# The Network of Proposed Bills in Congress Reveals both Productivity and Idleness

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**Abstract**

Can the interrelationships among bills improve our understanding of legislative productivity? We re-conceptualize the legislative agenda as a latent space in which policy alternatives cluster close to one another when they share an agenda item in common. We leverage network analysis to probe this space, and to empirically identify bill communities using community detection; an estimate of the latent policy agenda items in Congress. Drawing on a new dataset of related bills from the 93rd through 113th Congresses, we find that by examining community quantity and size we can clarify earlier findings on legislative productivity. We use this measure to investigate institutional-level causes of policy-making, finding that divided chambers and greater interchamber ideological distance decrease the number of bill communities enacted into law (while increasing the sizes of said communities). We find that a bill's degree—the number of connections a bill has to other bills—predicts whether or not it becomes law. We close by discussing how our results inform long-standing debates over the measurement of successful policymaking.
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Normative concerns over Congress's ability to govern (and the associated decline of public trust in the institution) have resulted in a burgeoning literature on the lawmaking process and legislative productivity. This line of work examines what Congress is able to accomplish, and the determinants of the quantity, quality, and type of legislation passed. Most research has concluded that recent congresses, fueled by strong partisan and ideological differences, have not governed as effectively as previous ones—at least as measured by the amount and importance of legislation enacted into law. Public trust in Congress is central to evaluations of the government (Hibbing & Theiss-Morse 1995, Chanley, Rudolph & Rahn 2000), and in an age of deep partisan divisions, polarization, and gridlock, the dominant narrative is one of a broken and ineffectual institution (Mann & Ornstein 2006). This is especially problematic given the explosion of the congressional agenda, which demands swift action on an array of issues (Adler & Wilkerson 2009, Smith & Flathman 1989, Smith 1989).

Substantial effort has been devoted to measuring legislative demand and output; the aim is to determine how well perceptions of congressional activity match reality, and to understand why Congress does a better/worse job of governing. These measures suffer from three major issues. First, such measures often depend on the subjective views of researchers and the media to characterize the demand for policy change and whether legislation is substantive or "important." Subjective measures are difficult to employ at scale and can be unreliable across researchers or coders. Second, conventional work conceptualizes each bill as a discrete entity, and views the success or failure of bills as the full range of possible outcomes, where the number of important bills passed defines legislative productivity. However, this measurement strategy misses the fact that bills are not always limited to discrete policy areas, and one bill usually incorporates the text of multiple other bills across a spectrum of issues. Finally, many measures are based on post-hoc evaluations of legislative importance, raising the question of whether a measure could be created to track productivity in near real-time. Like other recent efforts (e.g., Adler and Wilkerson (2013), Burstein, Bauldry & Froese (2005), Wilkerson 2015), we argue that bills themselves are little more than vehicles for policy change, and that by focusing on the amount of policy change—rather than the number and type of bills—a clearer view of congressional activity emerges

In this paper, bills are conceived as legislative offerings rather than introduced as fully-formed laws. We consider bills as pieces of incomplete text in latent space that are placed near to each other when they are related to the same latent policy agenda item or "policy community," each of which comprise a part of a broader latent policy agenda. The legislative process determines how closely the bills are placed to one another. The proximity between bills reveals important details about legislative productivity, power, and the legislative agenda. We provide a new dataset to match this operationalization, and predict passage of policy communities using network characteristics. Our goal is twofold: first, to inform the debate over the measurement of successful policymaking (as well as examinations of legislative productivity more generally). By better accounting for the *amount* of policy change, inferences about the factors driving legislative productivity are improved. As Volden and Wiseman (2014, 204) note, understanding "the extent to which the language of various original bills finds its way into the final agreements" will allow scholars to answer a variety of questions about congressional effectiveness.

