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FRIENDS IN HIGH PLACES

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ABSTRACT

In this paper we demonstrate that personal connections amongst politicians, and between politicians and firms, have a significant impact on the voting behavior of U.S. politicians. We exploit a unique database linking politicians to other politicians, and linking politicians to firms, and find both channels to be influential. Networks based on alumni connections between politicians, as well as common seat locations on the chamber floor, are consistent predictors of voting behavior. For the former, we estimate sharp measures that control for common characteristics of the network, as well as heterogeneous impacts of a common network characteristic across votes. For common seat locations, we identify a set of plausibly exogenously assigned seats (e.g., Freshman Senators), and find a strong impact of seat location networks on voting. Further, we show that connections between firms and politicians influence Congressional votes on bills that affect these firms. These network effects are stronger for more tightly linked networks, and at times when votes are most valuable.

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Firms have a vested interest in the passage of laws. Firms enlist the support of lobbyists, make campaign contributions to political elections, appoint board members with past political experience, and exert influence in a variety of ways, all in order to ensure that politicians protect their interests when voting on particular pieces of legislation. While the impacts of many of these channels of influence have been explored,[1] the effects of more subtle channels of influence are still largely unknown.

In this paper we explore one particular channel of influence, that of personal social networks. We use the laboratory of the U.S. Congress, and the firms represented by these Congressmen, to study the influence of personal connections on the voting behavior of politicians. We explore personal connections both *within* Congress (i.e., between politicians), and *outside* Congress (i.e., between politicians and firms). Exploiting the complete Congressional voting record over the past 20 years, we demonstrate that social networks have a significant impact on the voting behavior of U.S. politicians. We construct a unique database that links politicians to other politicians, and links politicians to firms, and find that both channels impact Congressional voting behavior. The primary network measure we exploit is based on the alumni networks of Congressmen. An advantage of our approach is that unlike many social networks,[2] these education networks are formed decades before the voting behavior we attempt to explain. Further, we directly address the issue of causation by examining situations where the network mechanisms are expected to be more utilized, while the characteristics of the network itself remain constant.

Our first main result is that alumni networks influence Congressional voting behavior, even after controlling for other well-known predictors of voting behavior. For example, the percentage of Senators in one's alumni network that vote in favor of a given bill is strongly related to a Senator's own likelihood of voting in favor of that bill. Further, the impact of school ties on voting is monotonically increasing with the strength of network, is found in the House as well as the Senate, and is robust to a variety of

[1] See, for example, Roberts (1990), Fisman (2001), Jayachandran (2006), Faccio (2006), Faccio and Parsley (2006), Faccio et. al (2006), Fisman et. al (2007), Goldman et. al (2007), Goldman et. al (2008), Duchin and Sosyura (2009), and Tahoun and Van Lent (2010).

[2] See Jackson (2005) for a review of network applications in economics, Williams (2009) for a review of network applications in politics, and Fowler et. al (2009) for a discussion of the causality inference problems that arise when studying typical political networks such as cosponsorship networks, which are formed endogenously during the legislative process.

different specifications and controls.

A key feature of our analysis is that we can identify a *causal* link between network effects and voting behavior by exploiting situations where the network mechanisms are likely to be more utilized, while the characteristics of the network itself remain constant. To do so we focus on: i.) votes that are "irrelevant" to those firms located in a Senator's home state, and ii.) votes that are close to passing (or failing to pass).

The mechanism behind this approach is to alter the supply of, and demand for, votes within a network while holding network characteristics constant. For example, supplying a vote when the bill in question is irrelevant to one's constituent firms is presumably not very costly. Similarly, close votes are times when the marginal vote is very valuable, and hence demand to influence peers is likely strongest. Thus these are the exact times that members would be expected to exert the most pressure on fellow network-connected Senators.

Our strategy employs a unique bill classification approach that categorizes each bill over the 1989-2008 period as being related to certain industries, depending upon the text of the bill. We expect those bills that impact firms in the Senator's home state to be the bills that the Senator will have a vested interest in voting either for or against, regardless of network effects; conversely, the remaining "irrelevant" votes for the Senator should be those for which her network should have the most persuasive ability in affecting her behavior. We find exactly this pattern in the data. The effect for irrelevant votes is nearly 100% larger. A similar dichotomy can be thought of with respect to close votes, and for these votes we again find evidence consistent with Senators using the network to actively influence voting behavior when the marginal value of votes is higher (and again, evidence against a simple unobservable characteristic explanation). On these close votes, the network influence on voting behavior is over twice as large. Finally, on votes that are both irrelevant *and* close, the impact of one's network on voting is over 200% larger than the unconditional effect.

We also explicitly rule out an alternative explanation based on heterogeneous impacts of our fixed network characteristic. For instance, it may be exactly when a vote is irrelevant to a senator that her intrinsic preferences are more expressed; preferences which can be correlated across the network. To address this possibility directly, for each vote we separate the senator's network into those who have a vested interest in the bill, and those to whom it is irrelevant. If the heterogeneous impact of a network characteristic is driving the results, we should see a given senator's voting *most* correlated with those senators in her network to whom the bill is irrelevant. By the same logic the senator's vote should be *less* correlated to those who are voting due to a separate vested interest (i.e., those senators who have many constituent firms impacted by the given bill). The direct network influence channel works in the exact opposite direction: senators who have a vested interest do the *most* to curry votes in their favor, while the senators with no vested interest do little. Thus if there is a direct channel of influence at work, the given senator's votes should follow more with these vested-interest senators.

Running these tests yields strong evidence for the direct network influence mechanism, and evidence against a heterogeneous impact of some fixed network characteristic. In particular, the school effect we mention above is entirely driven by the impact of those school connected votes for whom the vote is relevant; votes by senators in the network who do not have a vested interest in the bill have no impact.

To give an idea of the magnitude of the school network effect, we find that a one standard deviation increase in the percentage of school connected senators with a vested interest in a bill who vote in favor of a bill implies a 5 percentage point increase in the likelihood of a given senator voting in favor of a bill (controlling for party influences, state influences, congress-session, and a host of other controls). To put this into context, we compare it to the effect of state-level considerations for the Senator. State-level considerations are arguably one of the largest determinants of Senator behavior, as state constituents ultimately determine re-election outcomes. We find that the alumni network effect is close to 60% of the size of the state-level effect.

Our next key finding is that social ties between Congressmen and the firms domiciled in their home states also impact legislator behavior. We use alumni networks to link Senators to the senior management of firms in their states. An advantage of this identification strategy is that for the same Senator, and within the same state, we can exploit variation in the level of connectedness of the Senator to his various constituent industries. We construct links between each politician and each firm located in his state, and then aggregate these links to the industry level in order to form measures of network connectedness of each Senator to each industry that operates in his state. Using these links, we measure how social network connectedness to a given industry affects the voting behavior of a Senator. We find, consistent with the evidence on within-Congress networks, that these networks with firms also significantly affect behavior, and at roughly the same order of magnitude. For example, a one standard deviation increase in a Senator's social connectedness to an industry increases the chances of the Senator voting for (against) bills that are favorable (unfavorable) for the industry by about 2 percentage points. This is again over one-third the size of state-level considerations in the Senator's voting, with the state-level consideration undoubtedly a quite important consideration for the Senator.

Lastly, we show that an entirely distinct social network measure based on similar seat locations on the Senate Chamber floor also predicts Senate voting behavior. We use data on Senate Chamber seat mappings to test the idea that *where* a Senator sits in the Senate Chamber may affect which particular Senators he comes in contact with on a daily basis, and hence the opinions of those Senators seated close to him may influence his views on particular issues.[3] Since assignment to seats in the Senate Chamber is based almost exclusively on seniority, whereby senior Senators are given the first opportunity to select their desk, the practical impact of this seating rule is that Senators of a similar cohort (based on when they were first elected to the Senate) end up sitting close to each other. Thus the seating arrangements in the Senate help to reinforce the relationships that Senators may already form among those other Senators who start their careers at roughly the same times. We find that the votes of nearby Senators have a large and significant impact on a given Senator's voting behavior. However, as senior Senators may choose over a wide range of available seats, this may result in some (potentially unobservable) characteristic affecting both seat proximity to other Senators and common voting. In order to get around this endogeneity issue, we examine solely the subset of newly-elected junior Senators for whom seating choice is plausibly exogenous (since they can only choose among the last few remaining seats), and find a similarly large effect.

Collectively, our findings provide new evidence that personal connections have a

[3] See Patterson (1959) and Caldeira and Patterson (1987) for related evidence that seat distance impacts survey measures of friendship in the Wisconsin and Iowa state legislatures, and Masket (2008) for evidence that seating proximity between legislators affects voting in the California State Assembly.

significant impact on the voting behavior of U.S. politicians, and highlight a subtle channel through which firms can influence lawmakers. Networks based on alumni connections between politicians, alumni connections between politicians and their constituent firms, and seat-based connections between politicians are all consistent predictors of voting behavior in the U.S. Congress.

The remainder of the paper is organized as follows. Section I describes the related literature. Section II describes the data, while Section III explores the network characteristics of U.S. politics and firms. Section IV presents the impact of alumni networks on Congressional voting behavior. Section V examines times of increased network impact. Section VI provides a series of robustness checks. Section VII establishes the network links between politicians and firms, and how these network relationships impact voting behavior. Section VIII examines an alternative network in the U.S. political system. Section IX concludes.

I. Related Literature

Our paper adds to a growing literature exploring the benefits that firms perceive (and receive) from currying favor and/or making connections with politicians, such as higher valuations (Roberts (1990), Fisman (2001), Jayachandran (2006), Faccio (2006), Faccio and Parsley (2006), Fisman et. al (2007), Goldman et. al (2007)), corporate bailouts and government intervention (Faccio et. al (2006), Duchin and Sosyura (2009), Tahoun and Van Lent (2010)), and lucrative procurement contracts (Goldman et. al (2008). Our paper is unique in that we provide direct evidence that individual firm connections influence the voting behavior of politicians, using the complete Congressional voting record over the past 20 years.

Since our focus is on isolating a specific channel through which network effects operate in Congress, namely through well-defined alumni networks, our work also relates to a vast literature that demonstrates that neighbors, peers, parents, and siblings can impact a long list of individual behaviors ranging from educational attainment,[4] to

[4] See, for example, Black et. al (2005), Dahl and Lochner (2005), Hanushek et. al (2003), Hoxby (2000), Ruhm (2004), and Sacerdote (2001,2007).

welfare decisions (Bertrand et. al (2000)), to spousal choices (Fernandez et. al (2004)).[5]

Also, since we analyze Congressional voting behavior in particular, our paper is relevant to a large literature that studies the factors that influence the behavior of elected officials. In addition to political party, constituent interests (Stigler (1971), Peltzman (1985), and ideology (Kau and Rubin (1979, 1993), Poole and Rosenthal (1996), and Lee, Moretti, and Butler (2004)),[6] we demonstrate that alumni networks are an important determinant of politicians' voting behavior.[7] Our focus on alumni networks also adds to a body of work in the political science literature that explores the impact of different types of social networks in Congress, much of which focuses on cosponsorship networks.[8] An advantage of our approach relative to these studies is that our network measure is exogenous to the political process itself. Further, our network ties are formed decades before the voting behavior we attempt to explain.

II. Data

We use a variety of novel data sources to create the sample we use in this paper. First we hand-collect the complete biographical record of all Senators and Representatives from the 101st through 110th Congresses, using the Biographical Directory of the United States Congress available online.[9] From this website, and from the individual websites of the Congressmen, we extract information on academic institutions attended, religious affiliations, birthdates, home towns, and past work experience. We use this data to create the alumni connection and other connection variables that we exploit in our analysis. We also merge this data with data on the educational backgrounds of the senior management of corporations headquartered in the home state of the Senators and Representatives in our database (see Cohen, Frazzini, and

[5] See also Manski (1995) and Gaviria and Raphael (2001).

