order to project future election results, I use a composite of previous statewide election results between 2012-2020.<sup>2</sup> Next, I characterize the bias in Kansas’s plans based on an established, generally accepted metric of partisan fairness (the efficiency gap) and place the bias in Kansas’s plans into historical perspective. This analysis indicates that the proposed map has an extreme level of pro-Republican bias.

- Based on the statewide elections in Kansas between 2012-2020, the Democrats’ statewide two-party vote share averaged about 41% of the vote. When I average across these elections, however, Democrats would have won just 9% of the seats under the Ad Astra 2 plan.<sup>3</sup> This large disparity between the Democrats’ share of the statewide vote and their share of the seats provides an initial indication that the plan is biased in favor of Republicans. I quantify this bias using the efficiency gap to measure the relative efficiency of votes for the two parties. This indicates a 22.5% pro-Republican efficiency gap. This efficiency gap is more biased than 95% of previous congressional elections and more pro-Republican than 98% of previous elections over the past 50 years around the country.

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2. These include the following ten elections: 2020 President, 2020 Senate, 2018 Governor, 2018 Secretary of State, 2018 Treasurer, 2018 Attorney General, 2018 Insurance Commissioner, 2016 President, 2016 Senate, 2012 President. Unfortunately, precinct-level results from the 2014 election cycle are not available.

3. Following standard convention, throughout my analysis I focus on two-party vote shares. I also weight the composite scores to give each election cycle equal weight in the index. But in the appendix I show that I reach nearly identical results whether I weight each contest equally or not.

The remainder of the report proceeds as follows. First, I discuss how social scientists measure partisan bias in a districting plan. Next, I examine the partisan fairness of the proposed congressional plan, and compare it to the fairness of other plans around the country over the past 50 years. Finally, I briefly conclude.

## 4 Background on Partisan Fairness

This section provides background about how social scientists conceptualize partisan fairness in a districting plan. Partisan advantage in a districting plan means that one party’s voters are more “cracked” and “packed” than the other side’s supporters. In cracked districts, voters’ preferred candidates lose by relatively narrow margins; in packed districts, their candidates of choice win by enormous margins (Stephanopoulos and McGhee 2015). Thanks to disproportionate cracking and packing, the disfavored party is less able than the favored party to convert its statewide support among voters into legislative representation. This gives the favored party the ability to shift policies in its direction (Caughey, Tausanovitch, and Warshaw 2017) and build a durable advantage in downstream elections (Stephanopoulos and Warshaw 2020). It can even lead to undemocratic outcomes where the advantaged party wins the majority of the seats and controls the government while only winning a minority of the votes.

There are a number of approaches that have been proposed to measure partisan fairness in a districting plan. These approaches focus on asymmetries in the efficiency of the vote–seat relationships of the two parties. In recent years, at least 10 different approaches have been proposed (McGhee 2017; Warrington 2019). While no measure is perfect, much of the recent literature has focused on several related approaches, including the efficiency gap (McGhee 2014; Stephanopoulos and McGhee 2015), declination (Warrington 2018), partisan symmetry (Niemi and Deegan 1978; Gelman and King 1994; McGhee 2014; Katz, King, and Rosenblatt 2020), and the mean-median difference (Krasno et al. 2018; Best et al. 2017; Wang 2016). When I analyze a redistricting plan, I generally use each of these four approaches to quantify the partisan fairness of the plan. However, the declination, symmetry, and mean-median difference metrics are less applicable when, as in Kansas, one party wins a lopsided share of the statewide vote.<sup>4</sup> So I focus on the efficiency gap in

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4. The partisan symmetry and mean-median metrics both implicitly rely on counter-factual swings in vote share that are “more extreme and implausible as the [two-party] vote share drifts further from parity” (McGhee 2017, 9). Indeed, McGhee (2017) finds that the measures can yield invalid results in less competitive states where one party wins a lopsided share of the statewide vote. For instance, they can fail to show a growing advantage for a party when its seat share increases without a corresponding increase in its vote share. In addition, the declination metric is only valid in scenarios where both parties win at least one seat on a plan (Warrington 2018), which is not always true on congressional plans in

this report, which is applicable to plans such as Kansas.

## 4.1 Efficiency Gap

Both cracked and packed districts enable the advantaged party to translate its votes more efficiently into seats than the disadvantaged party is able to (McGhee 2014; Stephanopoulos and McGhee 2015). This suggests that partisan fairness can be measured based on asymmetries in the number of inefficient votes for each party. This *efficiency gap* (EG) is defined as “the difference between the parties’ respective [inefficient] votes, divided by the total number of votes cast in the election” (Stephanopoulos and McGhee 2015, 831; see also McGhee 2014, 2017). All of the losing party’s votes are inefficient if they lose the election. When a party wins an election, the inefficient votes are those above the 50%+1 needed to win.

If we adopt the convention that positive values of the efficiency gap imply a Democratic advantage in the districting process and negative ones imply a Republican advantage, the efficiency gap can be written mathematically as:

$$EG = \frac{W_R}{n} - \frac{W_D}{n} \quad (1)$$

where  $W_R$  are inefficient votes for Republicans,  $W_D$  are inefficient votes for Democrats, and  $n$  is the total number of votes in each state.

Table 1 provides a simple example about how to calculate the efficiency gap with three districts where the same number of people vote in each district. In this example, Democrats win a majority of the statewide vote, but they only win 1/3 seats. In the first district, they win the district with 75/100 votes. This means that 24 votes were unnecessary to win a majority of the vote in this district. But they lose the other two districts and thus all 40 of their votes in those districts do not translate into seats. In all, 104 Democratic votes are inefficient. For Republicans, on the other hand, all 25 of their votes in the first district do not translate into a victory. But they only 9 votes are unnecessary to win a majority in the two districts they win. In all, 43 Republican votes are inefficient in that they are unnecessary for seats. This implies a pro-Republican efficiency gap of  $\frac{43}{300} - \frac{104}{300} = -20\%$ .

In order to account for unequal population or turnout across districts, the efficiency gap formula in equation 1 can be rewritten as:

$$EG = S_D^{margin} - 2 * V_D^{margin} \quad (2)$$

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Kansas.

Table 1: Illustrative Example of Efficiency Gap

District	Democratic Votes	Republican Votes
1	75	25
2	40	60
3	40	60
<b>Total</b>	155 (52%)	145 (48%)
<b>Inefficient</b>	104	43

where  $S_D^{margin}$  is the Democratic Party’s seat margin (the seat share minus 0.5) and  $V_D^{margin}$  is the Democratic Party’s vote margin.  $V_D^{margin}$  is calculated by aggregating the raw votes for Democratic candidates across all districts, dividing by the total raw vote cast across all districts, and subtracting 0.5 (McGhee 2017, 11-12). In the example above, this equation also provides an efficiency gap of -20% in favor of Republicans. But it could lead to a slightly different estimate of the efficiency gap if districts are malapportioned or there is unequal turnout across districts.<sup>5</sup>

The efficiency gap mathematically captures the packing and cracking that are at the heart of partisan gerrymanders (Buzas and Warrington 2021). It measures the extra seats one party wins over and above what would be expected if neither party were advantaged in the translation of votes to seats (i.e., if they had the same number of inefficient votes). A key advantage of the efficiency gap over other measures of partisan bias is that it can be calculated directly from observed election returns even when, as in Kansas, the parties’ statewide vote shares are not equal.

