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Bipartisn Bills from Caucus Collaboration: Solutions to Polarized or Non-Polarized Issues?

Kaitlin Holden
Utah State University

BIPARTISN BILLS FROM CAUCUS COLLABORATION: SOLUTIONS

TO POLARIZED OR NON-POLARIZED ISSUES?

by

Kaitlin Holden

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Approved:

_____
Damon Cann, Ph.D.
Major Professor

_____
Greg Goelzhauser, Ph.D.
Committee Member

_____
Austin Knuppe, Ph.D.
Committee Member

_____
D. Richard Cutler, Ph.D.
Vice Provost of Graduate Studies

UTAH STATE UNIVERSITY
Logan, Utah

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ABSTRACT

Bipartisan Bills from Caucus Collaboration: Solutions

to Polarized or Non-Polarized Issues?

by

Kaitlin Holden, Master of Science

Utah State University, 2022

Major Professor: Dr. Damon Cann
Department: Political Science

This paper investigates whether caucus members pursue bipartisan collaboration on bills related to polarized or non-polarized policy issues. The aim is to determine whether caucuses may be used to pursue bipartisan solutions to major policy issues in an increasingly polarized political environment. I use survey results, unsupervised and supervised topic models to create a keyword dictionary of words related to highly polarized policy issues. I then use two logit models to see whether the effect that the presence of a women's caucus has on bipartisan collaboration in increasingly polarized legislatures also depends on whether the bill's title contains words related to polarized issues or its overall sentiment. Findings indicate that bipartisan women may be more likely to collaborate on polarized bills then non-polarized bills in legislatures with a women's caucus and in legislatures without a women's caucus if polarization is low; and that the presence of a women's caucus may not encourage bipartisan collaboration overall amongst women legislators but may reduce the rate at which increasing polarization slows bipartisan collaboration on polarized issues. These findings show how keyword

dictionaries may be used to measure the polarization level of bills and suggest that future research on how to increase bipartisan collaboration may benefit from investigating ways to reduce polarization levels in legislatures.

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PUBLIC ABSTRACT

Bipartisan Bills from Caucus Collaboration: Solutions

to Polarized or Non-Polarized Issues?

Kaitlin Holden

This paper investigates whether caucus members pursue bipartisan collaboration on bills related to polarized or non-polarized policy issues. The aim is to determine whether caucuses may be used to pursue bipartisan solutions to major policy issues in an increasingly polarized political environment. I model the effect that the presence of a women's caucus has on bipartisan collaboration in increasingly polarized legislatures, depending on whether a bill's title contains words related to polarized issues and its overall sentiment. Findings indicate that bipartisan women may be more likely to collaborate on polarized bills then non-polarized bills in legislatures with a women's caucus and in legislatures without a women's caucus if polarization is low; and that the presence of a women's caucus may not encourage bipartisan collaboration overall amongst women legislators but may reduce the rate at which increasing polarization slows their bipartisan collaboration on polarized bills. This paper illustrates a new way to measure the polarization level of bills and begins to consider how their polarization level may affect bipartisan collaboration.

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Introduction

Legislators may benefit and their policies may improve when they collaborate with one another (Kirkland & Gross, 2012; Tam Cho & Fowler, 2010). However, legislators may not collaborate with one another, especially across party lines, when either the opportunities to build trust with one another are too few or the costs of collaborating are too high. Increasing polarization in legislatures may exacerbate these barriers to bipartisan collaboration (Ainsworth & Akins 1997; Ringe et al., 2009; Osborn, 2012; Holman & Mahoney, 2018; Kanthak & Krause, 2011; Mackay et al., 2010). Past theories and research on caucuses suggest that caucuses may be able to help address these barriers and encourage bipartisan collaboration, even potentially in highly polarized legislatures. However, no past studies consider how the polarization of a bill may relate to legislators' choices to pursue bipartisan collaboration in legislatures with and without caucuses, and at different levels of polarization (Ainsworth & Akins 1997; Ringe et al., 2009; Holman & Mahoney, 2018; Kramer & Tyler, 1996). This gap in past research inspires the following research question: Can bipartisan caucuses encourage bipartisan collaboration on polarized policy issues in an increasingly polarized environment? I use logit models to see how the polarization of a bill, the presence of a bipartisan women's caucus, and the polarization of a legislature interact and effect whether bipartisan women choose to sponsor a bill. I find that in legislatures with a women's caucus and in legislatures without a women's caucus but low levels of polarization, bipartisan women are more likely to collaborate on polarized than non-polarized bills. If polarization in a legislature is too intense and there is not a women's caucus, bipartisan women are instead more likely to collaborate on non-polarized bills. Finally, while a women's caucus may

not improve bipartisan collaboration rates amongst women overall, they may mitigate the effect that increasing polarization has on their bipartisan collaboration over polarized bills.

The Importance of Collaboration in an Increasingly Polarized Environment

State legislatures and other political bodies are social networks. Legislators have relationships with and are dependent on one another for success (Tam Cho & Fowler, 2010; Caldeira et al., 1993; Fowler, 2006; Patterson, 1959; Peoples, 2008). When legislators choose to collaborate with one another, they craft better policies and are more successful in passing them. They aid each other by sharing information, developing legislation in its early stages, and by gaining support and building coalitions (Tam Cho & Fowler, 2010; Campbell, 1982; Kessler & Krehbiel, 1996; Mayhew, 1974). In these ways, collaboration helps legislators be more productive and efficient (Kirkland & Gross, 2012; Tam Cho & Fowler, 2010). Being productive and efficient in passing legislation benefits legislators as they seek approval from constituents, reelection, and other goals. In addition to benefiting legislators, collaboration may benefit our whole democratic system. Better-quality policies help people and may improve their general trust and satisfaction with the government (Kirkland & Gross, 2012; Durr et al., 1997; Ramirez, 2009).

Despite these benefits, legislators may opt out of collaborating with one another. Legislators may not collaborate when structures inside the legislature do not encourage the socialization that is needed to build prerequisite trust (Ainsworth & Akins 1997; Ringe et al., 2009; Osborn, 2012; Holman & Mahoney, 2018). Additionally, legislators may not collaborate when the costs of collaboration exceed its benefits (Holman & Mahoney, 2018; Kanthak & Krause, 2011; Mackay et al., 2010). Increasing polarization

in state legislatures exacerbates both barriers. These barriers and their relationship to polarization are highlighted when considering why legislators may not collaborate across party lines. Legislatures that are divided on partisan lines may provide few opportunities for Democrats and Republicans to build relationships with one another. If polarization in the legislature then increases, the cost of the time to build a relationship and the electoral cost of supporting and voting with a legislator of the opposite party increases. In recent years, polarization amongst political elites and the public has increased. Public opinion and legislators' votes are more divided on partisan lines (Holman & Mahoney, 2018; Shor & McCarty, 2011; Thomsen, 2014; Banda & Cluverius, 2018; McCarty et al., 2006). With greater polarization, the cost of bipartisan collaboration amongst legislators is higher, and bipartisan collaboration may decrease (Holman & Mahoney, 2018). The increasing polarization of our political environment and the need for high-quality policies, together, has inspired past political science research on caucuses.

Caucuses help form the social networks within which legislators interact. They may provide an opportunity structure for legislators to build trust and share information. As a result, they may accelerate collaboration among their members. Furthermore, some research indicates that bipartisan caucuses may help legislators collaborate across party lines, even when polarization increases (Ainsworth & Akins 1997; Ringe et al., 2009; Holman & Mahoney, 2018; Kramer & Tyler, 1996). Notably, Holman and Mahoney (2018) suggest that the presence of a women's caucus in state legislatures may help accelerate bipartisan collaboration on bills when polarization increases, while bipartisan collaboration may slow with the absence of a caucus. Holman and Mahoney (2018) and others suggest that caucuses may be a tool that we can use to help encourage bipartisan

collaboration as our political environment becomes more polarized. However, while their research investigates whether caucus members may collaborate with one another more often on bills, they do not investigate or consider the types of bills that those legislators collaborate on. Their research, then, is not focused on discovering whether we can use caucuses to help legislators pursue bipartisan collaboration on important bills and big issues. This gap in past political science research on caucuses is the inspiration for my research questions.

Research Questions

Past political science research on caucuses inspires the following research questions: Under what scope of conditions do bipartisan caucus members collaborate and on what types of bills is bipartisan collaboration most common? Do bipartisan caucus members collaborate on bills that provide creative, bipartisan solutions to important, polarized policy issues, or only on bills related to inherently less polarized issues? For example, do they collaborate on bills related to gun policy, or on bills declaring a holiday? Most importantly, can caucuses help bipartisan members collaborate on bills that provide solutions to polarized policy issues in an increasingly polarized environment? I investigate these research questions in this paper.

Why Bipartisan Caucus Members May or May Not Collaborate on Polarized Bills

Theories on social networks and collaboration offer different explanations of whether and why bipartisan caucus members may be more likely to collaborate on polarized or non-polarized bills, or bills that address polarized or non-polarized policy issues.

Social network theory posits that in an interconnected body like a state legislature, some people have relatively strong ties with one another, and others have relatively weak ties. People have weak ties when critical differences between them keep them from interacting together as frequently. Conversely, people with strong ties share critical similarities that encourage frequent interaction (Kirkland, 2011; Granovetter 1973). In a state legislature, party affiliation may be the critical attribute that keeps some legislators from interacting frequently and pushes others to interact frequently. The strength or weakness of social network ties affects the way that people interact with one another.

People with strong ties tend to share less novel information with one another than people with weak ties. When people with strong ties, or critical similarities, interact with one another, the information they can share is relatively limited because the information they have is relatively similar. When people with weak ties interact, however, they can share information that is new to one another because their critical attributes, perspectives and ideas are less similar (Kirkland 2011; Granovetter 1973). For example, members of a Democratic caucus are aware of the information shared within their caucus meetings, and those in a Republican caucus are aware of a different set of information. More novel information can be shared between the parties than within the parties. While people with weak ties can share more novel information with one another, they need to establish trust to share that information.

Caucuses may encourage opportunities for legislators to build friendships and trust with one another. This trust makes it easier for members to talk together (Kirkland & Gross, 2012). Caucuses with bipartisan members may help members establish trust to use weak ties as a basis for novel information sharing (Kirkland, 2011; Granovetter.

1973, 1983; Holman & Mahoney, 2018; Ringe et al., 2013). They may even shift legislators' focus from their critical differences to weaker similarities. For example, if bipartisan women's attachment to a group of women increases, they may be more willing to trust one another, even in polarized environments (Holman & Mahoney, 2018; Kramer & Tyler, 1996). Having a women's caucus with women from both parties may help them focus less on their critical difference and more on a less-critical similarity, so that they trust one other enough to share information but are still different enough to share novel information. Without a caucus that provides structure for members with different critical attributes to connect, it is assumed that the critical difference of party affiliation would keep legislators with weak ties from collaborating frequently (Kirkland, 2011).

These aspects of social network theory suggest the following explanation for why bipartisan caucus members may choose to collaborate on polarized bills more often than non-polarized bills: Caucus members that choose to collaborate across partisan lines may tend to collaborate on polarized bills because the information-sharing that occurs between members of different parties that trust one another is more likely to be related to novel, important information of polarized issues, rather than unimportant information of non-polarized issues that wouldn't require trust or diverse perspectives. However, other theories on collaboration suggest an explanation for why bipartisan caucus members may instead choose to collaborate on non-polarized bills.

Theories on collaboration posit that legislators are strategic when they choose to collaborate with others in their social networks. There are costs associated with collaboration, and legislators may try to reduce them. For example, it takes time for legislators to recruit cosponsors for collaboration on their bills (Tam Cho & Fowler,

2010; Kessler & Krehbiel, 1996). Additionally, choosing to cosponsor a bill is an indication of both support for the bill's policy and for the bill's main sponsor. This may be costly for a cosponsor if the bill's text or main sponsor's ideology is too far removed from the cosponsor's party or constituency (Kirkland & Gross, 2012; Kroger, 2003). Weighing the costs and benefits of collaboration, women legislators, for example, may strategically choose to collaborate when institutional structures help make it easier (Holman & Mahoney, 2018; Kanthak & Krause, 2011; Mackay et al., 2010). For instance, they may consider how many women are in the legislature, women legislators' partisanship, and the presence of a caucus (Holman & Mahoney, 2018; Barnes, 2016; Dodson, 1997; Osborn, 2012; Swers, 2001). The causal mechanism for collaboration here is ease, or low risks and costs. While it may be costly for legislators to engage in bipartisan collaboration in general, building trust with one another in a caucus may reduce the costs of collaborating (Holman & Mahoney, 2018; Kramer, 1999; Creed et al., 1996). However, even if trust between caucus members lowers the cost of bipartisan collaboration, collaborating on polarized bills may always be more costly than collaborating on non-polarized bills.

