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ABSTRACT

We demonstrate that personal connections amongst politicians have a significant impact on the voting behavior of U.S. politicians. 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 (Freshman Senators), and find a strong impact of seat location networks on voting. We find that the effect of alumni networks is close to 60% of the size of the effect of state-level considerations. The network effects we identify are stronger for more tightly linked networks, and at times when votes are most valuable.

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The passage or failure of any piece of legislation in the U.S. Congress depends ultimately on the individual votes of the legislators. While many influences determine whether a legislator votes in favor, or in opposition, of a bill, subtle influences can in some instances be quite powerful determinants of voting behavior, and thus final vote outcomes. In this paper, we explore one particular channel of influence, that of personal social networks. We add two insights into the rich literature on legislator behavior. First, we show that our identified social networks can have quite large real impacts on voting behavior, beyond those currently explored by the literature. Second, our empirical strategy to isolate the impact of social networks exploits rich data comprising firms (and employment) in a Congressmen's home constituency, which allows us to incorporate market information into measures of a bill's importance. Specifically, important bills are defined at the Senator-bill level, which offers a new way to classify the *same* bill as important or unimportant for different sets of Senators. Ultimately, we believe both of these contributions lead to a richer understanding of the drivers of legislator behavior.

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. 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,[1] 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 different specifications and controls. Importantly, we also demonstrate that this alumni network effect is not driven by a particular school, Senator, ideology, or time period.

[1] 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.

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 to the given senator *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 important; 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 effects, 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, indicating that network effects are significant in magnitude.

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.[2] 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 may help

[2] 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.

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.

Our paper adds to a large literature that studies the factors that influence the behavior of elected officials. In addition to political party and constituent interests (see, for example, Stigler (1971), Peltzman (1985)), we demonstrate that personal connections are an important determinant of politicians' voting behavior.[3] Importantly, we demonstrate that even after controlling for the impact of political ideology (see Clinton, Jackman, and Rivers (2004), Kau and Rubin (1979, 1993), Lee, Moretti, and Butler (2004), McCarty, Poole and Rosenthal (1997), McCarty, Poole and Rosenthal (2006), and Poole and Rosenthal (1985), (1997), (2007)), network ties influence legislator behavior.[4]

Our focus on alumni networks also adds to a growing body of work in the political science literature that explores the impact of different types of social networks in Congress (see, for example, Bogue and Marlaire (1975), Burkett and Skvoretz (2006), Caldeira and Patterson (1987), Fowler (2006a, 2006b), Patterson (1959), Porter et. al (2005, 2006), Routt (1938), Young (1966), and Williams (2009)). An advantage of our approach relative to many of 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.

Collectively, our findings provide evidence that a new form of personal connections, namely those based on past educational links, have a significant impact on the voting behavior of U.S. politicians. Further, the magnitude of this effect is economically significant. We believe our

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[3] 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.

[4] See also 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.

results imply important considerations for constituents regarding their legislators; specifically, the size and scope of the networks to which legislators have access in order to curry favor for votes, may prove quite important to their constituents (both individuals and firms).

The remainder of the paper is organized as follows. Section I describes the data. Section II presents the impact of alumni networks on Congressional voting behavior. Section III examines times of increased network impact. Section IV provides a series of robustness checks. Section V examines an alternative network in the U.S. political system. Section VI discusses the implications of our results, and Section VII concludes.

I. 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.[5] 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 Malloy (2008, 2010) for details on the construction of this firm-level biographical data).

Another key source of data that we collect is the complete legislative 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 collect 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 Congressman voting on the bill (or abstaining). We chose to start with the raw bill data, rather than use alternate, publicly available versions of the Congressional roll call data (see, for example, the Voteview website, as well as McCarty, Poole and Rosenthal (1997), McCarty, Poole and Rosenthal (2006), Poole and

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

Rosenthal (1985), (1997), (2007), among many others), or the Political Institutions and Public Choice (PIPC) House Roll Call Database (Aldrich, Brady, de Marchi, McDonald, Nyhan, Rohde, and Tofias (2008)), because we specifically wanted to exploit the text of each piece of legislation as described below.

Specifically, in a number of our tests, we utilize the content of the bills being voted on. To do so, we 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 49 industry classifications used in Fama and French (1997).[6] To do this we first construct a set of keywords for each industry. We then create an executable (shown in the Appendix Figure A1), in which we input all bills and their corresponding full-text and assign 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.[7] 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 A1 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 A1 displays the summary text at the top of the bill, which indicates that the bill clearly pertains to the oil and gas industry. The data Appendix provides more details on our bill assignment procedure. We have compared our bill categorizations to those used in other work (see, for example, Aldrich, Brady, de Marchi, McDonald, Nyhan, Rohde, and Tofias (2008), among others), but prefer our approach because it achieves our explicit goal of assigning each bill to the specific *firms* that are potentially affected, rather than to the specific policy issues under

[6] The "Fama-French 49" industry definitions map specific 4-digit SIC (standard industry classification) codes to 49 different industry categories, and are publicly available online from: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/.