Second, we use network measures to estimate the latent agenda and to understand legislative productivity more broadly (at both the bill and community level) under conditions of divided government and interchamber differences. The results are most robust for House-Senate differences, which are shown to reduce the probability a bill becomes law (accounting for bill importance), reduce the *number* of policy communities passed within a congressional term, but increase the *size* of said communities. Put differently, while fewer policy items are enacted during these periods, what is enacted is of greater substantive importance. We find little evidence that divided government has important effects on the quantity of policy enacted. These results clarify much of the confusing and contradictory findings surrounding the effects of party control across the House, Senate, and presidency. Our measures also allow us to gauge the overall productivity of a congressional term. Importantly, despite the relatively low number of bills passed in recent congresses, we find that levels of productivity in recent congresses remain comparable to past years due to a smaller latent congressional agenda.

## Political Conditions and Legislative Productivity

Literature examining the causes of bill success/failure has grown considerably in the last 20 years; this is due in part to observers' noting worrisome trends about the rise of do-nothing congresses, and normative debates over the usefulness of proposed institutional reforms (Mayhew 2009, Shepsle 2009, Sinclair 2009). The debate is largely driven by divided government, the new normal in national politics. Since 1955, a different party has controlled the presidency and at least one branch of Congress about two-thirds of the time (compared to only 14% of the time in the first half of the century.) As Krehbiel (1998) demonstrates, for any new policy to be approved by both the president and the pivotal actors in each chamber, the status quo must be on the same side of each of these actors' ideal points *and* farther from all of their ideal points than the proposed policy (in a one-dimensional space). When the preferences of each pivotal actor diverge, such as during divided party or chamber control of the three lawmaking institutions, change to all but the most extreme status quos is prevented.

The empirical evidence on the effects of institutional control is mixed. In the first comprehensive work on divided government, Mayhew (1991) found that partisan control of Congress and the president was not a particularly important determinant of legislative productivity. In response, Howell, Adler, Cameron & Riemann (2000) found that divided government reduces the amount of landmark legislation, though it slightly increases the enactment of "normal" bills. Edwards, Barrett & Peake (1997) find that under conditions of divided government, substantially less "significant" legislation passes, but that divided government fails to affect the likelihood of passage for "important" legislation that is supported by the president.

Differences between the chambers—rather than between Congress and the president—also have an important effect on bill enactment. Bicameralism is generally seen as making it more difficult to pass legislation (Tsebelis & Money 1997, but also see Rogers 2003), and empirical results have demonstrated that ideological divergence between the House and Senate reduces total lawmaking (Binder 1999, Binder 2003), as does divergence between chambers in state legislatures (Rogers 2005). Grant & Kelly (2008) find that divided government affected past congressional productivity, while more recent de-

terminants of public laws passage include party differences, as measured by the differences between DW-NOMINATE party means within each chamber. There is also evidence that higher levels of party factionalism/disagreement within the parties and the presence of filibuster-proof supermajorities decreases productivity (Coleman 1999).

## Approaches to the Measurement of the Policy Agenda and Productivity

Answering questions about productivity requires a measurement of policy change, typically operationalized as the subset of all legislation which is successfully enacted. There are no constraints on the number or types of bills a member can offer; duplicate, repetitive and seemingly silly bills are introduced for a wide variety of reasons, even when they have little chance of becoming law (Lee 2016).[1] Of course, even among those bills which are enacted, very few of them are considered to be of substantive importance because they do not contain salient policy changes.[2] As a result, researchers have attempted to classify legislation based on importance in order to more accurately determine how much substantive policy change is produced within a congressional term (Binder 1999, Clinton & Lapinksi 2006, Grant & Kelly 2008, Mayhew 1991, Howell et al. 2000).