A factor that complicates the calculation of the efficiency gap in Kansas is that the state only has four congressional seats. Past studies have found that states with small numbers of congressional results can have high variance in their efficiency gap over the course of a decade due to close elections in one or two districts (Stephanopoulos and McGhee 2015). But I address this concern by calculating the efficiency gap based on the composite of previous statewide election results. This provides a probabilistic estimate of the two-party vote shares, seat shares, and the efficiency gap that accounts for variation across election cycles.

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5. In general, the two formulations of the efficiency gap formula yield very similar results. Because Democrats tend to win lower-turnout districts, however, the turnout adjusted version of the efficiency gap in equation 2 tends to produce results that suggest about a 2% smaller disadvantage for Democrats than the version in Equation 1 (see McGhee 2018).



## 5 Maps of Kansas's proposed Congressional Plan

In this section, I show maps of the four congressional districts on the Ad Astra 2 plan (see Figure 1 for a statewide map of the plan). These maps show the political geography of each of the districts on the plan.

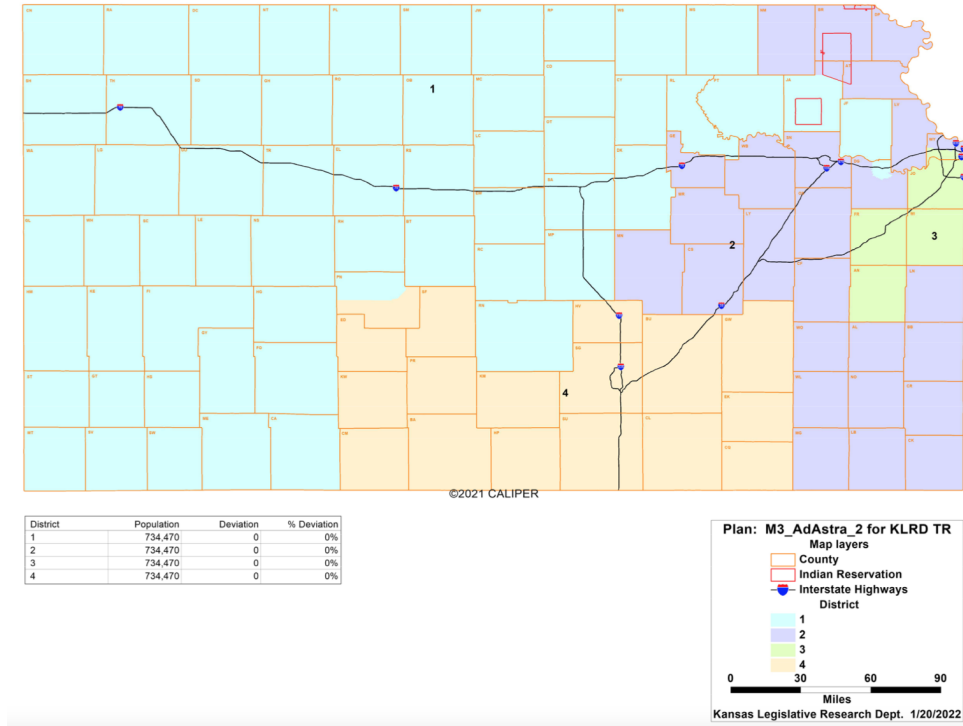


Figure 1: Map of the Enacted Ad Astra 2 plan

In order to create these maps, I first created an estimate of the Democratic vote share in each district based on available election data between 2012-2020. This vote share indicator was then multiplied by the number of votes cast for the Democratic and Republican presidential candidates in the 2020 election to generate a numerical margin between Democrats and Republicans for each voting district. For instance, if the Republican candidate received 600 votes and the Democratic candidate received 400 votes in a specific voting district, the district's margin would be calculated as Republican +200. This margin is then divided by the number of hectares in the voting district to get a margin per hectare score, reflecting how vote density plays a role in shaping districts. The overall margin between Republican and Democratic votes also does a better job of representing voter choice than a simple percentage as districts with smaller vote counts require fewer voters to flip from one party to the other.

Figure 2 shows the first congressional district. As the map shows, this district is overwhelmingly Republican. There are red areas across the district with just a few small

pockets of Democratic voters. Overall, Republicans are likely to win about 66% of the vote in this district.

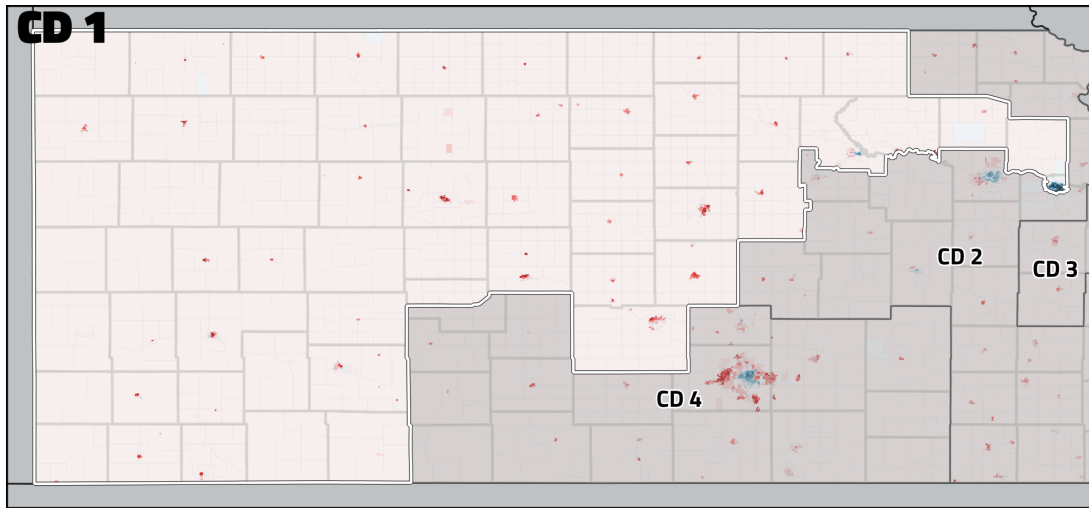


Figure 2: Map of District 1 on the Enacted Ad Astra 2 plan. Blue areas are Democratic and red areas are Republican. The shading reflects the margin of votes per hectare.

Figure 3 shows the second congressional district. This district also leans strongly toward Republicans. Most of the voting areas in the district are very Republican. The main areas of Democratic strength are in the northern Kansas City suburbs. Overall, Republicans are likely to win about 58% of the vote in this district.