[7] We have experimented with various thresholds, and our results are not sensitive to the particular threshold we employ. Please see the Appendix for more details on our bill classification procedure.

consideration.

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 V.

Our final 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. For the Senate, our data consist of roughly 650,000 vote-level observations made by 209 Senators over this twenty year period. Of the votes cast, over 65% are "yes" votes. Table A1 in the Appendix presents additional summary statistics for our sample: Panel A presents these statistics for the Senate, while Panel B (for brevity) shows only the main summary statistics for the House of Representatives. For example, 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).

Note that we have run all the tests in this paper using samples that consist only of final passage votes (i.e., the final votes on each of the bills in our sample), 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.[8]

In the Appendix Table A2 we tabulate two specific characteristics, namely educational

[8] Note that this separation into final votes is very similar to Theriault (2006), which separates procedural and non-procedural votes. Our final votes category matches closely to his "Substantive Votes" category. Please see the data Appendix for more details on the subsamples we have analyzed.

background and religious affiliation, for the Senators in our sample. Panel A of Table A2 indicates that the 209 Senators in our sample earned 375 academic degrees that we could match back to colleges and universities (Senators often have degrees from more than one academic institution). The most connected university to the U.S. Senate is Harvard University, followed by Yale, Virginia, Stanford, and Georgetown.[9] 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 of Table A2 presents the religious affiliations of the U.S. Senate. 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.

II. 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 V. 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.

II.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

[9] We demonstrate later in the paper (in Table IV) that our results are not driven by Harvard or any other single school.

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 primary 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. And finally, when constructing these measures for a particular Congressman-vote observation we always remove the impact of each individual Congressman's *own* votes, such that these measures reflect only the behavior of *other* Congressmen who are from the same school network, same party, or same state, as the Congressman in question.

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 I, 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 I 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 occasionally a few Senator who miss 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. In this table we run regressions is a linear probability model; however in Table IV 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.[10] In columns 1-3 of Table I 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

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[10] See Greene et al. (2002) for a discussion of the statistical problems associated with the use of fixed effects in non-linear regression frameworks.

(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 III, 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.

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

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 I, but now using the voting behavior of Representatives rather than Senators. In line with the Senate results, Column 3 of Table I 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 I 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 I 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).[11] 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).[12]

III. 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 Section III.A) a very strict test controlling for the possibility of heterogenous effects across votes of the fixed characteristic of network.

Our 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

[11] The percentage of regression observations (out of 671,520 total Senators' votes from Table A1) 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.
[12] We find similar results when varying the strength of school ties in the House as well.

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, 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 I 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.[13] 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

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

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 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 II 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 I 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 II 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.[14]

Columns 8 of Table II 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.

III.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 effects of the static network characteristic

[14] 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.

across votes.[15] 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 II).

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 senator for the given bill.

We perform exactly this test between the two potential explanations in Columns 9-11 of Table II. 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

[15] 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.

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.[16] 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.

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

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[16] 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 -0.021 (*t*=-1.67), while that on SCVR is again large, positive, and significant, at .049 (*t*=2.16).

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,[17] 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.

IV. Controlling for Ideology, Interactions with School Ties, and Robustness

In Table III, 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 political ideology as the Senator in question. We utilize the DW-Nominate measure of ideology, which is widely used in studies of Congressional roll-call voting (see Clinton, Jackman, and Rivers (2004), McCarty, Poole and Rosenthal (1997), McCarty, Poole and Rosenthal (2006), 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 "liberal/conservative" in the modern era.[18] 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*.[19]

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[17] 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.

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

[19] We have experimented with a variety of other specifications for ideology, for example forming quintile (or decile) groups based solely on the first DW-Nominate dimension, and our results are unchanged across these different

We also include the voting of the Religious group to which the given Senator belongs. From Table A2, 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 III presents the regressions results including these control variables. The specifications are identical to those in Table I, 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 III 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 II, 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 (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 III explore interactions of the alumni effect with the control

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specifications.

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 IV 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 I. 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. 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 I). Column 2 is run as a logit regression, and once again we see a large and significant effect of alumni networks on voting.

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 IV performs an OLS panel regression similar to the specifications in Table I-II, 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,[20] 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 Me* remains large and significant (0.068, t=2.34).[21]

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 I (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

[20] We have specifically replicated Table II 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.

[21] 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*.

given bill is 0.052 (t=3.31).[22]

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.

V. 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.[23] 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.[24]

The Senate chamber is typically divided in half, with Republicans on the right-hand side, and Democrats on the left-hand side (see Figure 1 for an example of what the Senate Chamber

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[22] 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.

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

[24] 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.