These reasonings suggest the following explanation for why bipartisan caucus members may choose to collaborate on non-polarized bills more often than polarized bills: Caucus members that choose to collaborate across partisan lines may tend to collaborate on non-polarized bills because the costs and risks of collaboration are lower.

Why Bipartisan Caucuses May or May Not Encourage Bipartisan Collaboration

While some past research and aspects of social network and collaboration theories suggest that bipartisan caucuses may encourage bipartisan collaboration in legislatures,

other principles of those theories explain why a bipartisan caucus may not be able to improve bipartisan collaboration rates.

Theories suggest that bipartisan caucuses may improve bipartisan collaboration rates amongst their members by providing a space for legislators that share similarities outside of party affiliation to build trust and share information with less time and energy (Kirkland, 2011; Granovetter. 1973, 1983; Holman & Mahoney, 2018; Ringe et al., 2013). However, while a caucus may reduce collaboration costs associated with the time and energy of building relationships inside the caucus, they may not be able to reduce costs associated with outsiders' perceptions of the caucus members. For example, even if a women's caucus may help its bipartisan women members build strong relationships and share information, it may not help those legislators' male colleagues or constituents view their potential bipartisan collaboration favorably. Furthermore, principles of homophily may explain why outsiders' perceptions may be very valuable to and a priority for bipartisan caucus members. In legislatures where party affiliation is the critical difference between people, legislators may highly prioritize strengthening trust and working with others who are critically similar to them over those who are critically different. For example, party homophily may be stronger than gender homophily for legislators in a women's caucus (Neal et al., 2020; Ferber & Pugliese, 2000). Women legislators may then be motivated to assure members of their own party that they prioritize party affiliation over gender by collaborating with members of their party's caucus instead of a women's caucus. For these reasons, legislators primarily concerned with the electoral costs of collaboration may avoid bipartisan collaboration, even if a bipartisan caucus helps them personally feel comfortable with members of the other party.

How Legislature Polarization May Discourage Bipartisan Collaboration

Theories on collaboration, social networks, and polarization suggest that increasing polarization in legislatures may discourage bipartisan collaboration in several ways. It may limit the opportunities while increasing the amount of time needed for legislators to build trust with one another, as well as distance legislators ideologically while increasing the electoral costs of associating with legislators of different ideologies (Holman & Mahoney, 2018; Kirkland & Gross, 2012; Kroger, 2003; Tam Cho & Fowler, 2010; Kessler & Krehbiel, 1996). Since increasing polarization is expected to continuously exacerbate these barriers to collaboration, increasing legislature polarization may lead to a linear decrease in bipartisan collaboration rates. The rate at which increasing polarization may linearly discourage bipartisan collaboration may depend, however, on whether there is a bipartisan caucus in the legislature. If a bipartisan caucus effectively addresses some of these barriers, increasing polarization in a legislature may not decrease bipartisan collaboration amongst its members, or may decrease bipartisan collaboration at a slower rate than amongst bipartisan legislators in legislatures without a bipartisan caucus.

How Bill Polarization, Bipartisan Caucuses, and Legislature Polarization May Interact

While some research indicates that bipartisan caucuses may help legislators collaborate across party lines, even when polarization increases, none of them consider how the object of what legislators may choose to collaborate on may relate to this interaction (Ainsworth & Akins 1997; Ringe et al., 2009; Holman & Mahoney, 2018; Kramer & Tyler, 1996). Considering how the polarization of a bill relates to this

interaction may help reveal whether caucuses may be used to encourage bipartisan collaboration on polarized policy issues in an increasingly polarized environment. Social network and collaboration theories offer different explanations of how the polarization of a bill may relate to this interaction.

First, social network theories suggest that in legislatures with bipartisan caucuses and low levels of polarization, bipartisan caucus members may be more likely to collaborate on polarized bills than non-polarized bills because legislators may share novel information related to polarized policy issues inside the caucuses (Kirkland, 2011; Granovetter. 1973, 1983; Holman & Mahoney, 2018; Ringe et al., 2013). When polarization in the legislatures increase, the causal mechanism of novel information sharing within the caucuses may stay the same, and bipartisan caucus members may continue be more likely to collaborate on polarized bills. In legislatures without bipartisan caucuses, however, legislators may lack a space that encourages the sharing of novel information across party lines, so legislators that collaborate across party lines may be more likely to collaborate on non-polarized bills. The lack of the causal mechanism of novel information sharing inside a caucus would be the same regardless of whether polarization in these legislatures is high or low, so legislators may continue to be more likely to collaborate on non-polarized bills as legislature polarization increases.

Collaboration theories instead suggest that in legislatures with bipartisan caucuses and low levels of polarization, bipartisan caucus members may be more likely to collaborate on non-polarized bills than polarized bills because legislators may prioritize the reduction of their electoral costs and risks (Holman & Mahoney, 2018; Kanthak & Krause, 2011; Mackay et al., 2010). When polarization in the legislatures increases and

makes bipartisan collaboration on polarized bills riskier, the causal mechanism of the priority of the reduction of risks may lead bipartisan caucus members to be increasingly more likely to collaborate on non-polarized bills. The causal mechanism of the priority of the reduction of risks may be the same in legislatures without a bipartisan caucus, so those legislators may also be more likely to collaborate on non-polarized bills when polarization is low, and increasingly more likely to collaborate on non-polarized bills when polarization is high.

Hypotheses

I offer three hypotheses: the null, novel information, and lowest cost hypotheses. Both the novel information and lowest cost hypotheses predict that the polarization of a bill will affect legislators' choices to collaborate on that bill, both in legislatures with or without caucuses and different levels of polarization. However, they predict different directions for this relationship.

Null hypothesis, H_0. The polarization of a bill has no effect on whether bipartisan women choose to collaborate on the bill, both in legislatures with and without women's caucuses and at all levels of legislature polarization.

Novel information hypothesis, H_1. In legislatures with a women's caucus, bipartisan women are more likely to collaborate on polarized bills than non-polarized bills, at all levels of polarization in the legislature, because the information-sharing that occurs in caucuses is more likely to be related to polarized issues. Conversely, in legislatures without a women's caucus, bipartisan women are more likely to collaborate on non-polarized bills than polarized bills, at all levels of polarization in the legislature,

because information-sharing related to polarized issues will be less likely to occur outside of a caucus.

Lowest cost hypothesis, H$_2$. Both in legislatures with and without a women's caucus, bipartisan women are more likely to collaborate on non-polarized bills than polarized bills, especially as polarization in the legislature increases, because the costs of collaboration will be lower for non-polarized bills.

To test these hypotheses, I expand on the design and data set from Holman and Mahoney's (2018) model. I use survey results and topic models to create a keyword dictionary and measurement for whether a bill is related to polarized policy topics and use a sentiment keyword dictionary to measure the bill's sentiment. I use these two measurements to see whether a bill is polarized and then use two logit models to see whether there is a relationship between the polarization of a bill, the level of polarization in the legislature, the presence of a women's caucus in the legislature, and the choice of bipartisan women to collaborate on the bill. These models do not indicate whether the suggested causal mechanisms are present and working as predicted. For example, the models help indicate whether bipartisan women may be more likely to collaborate on polarized bills than non-polarized bills in a legislature with a women's caucus and high levels of polarization, but not whether the information-sharing discussions that occur between those women are more often related to polarized or non-polarized issues.

Methodology

Units of Analysis

To test my hypotheses, I use individual bills considered in state legislatures as my units of analysis. I cleaned a data set of 166,049 bills to use a total of 142,247 bills that were considered in state legislatures in 2015, or in 2014 and 2016 for states that did not hold a legislative session in 2015. This data set includes information on the bills' sponsors and cosponsors, as well as information on the legislatures in which the bills were introduced. Of the original data set, I removed observations that had NA values related to key independent variables – more specifically, those that did not include bill titles, the presence of a caucus, or legislature polarization measurements.

Variables

Table 1 provides a summary of the dependent, independent and control variables and their measurements. In the following sections, these variables and the strengths and weaknesses of their measurements are discussed in detail.

Dependent Variable: Bipartisan Women Sponsors

I use the dichotomous dependent variable of whether a bill has bipartisan women sponsors to test my hypotheses. A bill is coded as 1 if it has bipartisan women sponsors. This measurement of cosponsorship is meant to indicate collaboration between legislators. This is a common measurement of collaboration in studies similar and prior to Holman and Mahoney's (2018) model. It is a useful measurement because all states legislatures and chambers, as well as Congress, use and record cosponsors (Bratton & Rouse, 2011; Fowler, 2006; Kirkland & Gross, 2012; Kirkland, 2011; Kroger 2003). Information on the bills' sponsors and cosponsors comes from Legiscan, and information

Table 1: Variables of Interest

Variable	Measurement
Dependent Variable:	
Bipartisan Women Sponsors	1 = a bill has bipartisan women sponsors
	0 = a bill does not have bipartisan women sponsors
Key Independent Variables:	
Bill Title Polarization	1) Title Words Related to Polarized Topics:
	1 = the bill's title contains words related to highly polarized policy issues
	0 = the bill's title does not contain words related to highly polarized policy issues
	2) Title Words Average Sentiment:
	The average AFINN sentiment of all words in a bill's title, from -5 to 5, with negative scores indicating negative sentiment and positive scores indicating positive sentiment
Women's Caucus	1 = there is any sort of women's caucus in the state
	0 = there is not a women's caucus in the state
Legislature Polarization	The difference in median points between the Republican and Democrat party within the legislature
Control Variables:	
Controlling Party	1 = Democratic party controls the chamber
	0 = Republican party controls the chamber
Number of Seats	Number of total seats in the House and Senate
Percentage of Women Seats	Percentage of women in the chamber
Term Limits	1 = there are term limits for either chamber in the state
	0 = there are not term limits for either chamber in the state
Professionalization Level	The state's professionalism score from 0 to 1, with 1 being more professional.
Percentage of Republican Sponsors	Percent of the bill's sponsors that are Republican
Share of State Vote for Democratic President	State's average vote share for the Democratic Presidential candidate in the 2012 and 2016 elections
Governor's Party	1 = Democratic governor
	0 = Republican governor

on the sponsors' gender and from the Center for American Women in Politics (Holman & Mahoney, 2018).

I remove observations from West Virginia, Wyoming, and Alabama because there were not enough women in their 2015 legislatures for the dependent variable to be measurable. West Virginia and Wyoming had only one woman in their Senate chambers and Alabama's women legislators were only Democrats. I also remove observations from Nebraska because its unicameral legislature does not recognize party affiliations (Holman & Mahoney, 2018).

Key Independent Variable: Women's Caucus

The first key independent variable is whether there is a women's caucus in the state legislature from which a bill was proposed. This variable is dichotomous. A bill is coded as 1 if there was a caucus, according to the National Conference of State Legislatures (Holman and Mahoney, 2018). While the broad question of interest is whether any caucus with Democratic and Republican members may encourage bipartisan collaboration on polarized issues in an increasingly polarized environment, I use the presence of only a women's caucuses as an independent variable because women's caucuses are good examples of bipartisan caucuses.

It is effective to use women's caucuses as an example of bipartisan caucuses because most, but not all, state legislatures have them. They have a more representative split between Republican and Democratic members than other caucuses and are as likely to be in Republican states as in Democratic states (Holman & Mahoney, 2018; Holman and Mahoney, 2019). Additionally, the majority of women legislators attend women's caucus meetings (Center for American Women and Politics, 2001). Furthermore, while

they may sometimes encourage a focus on women's issue legislation, they do not have a policy focus that is as directly partisan as other caucuses (Holman & Mahoney, 2018; Holman and Mahoney, 2019). However, using only women's caucuses in my analysis may reduce the external validity of my results because women may behave differently than men in caucuses. For example. women may be more likely to collaborate with one another to gain more power or advance their interests as a minority, or they may have more collaborative work patterns (Holman & Mahoney, 2018).