[6] See Levitt (1996), Ansolabehere et. al (2001), Synder and Groseclose (2000), Kalt and Zupan (1990), and Mian et. al (2009) for various perspectives on separating out the impact of ideology versus party interests, constituent interests, and special interests.

[7] See also Hibbing and Marsh (1991), Stratmann (2000), Pande (2003), Chattopadhyay and Duflo (2004), and Washington (2007) for evidence that personal characteristics such as service length, age, religion, race, gender, and the presence of a daughter in one's family can affect the behavior of elected officials.

[8] See Williams (2009) for a review of the literature on networks in politics. See also Fowler (2006), Caldeira and Patterson (1987), Patterson (1959), Routt (1938), Young (1966), Bogue and Marlaire (1975), Burkett and Skvoretz (2006), and Porter et. al (2005, 2006).

[9] See http://bioguide.Congress.gov/biosearch/biosearch.asp.

Malloy (2008, 2009) for details on the construction of this firm-level biographical data).

A key source of data we also collect is the complete voting record of all Senators and all Representatives on all bills from the 101st through 110th Congresses. We collect this from the Library of Congress' Thomas database. Each "Congress" is two years long, and is broken into two one-year-long "Sessions." Therefore, 10 Congresses represents twenty years of Congressional data from 1989-2008. We begin in 1989 as this is the first year that centralized data is available on all roll-call votes. The collection of this data requires us to download the result of each roll call vote for the twenty-year period in each chamber of the Congress, and record the individual votes for every Congress-person voting on the bill (or abstaining).

In a number of our tests, we also utilize the content of the bills being voted on. Thus, in addition to collecting the voting on the bills, we also download the full text of all bills being voted on over our sample. We collect the full-text data jointly from the websites of the Government Printing Office (GPO), and from the Thomas database. We then parse and analyze the full bill text to classify each bill into its main purpose. Specifically, for our tests, we attempt to assign each bill to one (or more) of the Fama-French 49 industries.[10] To do this we first construct a set of keywords for each industry. We then create an executable (shown in Figure 1), in which we input all bills and their corresponding full-text that assigns bills to industries based on the count of the number of times these keywords appear in a given bill. We only assign a bill to an industry if the number of instances of a particular keyword exceeds a certain threshold of frequency on a given bill relative to its overall frequency in the entire population of bills.[11] Individual bills can be assigned to more than one industry; however, we use a conservative assignment procedure such that our procedure only results in industry assignments of any kind for less than 20% of all bills, and specifically only those bills where we can confidently gauge that an industry is likely to be affected by the bill in question. Figure 1 presents an example of a particular bill that was assigned only to the Fama-French industry #30: Petroleum and Natural Gas, based on the relative frequency of pre-specified keywords in the bill that pertain to this industry. Figure 1 displays the

[10] These industry definitions are available from http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/.
[11] We have experimented with various thresholds, and our results are not sensitive to the particular threshold we employ.

summary text at the top of the bill, which indicates that the bill clearly pertains to the oil and gas industry.

We also "sign" the impact of each bill, as positive or negative, for the given industry it affects. We do so by exploiting the voting record of those Senators who are likely to identify this as a relevant industry to their constituents. To identify the constituent interests of a given Senator, we assign each firm domiciled in a Senator's home state to one of the Fama-French 49 industries; "relevant" industries to a particular Senator on a particular bill are those industries that: i.) are assigned to that bill using the procedure described above, *and* ii.) have at least one firm headquartered in the Senator's home state that belongs to the given industry. We then rank all the industries in each Senator's state by aggregating all firms in each industry by size (sales and market cap), and define "important" industries as those that rank in the top three for each state in terms of size. Next we sign each bill by looking at the voting records of those Senators who have "important" industries that are mentioned in the bill. The rationale behind this procedure is that a Senator's vote on a particular bill that affects important firms in his state is likely to suggest how that bill will affect those firms in his state; thus we can infer that a yes vote by a Senator with a vested interest in a bill is likely to mean that the bill is positive for the industry he cares about, and vice versa for a no vote.[12]

Figure 2 displays the executable program we created to implement our signing procedure for the same bill depicted in Figure 1. The summary text indicates that the goal of this bill is "to provide energy price relief and hold oil companies and other entities accountable for their actions with regard to high energy prices, and for other purposes," so the bill is likely to be perceived as negative for the oil and gas industry. And not surprisingly, even though this vote lined up largely along party lines, none of the 6 Republican Senators who voted in favor of the bill were Senators who were "tied" to this industry via constituent interests in their home state (all 8 industry-tied Republicans voted against), and 1 of the 2 Democrats who voted against the bill was Mary Landrieu of Louisiana, a state heavily represented by oil and gas interests (the other Democrat who voted against was Henry Reid from Nevada, a consistent supporter of oil and gas

[12] An alternate approach to sign each bill would be to employ lobbying data, but we do not yet have lobbying data on every bill over the past 20 years.

companies); the 6 industry-tied Democrats who voted in favor of the bill did so largely on party and ideological grounds (variables that we control for in our tests, as described below).

In our tests we experiment with a number of different measures to sign each bill, such as the absolute ratio ("Ratio" in Figure 2, i.e., the percentage of industry-tied Senators who vote for the bill), the relative ratio ("R/R" in Figure 2, i.e., the percentage of industry-tied Senators who vote for the bill divided by the percentage of all Senators who vote for the bill), and the ratio difference ("R-R" in Figure 2, i.e., the percentage of industry-tied Senators who vote for the bill minus the percentage of all Senators who vote for the bill); our results are not sensitive to the particular signing measure we employ.[13] We have also tried *within-party* signing measures that are computed identically to those above, except aggregated within each party (since many votes are along party lines) and again the results are very similar.

Lastly, for a series of tests we examine the seating proximity of Senators in the Senate chamber. We extract the historic Senate Chamber Maps from the Senate website (www.Senate.gov) in order to identify the seat location of every Senator in each of the 101st-110th Congresses. We then use these seat locations to construct our measures of Senate seat-based networks, which we describe in detail in Section VIII.

III. Social Networks in Congress

Table I lists summary statistics for our sample. Our sample covers the 20-year period of the 101st-110th Congresses. The unit of observation in our analysis is the Congressman-vote level. For example, Senator Clinton's vote of "yea" in the 110th Congressional Session on Recorded Vote No. 2 (regarding Senate Joint Resolution 9) is a single observation. Panel A contains data on the U.S. Senate, while Panel B (for brevity) contains only the main summary statistics for the U.S. House of Representatives. From Panel A of Table I, we have roughly 650,000 vote-level observations for the Senate made by 209 Senators over this twenty year period. The total number of Senators over this 20 year period may seem low, however the incumbency re-election rate is quite high for the

[13] Note that in our tests, we also remove the impact of each individual Senator's *own* votes when constructing these ratios for a particular Senator-vote observation, such that these ratios reflect only the behavior of *other* Senators who are tied to the same industry.

U.S. Congress. Of the votes cast, over 65% are "yes" votes. The remainder of Panel A shows additional summary statistics. Each "PctSumYes*" variable measures the percentage of the group in question that votes yes for a given bill, on average. So, for instance, the average percentage of Senators from the same school as a Senator that vote yes is 63.8%. These percentage measures are, not surprisingly, on average nearly identical regardless of grouping, and roughly match the overall sample average percentage of yes votes. The sum variables are measured similarly, but simply add the number of Senators that vote yes on a given bill. For instance, the average number of total yes votes from a given Senator's party on an average bill is 31 (roughly half the sample average). Panel B shows similar measures for the House, although there are many more observations stemming from the larger size of the chamber.

Note that we have run all the tests in this paper using samples that consist only of "measures" (i.e., the final versions of all bills voted on in the chamber), as well as samples that consist only of bills where we can ascertain that at least one industry is affected by the bill (and hence that the bill is relevant to at least one Senator), and our results are unchanged. Thus our results are *not* driven by multiple versions of the same bill, or by non-substantive and/or procedural votes.

Table II examines in more detail two specific characteristics of Congressmen, here focusing on the Senate. The first is the main network measure we use in the paper, namely alumni networks. We define everything at the degree level in Panel A. Thus, each of the 209 Senators that served in the Senate over this period is included once in these tabulations, but Senators often have degrees from more than one academic institution, hence the total number of degrees exceeds the total number of Senators. So, our 209 Senators earned 375 degrees that we could match back to colleges and universities. We list in this table those universities that represent the largest number of degrees in the U.S. Senate. The most connected university to the U.S. Senate is Harvard University, followed by Yale, Virginia, Stanford, and Georgetown. In addition, a number of the Senators were Rhodes Scholars, leading to a surprisingly high position of Oxford University on the connectedness list. Panel B contains the religious affiliations of the U.S. Senate. As can be seen, religious affiliation was unavailable for 42 of the Senators, so we have a total of 167 with religious group information. The most common religious affiliation is Roman Catholic, which accounts for nearly 25% of all Senators, followed by Methodist, Presbyterian, Episcopalian, Jewish, and Baptist.

IV. The Impact of Networks on Congressional Voting Behavior

We now examine in more detail the voting behavior of U.S. politicians, and how this behavior is affected by social networks. In order to test whether a politician's network affects her voting behavior, we need to define measures of possible groups that could influence her behavior. The first network we focus on is the alumni network; we also examine seat location-based networks in Section VIII. We use two main measures of the influence of this alumni network on a politician's voting, and construct equivalent measures for the two separate houses of Congress.

IV.A The Impact of School Ties on Senate Voting

Our first tests focus on the voting behavior of U.S. Senators. The first measure we employ in our Senate tests is the sum of the Senators in the given Senator's alumni network that vote in favor of the bill being considered. The second measure we use is the *percentage* of Senators in the given Senator's alumni network that vote in favor of the bill. The idea behind both of these measures is that they proxy for the amount of potential prodding the Senator could be receiving from within this alumni social network to vote for the given bill. While both pick up a measure of the intensity of the network's interest in passing the given bill, the two measures address two subtly different mechanisms by which the members of the network exert influence. The sum measure exploits the idea that it is the absolute number of fellow Congressmen putting pressure on a Congressman that has the biggest effect on voting. The percentage measure, in contrast, exploits the idea that it is the fraction of the Senator's social network putting pressure on her that more accurately measures the extent of influence on the Senator's voting. One benefit of the percentage measure is that it abstracts from the size of network, while the sum measure is jointly measuring the behavior of the network and the size of the network. To narrow the focus more on behavior, we focus mainly on the percentage measure, however we also show results for both the percentage and sum measures.

Our basic test examines the impact of networks on the voting behavior of each Senator. The main dependent variable we use is simply whether the given Senator voted yes (or no) on the given bill. To control for other determinants of a Senator's voting we construct a number of control variables. The first is the sum (or percentage) of the Senator's party voting in favor of the given bill. For instance, if we are considering a Democrat, it would be the sum of all other Democrats voting in favor of given bill, and equivalently for Republicans. The intuition behind this measure is that it will control for anything that is party-agenda related at the very fine level of the given vote on the specific bill in question. We also calculate the sum (percentage) of the other Congressmen from the same state voting in favor of the bill. For the Senate, the two (sum and percentage) are equal, as there is exactly one other delegate from any Senator's state. However, the House measures can vary, as there can be multiple delegates from a given state. The idea behind this measure is that it will again control for anything that is important at a state-agenda level for the given vote on the specific bill. In sum, to stress the granularity of these variables, these are quite fine controls for the party- and state-level importance of the *given* vote for the *specific* bill being voted upon.