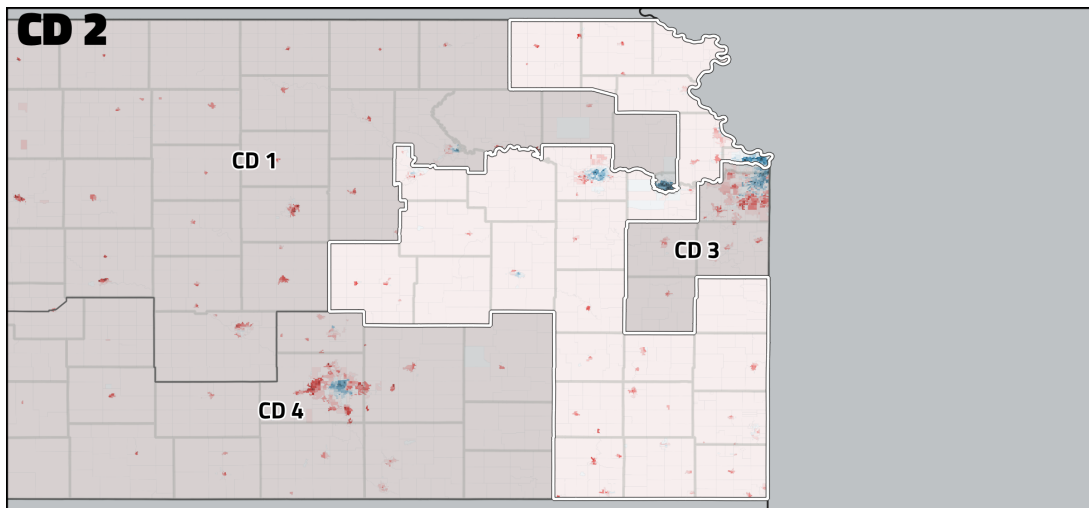
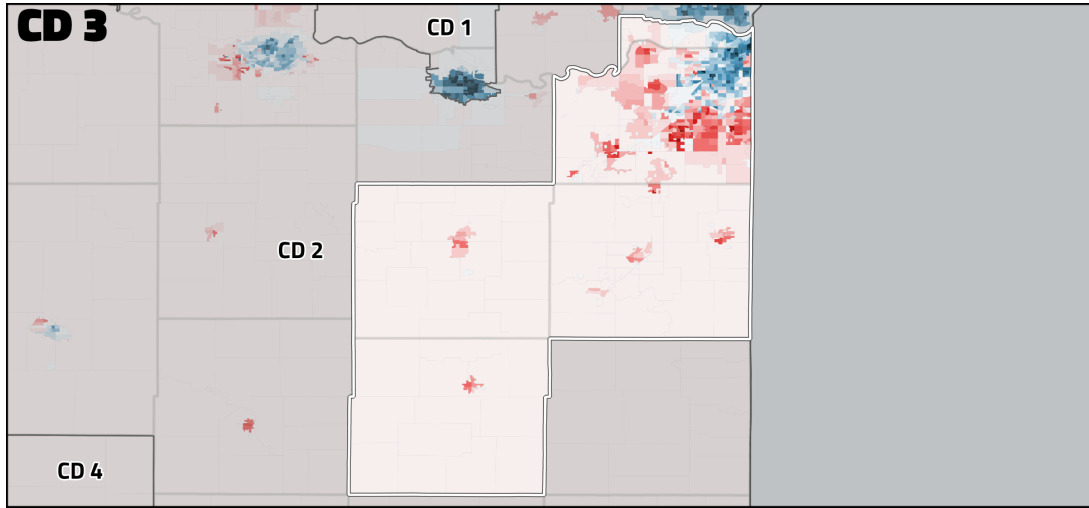


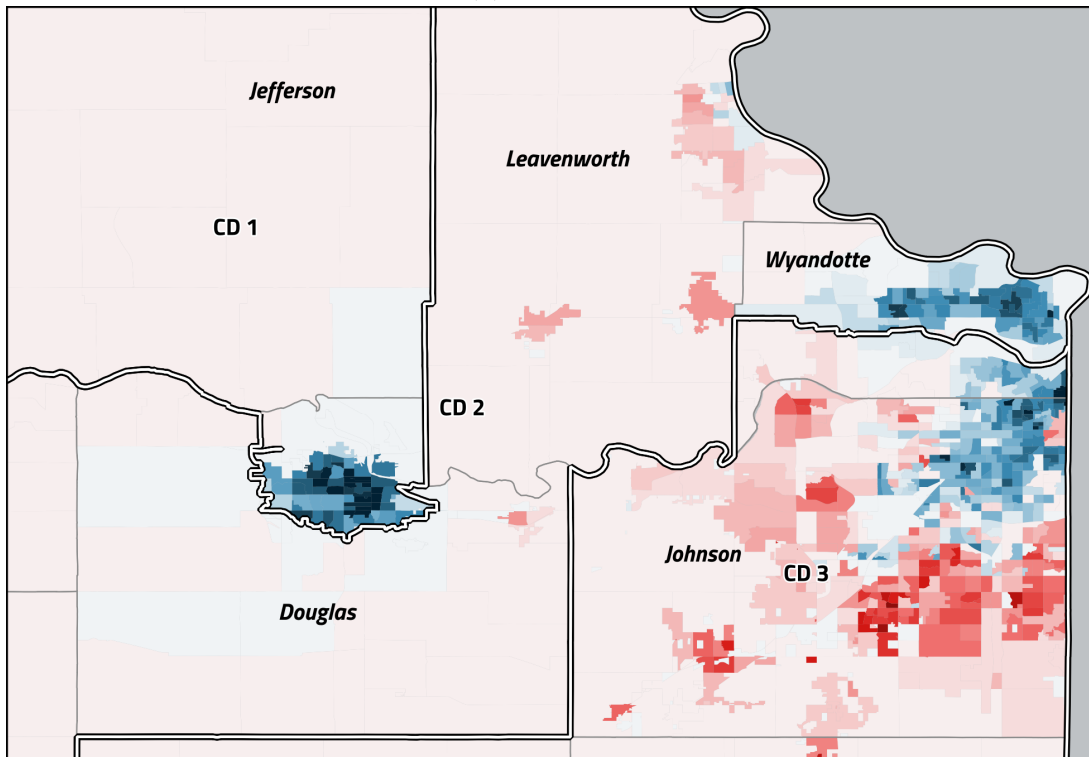
Figure 3: Map of District 2 on the Enacted Ad Astra 2 plan. Blue areas are Democratic and red areas are Republican. The shading reflects the margin of votes per hectare.

The top panel of Figure 4 shows the third congressional district. This district also leans slightly Republicans. But it is the closest district on the plan. The district combines

very Democratic areas of Kansas City with more Republican exurban and rural areas. The bottom panel of Figure 4 shows how the district cracks Democratic voters in the northern suburbs of Kansas City between the 2nd and 3rd districts. Overall, Republicans are likely to get about 53% of the vote in this district.



(a) District 3



(b) Kansas City Area

Figure 4: Map of District 3 on the Enacted Ad Astra 2 plan. Blue areas are Democratic and red areas are Republican. The shading reflects the margin of votes per hectare.

Finally, Figure 5 shows the fourth congressional district. Wichita is the main population center in this district. The core of Wichita leans Democratic, while the exurban and rural areas are strongly Republican. Overall, Republicans are likely to get about 62% of the vote in this district.