Key Independent Variable: Legislature Polarization

The second key independent variable is the level of polarization within the legislature. This variable is continuous and uses Shor & McCarty's (2011) measurement of the difference in median points between the Republican and Democrat party within the legislature. This variable is included in the interaction to see whether the presence of a women's caucus may lead to bipartisan collaboration on polarized bills in increasingly polarized environments, as past research suggests they may (Holman & Mahoney, 2018; Ringe et al., 2013).

Key Independent Variable: Bill Title Polarization

The final key independent variable is the level of polarization of the bill and is represented with two different measurements: 1) whether a bill's title contains keywords related to highly polarized policy topics; and 2) the average sentiment of all words within the bill's title. These measurements consider two distinct but complimentary dimensions of the polarization of a document – topic and sentiment. A document may be polarized by relating to a polarized topic, such as guns, or by containing individual words with

negative conations and sentiments. Considering both dimensions by using two measurements for the polarization of a bill tests my hypothesis more thoroughly, since both measurements have limitations and strengths in revealing whether a bill addresses polarized issues. It is also a helpful contribution to studies in polarization, since past studies do not often use multiple measurements that reflect both dimensions (Simchon, 2022; Jensen et al., 2012; Goet, 2019).

To measure the topic dimension of polarization, I created a list of keywords related to polarized policy topics and the dichotomous variable of whether a bill's title contains any of those keywords. A bill is coded as 1 if its title contains at least one word from the polarized keyword list. Information on the bill's title comes from Legiscan (Holman & Mahoney, 2018). The polarized topic keywords list is inspired by public surveys on the increasing polarization between the Republican and Democratic party and refined through analysis using word clouds, unsupervised and supervised topic models. The process of creating this list and an explanation of its strengths and weaknesses is provided in detail following descriptions of the control variables.

To measure the sentiment dimension of polarization, I use a continuous variable of the average AFINN sentiment score of all words in a bill's title. Nielsen's (2009) AFFIN list uses 2,477 words scored from -5 to 5, with negative scores indicating negative sentiment and positive scores indicating positive sentiment. For instance, the word "good" is scored as 3, while the word "disappoints" is scored as -2. This list is often used in sentiment analysis (Naldi, 2019).

This measure is meant to indicate whether a bill is polarized in the language it uses. Documents with negative sentiment are more polarized than those with positive

sentiment (Alsinet et al., 2021). However, this measurement also has limitations. Primarily, it was not designed to specifically measure the polarization of language often used in bills. Of the 142,247 bills used in the dataset, about 41% do not have an average sentiment score due to none of the words on the AFINN list being included in the bill's title. These observations are not included in the logit model using the bill title's average sentiment measurement, leaving 58,844 observations for this model. It is better to drop these NA measurements and have a smaller sample for one logit model than to score NA values as 0, which may label bills as neutral that have negative or positive words that are just not included in the AFFIN list.

I use word clouds and a supervised topic model to illustrate the difference between this AFINN list and polarized topic keyword list I created. This analysis is also provided after a discussion of the control variables.

Control Variables

In addition to these three key independent variables, I use the following control variables: 1) the controlling party in the chamber; 2) the share of women in the chamber; 3) the total number of seats in the House and Senate; 4) whether there are term limits in the legislature; 5) the professionalization level of the legislature; 6) the percentage of the bill's sponsors that are Republican; 7) the share of people in the state that voted for the recent Democratic Presidential candidate; and 8) the governor's party.

Information on the controlling party, governor's party, percent of women, and total number of seats in the chamber come from the National Conference of State Legislatures. The percentage of the bill's sponsors that are Republic comes from Legiscan. The share of people in the state that voted for the recent Democratic

Presidential candidate comes from David Leip's Presidential Atlas (Holman and

Mahoney, 2018). Whether there are term limits comes from the State Policy Database

and professionalism scores come from Squire's (2007) Professionalism Index (Holman

and Mahoney, 2018). I include these control variables because critical mass theory and

theories on collaboration suggest they may have an impact on collaboration amongst

women or caucus members in legislatures.

It is important to consider the controlling party of and share of women within the

chamber because, according to critical mass theory, minority groups like women may

need to reach a certain threshold within the legislature before being able to effectively act

on important issues (Holman & Mahoney, 2018; Beckwith & Cowell-Meyers, 2007;

Holman, 2014). Since the Democratic party has more women legislators than the

Republican party, women coalitions may be more likely to form and be successful in a

legislature led by Democrats, with a Democratic governor, or on bills with more

Democrat sponsors (Barnes & Cassese, 2017). Relatedly, it may be less costly for

Republican women that are in the minority to collaborate with Democratic women in the

majority party than it is for Democratic women in the minority to collaborate with

Republican women in the majority, especially if there is greater voter support for

Democratic candidates (Swers, 2002).

It is also important to consider the total number of seats in the House and Senate

because the size of the legislature may affect who legislators choose to collaborate with.

Legislators must actively search and ask for potential cosponsors and are unlikely to

actively ask to be a cosponsor. Before collaborating, legislators must develop

relationships with potential partners and then determine which legislators are the best and

least costly to collaborate with. In larger legislatures, legislators have more potential

partners to learn about and connect with. This makes it more difficult for legislators to

collect the information they need about potential partners' preferences and encourages

legislators to rely more on partisan cues (Gilligan & Krehbeil, 1989; Krehbeil, 1991;

Kirkland, 2014). It follows that bipartisan collaboration may decrease if the size of the

chamber increases. It is important to note, though, that this theory also suggests that

caucuses may help bipartisan collaboration, since it provides a space of fewer potential

partners (Kirkland, 2014).

Theories on the effect of term limits on bipartisan collaboration posit that term

limits may reduce bipartisan collaboration by reducing the amount of time that legislators

have to build relationships and learn and work independently of leadership, and by

increasing legislators' career uncertainty (Hibbing, 1991; Kousser, 2005; Sarbaugh-

Thompson et al., 2006; Carey et al. 2006; Herrick & Thomas, 2005; Swift &

VanderMolen; 2016). To improve their career opportunities outside of the chamber,

legislators with term limits may prefer to avoid bipartisan collaboration that has a higher

political cost and risk (Swift & VanderMolen; 2016). This effect may also depend on the

professionalization level of the chamber.

Chambers with higher levels of professionalization may encourage legislators to

build bipartisan relationships that can be beneficial in the long term. This may encourage

bipartisan collaboration. However, professionalization may also increase the career

uncertainty that legislators face since seats in professionalized legislatures are contested

more often. Chambers with term limits and high levels of professionalization, then, may

discourage legislators from pursuing bipartisan collaboration (Carey et al., 2006; Swift & VanderMolen; 2016).

Development of the Bill Title Polarization Key Independent Variable

As previously summarized, I created a list of keywords related to polarized policy topics and the dichotomous variable of whether a bill's title contains any of those keywords to measure the topic dimension of polarization. To create this polarized topic keywords list, I first use public surveys to identify the political topics that Republicans and Democrats were most divided on around 2015, as well as words associated with those topics. I then use word clouds, unsupervised and supervised topic models to see what policy issues are addressed in the bills whose titles contain and do not contain those words. This analysis helps reveal bills that are inadvertently coded into the wrong group of polarized or non-polarized bills. I then update and create a final polarized topic keywords list that effectively separates bills that are related and unrelated to the identified highly polarized political topics.

To create the polarized topic keywords list, I first use public polls to identify ten policy topics that Republicans and Democrats were most divided on around 2015. I then use the poll questions to choose five words that are contextually relevant to each policy topic. Surveys conducted by the Pew Research Center on Republican and Democratic adults from 2012-2019, the Brookings Institution in 2015, and Gallup from 2000-2017 show that Democrats and Republicans were consistently most divided and increasingly divided on issues related to gun policy, race, the environment, the social safety net, abortion, immigration, taxes, jobs, confidence in the police, and education (Kohut et al., 2012; Dimock et al., 2014; Doherty et al., 2015; Doherty et al., 2017; Doherty et al.,

2018; Doherty et al., 2019; Galston, 2015; Newport & Dugan, 2017). While some of these surveys were conducted before and after the 2015 bills were introduced, they are more detailed and directly focused on the division between Democrats and Republicans on a variety of issues than other surveys and together indicate that some issues have been consistently more polarized. The following list shows these topics and five words related to each.

Table 2: First Draft of the Polarized Topic Keywords List

Highly Polarized Topic	Keywords
Guns	gun, firearm, weapon, automatic, assault
Education	education, school, teacher, student, tuition
Immigration	immigrant, refugee, document, resident, citizen
Environment	environment, climate, carbon, energy, pollution
Social Safety Net	social, benefit, health, welfare, support
Race	race, discrimination, diversity, equal, equity
Police	police, criminal, justice, drug, force
Abortion	abortion, contraceptive, fetus, parenthood, pregnancy
Jobs	job, employment, work, wage, labor
Taxes	tax, income, credit, rate, corporate

To check and improve the effectiveness of this list in separating bills that are related and unrelated to these ten polarized topics, I use word clouds to broadly compare the issues of bills whose titles contain and do not contain these words. When determining whether a bill's title contains any of the keywords, the base of each word is used so that

close variations are also counted. For example, the word "teach" is used to determine if "teach," "teacher," "teachers," "teaching," etc. are found in the bill's title. Figure 1 shows the most frequently used words in the bills whose titles do not contain any of the above keywords and are coded as 0 for being unrelated to highly polarized topics, and Figure 2 shows the most frequently used words in the bills whose titles contain at least one of the above keywords and are coded as 1 for being related to highly polarized topics.

Figure 1 shows that, as intended, many of the most frequently used words in the bills coded as 0 are not directly related to the ten highly polarized topics. For example, the words "vehicle(s)," "motor," "license," "transportation," "highway," "election," and "registration" indicate that these bills may address issues related to vehicles, transportation, and elections. Additionally, words like "memorial," "honoring," and "awareness" may reflect bills that provide recognition to people in the community. However, some words may relate to the ten highly polarized topics. For example, the words "water," "waste," and "oil" may relate to the polarized topic of the environment. This indicates that these words may need to be added to the polarized topic keywords list to better separate bills that are related and unrelated to the highly polarized topics.

Figure 2 shows that many of the most frequently used words in the bills coded as 1 may be correctly related to the highly polarized topics. For example, the words "credit," "income," "exemption," "tax," "school," "university," "health," "care," "benefits," and others indicate that these bills may address the polarized topics of taxes, education, and the social safety net. Additionally, while occurring less frequently, words like "firearms" and "environmental" indicate that these bills are related to the other highly polarized topics of gun control and the environment. However, there are words that, even if they

Figure 1: Most Frequently Used Words in Bills Unrelated to Highly Polarized Topics, According to First Draft of the Polarized Topic Keywords List

Figure 2: Most Frequently Used Words in Bills Related to Highly Polarized Topics, According to First Draft of the Polarized Topic Keywords List

are related to a polarized topic, may incorrectly lead to a bill being categorized as polarized. For example, a bill containing the word "congratulating" is unlikely to be highly polarized. I use unsupervised topic models to expand on the initial insights that these word clouds provide.

I use unsupervised topic models to better see which policy issues are addressed in bills categorized as being related and unrelated to the highly polarized topics. The unsupervised topic models use Latent Dirichlet allocation to examine each bill's title as a potential mixture of topics and each topic as mixture of words, and then organize similar topics and words across the bills into groups (Silge & Robinson, 2017). I use this model on the bills coded as 0, and again separately on the bills coded as 1, to organize the bills in each group into 10 topic groups. While there may be more or less than 10 broad topics in the bill groups, I use the unsupervised model to separate them in ten in order to see which main topics the bills address. It is helpful to use an unsupervised topic model to investigate the topics of the bills coded as being unrelated to the highly polarized topics because their potential topics are unknown. It is also helpful to use an unsupervised topic model on the bills coded as being related to the highly polarized topics, even if their topics are known, to see if unintended bill issues are included in the group. I use bigrams, or groups of two words, in this model to expand on what was learned from single words in the word clouds. This is helpful to potentially learn, for example, if the word "registration" in Figure 1 is related to vehicle, voter, or another type of registration. Figure 3 shows the most frequently used bigrams in the bills coded as 0 grouped into common categories, while Figure 4 shows the most frequently used bigrams in the bills coded as 1 grouped into common categories.