Lastly, we include a number of fixed effects in the specifications. First, we include a fixed effect for the given Senator. This captures a Senator's average propensity to vote yes on any given bill, which could vary across Congressmen. We also include a fixed effect for Congress (as we mention in Section II, our detailed voting and biographical data cover the 101st-110th Congresses). As different Congresses often focus on quite different legislation (e.g., defense vs. healthcare vs. fiscal policy, etc.), this is meant to capture anything specifically related to these different agendas covered, and voted upon, across Congresses. Lastly, we also include in many specifications quite fine fixed effects at the Congress-session-vote level. That is, these are fixed effects for the specific vote on the specific bill, in the given Congress and session. These control for anything special that might affect all Congressmen's votes on the specific bill (e.g., deadline for approval). We obviously cannot include both this fixed effect and the Congress fixed effect in the same regression (as Congress is a linear combination of Congress-session-vote), so we use varying specifications including either fixed effect. Lastly, we adjust all standard errors for clustering at the Senator level to account for the fact that Senators may exhibit a tendency to vote in a similar way on multiple roll-call votes.

Table III presents the results of these voting behavior regressions. The observation-level is a given Senator's vote on the Senate roll-call (recorded) vote in question for the specific bill. Thus, for a given roll-call Senate vote we average 97 observations, or recorded yea, nay, or abstain votes (as there are often Senators missing a given vote). The dependent variable we focus on is *Yes*, which is a categorical variable equal to 1 if the given Senator votes yes on the given roll-call vote, and 0 otherwise.[14] In columns 1-3 of Table III we focus on the % measures of the independent variables, and in columns 4-7 we show results for the sum measures. The variable of interest in Column 1 is *School Connected Votes*, which is the percentage of the other Senators in the given Senator's alumni network who vote yes on the given bill. We also include controls for *State Votes* and *Party Votes*, which represent the percentage of the Senator's state and other party members voting in favor of the bill, respectively.

Column 1 indicates that the voting of other members of a Senator's alumni network is significantly related to the Senator's own vote, even after controlling for general party voting, the voting of the other Senator in one's state, and both Congress and Senator fixed effects. In Column 2, we include these same controls, plus both Senator and the finest Congress-session-vote level fixed effects, and find a similar result. The coefficient on *School Connected Votes* of 0.052 (t=3.31) in Column 2 implies that controlling for the general voting on the given bill, the Senator's own tendency to approve legislation, the party's views on the given bill, and the state-implied importance level of the given bill, a one standard deviation increase in the percent of the Senator's network voting for the bill implies a roughly 2 percentage point increase in the Senator's likelihood to vote in favor of the bill. In Section V, we construct sharper measures of the direct influence exerted through the network, and for this cleaner measure of direct influence, the magnitude of the network effect more than doubles.

IV.B House Results, Alternate Measures, and Variation in Strength of Network

[14] In this table we run regressions is a linear probability model; however in Table VII we also run logit and probit specifications and show that these imply slightly larger school effects in magnitude and significance. We prefer to use the linear framework as we can include relatively granular fixed effects, better controlling for fixed variation on a number of dimensions. See Greene et al. (2002) for a discussion of the statistical problems associated with the use of fixed effects in non-linear regression frameworks.

In this subsection, we first examine the impact of alumni networks on the voting behavior of Representatives in the U.S. House of Representatives. The first measure we examine is again *School Connected Votes*, here defined as the percentage of the other Representatives in the given Representative's alumni network voting yes for the given roll call vote on the given bill. We thus replicate the specification from Columns 2 of Table III, but now using the voting behavior of Representatives rather than Senators. In line with the Senate results, Column 3 of Table III indicates that Representatives' voting behavior is significantly related to the voting behavior of Representatives in her alumni network. In Column 4, we then go on to examine an alternate measure of alumni network influence. Specifically, we compute the *sum* of the Representatives in a given Representative's alumni network that vote in favor of the bill (as opposed to the percentage). We come to the same conclusions about the strong impact of a Representative's alumni network on her voting behavior. Specifically, the coefficient of 0.004 (t=5.96) in Column 4 implies that a one standard deviation increase in the number of Representatives voting in favor of a given bill in a given Representative's alumni network, increases the likelihood of the Representative voting in favor of the bill by over 2 percentage points.

We also examine this alumni network measure using sums (as opposed to percentages) in the Senate. The coefficient in Column 5 of Table III of 0.008 (t=3.44) implies that a one standard deviation increase in the number of Senators in the given Senator's alumni network voting in favor of the bill increases the Senator's likelihood of voting for the bill by 3.4 percentage points. This is comparable, although somewhat larger in magnitude to both the effect in the House and the effect in the Senate using the percentage measure. Thus the sum measures produce similar results in magnitude and significance to the percentage network measure.

In the last two columns of Table III we exploit variation in the *strength* of alumni network links. If it is the alumni network impacting voting, then we'd expect that the stronger the network connection, the more influence the network should have on a given Senator's voting behavior. Therefore, in Columns 6 and 7 we create two new measures of increasing connectedness. First, Column 6 measures the effect on a Senator's voting of those Senators that have not only gone to the same school as the Senator, but also have the same degree from that school (e.g., both have JDs from Yale). Even stronger, Column 7 measures the effect for networks of Senators that have gone to the same school, received the same degree, and overlapped on campus at the same time (e.g., both Harvard MBAs in 1965).[15] Consistent with the alumni network having an influence on voting, the impact of schools is monotonically increasing with the strength of network. From Column 7, the impact of the most connected network measure is over twice as large (0.020 (t=2.49)) as the other two measures (0.010 and 0.008).

V. Times of Increased Network Impact: Close and Irrelevant Votes

As noted earlier, a key feature of our analysis is that we can identify a *causal* link between network effects and voting behavior by exploiting situations where the network mechanisms are likely to be more utilized, while the characteristics of the network itself remain constant. We do so in this section by focusing on: i.) votes that are "irrelevant" to those firms located in a Senator's home state, and ii.) votes that are close to passing (or failing to pass). The idea behind this approach is that these are times when the supply of votes that can be swayed by peers is high (irrelevant votes to some senators in the network), and the demand by peers to sway them is also high (votes close to passing). Thus these are the exact times that members would be expected to exert the most pressure on fellow network-connected Senators. We then further explore (in Sub-section A), a very strict test controlling for the possibility of heterogenous effects across votes of the fixed characteristic of network.

Note that this approach helps to explicitly rule out an alternative explanation for any within-Congress alumni network findings that is based on a common characteristic of the network causing voting behavior to be related, rather than the direct effect of the network itself causing voting behavior to be related. For example, perhaps instead of Georgetown Senators using their Georgetown network to curry the votes they need to pass a bill, it might be that Georgetown Senators are related to each other in some unobservable way. This relation could come from common experiences at Georgetown,

[15] The percentage of regression observations (out of 671,520 total Senators' votes from Table I) that have at least one other Senator voting on the bill who is connected to the given Senator through either: (i) same school, (ii) same school and degree, or (iii) same school, degree, and year, are 65.8%, 52.6%, and 37.3%, respectively.

but need not, and could be any common characteristic that they share (correlated with both attending Georgetown, as opposed to another university). By varying the times when network impact is likely to be strongest, we can directly evaluate this alternative explanation. If our results are simply due to a common, unobserved characteristic, the characteristic and its predicted impact on Georgetown Senators' voting should impact all Georgetown Senators in the same manner across votes (as it is, by definition, a common characteristic across the network). However, if our effects are driven by Senators using their alumni networks to curry votes to help pass a bill, we can identify the exact times, and the exact Senators, *within* a given network, that will be impacted differentially from all other network agents, in an ex-ante predictable way.

To identify "irrelevant" votes for a Senator, we first use the bill classification system explained in Section II to classify each bill as being related to certain industries, depending upon the text of the bill. For the given bill, we then check whether any of the industries the bill addresses have operations in each Senator's state.[16] Thus, for each bill and Senator, we classify whether the bill is relevant for the given Senator by whether it covers industries that have operations in the Senator's state. In other words, we expect those bills addressing matters of relevance to firms in the Senator's state to be the bills that the Senator will have a vested interest in voting either for or against. We then examine the *complement* of this set of bills for each Senator. The complement of this set should represent those bills that the Senator has less of an interest (on average) in voting in one direction or the other, since these bills are essentially unrelated to any industries represented in his or her home state. Thus, it should be exactly these "irrelevant," uninterested votes for the Senator on which her network should have the most persuasive ability (relative to those bills in which the Senator herself has a direct interest).

Similarly, for a second measure, we define all votes that are close to passing or failing. Here, we use all votes that are within a close distance of 60 yeas. The reason we use a window around 60 votes is that in modern-day Congress the practice of filibustering, or the credible threat of filibustering, is enough to defeat votes that cannot meet the 60-vote threshold needed to avoid a filibuster. We do not center our "close" measure around 50 votes, since votes with say 40 yea votes would not need any

[16] Here we identify operations as any public firms domiciled in the state.

filibustering, because the idea of a filibuster is to prevent a vote from coming to the floor (i.e., to block a vote that was likely to pass), and votes with this magnitude of support are almost never brought to the floor for a vote, given their unlikely chance of passage.

The idea behind exploring close votes is that these are the exact votes where the marginal value of a vote is especially high, so that Senators might be expected to utilize any mechanism of influence to secure these votes. Thus, this may be a time of especially high exerted influence through the network channel. However, and most importantly, for both the close and the irrelevant measures the underlying characteristics of the network remain constant, and thus a common unobservable characteristic explanation predicts no change in network impact across network agents.

Table IV presents the results of these tests. The dependent variable is again the vote of each Senator, *Yes*. The first variable of interest is *Close*, measured three distinct ways, as a categorical variable equal to 1 for those votes that are either (±3%), (±5%), or (±7%) from 60% yeas, and 0 otherwise. We then interact this variable with *School Connected Votes (SCV)*, measured as the percentage of the other Senators in the given Senator's alumni network voting yes for the given vote on the given bill. This interaction term measures the increased impact of networks on voting behavior for the *Close* votes. The next variable of interest is *Irrelevant To Me*, measured as a categorical variable equal to 1 if the given bill does not address any industries (and hence firms) domiciled in the Senator's state, and 0 otherwise. The same controls from Table III are included in every specification. Finally, because the *Close* measure is identified at the vote level, and identifies a subset of all votes, we cannot include Congress-session-vote fixed effects in these regressions (as the close variable would be a linear combination of a subset of these fixed effects). Therefore we instead include both Congress and Senator fixed effects in all regression specifications, and continue to adjust standard errors for clustering at the Senator level.

Columns 1-3 of Table IV show the differing impact of alumni networks for close vs. non-close votes. Columns 1 and 2 estimate separate regressions for each set of votes (close and non-close), while Column 3 estimates a single specification with the interaction term of *Close* and *School Connected Votes* (denoted *Close*SCV* in the table). All three give the same implication: alumni networks exert significantly more influence over voting behavior when they are expected to be more utilized, namely in close votes. From the interaction term in Column 3 (0.035 (t=3.28)), the effect of networks nearly doubles at times of close votes. Column 4 then confirms a similar result using a slightly more moderate measure of *Close* ((±5%) as opposed to (±3%)). Column 5 then does the same for the (±7%) range. The differential impact of networks is still significant for (±7%), but is monotonically decreasing in point estimate from (±3%) to (±7%), as we would predict given that these we are decreasing in the level of closeness of the overall vote, and thus the marginal value of a given vote.