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 1 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 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 V 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 II-IV, as well as the effects of party votes and state votes (as in Table I). 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 V 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.[25] 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.

VI. Discussion

Given the results in the paper, it merits stepping back to ask the larger question of what

[25] These results are unaffected by adding a series of additional control variables such as *SameIdeology*, *SameReligion*, *SameAge*, *SameEthinicity*, and *SameCensusRegion*.

implications these patterns have for legislators, constituents (both firms and individuals), and perhaps even some broader measures of welfare. First, in terms of legislators, we believe the surprising, and important, aspect of these results is exactly how large of a factor networks are in impacting legislator behavior. What amplifies this importance is that the networks appear particularly useful in currying votes on *precisely* those pieces of legislation that are most important to the legislator. As mentioned earlier in the paper, the magnitudes of these network effects are roughly 60% that of the state-level considerations, which outside of party and ideology are perhaps the most important considerations of legislators. We believe the magnitude of these network effects have not been fully appreciated in the literature, nor by legislators' constituents, as they simply have not been quantified in as systematic a fashion across the legislative process over many decades.

Second, in terms of constituents, first considering individuals, we believe voters would be quite surprised to find exactly how large an effect these networks have on their elected officials' voting behavior. Perhaps more importantly, they would likely be interested to know exactly how helpful these networks can be in terms of currying the specific votes on which they (and thus their legislator) have a large vested interest. The implication would then be that thinking about the networks to which your elected official has access should potentially be a non-trivial aspect of any voter's decision, especially as these networks appear most useful precisely when the issue is most welfare-increasing to you as a constituent.

For firms, we provide strong, quantified evidence in Table A5 of the Appendix that legislation (perhaps not surprisingly) has a large effect on firm fundamental values. Of course, the evidence we provide is even an extreme lower bound, as we are simply measuring the aspects of the legislation that the market is not correctly taking into account at the time of its passing; the full impact, including anticipation, and announcement effects, are surely much larger. Still, the conclusion from this evidence is that anything that affects a piece of legislation's probability of passing (or being voted down) will be of large interest to firms, as their fundamental values are very sensitive to a piece of legislation's ultimate fate.

Lastly, we can also consider the implications of our results for broader measures of welfare. However, this issue is not straightforward. While it is certainly true that state level constituents would benefit from their congressmen currying votes from their networks at times that are most crucial, we need to also consider the impact on other states. Now, we provide evidence that the members within the network that supply their votes are those who have the least interest in the outcome of the votes. While this net transfer would seem positive within the network, the net effects outside the network are harder to quantify. In other words, say that Congress is voting on legislation to build plants in Massachusetts instead of in the neighboring states New Hampshire or Rhode Island. The Massachusetts congressmen can use their networks, say in California to vote in favor of the bill, and potentially pass it. While this is positive for Massachusetts, and has nearly no impact on California, it obviously has a negative impact for the constituents of New Hampshire and Rhode Island. We would need to add up all of these spillovers, some of which are quite subtle and difficult to quantify, in order to get a measure of the total social welfare implications, and thus the net effects of these networks are unclear. On the other hand, it appears that the networks provide one way for votes to have some notion of a "market price," (even if that is a constrained market to within-network), as votes are traded based on private valuations within the network. If legislators are acting in constituents best interests, we may want them to sell a vote on an issue that we do not care about for reciprocal votes on issues that have large welfare implications for us. If the networks allow for these market trades to take place is a less costly way, it may be a better state of the world than if no market at all (or a more costly market) existed for these votes.

VII. 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 constructs linkages between members of the U.S. Congress, we demonstrate that social networks 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, the state-implied importance of the given bill, and the Senator's own ideological views, a Senator's school network has 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. The magnitude of this effect is close to 60% of the effect of state-level considerations. 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, is not driven by a particular school, Congressman, or time period, 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.

Collectively our findings illustrate the power that informal social networks can have on the behavior of lawmakers, and underscore the need for a deeper understanding of the network forces that shape individual behavior more generally. As legislators, individuals, and firms all have large interests in the outcomes of the legislative process, our evidence provides important insights on the ways agents can better utilize these documented network mechanisms.

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Table I: 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. State 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***	0.052***	0.019***	0.004***	0.008***		
	[0.016]	[0.016]	[0.004]	[0.001]	[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***	0.122***	0.160***	0.004***	0.144***	0.144***	0.144***
	[0.013]	[0.012]	[0.012]	[0.000]	[0.012]	[0.012]	[0.012]
Party Votes	0.926***	0.945***	0.995***	0.005***	0.018***	0.018***	0.018***
	[0.022]	[0.024]	[0.001]	[0.000]	[0.000]	[0.000]	[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 II: 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 III), 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 I. 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 III: Controlling for the Impact of Ideology, plus 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 I. 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		0.409***			0.397***	0.398***	0.407***	0.408***	0.441***
(DW-Nominate)		[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 IV: 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 I-II. 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 I. 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 V: 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 V, 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 I. 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 V and depicted in Figure 1. 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.