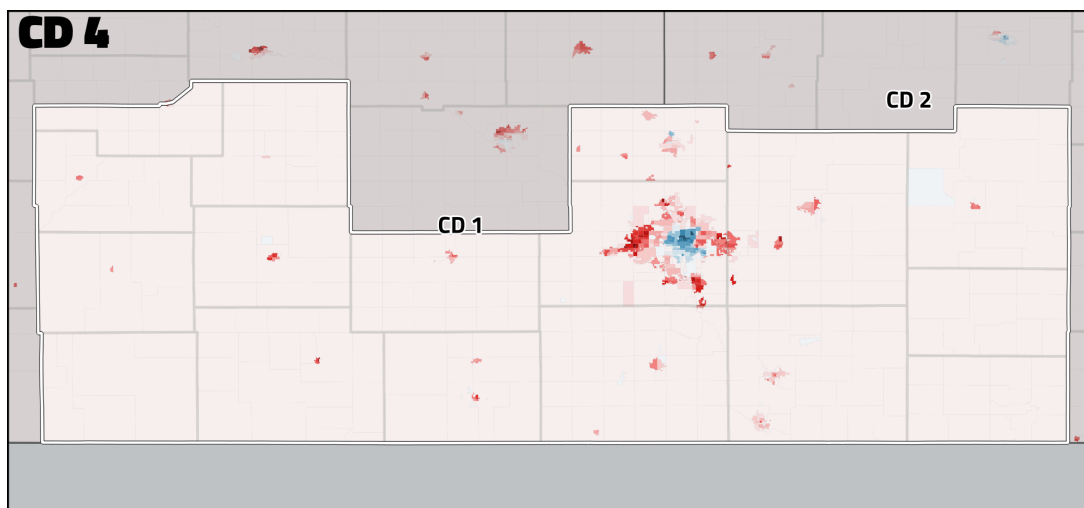


Figure 5: Map of District 4 on the Enacted Ad Astra 2 plan. Blue areas are Democratic and red areas are Republican. The shading reflects the margin of votes per hectare.

## 6 Partisan Fairness of Kansas’s proposed Congressional Plan

In this section, I will provide a comprehensive evaluation of the partisan fairness of Kansas’s enacted congressional districting plan. I will also compare the Ad Astra 2 plan with Kansas’s 2012-2020 plan and the alternative plans proposed over the past few months. In order to evaluate the Ad Astra 2 plan, we need to predict future election results on this map.

### 6.1 Composite of previous statewide elections

To predict future elections, I use a composite of previous statewide election results between 2012-2020 re-aggregated to the proposed map.<sup>6</sup> For each year, I estimate each party’s vote

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6. These include the following ten elections: 2020 President, 2020 Senate, 2018 Governor, 2018 Secretary of State, 2018 Treasurer, 2018 Attorney General, 2018 Insurance Commissioner, 2016 President, 2016 Senate, 2012 President. Unfortunately, precinct-level results from the 2014 election cycle are not available.

share, seat share, and the average of the partisan fairness metrics across races. I then average them together to produce a composite result.

Figure 6 shows the votes shares in each district of the 2012-2020 plan and the Ad Astra 2 plan based on the composite elections. The dots show the average results in each district and the confidence intervals show the range of results across years. The graph shows that the new plan substantially lowers the Democratic vote share in district 3. The average Democratic vote share in that district goes from just above 50% to about 47%. As a result, the Democratic candidate would likely only win in the new district 3 during a strong Democratic wave year.

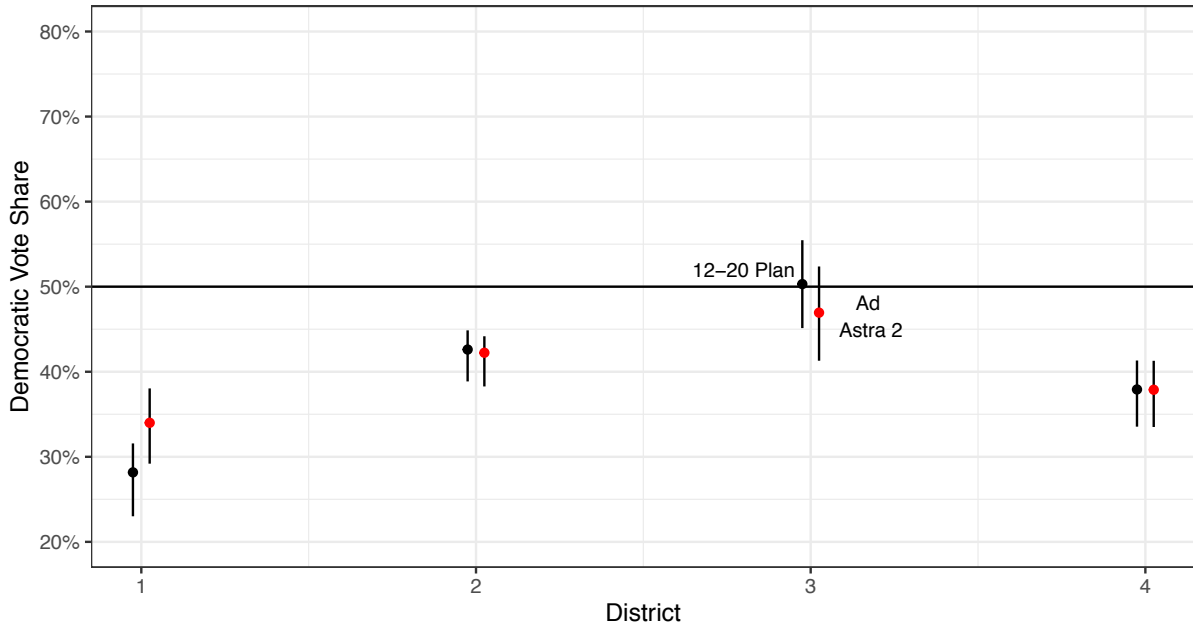


Figure 6: Vote share projections in each district based on the composite elections. The black dots show the 2012-2020 plan and the red dots show the Ad Astra 2 plan.

When I average across these statewide elections from 2012-2020, Democrats win 41% of the votes, but only 9% of the seats on the Ad Astra 2 plan (see Table A1). Specifically, I calculate that Democrats would win 0% of the seats on this plan in 2012, 0% of the seats in 2016, 12.5% of the seats in 2018 (averaged across races), and 25% of the seats in 2020.<sup>7</sup> In comparison, Democrats won 16% of the seats on the 2012-2020 plan (averaged across election cycles). This provides an initial indication that the Ad Astra 2 plan provides a

7. I weight the composite scores to give each election cycle equal weight in the index. The seat-level projections are based on the statewide elections where I have precinct-level data. This approach ensures that my results are not arbitrarily influenced by the fact that more election contests took place in some years than others. However, I reach very similar results whether I weight each contest equally or not (see the Supplementary Appendix to my report).

disproportionate advantage to the Republican Party.