Columns 6 and 7 examine the differing impact of networks on votes that are irrelevant vs. relevant to the Senator who is voting. These columns indicate that networks have significantly greater influence over voting behavior when the bills being voted on are not relevant to the given Senator (again where relevance is defined as pertinent to industries represented in one's home state). Comparing the coefficients on *School Connected Votes* in Columns 6 and 7, the impact of networks on voting behavior is almost twice as large when a vote is not relevant to the given Senator.[17]

Columns 8 of Table IV refine these tests even further in an attempt to isolate the specific times when network influence is strongest. For example, Column 8 combines these close and irrelevant measures to examine the effect of school networks at times when the vote is both a close vote *and* not pertinent to the Senator who is voting. The interaction term from Column 8 (0.060 (t=2.20)) implies that at these times, the network has an impact over 3 times larger than for all other votes.

V.A Controlling explicitly for heterogeneous impacts of a fixed characteristic

A remaining potential concern is that even though we show network impact is strongest precisely when there is: i.) the most demand to sway votes, and ii.) the most willing supply, there could still be a common characteristic that has varying impacts across votes. To be more specific, it is not implausible that there could be heterogeneous

[17] These regressions only include votes on bills for which we can ascertain that at least one industry is affected by the bill, and hence that the bill is relevant to at least one Senator. We have also run all of the tests in Columns 6-10 on all bills, where we designate bills that we cannot confidently assign to at least one industry as being "irrelevant" to all Senators, and the results are very similar to those presented here. We prefer the sample in which we can confidently assign all bills to sets of industries.

effects of the static network characteristic across votes.[18] Further, with respect to irrelevant votes, it may be exactly when a vote is otherwise irrelevant to a senator that you observe her relying more on intrinsic preferences, which could be correlated across the network, and thus the correlation with the mean network vote will be higher in these cases (giving the results in Columns 6-8 of Table IV).

In order to explicitly rule out the possibility of a varying impact of a fixed characteristic, we construct new measures in order to yield the sharpest estimate of the network impact on voting. Specifically, we create a new variable called *School Connected Votes Relevant (SCVR)*, which is the percentage of school friends for whom the bill is a "relevant" bill (i.e., who have a firm in that industry operating in their state) who vote yes on that bill. This variable is a subset of the *School Connected Votes* (defined as the percentage of *all* school friends who vote yes on the given bill), however a quite important one. The idea behind separating out these votes is that out of all the school friends voting on the bill, these are those that have an active *vested* interest in obtaining a certain outcome of the vote. For all other of the school friends, the vote is irrelevant, and thus they have no interest in swaying votes.

This is where the sharp contrast arises in predictions between the correlated characteristic (with heterogeneous impacts), and *direct* impact of influencing votes through the network. If it were simply an underlying, correlated network characteristic, this characteristic should be expressed *more* prevalently by the group of senators in the network for whom the given vote is irrelevant, as they have (on average) no other interests clouding their voting, and so their expressed vote is a better measure of the correlated network characteristic on the given vote. Thus, the vote of this group should be more correlated with the given senator's vote, while the corresponding vote of the SCVR (those school connected senators for whom the vote is relevant) should be less related. In contrast, if it is the direct influence channel driving these results, then the senator's vote should be more correlated with the SCVR, as these are precisely the senators that have an interest in currying votes in their favor. The senators with no vested interest in the bill, by contrast, will have no reason to exert influence on the

[18] For instance, Snyder and Groseclose (2000) show that the impact of party on voting behavior (a fixed characteristic, just as network is), varies over time and votes.

senator for the given bill.

We perform exactly this test between the two potential explanations in Columns 9-11 of Table IV. In Column 9, we find that all of the school effect is indeed driven by the SCVR, *School Connected Votes Relevant*. Including this measure in the regression, its coefficient is large and significant, while the coefficient on *School Connected Votes (SCV),* which now measures the impact of those school connected votes for whom the given bill is irrelevant, is small and insignificant.[19] This evidence is in line with the predictions of the mechanism of direct influence through the network, while it is the exact opposite of what is predicted by the mechanism of a heterogeneous impact of a common characteristic.

Columns 10 offers an even sharper test of the network influence channel. It replicates Column 9, but solely on the sample of votes that are irrelevant to the senator who is voting. The findings are similar to Column 9, with the point estimate on SCVR even slightly larger; again the votes of all senators in the network for whom the vote is irrelevant has no reliable impact on the given senator's voting behavior.

Column 11 then offers the sharpest test of the network influence channel by examining the effect of school ties (and specifically, the votes within one's network for whom the bill is relevant, i.e. *School Connected Votes Relevant (SCVR)*) at times when the vote is both a close vote *and* not pertinent to the Senator who is voting. These are times when demand to influence voting is high (since the vote is close), willingness to supply the vote is high (since the vote is irrelevant to the Senator who is voting), and where the school effect has been refined to capture solely the yes votes of the network members for whom the bill is relevant. Column 11 indicates that these are precisely the times when network influence is strongest: the interaction term in Column 11 (*Close & Irrelevant To Me * SCVR*) is large and significant (.097, t=2.47), and the magnitude of this coefficient implies that network effects at these times are over 6 times larger than for all other votes.

[19] For brevity of exposition, (since we already use SCV in all previous specifications) we report the coefficients for SCV and SCVR. We could have equivalently (containing the same information), explicitly split the network votes into SCVR, and SCVnotR (i.e., School Connected Votes Not-Relevant). This leads to identical conclusions. For instance, if we replicate Column 9 but explicitly splitting the network into the two components, the coefficient on SCVnotR is -.021 (t=-1.67), while that on SCVR is again large, positive, and significant, at .049 (t=2.16).

In fact, the estimate from Column 11 implies that controlling for the Senator's own tendency to approve legislation, the party's views on the given bill, and the state-implied importance level of the given bill, a one standard deviation increase in the percent of the Senator's network who have a vested interest in the bill and vote yes (SCVR) results in a roughly 5 percentage point increase in the Senator's likelihood to vote yes. To gain a better sense of what this magnitude means, consider it relative to the effect of state-level considerations. After the overall party agenda, this is arguably the largest determinant of what is expected to drive a Congressman's voting behavior. Comparing to a one standard deviation in state-level movement,[20] the alumni network effect is roughly 57% the size of the state effect.

In sum, these results on both close and irrelevant votes, as well as the impact of votes that are especially relevant to the members of one's network, strongly support school ties having an influence on a Senator's voting behavior though direct network effects. In contrast, these results are inconsistent with the alumni network results we find simply capturing some common characteristic. Even more strictly, the sharp tests of Columns 9-11 are inconsistent with heterogeneous impacts of a fixed characteristic driving our results, and provide the cleanest and strongest evidence of the network being used a direct channel of influence.

VI. Additional Controls, Interactions with School Ties, and Robustness

In Table V, we include a number of additional controls that have been shown to affect voting in the economics and political science literatures. The first additional control variable we include is how a given Senator votes with respect to other Senators that possess the same "ideology" as the Senator in question. We utilize a measure called DW-Nominate, which is a popular measure of each Congressman's ideology that is commonly used in the political science literature (see Poole and Rosenthal (1985), (1997), (2007)). All legislators are given a dynamic DW-Nominate score, which places them during each Congress into common space coordinates along two dimensions based on their historical voting record; for example, one dimension can be interpreted as

[20] While we realize that the state-level percentage measure for the Senate can only by 0 as 1, we still use the standard deviation of the measure here in order to get a measure that is standardized and comparable to that of the school network-level measure.

"liberal/conservative" in the modern era.[21] We take these two dimensions and split them according to their medians and thereby create four quadrants. We label Senators that lie in the same quadrant as having similar ideologies. We then use a variable that is equal to the percentage of these ideologically like-minded Senators that vote in favor of the given bill, which we label *Ideology Votes*.

We also include the voting of the Religious group to which the given Senator belongs. From Table II, there is large variation in religious affiliation, and the literature has shown some evidence of this affecting voting patterns (Hibbing and Marsh (1987)). Religious affiliation is also plausibly related to ideology, at least on certain issues. We create a measure called *Religious Votes*, which is the percentage of those Senators of the same religious group as the given Senator that vote in favor of the bill. Finally, we also explore the impact of votes by Senators who sit on the same Senate Committee as the Senator in question, and construct a measure analogous to those above called *Same Committee Votes*.

Table V presents the regressions results including these control variables. The specifications are identical to those in Table III, with the dependent variable being the voting of a given Senator on a given roll call vote (*Yes*), and controls included for *Party Votes* and *State Votes.* Table V shows that the *Ideology Votes* variable is strongly related to a Senator's voting patterns across all specifications. Including the ideology variable has a modest effect on the magnitude of the alumni network effect, but the network effect remains strong in significance and magnitude even in the presence of this variable. Also note that including the ideology variable in all the regressions in Table IV, where we explore the impact of networks around close and irrelevant votes, has no effect on these results. Meanwhile the *Religious Votes* variable is a positive but insignificant predictor of voting behavior. Finally, Columns 3 and 4 show that the yes votes of common committee members are negative predictors of yes votes, after controlling for school connected votes, party votes, and state votes. This is explained by the fact that we are controlling for party vote here already, and committees are typically organized with half the members in one party and half in the other. The committee variable is thus

[21] The other dimension, which is less empirically important over our sample period, can be interpreted as the Northern/Southern Democrat divide.

(after controlling for party vote) largely picking up the voting preferences of the opposing party, resulting in the negative sign. Importantly, none of these control variables explain the influence of the alumni networks on Senator voting behavior. We have also included additional controls for voting by groups of similar age, Congressional cohort, gender, ethnicity, and geographic region (as measured by Census region), and none of these additional control variables affect the results reported here.

Columns 7-9 of Table V explore interactions of the alumni effect with the control variables designed to capture the impact of party, state, and ideological influences on voting. Consistent with the finding in Mian et al (2009) that ideology helps to mitigate pressure from outside groups, we find a smaller impact of the alumni network on voting when the intrinsic interest in the vote is stronger. In fact, Columns 7-9 indicate that when an issue is important to one's party, one's state, or one's ideological peers, the school effect is significantly smaller (all three interaction terms are negative, and significant). These results lend additional support to our earlier findings that whenever a particular vote is inherently important to a Senator who is voting, the impact of outside influence mechanisms (including school ties) on their voting is weaker.

Next, in Table VI we explore a variety of different specifications designed as robustness checks for our main findings. In Columns 1 and 2 we run probit and logit regressions, respectively, that include the same explanatory variables as those in Table III. Specifically, Column 1 is run as a probit regression, with the coefficient estimate shown being the implied marginal effect of school ties on the probability of voting yes. Again we see that *School Connected Votes* is a strong predictor of voting behavior in the Senate. Column 2 is run as a logit regression, and once again we see a large and significant effect of alumni networks on voting. To give an idea of magnitudes, for the probit coefficient from Column 1 (0.095, t=3.65), a one standard deviation increase in the percent of the Senator's network voting for the bill implies a 3.71% increase in probability of voting yes for the given Senator (compared with a 2% estimated effect from the OLS estimates from Table III).

Next in Columns 3-5 we employ a Fama-MacBeth type framework, where the regression specifications (with controls and fixed effects) are run at the level of each group indicated separately. Then the coefficient estimates are averaged across the groups, with the standard errors calculated as the standard error of the group coefficients. For example, in Column 3 we run the regressions of the alumni network effect for each school separately; this approach effectively mitigates the impact of any single school that may be driving our results, as the reported coefficient is an equal-weighted average of the school effects across all schools in our sample. Columns 4 and 5 perform a similar procedure, running the regressions separately for every Senator and for every Congress-Session (i.e., year), respectively. The reported coefficients are then equal-weighted average across Senators (Column 4) and across years (Column 5). These regressions specifically rule out any particular (or a few) Senators or years from driving the results we find. Columns 3-5 all indicate that running the regressions by school, by Senator, or by Congress-Session has no effect on our main conclusions: the alumni network effect we document in this paper is not driven by a particular school, or a particular Senator, nor is it concentrated in a particular year.