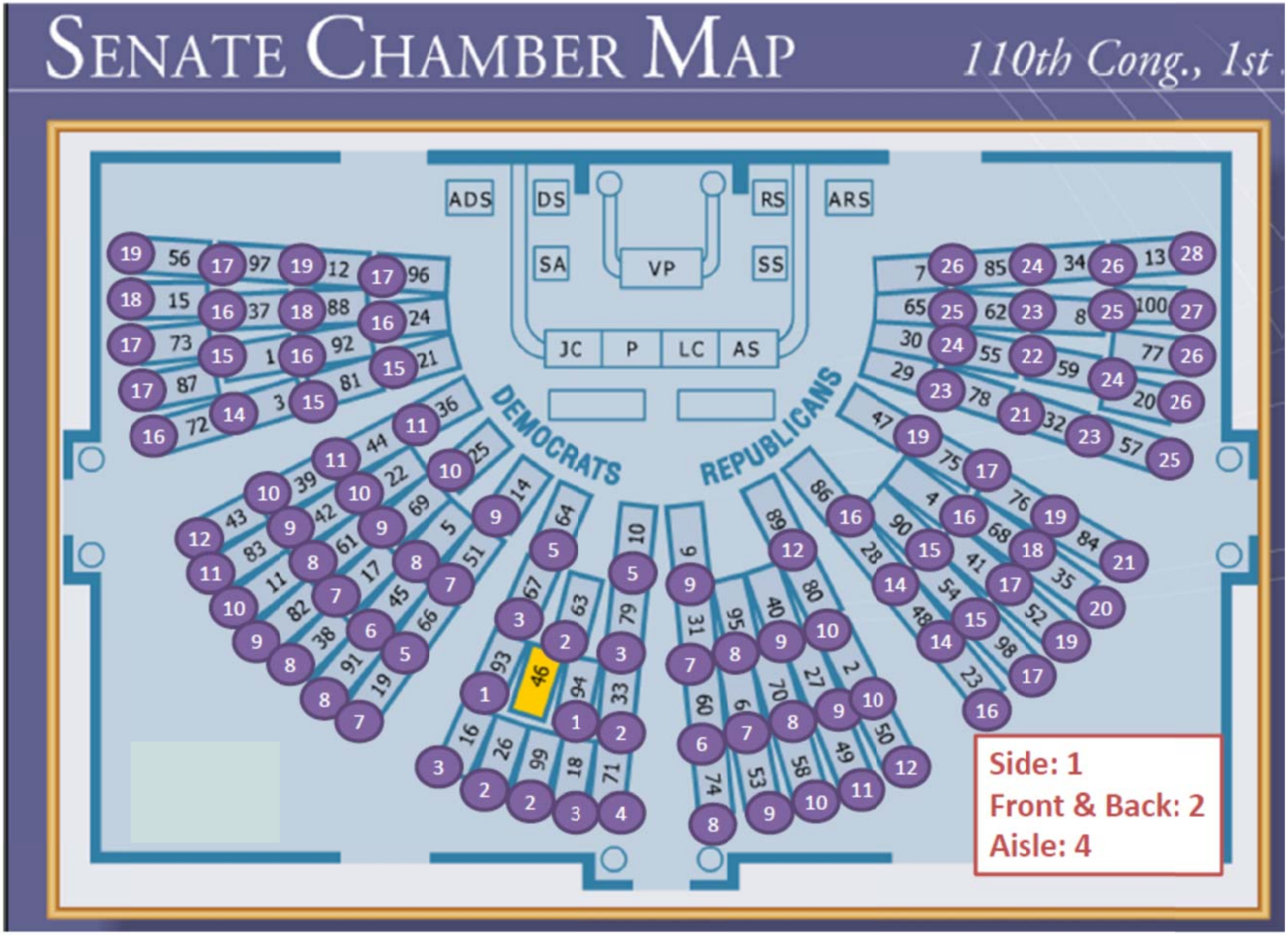
Panel A: The Impact of Seating Proximity on Voting

	(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

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. Generated Distances from Seat 46



Friends in High Places: Supporting Information

In this Appendix we describe in more detail the sample we use in the paper, as well as the method and data cut-offs we use to: i.) classify bills into industries and ii.) assign bills as positive or negative for the given industries to which it relates. We then provide evidence of independent verification for these measures. We also describe additional variations in vote samples that we have explored. Lastly, we provide some supplementary analysis on the impact of social connections between politicians and the senior management of firms located in a Senator's home state, as opposed to the *within*-Congress networks that we focus on in the paper.

A.1 Summary Statistics of Main Sample

Table A1 presents summary statistics for the main sample we use in the paper. The unit of observation in our analysis is the Congressman-vote level. 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 A1, we have roughly 650,000 vote-level observations for the Senate made by 209 Senators over this twenty year period. 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.