Figure 3: Most Frequently Used Bigrams Organized into Groups in Bills Unrelated to Highly Polarized Topics, According to First Draft of the Polarized Topic Keywords List
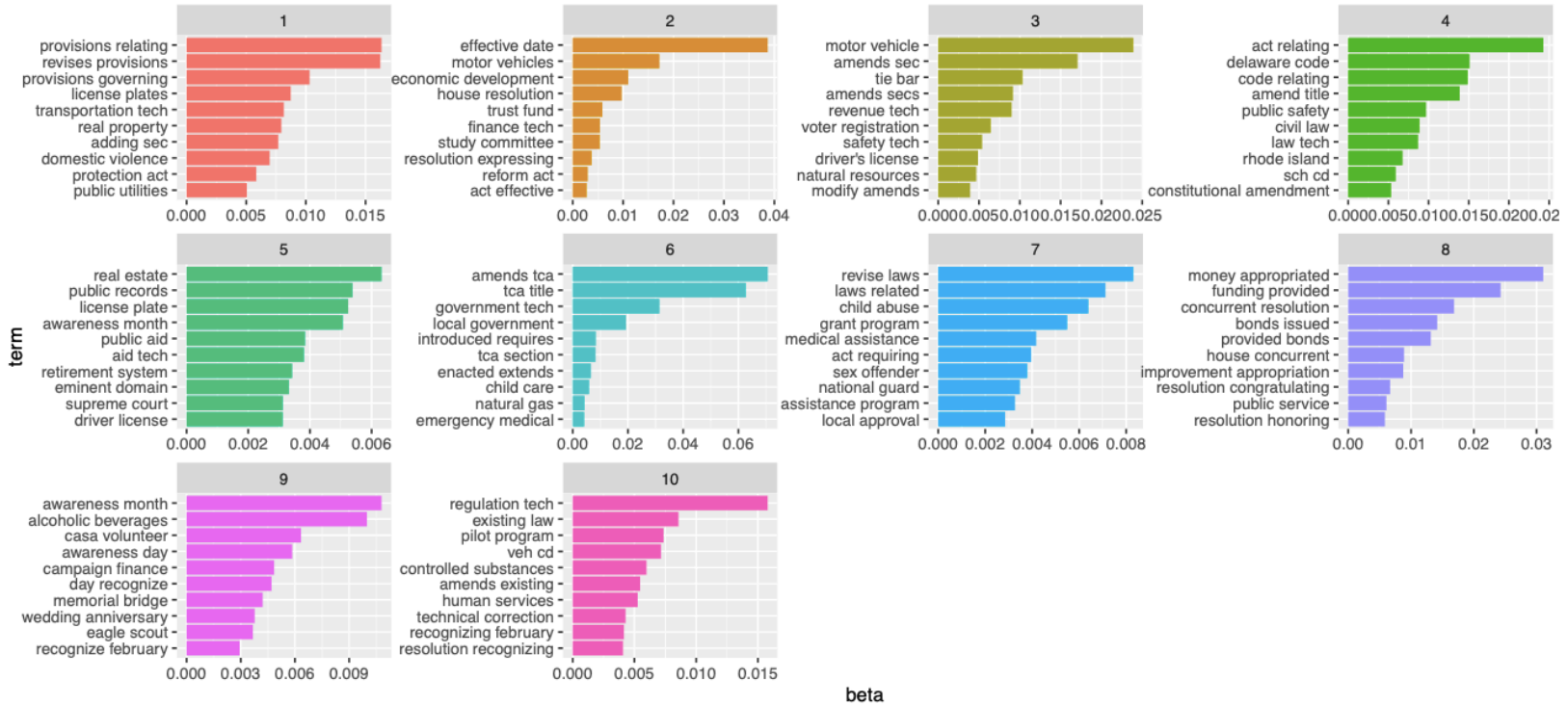
Figure 4: Most Frequently Used Bigrams Organized into Groups in Bills Related to
Highly Polarized Topics, According to First Draft of the Polarized Topic Keywords List
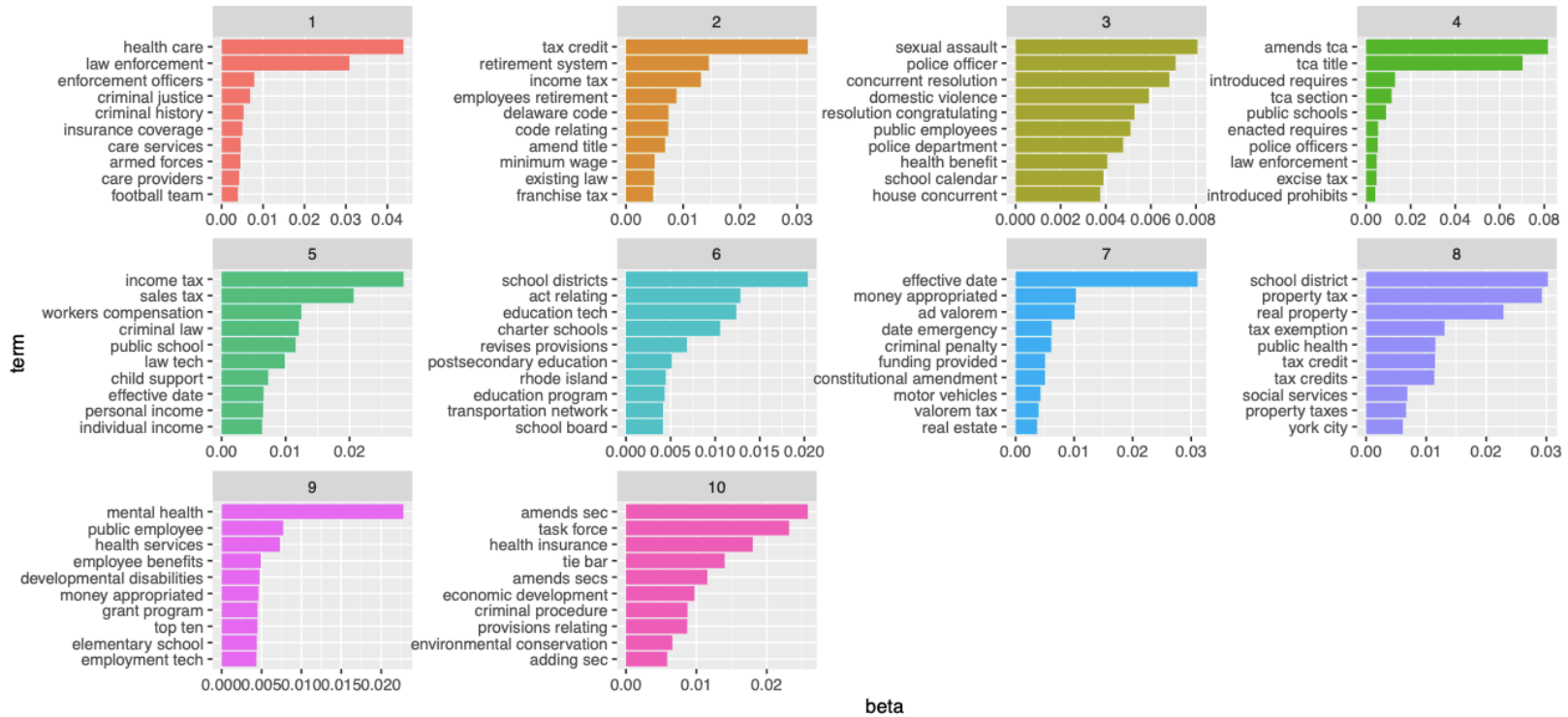
Figure 3 shows the most common bigrams in the bills coded as 0, organized into ten groups. While the specific topic of each group is not clearly and cleanly identifiable, the model provides further insight into what issues are covered in the bills labeled as being unrelated to the highly polarized topics. For example, the first topic group shows that some bills cover provisions related to license plates, property, transportation, domestic violence and public utilities. The model overall indicates that the bills address issues related to motor vehicle regulations and driver's licenses, real estate, retirement systems, eminent domain, technology, campaign finance, pilot programs, and alcoholic beverages. It also shows that the bills alter provisions and revise laws, appropriate money, and recognize, honor, or offer congratulations. These results indicate that many of the bills coded as 0 are correctly unrelated to the ten highly polarized topics. While many of these bills may still be divisive on partisan lines, they do not seem to be focused on the topics that are the most polarizing between the two parties. However, there are some words, such as "natural gas," that may directly relate to the highly polarized topics, suggesting that the polarized topic keywords list may need to be adjusted to code those bills as 1 instead of 0.

Figure 4 displays the most common bigrams in bills coded as 1, organized into ten groups. Several of the displayed bigrams directly relate to the intended highly polarized topics. For example, the terms "environmental conservation," "criminal justice," and "income tax" are words that intuitively make sense as being related to the polarized topics of the environment, police, and taxes. However, there are several displayed bigrams that, while they are related to the highly polarized topics, do not seem to reflect a polarized bill. For example, while "football team" relates to schools, it is less likely to

reflect a polarizing bill. Additionally, there are bigrams that are non-polarized and are less clearly related to the highly polarized topics. For example, bills using the term "resolution congratulating" may have been inadvertently coded as 1 for having a distant relation to several of the highly polarized topics. To understand which keywords are inadvertently bringing in non-polarized bills, I use a supervised model to analyze the bills that are coded as 1 for containing the keywords.

I use a supervised topic model to analyze only the bills that are coded as 1 for being related to the highly polarized topics. Supervised topic models, unlike unsupervised topic models, analyze the frequencies of words related to those selected. While the topics and keywords selected for supervised topic models are often inspired by the results of unsupervised topic models, I instead use the polarized topic keywords inspired by public surveys to analyze the distribution of topics and keywords that are polarized politically, rather than just occurring frequently in the bills. I use the initial polarized topic keywords list in this model to see which of the keywords are being used most frequently, and what words are most frequently being used with them. Figure 5 shows the probability that each topic uses keyword topic-word distribution in the bills. It shows that keywords related to education, guns and the police are more likely to appear in a bill coded as 1 than keywords related immigration, the social safety net or abortion.

A continuation of the supervised topic model is shown in Figure 6, which displays the ten words most frequently associated with the highly polarized topics. It shows that the words most often associated with some of the highly polarized topics are accurately related to that topic and potentially reflect a polarized bill. For example, the words "energy, "water," "environmental," "conservation," "waste," "gas," "electric,"

"renewable," "department," and "natural" are all related to the polarized topic of the environment. However, some highly polarized topics are commonly associated with words that are not related to the intended topic. For example, some keywords lead bills regarding track championships to be coded as being related to the highly polarized topic of racial discrimination, and bills regarding the armed forces to be coded as being related to immigration. This model confirms that the initial polarized topic keyword list requires adjustments to accurately separate bills that are related and unrelated to the highly polarized topics.