Column 6 of Table VI performs an OLS panel regression similar to the specifications in Table III-IV, but checks to see if the effect of ideology is *also* concentrated around times of increased network impact (again defined as when a vote is both a close vote *and* not pertinent to the Senator who is voting). The concern is that the marginal probability of *any* relevant regressor may be bigger if the outcome of the dependent variable is uncertain; since close and irrelevant votes may be more uncertain, the use of a linear probability model may simply pick up the change in the marginal effect of the regressor. Although this concern is alleviated somewhat by the fact that our results show up in a logit and probit framework,[22] for completeness we also include in Column 6 the interaction of *Ideology Votes* and *Close & Irrelevant To Me*.

The idea behind using *Ideology Votes* is that the control variable *Ideology Votes* is designed to capture a shared common characteristic of particular Senators, and *not* a channel through which influence is directed; hence we would not expect the effect of ideology to be necessarily more pronounced around times when potential network use is thought to be greatest. Column 6 indicates that the interaction term is small and insignificant, while the interaction of *School Connected Votes* and *Close & Irrelevant to*

[22] We have specifically replicated Table IV using probit and logit specifications, and as above, the results are in fact slightly larger, and strongly significant. We choose the linear probability model so that we can control more finely for a number of fixed effects that can impact voting behavior.

Me remains large and significant (0.068, t=2.34).[23]

Lastly, we have also performed a variety of additional robustness checks that we do not report here in order to conserve space. For instance, using the full-specification of the last column of Table III (including Senator- and vote-level fixed effects), we also include school-level fixed effects to control for the propensity of a given school (or any common characteristic correlated with attendance at that school) to impact voting (on average) in a specific way. Including these school fixed effects has nearly no impact on our direct measure of the network's influence on a given Senator's voting for that *particular* bill. The coefficient on *School Connected Votes* on the given bill is 0.052 (t=3.31).[24]

Taken as a whole, our results demonstrate that the impact of alumni networks on Senate voting behavior: a) is robust to a variety of different specifications, b) is not driven by a particular school, Senator, or time period, and c) is not simply measuring some common characteristic, but rather reflects a channel of direct influence.

VII. Networks between Politicians and Firms

The paper thus far has focused on network connections between politicians, and how these network connections affect voting behavior. In this section, we extend this idea to also consider networks between Congressmen and firms in the constituencies these politicians represent. A nice aspect of this identification is that for the same Senator, and within the same state, we can exploit variation in the level of connectedness of the Senator to his various constituent industries.

We measure connections in this section using alumni network connections. To do so, we use the educational backgrounds of all of the senior officers (defined as CEO, CFO, and Chairman) of all publicly traded firms, and then create links between each politician and the senior management of each firm in his respective state. Then, we aggregate these links to the industry level to give measures of network connectedness of each Senator to

[23] We find similarly small and insignificant coefficients on the interaction terms of *Close & Irrelevant to Me* with other control variables, such as *Religious Votes*, *Party Votes*, and *State Votes*.

[24] In addition, we have run all regressions on the sample of only measures (the final versions of the bills voted on in the chamber), we have included total network size in all of these regressions, and we have included squared or cubed versions of the control variables *Party Votes, State Votes,* and *Ideology Votes* (in order to test if the alumni effect is simply capturing a non-linear effect of one of these control variables). In all cases, *School Connected Votes* remains large and significant.

each industry that operates in his state. Using these links, we are then able to measure how social network connectedness to a given industry affects the voting behavior of a Senator.

We examine these networks between politicians and firms in Table VII. The dependent variable is Senator voting on a given bill, *Yes*. For this analysis, we must not only classify bills into industries, but we also need a way to classify our bills into those that are positive or negative for the given industry. Our classification mechanism for positive and negative bills is described in detail in Section II. It basically relies on the voting behavior of Senators to whom the bill is particularly important, and the aggregation of their votes (either positive or negative). Specifically, we define positive and negative bills using the ratio difference ("R-R") measure described earlier; our results are not changed if we use the absolute ratio, the relative ratio, or all three of these measures defined at the within-party level, instead. Using this measure of the positive or negative nature of the bill for a given industry that is affected by the bill, we can then measure how the extent of network connectedness affects the Senator's voting for (against) a bill that is positive (negative) for the connected industry. We use a simple measure of network connectedness based on the number of firms that are connected to the given Senator. Specifically, we use the percentage of firms in a given industry that the given Senator is connected to as a percentage of the total firms that the Senator is connected to in his given state.[25] The intuition behind this measure is that it attempts to capture the percentage of total influence through network connections that the given industry has over the Senator. All of the control variables (including *School Connected Votes*) from Table III are included, as well as an additional control variable called *% Industry in State Total* (which is equal to the percentage of the total firms in the state that are from the given industry). *% Industry in State Total* controls for the importance of a given industry, as a whole, in the given Senator's state. Fixed effects for Congress-session-vote and for Senator are included in all regression specifications, and all standard errors are adjusted for clustering at the Senator level.

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[25] We have also constructed analogous connection measures using the total market capitalization of connected firms in a state *(% Industry ME School Connected)*, or the total sales of connected firms in a state *(% Industry Sales School Connected)*, rather than using the total number of connected firms, and find similar results to those reported here.

The independent variable of interest is *% Industry Firms School Connected*. The coefficient on *% Industry Firms School Connected* measures the influence of industry connectedness on Senator voting behavior. Columns 1-3 (4-6) of Table VII show that Senators are significantly more likely to vote in favor of (against) a bill that is positive (negative) for an industry to which the Senator has alumni network connections. This network effect increases in magnitude, as one would predict, for bills that are especially positive or especially negative for a given industry, as defined by the top 25% (or top 10%) most positive or bottom 25% (or bottom 10%) most negative. To get an idea of the magnitude, the Column 3 coefficient of 0.171 (t=3.25) implies that a one-standard deviation increase in the percentage of connectedness of an industry equates to a roughly 1.5% increase in the likelihood of the Senator voting in favor of the positive industry bill. Similarly, the Column 6 coefficient of -0.139 (t=2.73) implies that a one-standard deviation increase in the percentage of connectedness of an industry equates to a nearly 2% increase in the likelihood of the Senator voting against a bill that is negative for the connected industry. These results provide additional, and independent, evidence of social networks having an impact on political voting behavior, through a very different channel, namely network connections with firms.

VIII. Seat-Based Social Networks

In this section we explore an additional type of social network that might plausibly affect Congressional voting in the same manner as the school tie effects we document above. The alternate measure we use is based on the idea that *where* a Senator sits in the Senate Chamber may affect which particular Senators he comes in contact with on a daily basis. Hence, his location on the Senate Chamber floor may help shape his social network, and thus the opinions of those Senators seated close to him may influence his views on particular issues.

Importantly, assignment to seats in the Senate Chamber is based almost exclusively on seniority, whereby senior Senators are given the first opportunity to select their desk. Senators are encouraged to choose seats close to the front as possible, and we have verified that distance from the podium is in fact correlated highly with seniority.[26]

[26] There are a few exceptions to the general pattern of seniority-based seating. For example, the "Candy

The practical impact of this seating rule is that Senators of a similar cohort (based on when they were first elected to the Senate) end up sitting close to each other. Thus the seating arrangements in the Senate help to reinforce the relationships that Senators may already form among those other Senators who start their careers at roughly the same times.[27]

The Senate chamber is typically divided in half, with Republicans on the right-hand side, and Democrats on the left-hand side (see Figure 3 for an example of what the Senate Chamber map looked like in the 110th Congress, as well as a depiction of how we compute our distance measures for one particular Senator). We compute distances between Senators based on the simple idea that each Senator lies at the geographic epicenter of his own social circle. For example, for a given Senator, those Senators directly next to him are assigned distances of 1, while those immediately in front or in back of a Senator are given distances of 2 (note that the Senate chamber slopes down, so there is a height distance between rows), as are Senators in the same row but not immediately next to the Senator in question. From there, we simply count the number of people one has to go through to get to the next person, and assign numbers that increase accordingly; also, the distance between two people across a given aisle is considered to be an increase of 4 in terms of distance. Figure 3 displays our generated seat distances from a particular Senator, in this case the Senator seated in Seat #46. We construct similar seat distances for every Senator in the chamber, for the each of the 101st-110th Congresses (Senators are re-seated each Congress). This is made more difficult by the fact that for older Congresses (from the 106th Congress back), the Chamber seating map is contained in scanned pdf documents that are not easily machine readable. We thus use an additional OCR (Optical Character Recognition) program on these documents, and then hand-check its results, to extract the Chamber seating for these earlier Congressional sessions.

Similar to our tests in Section II, which exploit school-based connections between

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Seat" in the back is a highly sought-after Senate desk, even despite its location near the back edge of the Republican seating area, because it has historically been the job of the Senator who sits at this desk to stock it with candy; hence, the seat has become a desirable seat for senior Senators over the years despite its distant location.

[27] Note that we have also constructed measures of cohort voting (both by age and by start-year in Congress), and the close-seat variable we construct here subsumes the pure effect of cohort voting, suggested that seating arrangements impact voting above and beyond any long-standing cohort effects.

Senators, here we use the seat distances to define the social networks of each Senator. We compute three measures of "closeness": for each Senator, *CloseSeat4 Votes* is a dummy variable equal to 1 for all Senators with a distance of 4 or less according to our seat distance mapping methodology who vote yes on the given bill; *CloseSeat8 Votes* is a similar variable equal to 1 for all Senators with a distance of 8 or less; and *CloseSeat16 Votes* is a similar variable equal to 1 for all Senators with a distance of 16 or less. To the extent that we find any impact of seat distance, our prediction is that the voting behavior of those in the closer circle (*CloseSeat4 Votes*) should have a larger impact on a Senator's voting than the voting behavior of those in the wider circles (*CloseSeat8 and CloseSeat16 Votes)*.

Panel A of Table VIII presents the results of regressions of individual Senate votes on the votes of those Senators seated nearby. In all of these tests we control for the effect of school ties documented in Sections IV-VI, as well as the effects of party votes and state votes (as in Table III). Our main variable of interest is *CloseSeat4 Votes*, the percentage of Senators within 4 seats of the Senator in question who voted yes on the given bill. Column 1 indicates that this measure strongly predicts the yes votes of individual Senators (=0.135, *t*=4.35). Further, the economic magnitude of this effect is large: a one-standard deviation move in the *CloseSeat4 Votes* measure increases the likelihood of voting yes by over 5 percentage points.

Of course since Senators are allowed to choose their seats according to seniority, they may simply choose to sit next to Senators with similar political views. In Column 2 we test the importance of this endogenous seat choice explanation by replicating our results on a subset of newly-elected Senators for whom seating choice is plausibly exogenous; since Freshman Senators can only choose among the last few remaining seats, their seats as essentially randomly assigned. Column 2 indicates that the effect of seating proximity on voting is large and significant for Freshman Senators (coefficient on *CloseSeat4 Votes*=0.164, *t*=2.45), demonstrating that even for those Senators who have little choice where to sit, the impact of Senators seated nearby on voting behavior is still pronounced.

Interestingly, and consistent with the hypothesis that seating proximity impacts voting behavior, this effect is weaker as we widen our definition of closeness. For example, the magnitude of the coefficient on *CloseSeat8 Votes* is smaller than the coefficient on *CloseSeat4 Votes*, and the magnitude of the coefficient on *CloseSeat16 Votes* is even smaller (and insignificant). When we include all three measures in a multiple regression, only *CloseSeat4 Votes* remains significant. Taken together, these results suggest that proximity to others, initiated through rule-based seating assignments, can help to foster and strengthen the social ties between Senators, and that these ties ultimately influence voting behavior.