Table A2 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.

A.2 Industry Classification, Keywords, and Cut-offs

As described in the data section, we first download the full text of all bills jointly from the Government Printing Office (GPO) and Congress's Thomas database. We then parse each bill's entire text, and use a list of matching words to classify each bill into the industries to which it applies. Table A3 displays the words we use to classify into the Fama-French 49 industries, for three sample industries. We are happy to provide the entire list upon request, for all 49 industries, but including them in the appendix table yielded a 13 page table. Again, the Fama-French 49 industries are somewhat analogous to the SIC 2 digit industry classification, with some improvements and aggregations of similar SIC 2 sub-industry components. As Table A3 shows, we obviously attempt to use a number of keywords to capture the bills relevance to a given industry. However, we balance this by not choosing too many keywords to induce false positives. In the table, we include when a given industry (or keyword) was removed, because it was capturing too many false positives in the industry assignment process.

To give a few examples, we remove the word "soda" from the "Candy and Soda" industry, as it kept matching with "soda ash" and "soda mountain" from a number of bills, both having nothing to do with the desired industry. As another example, for the "Personal Services Industry," we initially included the keyword "beauty shop." Unfortunately, nearly all of the instances of this keyword in bills refer to the "House Beauty Shop," referencing a (debate about) and the eventual closing of this service in one of the House of Representative buildings, and so we remove this keyword as well.

Another important aspect of this table is that after deciding upon keyword roots, we then go through each extension and conjugation that we see in the bills in order to determine which extensions and conjugations reasonably refer to the given industry. So, for instance, for the "Utilities" industry, we use the keyword root "utilit-." While this matches correctly "utility" and "utilities," it incorrectly picks up "utilize" and "utilitarian," which also appear in bills. We thus remove all of the final two matches from the bill matched sample to Utilities through "utilit-." We do this for every keyword root in every industry to ensure that the given keyword root matches to the intended industry.

The last element of the process is then choosing threshold frequencies for each keyword appearing in a given bill relative to that keyword's use across all bills, in order to classify a given bill as referring to that keyword's industry. We use two potential methods for this, the first is the absolute count of the keyword, and the second is the ratio of that word to the entire number of words in the bill. For instance, the word "electricity" has a frequency cut-off of 11 times, representing the 95th percentile of that keyword's distribution amongst bills. We have used cut-offs for both measures ranging from the 75th-95th percentile, and the results in the paper are unaffected. All results reported in the paper are for the middle of this range, 85th percentile, using the absolute number of keyword appearances.

The outcome of this process is a match of relevant industries to each bill considered in congress. We believe we have a quite conservative match process, but match fairly definitively 20% of all bills to a relevant industry (or industries).

A.3 Bill Signing Procedure

Although the tests in the main paper do not require us "sign" each bill as either positive or negative for the assigned industry, some of the supplementary tests described below do require us to sign each bill. To do this, we examine the voting record of the Senators who have an interest in each of our assigned industries.[26] We establish this by summing up the constituent firms located in each Senator's state (we have used market equity, sales, and number of firms, and they are highly correlated and yield nearly identical results in terms of magnitude and significance). Then, for each state, we rank all industries that reside in that state and define "important" industries for that state as those that rank in the top 3 for that year. We assign these for each state in each congress, so again displaying the entire table would be quite large. However, in Table A4 we include a subset of state-industry and congress classifications (again, we are happy to provide the entire table upon request, but including them all made this table over 17 pages). To give an example from the Table A4, in the state of New York during the 110th Congress (2007-2008), the most important industries in the state were Banks, Insurance, and Sales & Trading.

Once the important industries for each state are established, we then map these to the voting

[26] An alternate approach to sign each bill for each industry would be to employ lobbying data, but we unfortunately were not able to find *bill-level* lobbying data for each bill and lobbying organization over the past 20 years.

records of the Senators in each state. We then classify each bill that mentions the given industry as positive or negative for the mentioned industry using the interested Senators' votes. For instance, consider bill S.3044 form the 110th Congress shown in the Appendix Figures A1 and A2. Figure A1 indicates that this 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 A1 displays the summary text at the top of the bill, which indicates that the bill clearly pertains to the oil and gas industry. Figure A2 then displays the executable program we created to implement our signing procedure for the same bill depicted in Figure A1. The summary text indicates that the goal of this bill was "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 was likely to be perceived as negative for the oil and gas industry. The Petroleum and Natural Gas Industry qualified as an important industry in 8 states (including TX and LA), so the total number of "interested" votes in the bill was 16. 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 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).

Using this procedure, we experiment with a number of different signing measures. For instance, one measure we use is called the absolute ratio ("Ratio" in Figure A2, i.e., the percentage of industry-tied Senators who vote for the bill). We also use the relative ratio ("R/R" in Figure A2, 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 A2, 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. We have also explored *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. One last important note about the "sign" measure is that in our tests below, 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.