		2012-2020 Composite	
Metric	Value	> Biased than this % Elections	> Pro-Rep. than this % Elections
2012-2020 plan			
Democratic Vote Share	41%		
Democratic Seat Share	16%		
Efficiency Gap	-15.6%	83%	93%
Enacted Ad Astra 2 plan			
Democratic Vote Share	41%		
Democratic Seat Share	9%		
Efficiency Gap	-22.5%	95%	98%

Table 2: Composite bias metrics for Ad Astra 2 plan based on statewide elections

A more detailed look at the efficiency gap reinforces this conclusion. Indeed, the plan has a -22.7% pro-Republican efficiency gap.<sup>8</sup> This means that votes for Republican candidates are expected to be inefficient at a rate 22.7% lower than votes for Democratic candidates. This is more biased than 95% of previous congressional elections in states with at least 3 seats over the past 50 years. It is more pro-Republican than 98% of previous congressional elections.

## 6.2 Comparison with other proposed plans

In this section, I compare the enacted Ad Astra 2 plan with other congressional plans that were considered by the Kansas state legislature.<sup>9</sup> Table 3 shows each of the proposed plans.<sup>10</sup> It also shows the party of the state legislator that proposed the plan.<sup>11</sup> The table indicates that at least 14 individual plans were proposed. Moreover, plans were proposed by members of both political parties.

To begin, Figure 7 compares the expected Democratic vote share in district 3 in the enacted Ad Astra 2 plan (red), the 2012-2020 plan (purple), and other potential plans in Kansas (black) based on the composite of statewide elections. I focus on district 3 because this is the only potentially competitive district on the Kansas congressional map, which makes its outcome the most important feature of any plan. In the 2012-2020 plan, the

8. I also calculate that the plan had a large pro-Republican efficiency gap in every individual year where I have data.

9. I omit the Ad Astra and Ad Astra 3 plans since these are nearly identical to the enacted Ad Astra 2 plan.

10. See <http://www.kslegresearch.org/KLRD-web/Redistricting-2022-Plans.html>

11. These are based on the [www.fivethirtyeight.com](http://www.fivethirtyeight.com) website. <https://projects.fivethirtyeight.com/redistricting-2022-maps/kansas/>.

Plan	Proposing Party
“Ad Astra 2”	Republican
“Wildcat”	Republican
“Patriot”	Republican
“Eagle”	Republican
“Sunflower”	Republican
“Sunflower 3”	Republican
“Prairie Dog”	Democratic
“Mushroom Rock 2”	Democratic
“Meadowlark 5”	Republican
“Meadowlark 6”	Republican
“United”	Democratic
“Buffalo 2”	Democratic
“Bluestem”	Republican
“Jayhawk”	Unknown

Table 3: Plans considered by Kansas State Legislature

expected Democratic vote share in district 3 is about 50.3%. The enacted plan shrinks the expected Democratic vote share in district 3 to 46.9%. This decrease is much more than on other proposed plans. In fact, only one other plan (Sunflower) shrinks the expected Democratic vote share in district 3 below 50%.

This indicates that the decrease in Democratic performance in district 3 appears to be intentional. It is not an inevitable result of Kansas’s political geography since every other plan led to a higher Democratic vote share in district 3 than the enacted plan.

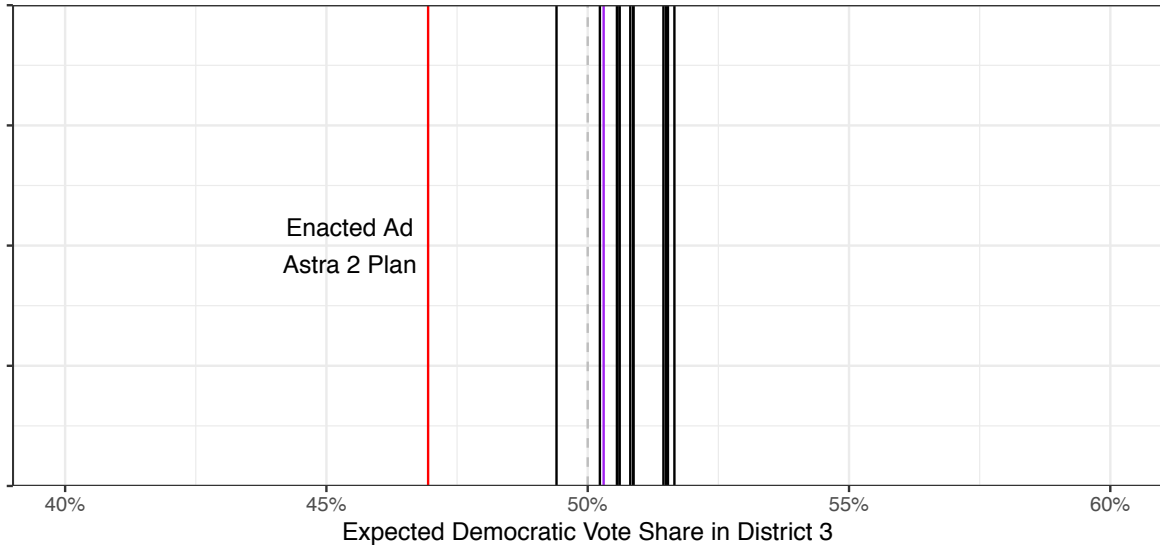


Figure 7: Comparison of Democratic vote share in district 3 in Ad Astra 2 plan (red), 2012-2020 plan (purple), and other potential plans in Kansas (black) based on composite of statewide elections.

Next, Figure 8 compares the expected Democratic seat share in district 3 on the

enacted Ad Astra 2 plan (red), the 2012-2020 plan (purple), and other potential plans in Kansas (black) based on the composite of statewide elections. On the 2012-2020 plan, Democrats win in district 3 about two thirds of the time. As a result, their overall expected seat share on the plan is 16%. In the enacted plan, however, Democrats only are expected to win district 3 about a third of the time. As a result, their expected seat share falls to 9%. Moreover, the Democratic seat share on the enacted plan is lower than in any of the other proposed plans.

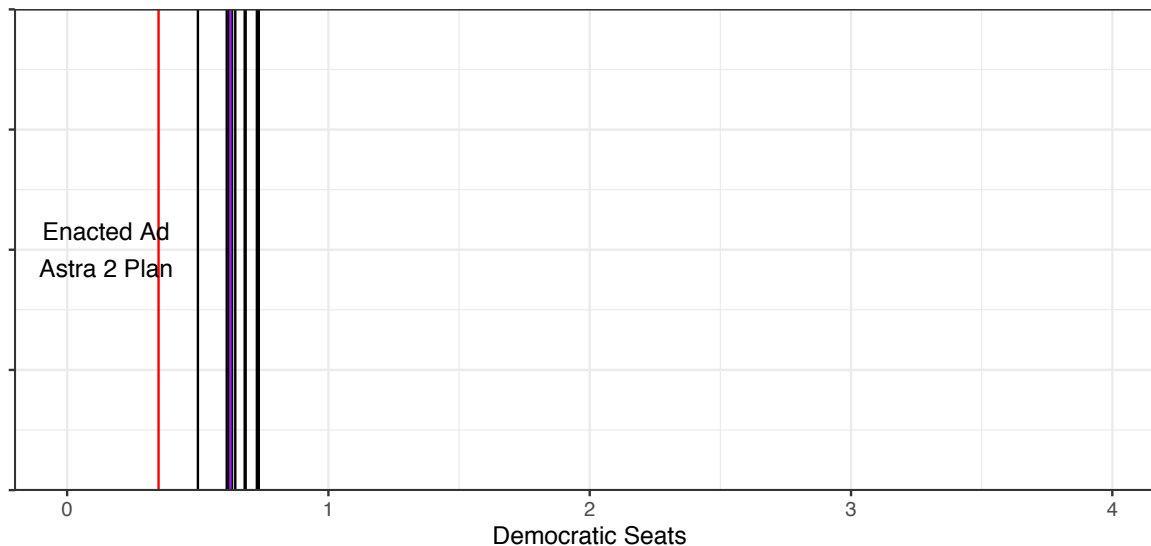


Figure 8: Comparison of Democratic seat share in district 3 on Ad Astra 2 plan (red), 2012-2020 plan (purple), and other potential plans in Kansas (black) based on composite of statewide elections.