Finally in Panel B of Table VIII we perform a verification test of Freshman Senators not having a choice of seating in the Chamber Floor; this is thus a test of the exogeneity of their seating assignments. To do this we run a seating choice model for all Senators, and then again for only Freshman Senators. The dependent variable in these tests is the distance (*Distance*) between each Senator and every other Senator (excluding himself), where distance is measured in number of seats as described above for our tests in Panel A. Larger values of the dependent variable therefore mean that the Senators are seated further away from each other. The explanatory variables we employ are *Abs. Diff. in Seniority* (equal to the absolute difference in years of seniority between the two Senators), *Same Party* (equal to 1 if the two Senators are in the same party, and 0 otherwise), *Same State* (equal to 1 if the two Senators hail from the same state, and 0 otherwise), and *Same School* (equal to 1 if the two Senators went to the same school, and 0 otherwise).

Not surprisingly, given the layout of the Chamber and the seniority seating rules described above, Column 1 of Panel B shows that Senators choose to sit closer to members whose seniority is closer to their own (the coefficient on *Abs. Diff. in Seniority* is positive and significant). Additionally, Senators choose to sit closer to members of the same party (the coefficient on *Same Party* is negative and significant), which is again not surprising given the layout of the Senate Chamber. Interestingly, there is no evidence that Senators choose to sit closer to the other Senator from their home state, but we do find some evidence that Senators choose to sit closer to other Senators within their alumni network (*Same School* is a significant negative predictor of seat distance between any two Senators).

We see a very different picture when we examine only the seating assignments of

Freshman Senators in Column 2 of Panel B. Consistent with these Freshman Senators having little discretion over their seating locations, we find that the only predictor of seating distance for these Senators is *Same Party*, which is hard-wired by the fact that Senators must sit on their party's side of the Chamber Floor. *Same School* and *Abs. Diff. in Seniority* are no longer significant predictors of seat distance; the magnitude drops by 80% for *Same School,* and the sign even flips for *Abs. Diff. in Seniority*. These results provide strong corroborating evidence that the seating assignments of Freshman Senators are determined quite differently than those of all other Senators, and are plausibly exogenous. This finding implies that the impact of seat distance on voting for Freshman Senators that we document in Panel A should be interpreted as a direct, causal effect of seat-based networks affecting voting.

In summary, our results in this section demonstrate that the impact of social networks on Congressional voting is not confined to one particular definition of social networks based on direct school connections, but rather extends to an alternate measure based on common seating locations in the Senate.

IX. Conclusion

In this paper we examine the impact of personal connections on the voting behavior of U.S. politicians. Using a new, hand-collected database that links politicians to other politicians, and links politicians to firms, we demonstrate that both network channels influence Congressional voting behavior.

The primary network measure we use is based on the alumni networks of Congressmen. An advantage of these education-based networks is that they are formed decades before the voting behavior we attempt to explain. We show that controlling for the general voting on the given bill, the Senator's own tendency to approve legislation, the party's views on the given bill, and the state-implied importance of the given bill, a senator's network can have a large and significant impact on their voting behavior. Using our sharpest measure of direct influence, a one-standard deviation increase in the percentage of a Senator's interested alumni network voting in favor of a bill implies a roughly 5 percentage point increase in the Senator's own likelihood of voting in favor of a bill. Further, the impact of school ties on voting is monotonically increasing with the strength of network, is found in the House as well as the Senate, and is robust to a variety of different specifications and controls.

A key aspect of our empirical strategy is that we can identify a *causal* link between network influence and voting behavior by exploiting situations where the network mechanisms are likely to be more utilized, while the characteristics of the network itself remain constant. We demonstrate that the alumni network effect increases significantly at times when the network is plausibly the most important, such as for close votes, for votes that are less important to the Senator who is voting, and particularly for votes that are both close *and* irrelevant to the Senator who is voting. We also decompose each Senator's network into those who have a vested interest in the bill, and those for whom it is irrelevant, and find that the entire school network effect is driven by the influence of the interested network Senators. These tests help rule out the possibility of heterogeneous effects of a static network characteristic driving our results. Taken together, our analysis provides strong evidence in support of the alumni network being used as a direct channel of influence. Additionally, we demonstrate that our results are not confined to this particular network definition based on school connections, but also extend to a measure based on seat locations in the Senate Chamber, where we have a plausibly exogenous network measure based on Freshman Senator seat assignments.

We complement this within-Congress evidence by showing that networks between politicians and firms are also informative for Congressional voting behavior. An advantage of this politician-to-firm identification strategy is that for the same Senator, and within the same state, we can exploit variation in the level of connectedness of the Senator to his various constituent industries. We measure connections between politicians and firms using alumni network connections, and show that the extent of network connectedness predicts the Senator's voting for (against) a bill that is positive (negative) for the connected industry.

Collectively our findings illustrate the power that informal social networks can have on the behavior of lawmakers, highlight a subtle channel through which firms can influence government policy, and underscore the need for a deeper understanding of the network forces that shape individual behavior more generally.

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Table I: Summary Statistics

This table reports summary statistics for the sample. Yes is a dummy variable equal to 1 if the Senator or Representative voted "Yes" or "Yea" on a given vote. SumSameSchool is equal to the number of Senators (repreSenatives) who attended the same university as the Senator (repreSenative) in question, SumYesSameSchool is equal to the number of Senators (Representatives) who attended the same school as the Senator in question (Representative), and PctSumYesSameSchool is equal to (SumYesSameSchool/SumSameSchool). Analogous variables are computed for SameSchoolDegree (which requires common attendance at the same university and for the same degree), as well as similar variables for Party, State, Religion, Census Region, and Ideology (based on the DW-Nominate coordinates). CloseSeat4 is a measure of Senate Chamber Seat Distance from one Senator to another (see Table VII). Top 40 is a dummy variable equal to 1 if the Senator went to a Top 40 university as ranked by the U.S. News and World Report, and Important Vote is equal to 1 if the given vote is important to that Senator (see Table VI).

Panel A: Vote-Level Variables (Senate)	101st-110th Congresses (1989-2008), Senators = 209			
	Mean	Median	Standard Deviation	Nonmissing Observations
Yes	0.653	1.00	0.476	651,705
SumSameSchool	3.952	1.00	5.937	671,520
SumYesSameSchool	2.528	1.00	4.258	671,520
PctSumYesSameSchool	0.638	0.75	0.389	441,746
SumSameSchoolDegree	2.074	1.00	3.275	671,520
SumYesSameSchoolDegree	1.327	0.00	2.354	671,520
PctSumYesSameSchoolDegree	0.639	0.75	0.393	353,063
SumYesSameParty	31.139	39.00	18.668	671,520
PctSumYesSameParty	0.633	0.82	0.369	668,438
SumYesSameState	0.633	1.00	0.481	671,520
PctSumYesSameState	0.634	1.00	0.482	671,240
SumYesSameIdeology	16.365	17.00	10.675	671,520
PctSumYesSameIdeology	0.633	0.81	0.370	670,839
SumCloseSeat4	10.616	11.00	2.850	668,534
SumYesCloseSeat4	6.745	7.00	4.546	668,534
PctSumYesCloseSeat4	0.633	0.80	0.376	668,534
SumYesCloseSeat8	15.782	17.00	9.404	668,534
PctSumYesCloseSeat8	0.633	0.78	0.353	668,534
SumYesCloseSeat16	33.482	36.00	17.533	668,534
PctSumYesCloseSeat16	0.634	0.72	0.318	668,534
SumYesSameCensusRegion	6.743	6.00	3.955	671,520
PctSumYesSameCensusRegion	0.634	0.67	0.289	671,520
SumYesSameReligion	5.954	5.00	5.721	671,520
PctSumYesSameReligion	0.634	0.67	0.302	573,853
Measure	0.256	0.00	0.437	671,520
Top 40 School	0.423	0.00	0.494	671,520
Important Vote	0.080	0.00	0.271	671,520

Panel B: Vote-Level Variables (House)	101st-110th Congresses (1989-2008), Representatives = 816			
	Mean	Median	Standard Deviation	Nonmissing Observations
Yes	0.646	1.00	0.478	4,644,392
SumSameSchool	5.429	3.00	7.110	4,935,687
SumYesSameSchool	3.364	1.00	5.070	4,863,268
PctSumYesSameSchool	0.618	0.67	0.352	3,652,054

Table II: Academic Institutions and Religions Represented in the U.S. Senate (101st-110th Congresses)

This table shows summary statistics of the academic institutions and religions that are most represented in the 101st-110th Congresses of the Senate. Each of the 209 Senators that served in the Senate over this period is included once in these tabulations, but Senators often have degrees from more than one academic institution, hence the total number of degrees exceeds the total number of Senators. Religion information is unavailable for 42 of the 209 Senators.

Panel A: Schools Represented in the Senate				Panel B: Religions Represented in the Senate			
Rank	Academic institution	# of degrees	% of total	Rank	Religion	# of Senators	% of total
1	Harvard University	35	9.33	1	Roman Catholic	38	22.75
2	Yale University	23	6.13	2	Methodist	25	14.97
3	University of Virginia	10	2.67	3	Presbyterian	22	13.17
4T	Stanford University	8	2.13	4	Episcopalian	17	10.18
4T	Georgetown University	8	2.13	5T	Jewish	16	9.58
6T	Oxford University	7	1.87	5T	Baptist	16	9.58
6T	Vanderbilt University	7	1.87	7	Lutheran	7	4.19
6T	University of Chicago	7	1.87	8	Congregationalist	6	3.59
9T	Princeton University	6	1.60	9	Mormon	5	2.99
9T	University of Georgia	6	1.60	10	United Church of Christ	4	2.40
9T	University of Alabama	6	1.60				
9T	University of Mississippi	6	1.60				
9T	University of Minnesota	6	1.60				
All Degrees		375	100	All		167	100

Table III: The Impact of School Ties on U.S. Congressional Voting Behavior

This table reports panel regressions of individual votes on the voting behavior of different Senate and House groupings. The dependent variable is equal to 1 if the Senator or Representative voted "Yea," and zero otherwise. In Columns 1-2, School Connected Votes is the percentage of Senators from the same school as the Senator in question who voted yes on the given bill. In Column 3, School Connected Votes is the percentage of Representatives from the same school as the Representative in question who voted yes on the given bill; in Column 4, School Connected Votes is the sum of Representatives from the same school as the Representative in question who voted yes on the given bill; In Columns 5-7, School Connected Votes is the sum of Senators from the same school as the Senator in question who voted yes on the given bill; School Connected Votes (School and Degree) is the sum of Senators from the same school (and who received the same degree) as the Senator in question who voted yes on the given bill; and School Connected Votes (School, Degree, and Year) is the sum of Senators from the same school (and who received the same degree and who were born within 3 years of each other) as the Senator in question who voted yes on the given bill. Stete Votes is the percentage (in Columns 1-3), or sum (in Columns 4-7), of Senators (Representatives) from the same state as the Senator (Representative) in question who voted yes on the given bill. Party Votes is the percentage (in Columns 1-3), or sum (in Columns 4-7), of Senators (Representatives) from the same party as the Senator (Representative) in question who voted yes on the given bill. Congress fixed effects, Congress-Session-Vote (C-S-Vote) fixed effects, and Representative (or Senator)-fixed effects are included where indicated. All standard errors are adjusted for clustering at the Senator (Representative) level, and t-stats using these clustered standard errors are included in parentheses below the coefficient estimates. ***Significant at 1%; **significant at 5%; *significant at 10%.