A.3 External Validity of Industry Classification Strategy and Signing Measures

We also obtain strong independent verification for our industry assignment and signing procedures. The most compelling evidence supporting both is in Table A5 below. Here, we form long-short calendar-time portfolios of all stocks that are in an industry that appeared in a bill that was passed in the prior month, and that was signed as either positive or negative for that industry. To be more specific, we long the stocks that are in an industry voted on in a signed positive bill for that industry, and short those stocks that are in an industry voted on in a signed negative bill. The monthly returns in Table A5 then represent the subsequent returns to those positive and negatively coded firms using our industry assignment and signing procedures. The large and significant abnormal returns of the long-short portfolio range from 69 to 84 basis points per month, or 8.3% to 10.1 percent annualized (t=2.34 to t=2.92), depending on the risk-adjustment method used. This result suggests two important things: First, that the market is somewhat slow to recognize the impact of legislation on firms (likely because deciphering which firms will be affected, and how they will be affected, is difficult), but ultimately does so in the expected direction. As mentioned in the text, we have examined announcement returns as well, but we find that much of the return response occurs gradually over the two to three months following the passage of a bill.[27] Second, and more importantly, the result gives strong evidence that bills have an economically important impact on firms, and that our procedures for both i.) assigning bills to industries and, ii.) signing these bills, appear to capture those firms that are impacted by the given bill, and the correct *direction* in which the firms are impacted. In other words, the firms that we would expect to be affected by a given bill are in fact affected, and they are affected in the precise direction we would expect (as evidenced by the strong return relation in Table A5).

A.4 Vote Subsamples

All results that we report in the paper's tables include all votes. However, it is important to note that we have looked at a number of other subsets of votes as well, and that the results are robust across all of these subsamples. First, looking only at final votes on bills that eventually are passed into

[27] We have additionally run this basic test using a variety of different specifications, e.g., over-weighting firms/industries that are mentioned more often in a given bill, looking at longer "more important" bills, extending forward (and backward) the horizon over which we measure returns, etc., and this result is robust to a variety of permutations.

law gives roughly identical results in terms of magnitude and significance.[28] The reason we report results for all votes in the paper is that we believe vote-trading within the social network may be going on across many types of votes.

Second, in Table IV in the paper we show a number of vote subsamples according to important economic sub-classifications within our sample, and show that no single subsample drives our our results. Specifically, we split our sample out separately for every school, every Senator, and every Congress-Session. We then run our tests separately for every sub-set (for instance, in the school case, we run our tests separately for every school that appears in our sample), and report average coefficients across the subsets (along with the cross-sectional t-stat across all school estimates). Using this method drastically reduces power, but *equally weights* across each subsample we consider (in the case of Congress-Session, for example, we only have 20 estimates (20 years) enter into the average coefficient estimate, and 20 observations entering into the standard error measurement). Thus if our results were driven by a certain subsample, or a small set of subsamples, the equally-weighted average of the coefficients across subsamples would look much different in magnitude than the pooled regressions (and likely significance, given the then implied differences in estimates across subsamples), and so these tests would yield different implications. From Table IV, we see that our school network effects are remarkably consistent across all subsamples, using school, Senator, or Congress-Session. Again, we are happy to provide the sub-sample estimates for every Senator, every school, and every Congress-Session.

Lastly, we have used variation in "important" bills to each Senator. We considered using measures of important votes identified by Mayhew (1991) and updated on his website,[29] and also Edwards et al. (1997, 2000). These are certainly valid measures of important bills at the bill level. However, we instead opt to use a measure of "important" bills defined at the Senator-bill level. In other words, we allow the *same* bill to be important or unimportant for *different* sets of Senators. We define "importance" quite flexibly throughout the paper, using important to the given Senator's party, state (through industries domiciled there), and ideology. We then interact these measures of important bills for the given Senator (or use varying subsamples),[30] and show how our estimated impacts vary.

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[28] Note that this separation into measures is very similar to Theriault (2006), which separates procedural and non-procedural votes. Our measures category matches closely to his "Substantive Votes" category.

[29] http://pantheon.yale.edu/~dmayhew/data3.html

[30] These two methods are obviously nearly equivalent, except that the subsample method allows all regression coefficients to vary (be freely estimated) across subsamples, whereas the interaction method (including main effects) only allows the

Throughout the paper, we show that school networks do have quite a different impact across important and unimportant votes to the given Senator (and also important and unimportant votes to other Senators in the given Senator's school network). We think these are important and strong validating pieces of evidence. In sum, the subsample analyses we have done help to pin down and strengthen the mechanism of school network influence.