Figure 5: Distribution of Keywords and Issues Amongst Bills Related to Highly Polarized Topics, According to First Draft of the Polarized Topic Keywords List
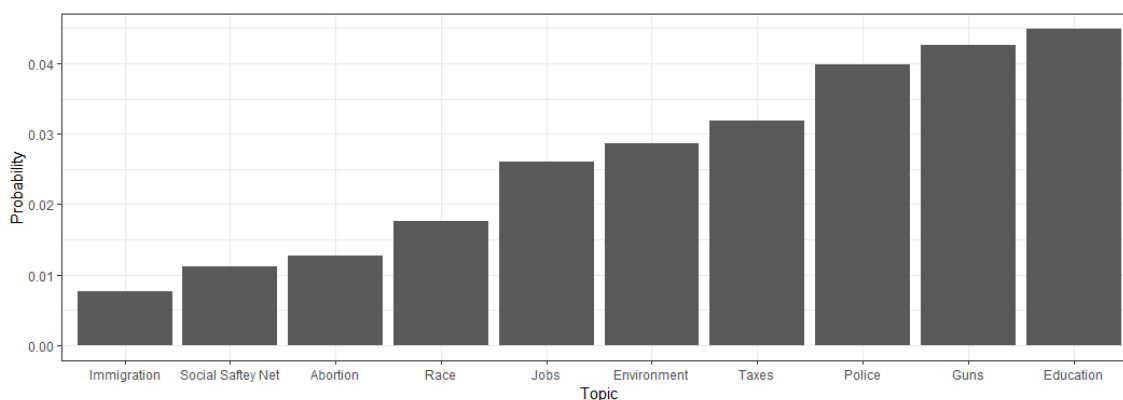
To improve the effectiveness of the polarized topic keywords list, I change some keywords and produce new unsupervised and supervised topic models until the words in each model align with the intended polarized topics. Repeating this process several times reveals bills that occur less frequently but whose issues still are incorrectly labeled as being related to the highly polarized topics. For example, after pruning the keywords related to the polarized topic of racial discrimination so that bills related to track championships were not included, the model revealed that bills related to gambling on

Figure 6: Words Most Frequently Associated with Polarized Topic Keywords in Bills
Related to Highly Polarized Topics, According to First Draft of the Polarized Keywords List
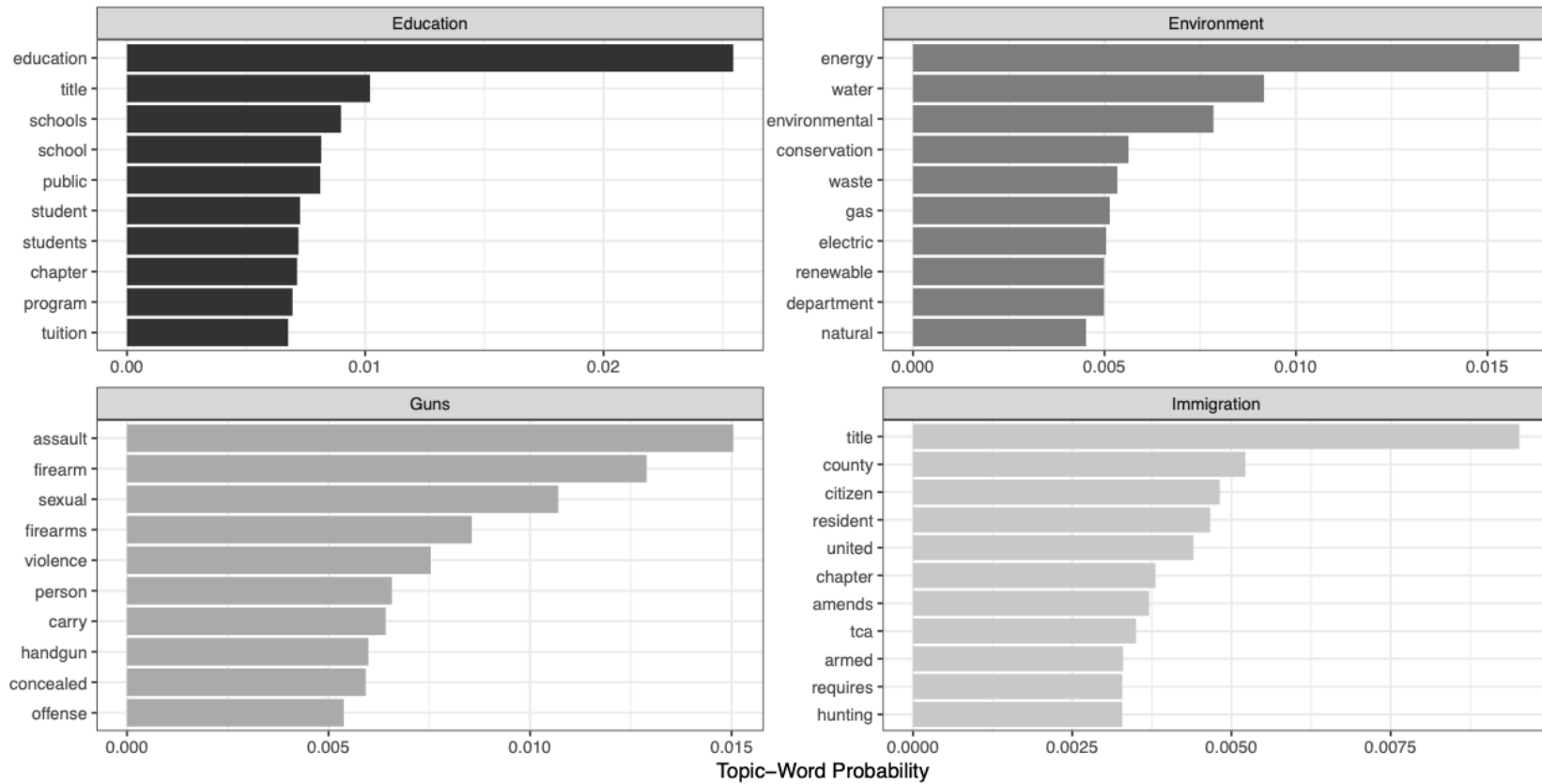
Figure 6 (continued): Words Most Frequently Associated with Polarized Topic Keywords in Bills
Related to Highly Polarized Topics, According to First Draft of the Polarized Keywords List
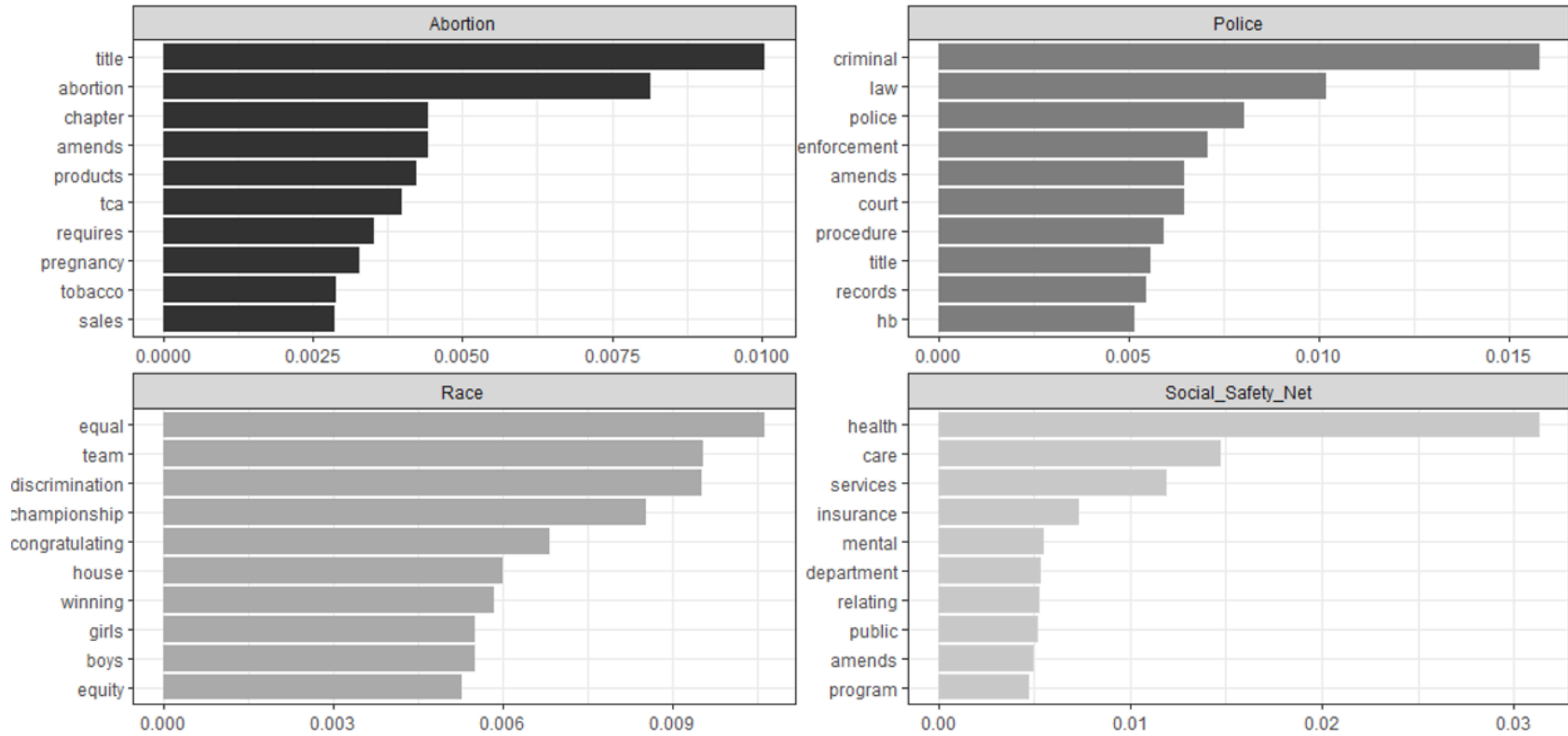
horse races were also being incorrectly included. Table 3 shows the final polarized topic keywords list, along with a list of words whose bills are coded as 0, even if they also contain one of the polarized topic keywords.

Table 3: Final Polarized Topic Keywords List

Highly Polarized Topic	Keywords
Guns	gun, firearm, weapon, automatic
Education	education, school, teacher, student, tuition
Immigration	immigrant, refugee
Environment	environment, climate, carbon, energy, pollution, fuel, gas
Social Safety Net	social, benefit, health, welfare, support
Race	Racial, ethnicity, discrimination, diversity, equal, equity
Police	police, criminal, justice, drug, force
Abortion	abortion, contraceptive, fetus, parenthood, pregnancy
Jobs	job, employment, work, wage, labor
Taxes	tax, income, credit, rate, corporate
Words restricted from being coded as 1	team, calendar, hunting, championship, winning, congratulating, honoring, basketball, football

Of the 142,247 bills in the dataset, about 37% contain at least one of the above polarized topic keywords. I am interested in whether a bill's title contains these words related to polarized policy topics, and not necessarily words specifically related to women's issues, because I am broadly interested in whether caucuses can help lead to

bipartisan collaboration on major policy problems and am using women's caucuses as an example of a type of caucus.

This variable and its measure are meant to indicate whether a bill is related to an important, highly partisan issue. However, this measurement has several shortcomings. First, this list of keywords is not exhaustive of all words related to each topic, and the included keywords were initially intuitively selected with guidance from survey questions. Before using unsupervised and supervised models to improve this measurement, I searched for polarized topic keyword dictionaries that were already created from studies of which words and policy topics were more polarized in their usage by both parties. The topic keyword dictionaries that are currently available, however, are not relevant for analyzing bills in the US. For example, there are dictionaries of politically polarized words in a social media context that include internet slang, politically polarized words from Congressmen's speeches that include the names of people and media organizations, and politically polarized words related to policy issues in the United Kingdom (Simchon, 2022; Jensen et al., 2012; Goet, 2019). These dictionaries were created by identifying which words are used differently by separate groups over many observations, such as by seeing which words Democratic Congressmen include in speeches that Republicans do not (Jensen et al., 2012). My method of using surveys and topic modeling to create and refine a polarized topic keywords list that is relevant to the bill texts I am studying illustrates a new way for researchers to create their own topic keyword dictionaries and for the polarization of bills to be measured.

Another shortcoming of this measurement is that analyzing bill titles, rather than full bill texts, may prevent keywords included in the bill from being counted.

Furthermore, some bills in the dataset do not have complete titles or contain more of a bill than just its title. Some contain a single word in the bill title, such as "Energy," while others contain a summary of the bill. I include all these bills and use a dichotomous variable of whether a polarized topic keyword was present, rather than a continuous variable of the percentage of polarized topic keywords in a bill title, to best reflect whether a bill is related to a polarized topic. While analyzing the full text of each bill would improve this measurement, retrieving, merging and analyzing entire bill texts with the bill title dataset was not doable due to time constraints.

Finally, whether a bill title contains any of the polarized topic keywords may not fully reflect what the bill is focused on, or whether it is consequential. If bipartisan sponsors and cosponsors are working together on crafting a bill, they may purposefully choose to avoid triggering words. Despite all these shortcomings, this measurement makes progress in considering the content of bills in collaboration studies, since the content of bills has not been considered before.