This provides further evidence that the decrease in Democratic performance in the enacted plan appears to be intentional. The enacted plan is the only one where Democrats are not expected to win a seat in Kansas’s congressional delegation at least half the time (and thus, at least .5 seats averaged across years). So the Republican sweep that is the likely result of the enacted plan is not an inevitable result of Kansas’s political geography.

Finally, Figure 9 graphically shows the bias of the Ad Astra 2 plan compared to previous plans from 1972-2020 around the country. Overall, the graph shows that the Ad Astra 2 plan is more pro-Republican than the vast majority of previous plans over the past 50 years. In other words, it is an extreme historical outlier. The graph also shows that the enacted plan has a more pro-Republican efficiency gap than either the 2012-2020 plan or other plans proposed in Kansas this cycle (including other plans proposed by Republicans).



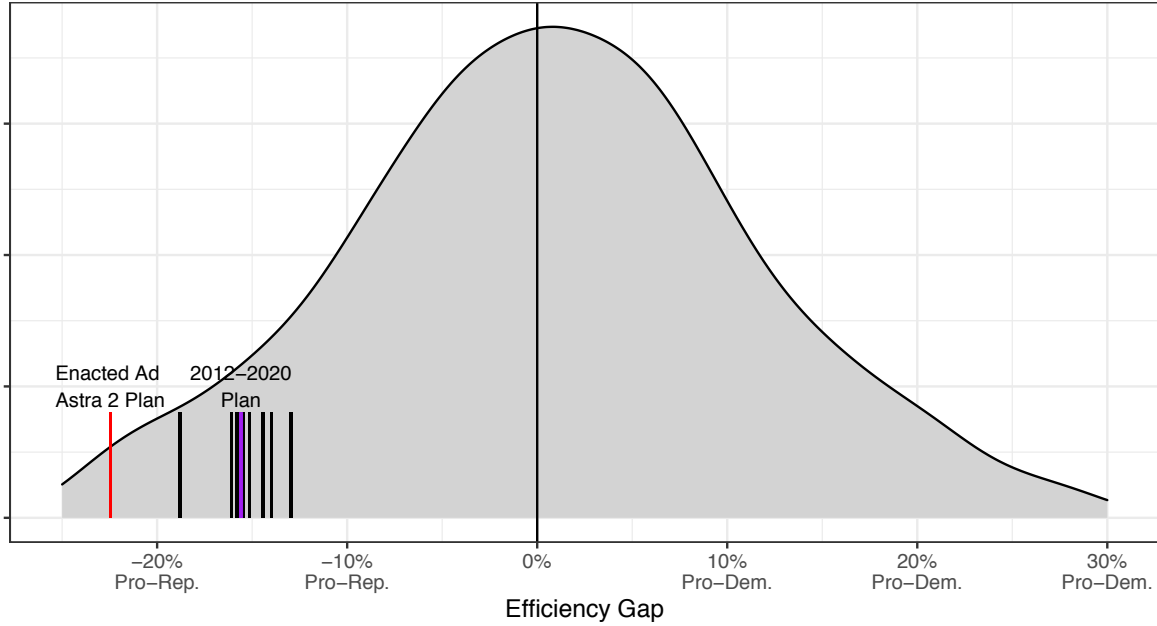


Figure 9: Comparison of efficiency gap on Ad Astra 2 plan, 2012-2020 plan, and other potential plans in Kansas based on composite of statewide elections with other congressional districting plans from 1972-2020 around the country.

## 7 Partisan Gerrymandering & Representation in Congress

In the previous sections, I have shown that Kansas’s enacted congressional districting plan is likely to lead to a substantial and durable partisan advantage for Republicans. Moreover, this partisan bias is large both relative to other states and relative to other proposed districting plans in Kansas. Now, I turn to the effects of this partisan advantage for the representation that Kansas’s citizens receive in Congress. The pro-Republican efficiency gap diminishes the ability of Democratic voters in Kansas to elect representatives of their choice. The growing polarization in Congress means that representatives in Congress nearly always vote the party line. So Democrats whose votes are inefficient due to gerrymandering do not have their views represented in Congress. This means that they have little, if any, voice on important issues. Thus, the combination of partisan gerrymandering and polarization in Congress has a profound, pernicious effect on democratic representation.

### 7.1 Growth of Polarization in Congress

It has been widely documented that partisan polarization in Congress has grown significantly in recent decades. This work has shown that congressional voting is increasingly

polarized by party. Indeed, the gap between the roll call behavior of the two parties has grown substantially since the 1970s (Poole and Rosenthal 1997; McCarty, Poole, and Rosenthal 2006, 2009; Bartels, Clinton, and Geer 2016).<sup>12</sup> The responsiveness of legislators to district preferences has also waned during this period. In recent years, there has been “muted responsiveness to localities” (Ansolabehere, Snyder, and Stewart 2001).

In this section, I first use a variety of methods to document the growing polarization in Congress. One simple approach to showing the growth in polarization is to examine changes in the proportion of the time that members of each party vote in a conservative direction on individual roll calls.<sup>13</sup> Recent work by Professors Anthony Fowler and Andrew Hall has classified whether each roll call vote is liberal or conservative, and the percentage of the time that each member of congress votes in a conservative direction relative to the median legislator (Fowler and Hall 2017).

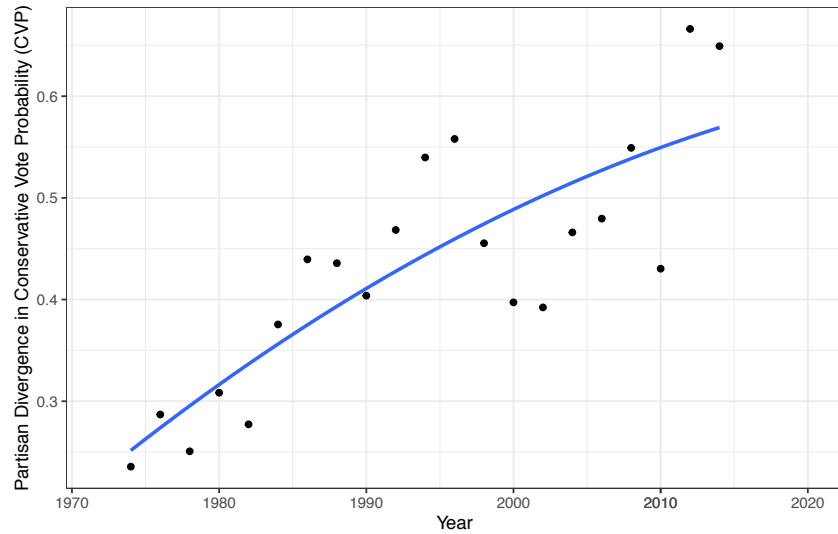


Figure 10: Difference in the Proportion of the Time that Members of Each Party Vote Conservatively. The dots represents the averages in each year, and the line shows a moving average.