	Dependent Variable: Vote(Yes/No)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Votes Sample	Senate	Senate	House	House	Senate	Senate	Senate
Measure of Connections	%	%	%	Sum	Sum	Sum	Sum
School Connected Votes	0.045*** [0.016]	0.052*** [0.016]	0.019*** [0.004]	0.004*** [0.001]	0.008*** [0.002]		
School Connected Votes (School and Degree)						0.010*** [0.004]	
School Connected Votes (School, Degree, and Year)							0.020** [0.008]
State Votes	0.119*** [0.013]	0.122*** [0.012]	0.160*** [0.012]	0.004*** [0.000]	0.144*** [0.012]	0.144*** [0.012]	0.144*** [0.012]
Party Votes	0.926*** [0.022]	0.945*** [0.024]	0.995*** [0.001]	0.005*** [0.000]	0.018*** [0.000]	0.018*** [0.000]	0.018*** [0.000]
Fixed Effects	Congress	C-S-Vote	C-S-Vote	C-S-Vote	C-S-Vote	C-S-Vote	C-S-Vote
Fixed Effects	Senator	Senator	Rep	Rep	Senator	Senator	Senator
Adjusted R^2	0.64	0.64	0.57	0.54	0.62	0.62	0.62
No. of Obs.	425653	425653	3444036	3444036	651705	651705	651705

Table IV: The Impact of School Ties on Senate Voting Behavior: Close and Irrelevant Votes

This table reports panel regressions of individual U.S. Senator votes on the voting behavior of other Senators. The dependent variable is equal to 1 if the Senator voted "Yea," and zero otherwise. The sample of votes examined is indicated in each column: i.) *Close Votes* are all votes that are functionally won or lost by (±3) or (±5) or (±7) votes as indicated (described in Section V), ii.) *Non-Close Votes* are the complements to these votes, iii.) *Relevant To Me* are those votes where the given bill addresses an industry that has public firms operating in the voting Senator's home state, iv.) *Irrelevant To Me* are those votes that don't address any public firms operating in the given voting Senator's home state, and v.) *All* include all votes in the sample. The independent variables of *Close Votes*, *Irrelevant Votes*, and *Close & Irrelevant To Me*, are defined as categorical variables equal to 1 if the given vote being considered corresponds to the respective classification (as described above in i-iv), and is equal to 0 for all other votes. Interaction terms are then constructed between these three categorical variables and *School Connected Votes (SCV)*, which is the percentage of Senators from the same school as the Senator in question who voted yes on the given bill. *School Connected Votes Relevant (SCVR)* equals the percentage of Senators from the same school as the Senator in question *and* who find the bill in question to be *Relevant* to them, who voted yes on the given bill. The controls of *Party Votes* and *State Votes* are included in all regressions (as indicated) and are described in Table III. Both Senator fixed effects and Congress-Session (Cong-Sess) fixed effects are included where indicated. All standard errors are adjusted for clustering at the Senator level, and t-stats using these clustered standard errors are included in parentheses below the coefficient estimates. Significance levels are denoted by: *** for the 1%; ** for the 5%; and * for the 10% level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Votes Sample:	Non-Close	Close	All	All	All	Relevant To Me	Irrelevant To Me	All	All	Irrelevant To Me	All
Measure:	(±3)	(±3)	(±3)	(±5)	(±7)			(±5)			(±5)
School Connected Votes (SCV)	0.043***	0.068***	0.041**	0.040**	0.039**	0.029**	0.052**	0.026*	-0.014	-0.022	0.011
	[0.016]	[0.021]	[0.016]	[0.016]	[0.016]	[0.015]	[0.026]	[0.014]	[0.024]	[0.046]	[0.032]
Close * SCV			0.035***	0.027***	0.021**						
			[0.011]	[0.010]	[0.010]						
Close & IrrelevantToMe * SCV								0.060**			
								[0.027]			
School Connected Votes Relevant (SCVR)									0.044**	0.056**	0.016
									[0.021]	[0.025]	[0.032]
Close & IrrelevantToMe * SCVR											0.097***
											[0.039]
Close Votes			-0.019*	-0.013	-0.008						
			[0.011]	[0.010]	[0.010]						
Close & IrrelevantToMe								-0.028			-0.033
								[0.021]			[0.025]
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects	Cong-Sess	Cong-Sess	Cong-Sess	Cong-Sess	Cong-Sess	Cong-Sess	Cong-Sess	Cong-Sess	Cong-Sess	Cong-Sess	Cong-Sess
Fixed Effects	Senator	Senator	Senator	Senator	Senator	Senator	Senator	Senator	Senator	Senator	Senator
Adjusted R^2	0.66	0.54	0.64	0.64	0.64	0.59	0.60	0.59	0.59	0.56	0.59
No. of Obs.	382894	42759	425653	425653	425653	54075	15559	49551	60557	8538	46823

Table V: Additional Controls, and Interactions With School Ties

This table reports panel regressions of individual Senate votes on the voting behavior of different Senate groupings. The dependent variable is equal to 1 if the Senator voted "Yea," and zero otherwise. School Connected Votes (SCV) is the percentage of Senators from the same school as the Senator in question who voted yes on the given bill. Religious Votes is the percentage of Senators of the same religious affiliation as the Senator in question who voted yes on the given bill. Ideology Votes (DW-Nominate) is the percentage of Senators in the same DW-Nominate Ideology quadrant as the Senator in question who voted yes on the given bill. Same Committee Votes is the percentage of Senators on the same committee as the Senator in question who voted yes on the given bill. The controls of *Party Votes* and *State Votes* are included in all regressions (as indicated) and are described in Table III. We also include interactions of School Connected Votes (SCV) and the control variables Party Votes, State Votes, and Ideology Votes where indicated. Congress-Session-Vote (C-S-Vote) fixed effects and Senator-fixed effects are included where indicated. All standard errors are adjusted for clustering at the Senator level, and t-stats using these clustered standard errors are included in parentheses below the coefficient estimates. ***Significant at 1%; **significant at 5%; *significant at 10%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
School Connected Votes (SCV)	0.051***	0.040***	0.053***	0.050***	0.038***	0.037***	0.074***	0.051***	0.074***
	[0.017]	[0.013]	[0.017]	[0.018]	[0.013]	[0.014]	[0.016]	[0.014]	[0.015]
Religious Votes	0.041			0.035	0.022	0.013			
	[0.031]			[0.035]	[0.022]	[0.024]			
Ideology Votes (DW-Nominate)		0.409***			0.397***	0.398***	0.407***	0.408***	0.441***
		[0.035]			[0.039]	[0.039]	[0.035]	[0.035]	[0.035]
Same Committee Votes			-0.337***	-0.341**		-0.347***			
			[0.070]	[0.080]		[0.075]			
SCV * Party Votes							-0.064***		
							[0.013]		
SCV * State Votes								-0.023***	
								[0.007]	
SCV * Ideology Votes									-0.063***
									[0.012]
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects	C-S-Vote	C-S-Vote	C-S-Vote	C-S-Vote	C-S-Vote	C-S-Vote	C-S-Vote	C-S-Vote	C-S-Vote
Fixed Effects	Senator	Senator	Senator	Senator	Senator	Senator	Senator	Senator	Senator
Adjusted R^2	0.64	0.65	0.63	0.64	0.65	0.66	0.65	0.65	0.65
No. of Obs.	351202	424991	384143	318745	350540	318314	424991	424991	424991

Table VI: Alternate School Ties Specifications

This table reports regressions of individual votes on the voting behavior of different Senate groupings. The dependent variable in all regressions is equal to 1 if the Senator voted "Yea," and zero otherwise. Column 1 is run as a Probit regression, with the coefficient estimate shown being the implied marginal effect on the probability of voting yes. Column 2 is run as a Logit regression. Columns 3-5, are run in a Fama-MacBeth type framework, where the regression specifications (with controls and fixed effects) are run at the level of each group indicated separately. Then the coefficient estimates are averaged across the groups, with the standard errors calculated as standard error of the group coefficients. Column 6 is an OLS Panel regression similar to the specifications in Table III-V. School Connected Votes is the percentage of Senators from the same school as the Senator in question who voted yes on the given bill. Votes that are *Close & Irrelevant to Me* are defined as those votes that are functionally won or lost by (±5) votes, and that do not address any public firms operating in the given voting Senator's home state. Controls for Party Votes and State Votes are included in all regressions, and are described in Table III. Ideology Votes (DW-Nominate) is the percentage of Senators in the same DW-Nominate Ideology quadrant as the Senator in question who voted yes on the given bill. Interactions between *Close & Irrelevant to Me* and *School Connected Votes* and *Ideology Votes* are included in Column 6. Congress, Senator, and Congress-Session (Cong-Sess) fixed effects are included where indicated. All standard errors are adjusted for clustering at the Senator level, and t-stats using these clustered standard errors are included in parentheses below the coefficient estimates. ***Significant at 1%; **significant at 5%; *significant at 10%.

Dependent Variable: Vote(Yes/No)						
	(1)	(2)	(3)	(4)	(5)	(6)
Regression Specification	Probit	Logit	OLS by: School	OLS by: Senator	OLS by: Congress-Session	OLS
School Connected Votes (SCV)	0.095***	0.544***	0.052***	0.073***	0.047***	0.015
	[0.026]	[0.149]	[0.016]	[0.023]	[0.004]	[0.012]
Close & IrrelevantToMe * SCV						0.068**
						[0.029]
Close & IrrelevantToMe * Ideology						0.006
						[0.034]
Ideology Votes						0.350***
						[0.034]
Close & IrrelevantToMe						-0.037
						[-0.029]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects			Congress	Congress	Senator	Cong-Sess
Fixed Effects			Senator			Senator
Adjusted R^2	0.59	0.58				0.60
No. of Obs.	425653	425653	106	156	20	49480

Table VII: The Impact of School Ties on Senate Voting Behavior: School Ties with Firms

This table reports panel regressions of individual Senate votes on school ties with firms. School Connected Votes is the percentage of Senators from the same school as the Senator in question who voted yes on the given bill. As described in Section II, we assign each bill to the industries that are mentioned prominently in the bill, and we then construct measures of how positive and negative each bill is for a particular assigned industry based on the votes of those Senators who have that industry as one of the important industries in their state. Important industries for each Senator are defined as the top three industries in terms of annual sales that are headquartered in the home state of the Senator. % Industry Firms School Connected is the percentage of firms in the assigned industries that are connected to their home Senator in the following way: either their CEO, CFO, or Chairman of the Board must have attended the same school as the Senator in question. % Industry Sales School Connected and % Industry in State Total is the percentage of the total firms in the state that are from the given industry. The dependent variable is equal to 1 if the Senator voted "Yea," and zero otherwise. The controls of Party Votes and State Votes are included in all regressions (as indicated) and are described in Table III. Congress-Session-Vote (C-S-Vote) fixed effects, and Senator-fixed effects are included where indicated. All standard errors are adjusted for clustering at the Congress level, and t-stats using these clustered standard errors are included in parentheses below the coefficient estimates. ***Significant at 1%; **significant at 5%; *significant at 10%.