To further improve my investigation of the effect of a bill's polarization on bipartisan collaboration, I also use the AFINN sentiment keyword list to measure the average sentiment of the bill's title. I use word clouds and a supervised topic model to illustrate the difference between these two measurements of bill polarization and show the issues addressed in bills with negative and positive title sentiments. Figure 7 shows the most frequently used words in the bills that have a positive average sentiment score, while Figure 8 shows the most frequently used words in bills that have a negative average sentiment score.

Figure 7: Most Frequently Used Words in Bills with Positive Sentiment

Figure 8: Most Frequently Used Words in Bills with Negative Sentiment

Figures 7 shows that some bills with a positive sentiment score are related to highly polarized topics. For example, the bills are frequently related to schools, health care, and taxes. These bills may be related to these highly polarized topics but address a less polarizing subtopic issue or use language that is widely positive and unifying. For example, the word "grant" has a positive connotation, as opposed to "restrict," so bills that provide grants to schools may have an average positive sentiment score and be relatively less polarizing than bills addressing other education-related issues. Figure 8 then shows that bills with a negative sentiment score are frequently related to those same topics but address issues like penalties and criminal offenses more frequently. This illustrates how using an additional measurement for bill polarization that is focused on sentiment, rather than topic, may be helpful in determining whether legislators are more likely to collaborate on polarized or non-polarized bills.

To further illustrate the difference between bills that have positive and negative average sentiment scores, Figures 9 and 10 are word clouds that show the most frequently used words in bills that contain polarized topic keywords related to guns, with both positive and negative average sentiment scores. These figures show that bills related to guns with positive sentiment scores are more focused on subtopic issues like gun safety education and the effectiveness of those programs, while bills related to guns with negative sentiment are more focused on gun crime, violence, and penalties. This provides a specific example of how sentiment and topic reveal different dimensions of the polarization of a bill, and why it is helpful to consider both dimensions in this study.

Finally, I use a supervised topic model in Figure 11 to show whether bills containing the polarized topic keywords are more likely to have positive or negative

Figure 9: Most Frequently Used Words in Bills
Related to Guns with Positive Sentiment

Figure 10: Most Frequently Used Words in Bills
Related to Guns with Negative Sentiment

Figure 11: Probability of Bills Related to Highly Polarized Issues Having Negative or Positive Sentiment
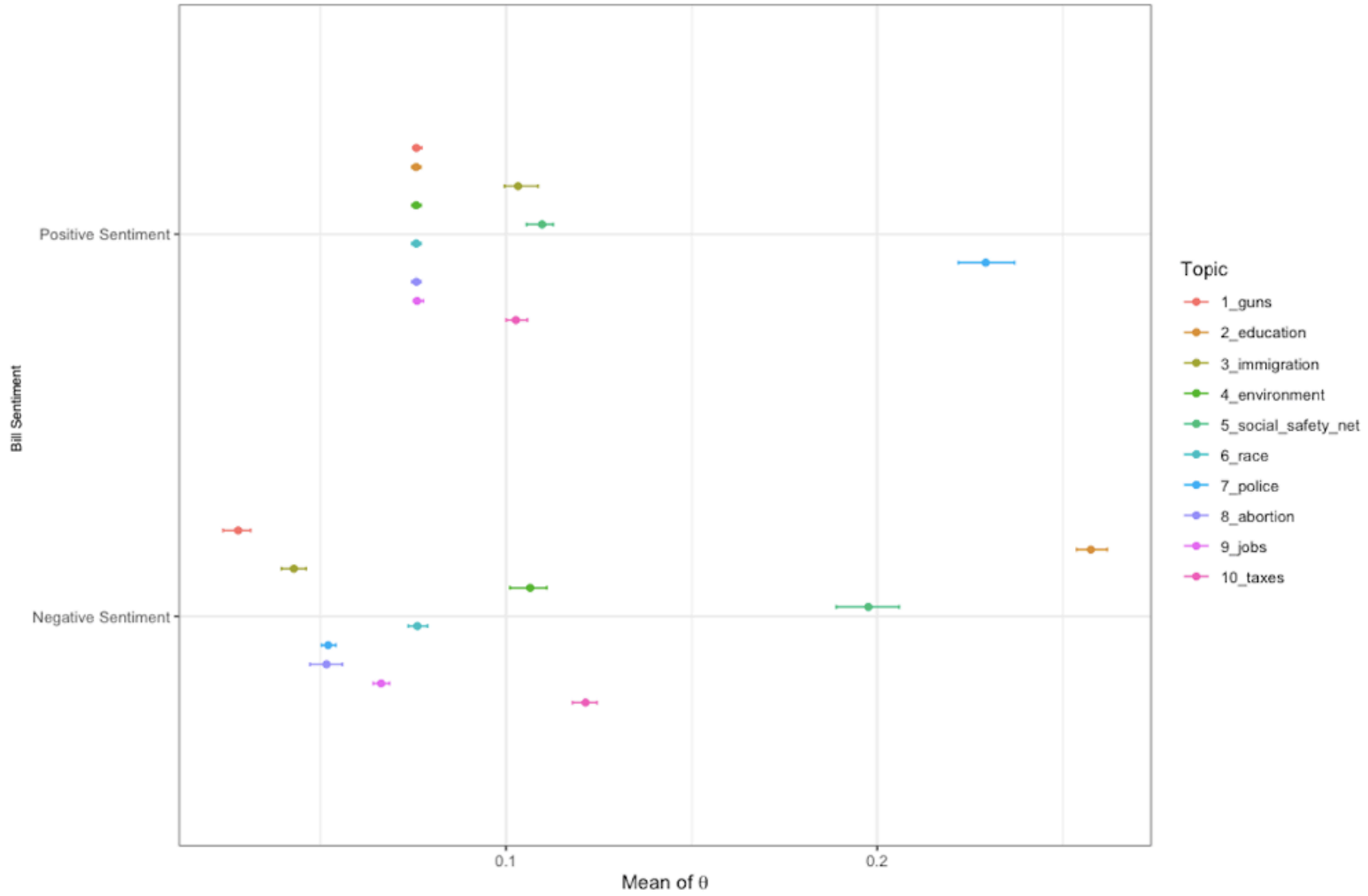
average sentiments. The model uses a Dirichlet-Multinomial regression to analyze the distributions of the polarized topic keywords among the bills and show the probability that a bill with positive or negative sentiment focuses on one of the highly polarized topics, with 90% confidence intervals (Eshima et al., 2020).

Figure 11 shows that bills containing polarized topic keywords related to the police, immigration and guns are more likely to have an average positive sentiment, while bills containing polarized topic keywords related to education, the social safety net, taxes, and the environment are more likely to have an average negative sentiment. This model aligns with previous ones in showing that whether a bill is polarized may depend on whether a measurent reflecting a bill's sentiment or topic is being used.

Logit Models

I use two logit generalized linear models to analyze the relationship between the polarization of a bill, the polarization of a legislature, the presence of a women's caucus and the choice of bipartisan women to collaborate on a bill.

In the logit models, I use a three-way interaction term. I run a logit model twice, with two different types of measurements for one of the interaction terms. The first logit model uses the following variables in the three-way interaction: 1) whether there is a women's caucus in the state legislature from which a bill is proposed; 2) the level of polarization within the legislature; and 3) whether a bill's title contains words related to highly polarized topics. The second logit model instead uses the following interaction terms: 1) whether there is a women's caucus in the state legislature from which a bill is proposed; 2) the level of polarization within the legislature; and 3) the average sentiment score of all the bill's title words. I do not use random effects at the state level in my logit

model. I ran the model with random effects to see if it made a difference in my results, but it did not.

In the second logit model, I use the continuous variable of average sentiment score as a categorical variable with three categories of low, mean and high sentiment scores. This makes the predicted probabilities graph of a three-way interaction easier to interpret. The low category is a negative sentiment score of -1.78, which is one standard deviation less than the near neutral mean sentiment score of 0.21. The high category is a positive sentiment score of 2.2, one standard deviation more than the mean sentiment score.

A logit model is suitable to my analysis because the dependent variable of whether bipartisan women sponsor a bill is dichotomous. I have more observations, with n=142,247, than my 12 independent variables. The observations are independent of each another and each independent variable varies with at least two values. Furthermore, the independent variables prevent perfect multicollinearity and there are no strongly influential outliers. Finally, the independent variables are linearly related to the log odds.

Results

Logit Model Using Title Words Related to Polarized Topics Interaction Term

Table 4 displays the predicted probabilities of the logit model with the interaction term of whether a bill's title contains words related to polarized topics. These results show the effect that an increase of one standard deviation from the mean of each independent variable has, with all other variables kept constant at their mean or mode values, on the probability of a bill having bipartisan women sponsors.

Table 4: Predicted Probabilities of the Effect of a Women's Caucus, Polarization in the Legislature, and Bill Title Words Related to Polarized Topics on Whether a Bill has Bipartisan Women Sponsors

Independent Variable	Mean/Mode	Predicted Probability at Mean/Mode	95% Confidence Interval at Mean/Mode	Mean+1SD/ Non-Modal Value	Predicted Probability at Mean+1SD/ Non-Modal Value	95% Confidence Interval at Mean+1SD/ Non-Modal Value
Women's Caucus	1	.142	.138-.147	0	.231	.224-.237
Polarized Topic Words	0	.142	.138-.147	1	.125	.120-.130
Legislature Polarization	1.615	.142	.138-.147	2.127	.131	.126-.136
Controlling Party	0	.142	.138-.147	1	.110	.106-.114
Share of Women	.220	.142	.138-.147	.292	.160	.154-.166
Senate Seats	45.499	.142	.138-.147	57.511	.140	.135-.144
House Seats	120.633	.142	.138-.147	162.136	.170	.165-.175
Term Limits	0	.142	.138-.147	1	.137	.131-.144
Professionalization	.247	.142	.138-.147	.389	.156	.150-.161
Share of Republican Sponsors	.475	.142	.138-.147	.921	.143	.138-.148
Democratic President Vote	50.631	.142	.138-.147	58.631	.158	.151-.165
Governor's Party	1	.142	.138-.147	0	.182	.176-.188

The predicted probability of each term when all variables are at the mean or mode values is .142, with a 95% confidence interval of .138-.147. The predicted probability of the women's caucus variable at its nonmodal value is .231, with a 95% confidence interval of .224-.237. This means that not having a women's caucus in the legislature, as opposed to having a women's caucus, is associated with approximately a 9% increase in the probability of a bill having bipartisan women sponsors, when all other variables are held constant at their mean or mode values. The 95% confidence intervals of both predicted probabilities do not overlap. This means that we can be 95% confident in rejecting the null hypothesis that in the true population there is no difference between the choice of bipartisan women to collaborate when there is a women's caucus and when there is not women's caucus in the legislature, when all other variables are held constant at their mean or mode values.