Figure 10 above shows the difference in the proportion of votes that members of each party vote in a conservative direction. It shows that the gap between the parties grew substantially in the late 1980s and early 1990s, and then again in 2012. In the most recent Congress where data is available (113th), there was a 65% difference between Democrats

12. It is important to note that there is no evidence using pre-2011 redistricting data that gerrymandering causes this polarization (McCarty, Poole, and Rosenthal 2009). There is not yet a consensus about the effect of redistricting on polarization in recent years. Regardless of whether gerrymandering causes polarization, however, polarization exacerbates the effects of gerrymandering on the political process.

13. The conservative polarity in this analysis is arbitrary, and all the analyses are symmetric for voting in a liberal direction.

and Republicans.

A limitation of this analysis, however, is that it implicitly treats all “conservative” roll calls as equally conservative (and, conversely, all liberal votes as equally liberal). Imagine that conservative roll calls today would enact more conservative policies than conservative roll calls in the 1980s. In this case, it might be reasonable for a moderate congressperson, who is equally conservative in both periods, to vote for the conservative position in the 1980s and against it today. Thus, the estimates of conservative vote probabilities are not comparable inter-temporally either for individual members or for Congress as a whole.

To address this issue, Political Scientists have developed a number of different ways to estimate the latent ideology of members of Congress based on their roll call votes (for a review, see McCarty 2011). In this section, I’ll focus on the most prevalent model – the DW-Nominate scores developed by Professors Howard Rosenthal and Keith Poole (Poole and Rosenthal 1997). These scores are considered the classic, established estimates of the ideology of members of Congress. They have been used by hundreds of political science studies.

These scores characterize legislators’ latent ideology using a statistical model based on all of their roll call votes.<sup>14</sup> The score for each member ranges from -1 (most liberal) to +1 (most conservative). These ideology scores are made inter-temporally comparable based on the assumption that individual members of Congress keep the same ideological position throughout their career in Congress.<sup>15</sup>

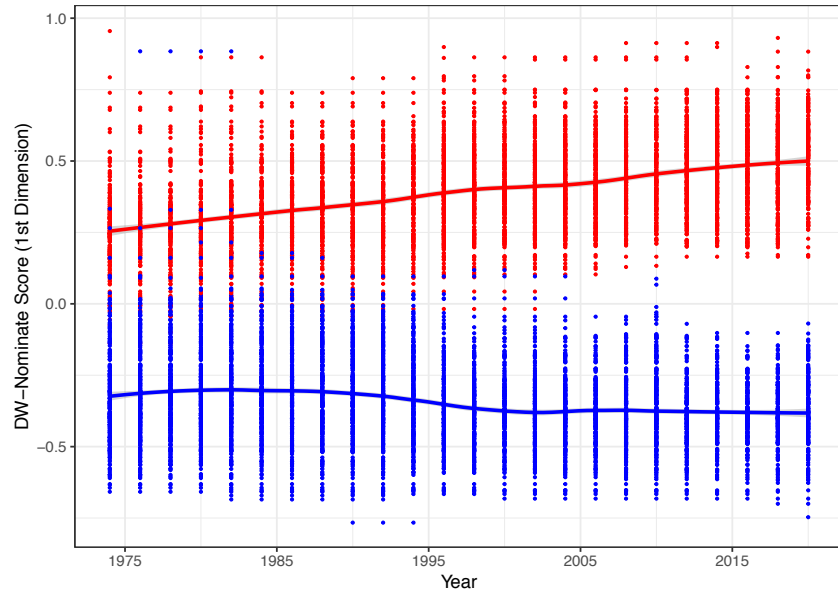
The top panel of Figure 11 (below) shows the trends in the average ideology of Democrats and Republicans in the United States House over the past forty years. It shows the DW-Nominate scores of each member of Congress, as well as the average for each party. It illustrates that there is no overlap at all in today’s Congress between the ideologies of Democrats and Republicans. In other words, Republicans are *always* substantially more conservative than Democrats in Congress. The bottom panel of Figure 11 shows the gap between the parties. It indicates that the gap between Democrats and Republicans has been steadily growing for the past few decades. However, polarization has increased substantially in recent years.

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14. Poole and Rosenthal (1997) show that a single dimension is sufficient to summarize congressional voting behavior quite accurately for most of the history of the United States.

15. Poole and Rosenthal also estimated DW-Nominate scores that assume that each legislator’s ideology can only change over time in a parametrically specified manner which generally rules out dramatic shifts in the ideology of individual legislators from one Congress to the next (see Bartels, Clinton, and Geer 2016). These scores show even larger increases in polarization than the scores that assume individual members of Congress keep the same ideological position. However, due to their more transparent assumptions and the fact that they yield more conservative estimates (in the nonpolitical sense of conservative) of the growth in polarization, I use the DW-Nominate scores that assume individual members of Congress keep the same ideological position throughout the analyses that follow.

(a) Average Ideology of Democrats and Republicans in the U.S. House



(b) Partisan Polarization in the U.S. House

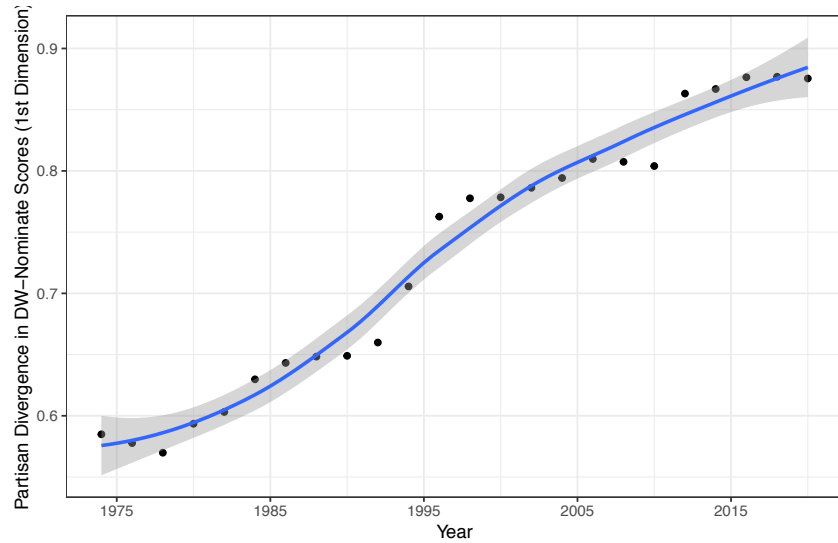


Figure 11: Polarization in Congress: The top panel shows the average ideology of members of each party in the U.S. House. The bottom panel shows the growth in polarization between members of the two parties in the U.S. House.