A.4 Networks Between Politicians and Firms

The main paper focuses exclusively on network connections between politicians, and how these network connections affect voting behavior. In this supplementary analysis section, we extend this idea and 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 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 A6. 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 above, and 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

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intercept and interacted coefficient to vary. In Table II where we use both, you can see that the two methods (not surprisingly) yield nearly identical results in our sample.

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.[31] 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 I 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.

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 A6 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.

[31] 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.

Table A1: Summary Statistics of Main Sample

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 V), and Important Vote is equal to 1 if the given vote is important to that Senator (see Table II).

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
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 A2: 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 A3: Industry Assignment Keywords and Cut-offs

This table shows the keywords used in assigning the full text of each bill in our sample to the resultant industries covered by the bill, along with the cut-offs for the percentile in the distribution of that keyword for the entire sample. We assign the given industry to a bill if any one of its keywords is above the 85th percentile cut-off given in the table. We choose a subset of the 49 industries (Fama-French Industry Classification) that we use, as the table would otherwise be prohibitively long. We are happy to provide the entire table of keywords and cut-offs upon request.

Fama-French Industry # / Industry Name	Keyword	Count Greater Than / Equal To	Count Percentile
	agricultur-	12	85
	animal feed	7	85
	corn	4	85
1 – Agriculture	crop(s)	14	85
	farm(s)(land)	11	85
	fishing	8	85
	livestock	7	85
	wheat	8	85
	air force	31	85
	Ammunition	15	85
	armed force(s)	10	85
	army	13	85
	gun(s)(runners)(powder)	8	85
26 – Defense	marine corps	30	85
	military	11	85
	missile(s)	23	85
	national guard	30	85
	navy	19	85
	ordnance	7	85
	space vehicle(s)	3	85
	tanks	9	85
	weapon(s)	15	85
	broker dealer(s)	3	85
	closed end	2	85
	commodity broker(s)	14	85
	financial services firm(s)	2	85
	investment bank(s)	8	85
	investment firm(s)	2	85
48 – Trading	investment management	6	85
	investment trust(s)	12	85
	mutual fund(s)	3	85
	reit(s)	44	85
	broker-dealer(s)	No Keyword Count Information Available	
	closed-end	No Keyword Count Information Available	
	security broker(s)	Keyword removed : Only 2 bills with the keyword, and all appear in definition clauses	
	unit trust(s)	No Keyword Count Information Available	

Table A4: Industry Assignments by State

This table shows the 3 most important industries for each state at the beginning, midpoint, and endpoint of our sample. "Importance" is measured by summing up the market equity of all publicly traded firms in each industry residing in a state, and then ranking industries. We thus show below the three largest industries operating in each given state over each Congress. We choose a subset of states and Congresses, as the table would otherwise be prohibitively long. We are happy to provide the entire table of states, industries operating in those states, and most important industries for each state and Congress upon request.

State	Fama-French Industry #	Industry Name	Congress
TX	30	Oil	101
TX	31	Utilities	101
TX	32	Telecom	101
TX	30	Oil	105
TX	32	Telecom	105
TX	35	Computers	105
TX	30	Oil	110
TX	31	Utilities	110
TX	32	Telecom	110
NY	45	Banks	101
NY	46	Insurance	101
NY	48	Trading	101
NY	45	Banks	105
NY	46	Insurance	105
NY	48	Trading	105
NY	45	Banks	110
NY	46	Insurance	110
NY	48	Trading	110
CA	32	Telecom	101
CA	35	Computers	101
CA	43	Retail	101
CA	35	Computers	105
CA	36	Software	105
CA	37	Electronic Equipment	105
CA	35	Computers	110
CA	36	Software	110
CA	37	Electronic Equipment	110

Table A5: Industry Portfolio Returns after Positive/Negative Bill Passage

This table examines the stock returns of industries that are classified as affected by a given piece of legislation, after that given piece of legislation passes, for the subset of bills that are passed by the Senate. We perform a calendar-time portfolio approach as follows: for each final Senate vote on a bill that ultimately passes, we examine the stock returns of affected firms following the passage of the bill. We form a "Long" portfolio that buys the firms in each industry that we assign to a bill (weighted by market capitalization) where the "R-R" measure described in the Appendix is positive, and a "Short" portfolio that sells the firms in each industry that we assign to a bill (weighted by market capitalization) where the "R-R" measure is negative. Affected stocks do not enter the portfolio until the month following the passage of a bill, and portfolios are rebalanced monthly. This table reports the average monthly "Long-Short" portfolio return for a portfolio that goes buys the "Long" portfolio and sells the "Short" portfolio each month. The "CAPM alpha" is a risk-adjusted return equal to the intercept from a time-series regression of the Long-Short portfolio on the excess return on the value-weight market index (see Fama and French (1996). The "Fama-French alpha" is a risk-adjusted return equal to the intercept from a time-series regression of the Long-Short portfolio on the excess return on the value-weight market index, the return on the size (SMB) factor, and the return on the value (HML) factor (see Fama and French (1996)). The "Carhart alpha" is a risk-adjusted return equal to the intercept from a time-series regression of the Long-Short portfolio on the excess return on the value-weight market index, the return on the size (SMB) factor, the return on the value (HML) factor, and the return on a prior-year return momentum (MOM) factor (see Carhart (1997)). *t*-statistics are shown in parentheses, and 1%, 5%, and 10% statistical significance are indicated with ***,**, and *, respectively.