Dependent Variable: Vote(Yes/No)						
	(1)	(2)	(3)	(4)	(5)	(6)
Votes Sample	Positive >Median	VeryPositive >75%	ExtremePositive >90%	Negative <Median	VeryNegative <25%	ExtremeNegative <10%
School Connected Votes	0.054***	0.059***	0.066***	0.044***	0.049***	0.059***
	[0.019]	[0.020]	[0.019]	[0.015]	[0.017]	[0.017]
% Industry Firms School Connected	0.029*	0.094***	0.171***	-0.027**	-0.070***	-0.139***
	[0.016]	[0.026]	[0.053]	[0.011]	[0.024]	[0.051]
% Industry in State Total	0.035	-0.125**	-0.133	-0.101***	-0.142***	-0.247***
	[0.028]	[0.051]	[0.131]	[0.026]	[0.049]	[0.100]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects	C-S-Vote	C-S-Vote	C-S-Vote	C-S-Vote	C-S-Vote	C-S-Vote
Fixed Effects	Senator	Senator	Senator	Senator	Senator	Senator
Adjusted R^2	0.61	0.64	0.70	0.70	0.69	0.65
No. of Obs.	118307	122085	23362	23331	23507	22648

Table VIII: Seat-Based Social Networks

Panel A reports panel regressions of individual Senate votes on the voting behavior of different Senate groupings based on seat location on the Senate Chamber floor. The dependent variable is equal to 1 if the Senator voted "Yea," and zero otherwise. School Connected Votes is the percentage of Senators from the same school as the Senator in question who voted yes on the given bill. As described in Section VII, CloseSeat4 Votes is the percentage of Senators who sit within 4 seats of the Senator in question who voted yes on the given bill, CloseSeat8 Votes is the percentage of Senators who sit within 8 seats of the Senator in question who voted yes on the given bill; and CloseSeat16 Votes is the percentage of Senators who sit within 16 seats of the Senator in question who voted yes on the given bill. The controls of Party Votes and State Votes are included in all regressions (as indicated) and are described in Table III. Panel B reports panel regression of the seat distance (*Distance*) in number of seats between any two senators' seats on the Chamber floor and a host of explanatory variables. Distance is defined in Section VII and depicted in Figure 3. Abs. Diff. in Seniority is the absolute difference in years of seniority between the senator-pair in question. SameSchool is a dummy equal to one if the senator-pair in question went to the same school, and zero otherwise. SameParty and SameState are defined analogously, but for party and state, respectively. Congress fixed effects, Congress-Session (Cong-Sess) fixed effects, Congress-Session-Vote (C-S-Vote) fixed effects, and Senator-fixed effects are included where indicated. All standard errors are adjusted for clustering at the Senator level, and t-stats using these clustered standard errors are included in parentheses below the coefficient estimates. ***Significant at 1%; **significant at 5%; *significant at 10%.

Panel A: The Impact of Seating Proximity on Voting

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable:	Yes	Yes	Yes	Yes	Yes	Yes
Sample:	(All Votes)	(Freshman Votes Only)	(All Votes)	(All Votes)	(All Votes)	(All Votes)
School Connected Votes	0.044***	0.029	0.051***	0.052***	0.052***	0.052***
	[0.016]	[0.021]	[0.008]	[0.008]	[0.008]	[0.015]
CloseSeat4 Votes	0.135***	0.164***	0.137***			0.107***
	[0.031]	[0.068]	[0.015]			[0.030]
CloseSeat8 Votes				0.117***		0.073
				[0.023]		[0.066]
CloseSeat16 Votes					0.061	-0.018
					[0.055]	[-0.072]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects	Cong-Sess	Cong-Sess	C-S-Vote	C-S-Vote	C-S-Vote	C-S-Vote
Fixed Effects	Senator	Senator	Senator	Senator	Senator	Senator
Adjusted R^2	0.64	0.69	0.64	0.64	0.64	0.64
No. of Obs.	424041	43323	424041	424041	424041	424041

Panel B: Determinants of Seat Distance Between Any Two Senators on Chamber Floor		
	(1)	(2)
Dependent Variable:	Distance	Distance
Sample:	(All Senators)	(Freshman Senators Only)
Same School	-1.090***	-0.194
	[0.398]	[0.581]
Abs. Diff in Seniority	0.039***	-0.008
	[0.014]	[0.007]
Same Party	-14.830***	-21.389***
	[0.408]	[0.416]
Same State	0.090	0.348
	[0.368]	[0.659]
Adjusted R^2	0.51	0.72
No. of Obs.	128106	12744

Figure 1. Congressional Bill Industry Assignment Example

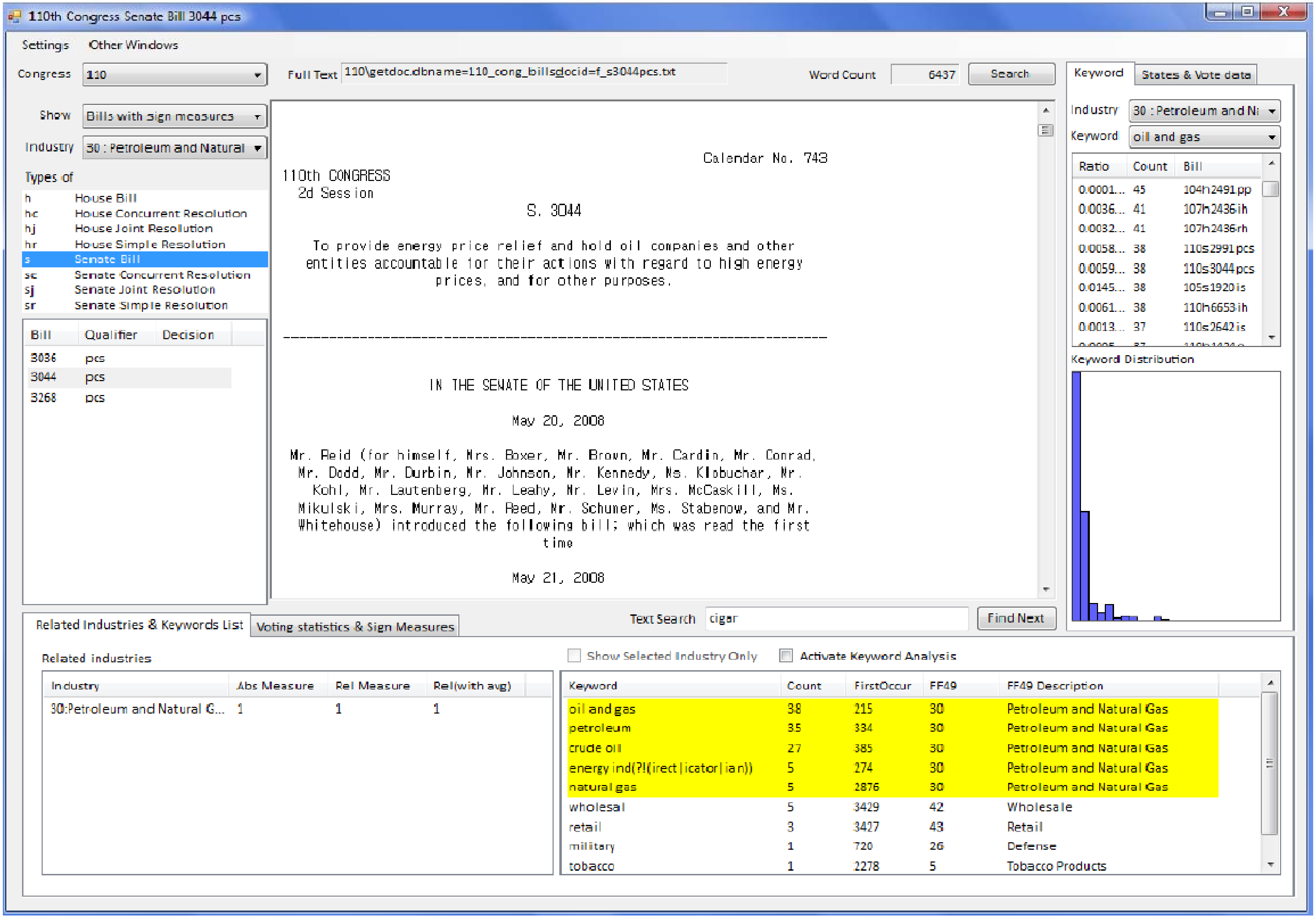

Figure 2. Congressional Bill Positive/Negative Signing Example

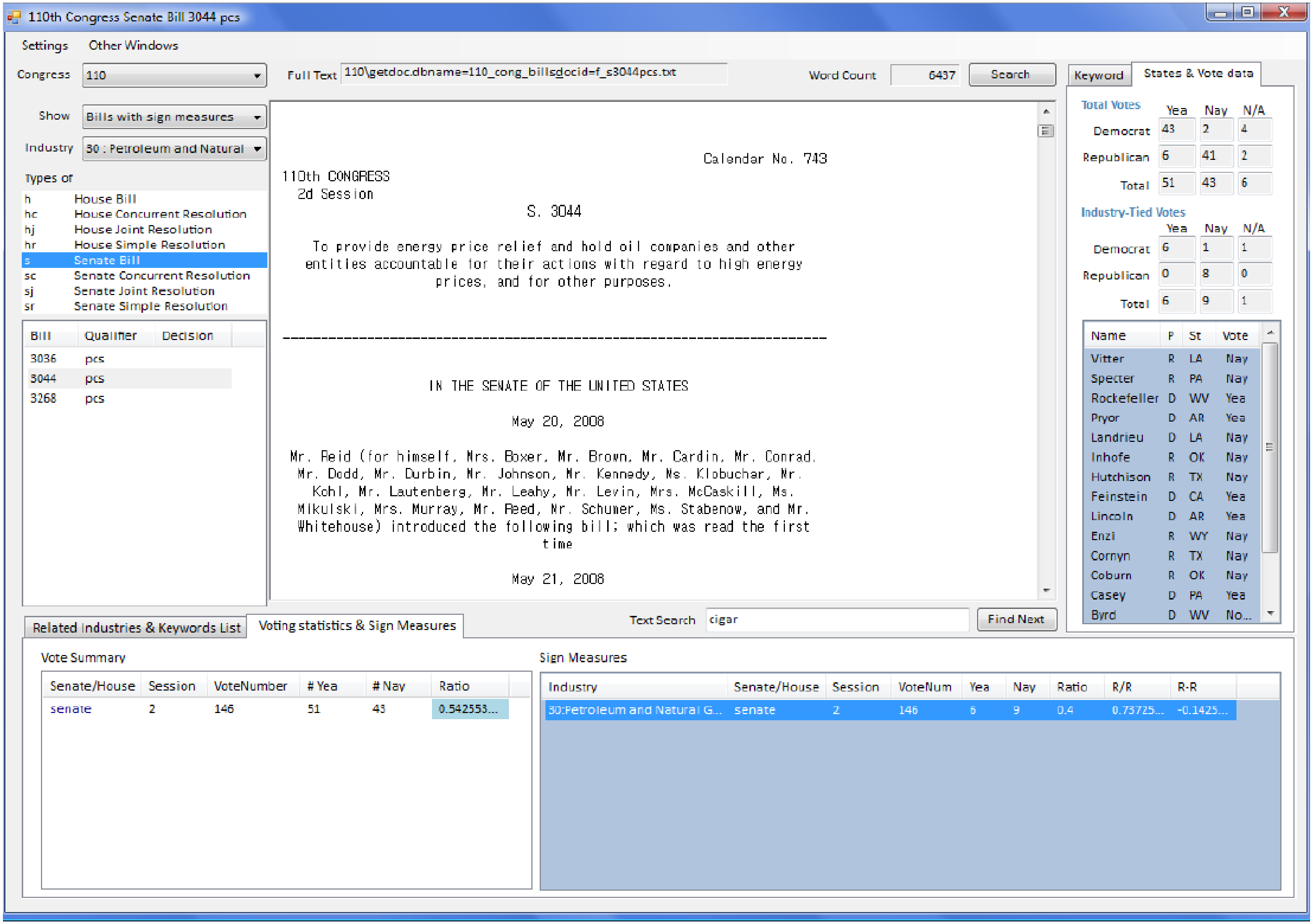

Figure 3. Generated Distances from Seat 46