## 7.2 The Efficiency Gap and Roll Call Voting in Congress

In this section, I examine the effect of the efficiency gap on roll call voting patterns in Congress. I show that a more pro-Republican efficiency gap leads to more conservative roll call voting. To be clear, I do not argue that gerrymandering causes more polarization in Congress. Rather, building upon previous work on both state legislatures (Caughey,

Tausanovitch, and Warshaw 2017) and Congress (Stephanopoulos 2018), I show that pro-Republican changes in the efficiency gap leads to more conservative roll call voting in Congress because (1) more pro-Republican Efficiency Gaps lead to more Republicans taking office (see Section 4) and (2) more Republican seats leads to more conservative roll call voting patterns (and increasingly so in recent years, as Republicans have gotten more conservative over time, as shown in Section 7.1).

Table 4: Effect of Efficiency Gap on Average Legislator Ideology in Each State

<i>Dependent variable: Ave. Ideology of Legislators in Each State</i>		
	(1)	(2)
Efficiency Gap	−0.0076*** (0.0004)	
EG (1970s)		−0.0066*** (0.0007)
EG (1980s)		−0.0047*** (0.0009)
EG (1990s)		−0.0070*** (0.0008)
EG (2000s)		−0.0070*** (0.0008)
EG (2010s)		−0.0108*** (0.0007)
State Fixed Effects	X	X
Year Fixed Effects	X	X
Observations	580	580
R <sup>2</sup>	0.8716	0.8796
<i>Note:</i> *p<0.1; **p<0.05; ***p<0.01		

The details of my analysis is found in Table 4 (above).<sup>16</sup> The key finding is that changes in the efficiency gap have a strong and robust relationship with roll call voting behavior. Across the entire time period, a 10% pro-Republican shift in a state’s efficiency gap (as the enacted plan would likely cause in Kansas) is associated with a .07 shift

16. I use a model with fixed effects for state and year. This model is the workhorse model for causal inference in economics and political science (Angrist and Pischke 2009). The state fixed effects account for time-invariant confounders in each state and the year fixed effects account for shocks that affect all states equally.

to the right in legislators' ideology (i.e., DW-Nominate scores). Moreover, due to the growing polarization in Congress, the effect of the efficiency gap on legislators' average ideology has grown substantially in recent years. The right column shows that in the most recent Congresses, a 10% pro-Republican shift in the efficiency gap is associated with a .09 shift to the right in DW-Nominate scores. This is roughly equivalent to the difference between the ideologies of Republican Representatives Adam Kinzinger and Hal Rogers. Kinzinger was rated as more liberal than 97% of Republican House members based on his roll call record<sup>17</sup> and voted to impeach President Donald Trump in the wake of the Capitol insurrection.<sup>18</sup> In contrast, Rogers often takes more conservative positions.<sup>19</sup> Rogers opposed Trump's impeachments. Overall, Rogers supported Trump about 96% of the time in Congress.<sup>20</sup>

### 7.3 Other Evidence on Gerrymandering and Representation

There is also broad array of additional evidence that partisan gerrymandering harms the democratic process in our country (see McGhee 2020).

- **Partisan gerrymandering biases the policymaking process in favor of the advantaged party.** In a recent article, two co-authors and I find examine evidence on the link between the efficiency gap and state policymaking over the past 5 decades (Caughey, Tausanovitch, and Warshaw 2017). We find that partisan bias in state legislative maps biases governance in the ideological direction of the advantaged party. In states where there is a pro-Democratic efficiency gap, state policies shift in a liberal direction. And in states where there is a pro-Republican efficiency gap, state policies shift in a conservative direction.
- **Partisan gerrymandering reduces the congruence between the public's preferences and state policies.** In my forthcoming book, a co-author and I examine evidence from the past 7 decades on the relationship between the efficiency gap and the congruence of state policies with public opinion (Caughey and Warshaw 2022). We find when and where the efficiency gap is larger, the match between state policies and mass preferences is poorer.
- **Gerrymandering can reduce voter turnout.** In a recent article Fraga, Moskowitz,

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17. <https://voteview.com/person/21128/adam-kinzinger>

18. <https://projects.fivethirtyeight.com/congress-trump-score/adam-kinzinger/>

19. <https://voteview.com/person/14854/harold-dallas-hal-rogers>

20. <https://projects.fivethirtyeight.com/congress-trump-score/harold-rogers/>

and Schneer (2021) finds that voters that are cracked into districts where their preference are misaligned with other voters are less likely to turnout to vote.

- **Partisan gerrymandering harms political parties.** In a recent article, a co-author and I find that districting bias impedes numerous party functions at both the congressional and state house levels (Stephanopoulos and Warshaw 2020). Candidates are less likely to contest districts when their party is disadvantaged by a districting plan. Candidates that do choose to run are more likely to have weak resumes. Donors are less willing to contribute money. And ordinary voters are less apt to support the targeted party. These results further suggest that gerrymandering has long-term effects on the health of the democratic process beyond simply costing or gaining parties seats in the legislature.
- **Partisan gerrymandering makes it less likely voters will visit their congressional office.** In-person visits to congressional offices are widely viewed as an important mechanism for communicating constituents’ opinions and needs to Congress. Niven, Cover, and Solimine (2021) finds that gerrymandering increases the prevalence of mismatched district offices (i.e., the closest district office for a voter is in a different congressional district). This, in turn, makes it less likely that constituents will make in-person visits to their district office.

## 8 Conclusion

This report has provided a comprehensive, holistic evaluation of the partisan fairness of the Kansas enacted Ad Astra 2 congressional plan. I find that the plan provides an extreme, disproportionate advantage to the Republican Party. On this plan, Republicans are likely to win nearly all the congressional elections over the next decade while only winning 57-59% of the votes in Kansas. The new plan is a historical outlier. It has a more extreme efficiency gap than 95% of prior congressional elections around the country over the past fifty years and a more pro-Republican efficiency gap than 98% of prior elections. Moreover, the fact that all of the other proposed plans yield a more fair plan indicates that the partisan bias in the Ad Astra 2 plan is not simply due to political geography or other unintentional factors. The extreme partisan bias of the enacted plan damages the political representation of Kansans in Congress, and, in particular, reduces the political voice of Democratic voters.

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# Supplementary Appendix

In this appendix, I present the partisan bias metrics I discuss in Sections 5.1 of my main report where I weight each statewide contest equally from 2012-2020 rather than weighting each election year equally. The results are very similar to the ones I present in the main report. This indicates that my results are robust to alternative ways of aggregating past elections, or projecting future ones.

Metric	Value	2012-2020 Composite	
		> Biased than this % Elections	> Pro-Rep. than this % Elections
2012-2020 plan			
Democratic Vote Share	42%		
Democratic Seat Share	20%		
Efficiency Gap	-13.4%	83%	93%
Enacted Ad Astra 2 plan			
Democratic Vote Share	42%		
Democratic Seat Share	10%		
Efficiency Gap	-23.4%	95%	98%

Table A1: Composite bias metrics for Ad Astra 2 plan based on statewide elections

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge.



3/9/22