	(Long-Short) Monthly Portfolio Return
Average returns	0.69
Standard deviation	3.64
CAPM alpha	0.69**
	(2.34)
Fama-French alpha	0.75***
	(2.66)
Carhart alpha	0.84***
	(2.92)

Table A6: 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 I, 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 I. 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

Figure A1. Congressional Bill Industry Assignment Example

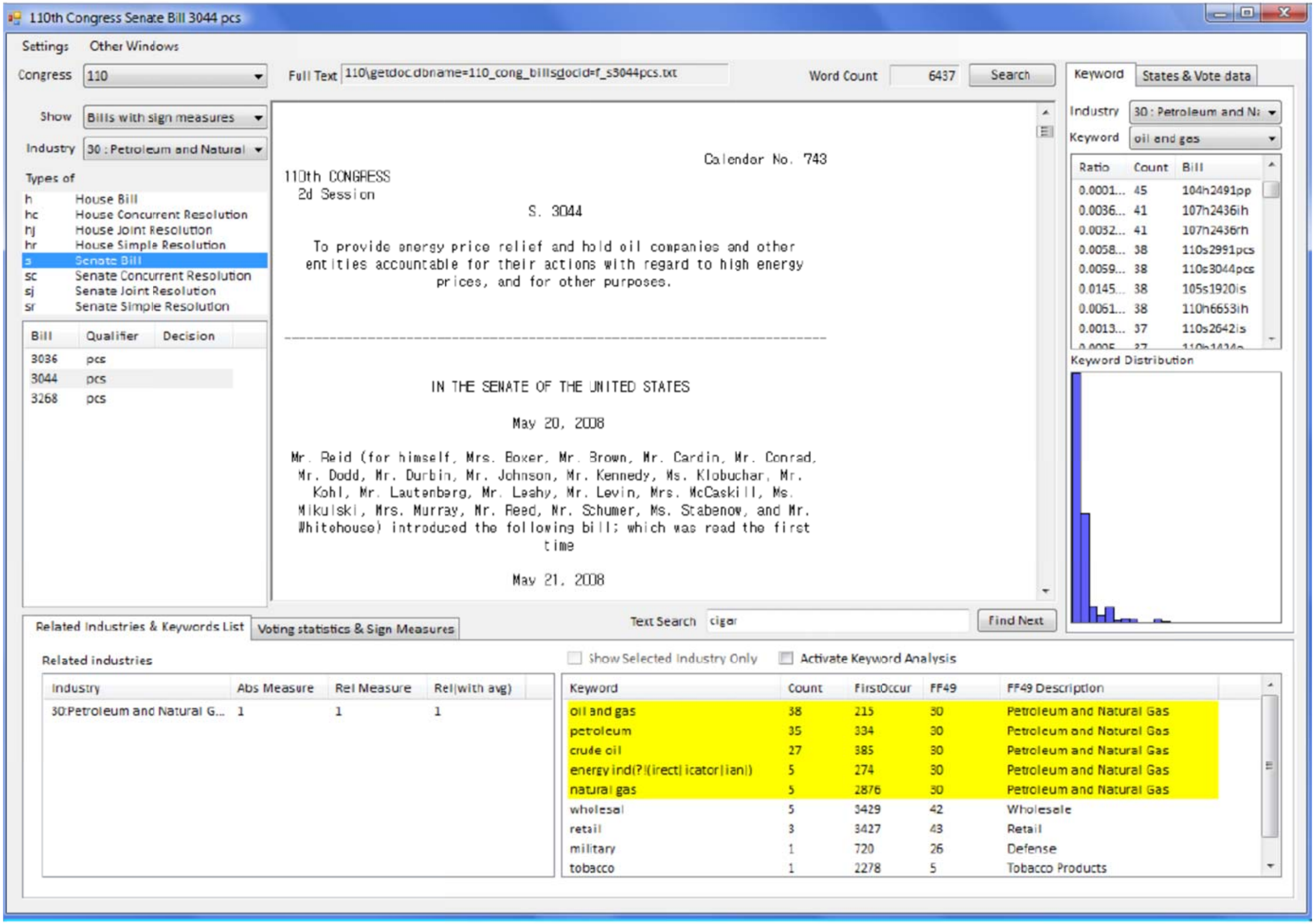

Figure A2. Congressional Bill Positive/Negative Signing Example