The predicted probability of the polarized topic title words variable at its nonmodal value is .125, with a 95% confidence interval of .120-.130. This means that having words related to polarized topics in the bill title, as opposed to not having words related to polarized topics in the title, is associated with approximately a 2% decrease in the probability of a bill having bipartisan women sponsors, when all other variables are held constant at their mean or mode values. The 95% confidence intervals of the predicted probabilities at the variable's mode and non-modal values do not overlap. This means that we can be 95% confident in rejecting the null hypothesis that in the true population there is no difference between the choice of bipartisan women to collaborate on a bill whose title contains or does not contain words related to polarized topics when all other variables are held constant at their mean or mode values. This also means that
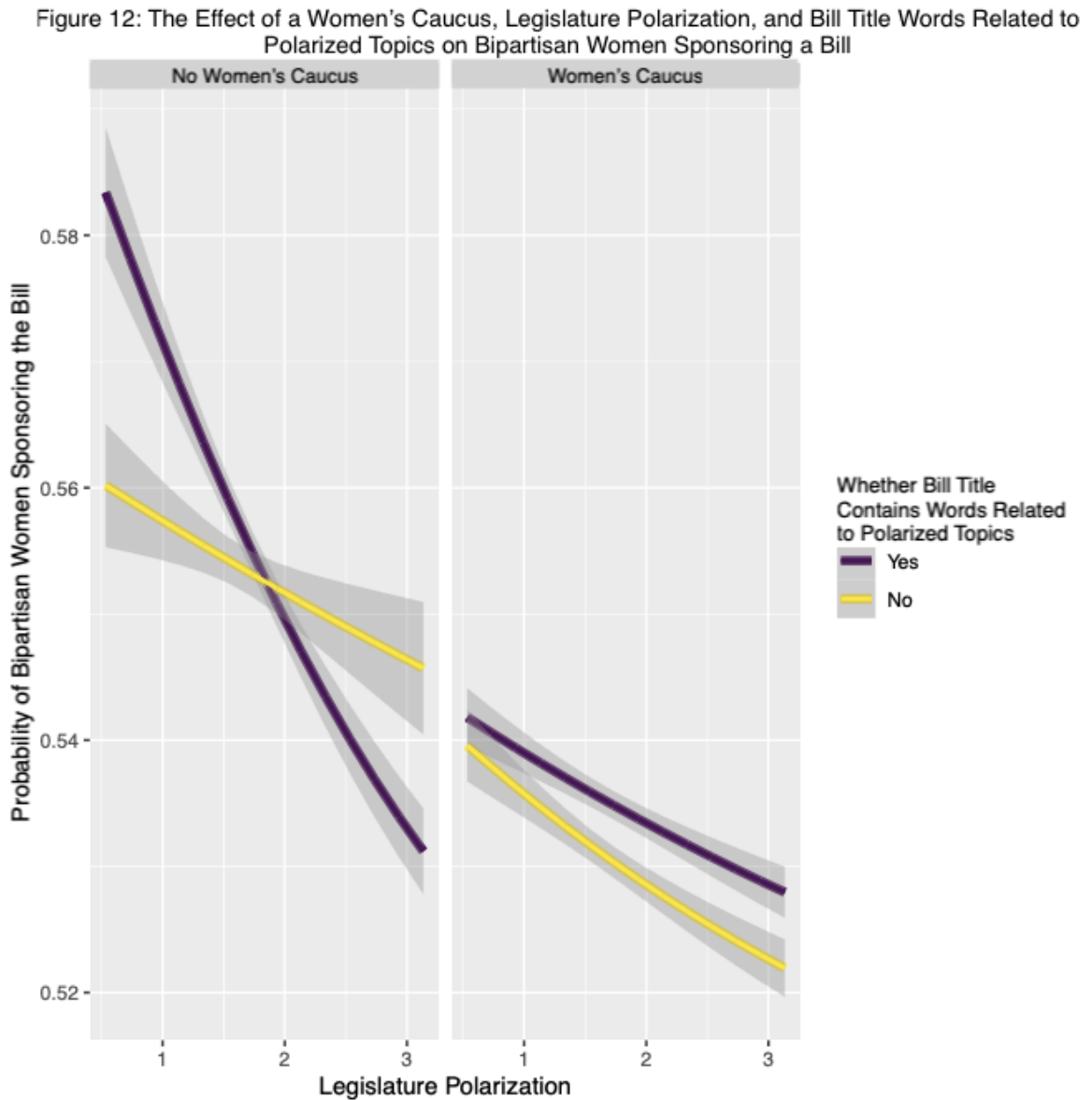
the differences shown in the number of bills with bipartisan women sponsors that have

title words related to polarized topics are due to something other than random chance.

The negative value of this statistically significant predicted probability may support the

lowest cost hypothesis, H_2, that bipartisan caucus members are more likely to collaborate

on non-polarized bills than polarized bills.

The predicted probability of the legislature polarization variable at one standard

deviation above the mean is .131, with a 95% confidence interval of .126-.136. This

means that an increase of one standard deviation in the polarization of a legislature is

associated with approximately a 1% decrease in the probability of a bill having bipartisan

women sponsors, when all other variables are held constant at their mean or mode values.

The 95% confidence intervals of the predicted probabilities at the variable's mean and

one standard deviation above the mean do not overlap. This means that we can be 95%

confident in rejecting the null hypothesis that in the true population there is no difference

between the choice of bipartisan women to collaborate at the two levels of legislature

polarization when all other variables are held constant at their mean or mode values.

Figure 12 expands on these results. It shows the predicted probabilities of this

logit model and is used to interpret the three-way interaction of the women's caucus,

polarized topic title words, and legislature polarization variables.

Figure 12 shows that whether a bill's relation to polarized topics affects the

chances of the bill having bipartisan women sponsors depends on the level of polarization

in the legislature and the presence of a women's caucus. The relationship between these

variables in legislatures with a women's caucuses supports some aspects of the novel

information, H1, hypothesis, while their relationship in legislatures without a women's

caucus support some aspects of the lowest cost, H_2, hypothesis. Furthermore, the

presence of a women's caucus may mediate the effect of increasing polarization in the

legislature when a bill is related to a highly polarized topics, but not increase rates of

bipartisan collaboration overall.

Figure 12: The Effect of a Women's Caucus, Legislature Polarization, and Bill Title Words Related to Polarized Topics on Bipartisan Women Sponsoring a Bill

In legislatures with a women's caucus, bipartisan women sponsors are more likely to collaborate on bills whose titles contains words related to polarized topics at nearly all levels of legislature polarization. It is only unclear whether bipartisan women sponsors are more likely to collaborate on bills with polarized topic title words when polarization in the legislature is very low. Since the 95% confidence intervals overlap when legislature polarization is low, we cannot be 95% confident that there is a difference between the likelihood of bipartisan women sponsoring polarized or non-polarized bills at low levels of polarization. It is important to note that a polarization level of 0 is not substantively meaningful, since legislatures divided by party are naturally polarized. When polarization in the legislature increases, women become more likely to sponsor bills with polarized topic title words. The confidence intervals show that this is significant at the 95% confidence level. This result supports the novel information hypothesis, H_1, that in legislatures with a women's caucus bipartisan women are more likely to collaborate on polarized bills than non-polarized bills, even when polarization increases, because the information-sharing that occurs in caucuses is more likely to be related to polarized issues. The model does not support the H_1 hypothesis prediction that the opposite relationship will occur in legislatures without a women's caucus.

In legislatures without a women's caucus and low levels of polarization, bipartisan women sponsors are more likely to collaborate on bills whose titles contains words related to polarized topics than on bills whose titles do not contain those words. As polarization in the legislature increases, however, bipartisan women sponsors become less likely to collaborate on bills whose titles contains words related to polarized topics. The confidence intervals show that this is significant at the 95% confidence level. When

polarization in the legislature is high and continues to increase, the model supports part of the lowest cost, H_2, hypothesis that bipartisan women are more likely to collaborate on non-polarized bills than polarized bills, especially as polarization in the legislature increases. However, the model does not support this when polarization is low. When polarization is low, the model does not support the H_1 hypothesis, either, which predicts that bipartisan women without a caucus are more likely to collaborate on non-polarized bills than polarized bills because information-sharing related to polarized issues will be less likely to occur.

Furthermore, bipartisan women sponsors are more likely to collaborate with one another on bills in legislatures without a women's caucus than in legislatures with a women's caucus, regardless of whether a bill's title contains words related to polarized topics or polarization in the legislature increases. When polarization in the legislature increases, the chances of a bill having bipartisan women sponsors decreases, no matter whether there is a women's caucus or whether a bill's title contains words related to polarized topics. However, increasing polarization in the legislature lowers the probability of bipartisan women sponsorship at a slower rate for bills with polarized topic title words in legislatures with a women's caucus than in legislatures without a women's caucus. This indicates that having a women's caucus may mediate the effect of increasing polarization in the legislature by slowing the rate at which it makes bipartisan collaboration on polarized bills less likely. However, it may not improve overall rates of bipartisan cosponsorship.

Logit Model Using Title Sentiment Interaction Term

Table 5 displays the predicted probabilities of the logit model using the third

interaction term of the average sentiment score of a bill's title. These results show the

effect that an increase of one standard deviation from the mean of each independent

variable has, with all other variables kept constant at their mean or mode values, on the

probability of a bill having bipartisan women sponsors.

The predicted probability of each term when all values are at the mean or mode

values is .112, with a 95% confidence interval of .106-.117. The predicted probability of

the women's caucus variable at its nonmodal value is .209, with a 95% confidence

interval of .201-.218. This means that not having a women's caucus in the legislature, as

opposed to having a women's caucus, is associated with approximately a 10% increase in

the probability of a bill having bipartisan women sponsors, when all other variables are

held constant at their mean or mode values. The 95% confidence intervals of both

predicted probabilities do not overlap. This means that we can be 95% confident in

rejecting the null hypothesis that in the true population there is no difference between the

choice of bipartisan women to collaborate when there is a women's caucus and when

there is not women's caucus when all other variables are held constant at their mean or

mode values.

The predicted probability of the title sentiment variable at its nonmodal value is

.108, with a 95% confidence interval of .102-.114. This means that an increase of one

standard deviation in a bill's title sentiment is associated with approximately a .4%

decrease in the probability of a bill having bipartisan women sponsors, when all other

variables are held constant at their mean or mode values. However, the 95% confidence

Table 5: Predicted Probabilities of the Effect of a Women's Caucus, Polarization in the Legislature, and Bill Title Sentiment on Whether a Bill has Bipartisan Women Sponsors

| Independent Variable	Mean/Mode	Predicted Probability at Mean/Mode	95% Confidence Interval at Mean/Mode	Mean+1SD/ Non-Modal Value	Predicted Probability at Mean+1SD/ Non-Modal Value	95% Confidence Interval at Mean+1SD/ Non-Modal Value
Women's Caucus	1	.112	.106-.117	0	.209	.201-.218
Title Sentiment	.211	.112	.106-.117	2.204	.108	.102-.114
Legislature Polarization	1.585	.112	.106-.117	2.058	.099	.093-.104
Controlling Party	0	.112	.106-.117	1	.109	.103-.115
Share of Women	.212	.112	.106-.117	0.280	.133	.125-.140
Senate Seats	45.732	.112	.106-.117	57.830	.109	.103-.115
House Seats	121.890	.112	.106-.117	161.903	.147	.140-.154
Term Limits	0	.112	.106-.117	1	.124	.116-.133
Professionalization	.252	.112	.106-.117	.396	.112	.106-.119
Share of Republican Sponsors	.480	.112	.106-.117	.923	.115	.109-.121
Democratic President Vote	50.120	.112	.106-.117	59.515	.131	.122-.141
Governor's Party	1	.112	.106-.117	0	.146	.139-.154

intervals of the predicted probabilities at the variable's mode and non-modal values overlap. This means that we cannot be 95% confident in rejecting the null hypothesis that in the true population there is no difference between the choice of bipartisan women to collaborate on a bill whose title sentiment is positive and negative, when all other variables are held constant at their mean or mode values. This may indicate support for the H_3 null hypothesis that the polarization of a bill has no effect on whether bipartisan women choose to collaborate on the bill.

The predicted probability of the legislature polarization variable at one standard deviation above the mean is .099, with a 95% confidence interval of .093-.104. This means that an increase of one standard deviation in the polarization of a legislature is associated with approximately a 1% decrease in the probability of a bill having bipartisan women sponsors, when all other variables are held constant at their mean or mode values. The 95% confidence intervals of the predicted probabilities at the variable's mean and one standard deviation above the mean do not overlap. This means that we can be 95% confident in rejecting the null hypothesis that in the true population there is no difference between the choice of bipartisan women to collaborate at the two levels of legislature polarization when all other variables are held constant at their mean or mode values.

Figure 13 expands on these results. It shows the predicted probabilities of this logit model and is used to interpret the three-way interaction of the women's caucus, bill title sentiment, and legislature polarization variables.

Figure 13 shows that the relationship between a bill title's sentiment, legislature polarization, the presence of a women's caucus and the likelihood of bipartisan women sponsoring a bill supports some aspects of the novel information, H_1, hypothesis.

Additionally, the presence of a women's caucus may mediate the effect of increasing

polarization in the legislature when a bill is polarized but not increase rates of bipartisan

collaboration.

Figure 13: The Effect of a Women's Caucus, Legislature Polarization, and Bill Title Sentiment on Bipartisan Women Sponsoring a Bill
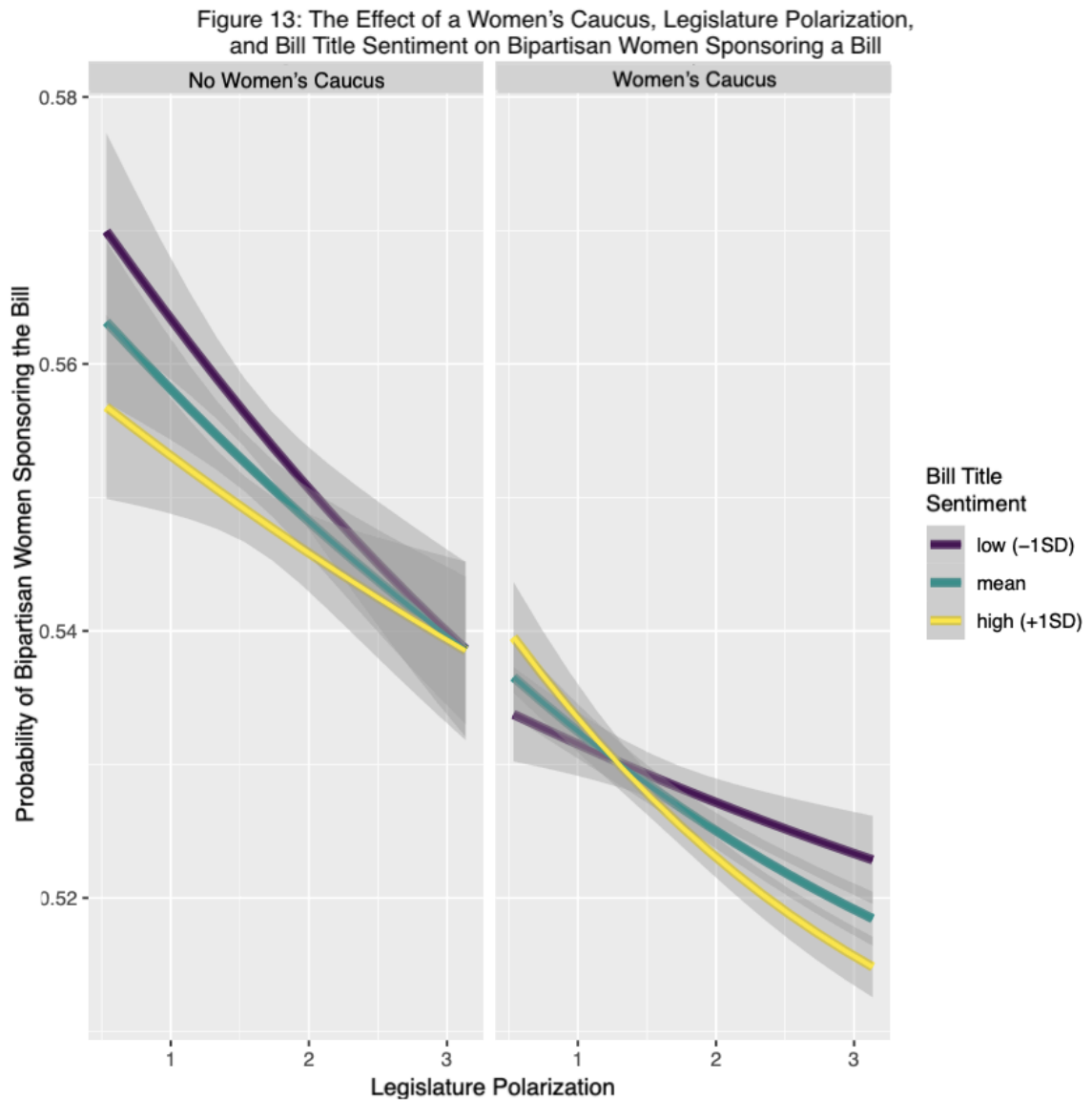
In legislatures with a women's caucus and low levels of polarization, the

relationship between whether bipartisan women sponsors are more likely to collaborate

on bills whose titles' sentiment is negative or positive is not significant at the 95%

confidence level. However, the confidence intervals show that we can be 95% confident that when polarization in the legislature increases, bipartisan women sponsors are more likely to collaborate on bills whose title sentiment is negative than positive. This relationship supports the novel information hypothesis, H_1, that in legislatures with a women's caucus, bipartisan women are more likely to collaborate on polarized bills than non-polarized bills. However, it does not support the hypothesis' prediction that this would occur at all levels of polarization.

In legislatures without a women's caucus and low levels of polarization, bipartisan women sponsors are more likely to collaborate on bills whose title sentiment is negative than on bills whose title sentiment is positive. This relationship does not support the novel information hypothesis, H_1, nor the lowest cost hypothesis, H_2, that both predict that bipartisan women are more likely to collaborate on non-polarized bills in legislatures without women's caucuses. When polarization increases in legislatures without a women's caucus, the interaction relationship is not significant at the 95% confidence level.

Furthermore, bipartisan women sponsors are more likely to collaborate on bills in legislatures without a women's caucus than in legislatures with a women's caucus, regardless of whether a bill's title sentiment is negative or positive or polarization in the legislature increases. When polarization in the legislature increases, the chances of a bill having bipartisan women sponsors decreases, no matter whether there is a women's caucus or whether a bill's title sentiment is negative or positive. However, increasing polarization in the legislature lowers the probability of bipartisan women sponsorship at a slower rate for bills with negative sentiment in legislatures with a women's caucus than

in legislatures without a women's caucus. This indicates that having a women's caucus may mediate the effect of increasing polarization in the legislature by slowing the rate at which it makes bipartisan cosponsorship on polarized bills less likely but may not improve the overall rates of bipartisan cosponsorship.

Conclusions and Implications

These results address the following research questions: Under what scope of conditions do bipartisan caucus members collaborate and on what types of bills is bipartisan collaboration most common? Can caucuses help bipartisan members collaborate on polarized policy issues in an increasingly polarized environment? The results indicate that bipartisan women may be more likely to collaborate on polarized bills than non-polarized bills in legislatures with women's caucuses and in legislatures without women's caucuses if polarization is low. They also indicate that the presence of a women's caucus may not improve bipartisan collaboration amongst women legislators, but that it may reduce the rate at which increasing polarization slows bipartisan collaboration on polarized bills.

The first logit model's predicted probabilities results (Table 3) indicate that having words related to polarized topics in the bill's title, as opposed to not having those words, is associated with approximately a 2% decrease in the probability of a bill having bipartisan women sponsors, when all other variables are held constant at their mean or mode values. This may support the lowest cost hypothesis, H_2, that bipartisan legislators are more likely to collaborate on non-polarized bills than polarized bills in legislatures with and without caucuses and at all levels of polarization. However, the predicted

probabilities graph for this model (Figure 12) expands on these results to show that in legislatures with a women's caucus and in legislatures without a women's caucus but low polarization levels, bipartisan women are more likely to collaborate on bills with polarized topic words in their titles than bills without those words. This supports the novel information hypothesis, H_1, prediction that bipartisan legislators are more likely to collaborate on polarized bills when there is a women's caucus, but not its prediction that they are more likely to collaborate on non-polarized bills when there is not a bipartisan caucus. Bipartisan women are more likely to sponsor bills without polarized topic words in their titles in legislatures without women's caucuses and high polarization levels. This supports the lowest cost hypothesis, H_2, prediction that bipartisan legislators are more likely to collaborate on non-polarized bills than polarized bills, but not its prediction that this relationship will occur regardless of whether there is a women's caucus and at all levels of legislature polarization. When bill title sentiment is used as the measurement for bill polarization, the results are similar.

The second logit model's predicted probabilities results (Table 3) indicate that the relationship between a bill title's sentiment and the probability of the bill having bipartisan women sponsors, with all other variables held at their mean or mode values, is not significant at the 95% confidence level. However, the predicted probabilities graph clarifies that we can be confident at the 95% level that bipartisan women are more likely to collaborate on bills with negative title sentiment in legislatures with women's caucuses and high polarization levels and in legislatures without women's caucuses and low polarization levels. This supports the H_1 hypothesis prediction that bipartisan legislators are more likely to collaborate on polarized bills than nonpolarized bills when there is a

bipartisan caucus, but not its prediction that this relationship will occur at all levels of legislature polarization when there is a bipartisan caucus and reverse when there is not a bipartisan caucus. Both logit models indicate that bipartisan women are less likely to collaborate when there is a women's caucus than when there is not, and when polarization in the legislature increases.

Both logit models' predicted probability results show that legislatures without a women's caucus, as opposed to those with a women's caucus, are associated with an increase in the probability of a bill having bipartisan women sponsors, when all other variables are held constant at their mean or mode values. They also show that an increase of one standard deviation in the polarization of a legislature is associated with a decrease in the probability of a bill having bipartisan women sponsors. The predicted probability graphs show that while bipartisan women are always more likely to collaborate in legislatures without a women's caucus and when polarization is lower, the rate at which their collaboration on polarized bills decreases with increasing legislature polarization slows dramatically when there is a women's caucus. These results together illustrate how bill polarization may be measured.

The similarities in the logit models' results indicate that my findings on the relationship between bill polarization, legislature polarization, the presence of a bipartisan caucus, and bipartisan collaboration are robust across two different measurements, dimensions of polarization, sample sizes, and keyword lists. This adds credibility to both measurements. While both measurements align, my topic model analysis of the bills illustrates how the measurements are different and provide unique insights into polarized and non-polarized bills. The topic model analysis and logit model

findings show that two measurements of document topic and sentiment may also be used in future studies so that both aspects of a document's polarization can be understood and corroborate one another. The robust findings offer unique implications for how legislators may approach bipartisan collaboration.

The findings imply that women legislators may approach bipartisan collaboration on polarized bills differently depending on the level of polarization in the legislature and the presence a women's caucus. They may prioritize the reduction of political risk in some circumstances, and at others the sharing of novel information. For instance, they may be willing and able to trust one other, share novel information, and collaborate on polarized bills without a caucus until the risks associated with legislature polarization become too intense. Additionally, they may be willing to trust one another, share novel information, and collaborate on polarized bills within a caucus, even when polarization increases, because a caucus may slow the increase of collaboration costs. Finally, they may be more willing to share novel information and collaborate on polarized bills outside of a formal caucus structure than within a caucus structure. This raises questions for future research.

Future research may first investigate why the presence of a women's caucus may discourage bipartisan collaboration rates overall. If party homophily is stronger than gender homophily, may women legislators face political risks for collaborating across party lines within a women's caucus and be more willing to collaborate outside of a structure that prioritizes their shared gender over their party affiliation (Neal et al., 2020; Ferber & Pugliese, 2000)? Surveys of legislators may reveal whether a caucus structure makes bipartisan women concerned with showing preference for legislators of their same

gender over their party. Second, future research may use statistical analyses or case studies on the creation and removal of women's caucuses to see whether their presence is ever in response to other independent variables, such as the share of women in the legislature, size of the legislature, or polarization within the legislature. Third, case studies of legislatures and interviews with legislators may be used to investigate whether the casual mechanisms for the lowest cost and novel information hypotheses are present and work as theories predict. Fourth, future research may benefit from creating a variable that combines the two measurements of bill topic and sentiment. This may provide insight into whether bills related to polarized topics with negative sentiment affect bipartisan collaboration differently than those with positive sentiment. Finally, studies on how to increase bipartisan collaboration rates may investigate strategies to directly reduce polarization levels in legislatures, rather than investigate whether caucuses may encourage bipartisan collaboration despite polarization.

In conclusion, my research contributes to political science by illustrating a new way to measure the polarization of a bill and by considering how the polarization of a bill relates to bipartisan collaboration. Using public surveys to create an initial keywords list, and then topic models to modify that list, illustrates a new way to create a topic keywords list that is applicable to a specific set of documents like state-level legislation. Measuring both the topic and sentiment of a bill effectively captures different but complementary aspects of a bill's polarization level. Considering bill polarization as an interacting variable reveals that the extent to which a caucus mediates the effect of polarization on bipartisan collaboration also depends on whether bills are polarized. While women's caucuses may not improve bipartisan women collaboration rates overall, they may help

mitigate the effect that an increasingly polarized environment has on bipartisan

collaboration on polarized policy issues.

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