All of these classification schemes rely on current and retrospective evaluations of legislative significance. For example, Mayhew (1991) uses end-of-the-term congressional wrap-ups from the New York Times and Washington Post (as a contemporary measure), along with evaluations by political experts (as a retrospective measure), to determine which bills to include. Clinton and Lapinski (2006) rely on an item response model which draws from a far larger sample of retrospective and contemporaneous raters, while Grant and Kelly (2008) create a measure incorporating evaluations of legislative importance with the total number of laws enacted within a congressional session. Other measures commonly used include bills which were subject to what Congressional Quarterly (CQ) codes as a "key vote," (Bendix 2016, Mouw & Mackuen 1992) or bills which received a certain number of article lines in a CQ write-up (Anderson, Box-Steffensmeier & Sinclair-

[1] This is in contrast to many states where limitations exist on the number and types of bills that can be proposed by legislators; see the National Conference of State Legislatures 2010.

[2] These bills are called "hurrah" or "apple pie" votes, and include things like naming federal buildings or recognizing individuals. They are excluded from most analyses.

Chapman 2003, Baumgartner & Jones 2013, Volden & Wiseman 2014).

Quantifying the level of productivity also requires a measure of the congressional agenda. Comparing the absolute number of important bills enacted across congresses is misleading if the agenda in a particular term was smaller due to reduced demand for policy change. Thus, the total amount of policy change is a function of the universe of all possible agenda items which *could* have been passed within a given congress, and is typically measured through media attention (Binder 2003), or public opinion (Erikson, MacKuen & Stimson 2002, Stimson 1999). In either case, demand corresponds to public preferences for policy change: when the public is more liberal/prefers that elected officials change a variety of status quos, the possible set of bills which could be passed becomes larger (what Binder (2003) calls "the denominator"). By this logic, legislative productivity must keep pace with the public's appetite for change.

Measures of both productivity and agenda size suffer from significant limitations. Most constructs of importance capture only bills enacted into law, but ignore those which fail during the passage process. This creates a selection problem, making it impossible to predict *a priori* which bills are likely to be agreed upon by the chambers and the president. In the case of measures such as the amount of attention given to the bill by CQ, the vast majority of observations have a zero value (because most bills are ignored). Further, relying on academic and media evaluations to determine the importance of legislation and the size of the policy agenda almost certainly favors some policy areas or types of bills. For example, Shull and Vanderleeuw demonstrate that key votes "represent a more biased set of roll-call votes" (Shull & Vanderleeuw 1987, 581). As Clinton and Lapinski note, "although existing lists of legislation purport to identify legislation that is 'landmark,' 'significant,' 'innovative,' or 'consequential,' what is meant by 'important' legislation is inevitably, if not hopelessly, imprecise. Any characteristics that one could plausibly identify as defining 'significant' legislation are themselves plagued by imprecision"(Clinton & Lapinksi 2006, 234).[3]

[3]See Clinton & Lapinksi (2006) for a summary of the variety of ways scholars have defined legislative productivity.

## The Legislative Process and Bill Production

The conventional view of congressional action is one in which each bill is a discrete piece of legislation, where the choice for members to support the legislation is binary. A bill emerges from committee fully formed, reaches the floor, and members (do not) favor the bill; votes are counted, and bills with sufficient support pass the chamber. We question this view of lawmaking, for *individual bills are not discrete vehicles of policy change, but interconnected parts of a larger lawmaking process.*

Large and visible issues attract a great deal of attention from members of Congress who do not want to pass up a policy-making opportunity and a chance to promote their preferences to their colleagues/home districts. Frequently, the committee of jurisdiction modifies each of these policy proposals in one (or a series of) lengthy mark-up session(s). What emerges from the committee is a consolidated piece of legislation sponsored by the chair of the committee and sent to the floor in a single legislative vehicle. It is unreasonable to treat the bill which emerges from committee as the "winning" legislative alternative when in fact it is a combination of a number of other bills introduced by many different members.

Thus, the choice for a member is not between the proposed bill and the status quo; it is between competing sets of bills which collectively represent items on the congressional agenda, and which may or may not be preferred to other possible sets of bills. The modification of legislation through the addition and subtraction of policy components is a crucial part of coalition building and generates support among members by distributing policy benefits to a majority of members (Adler 2000, Shepsle & Weingast 1981, Shepsle & Weingast 1987, Weingast & Marshall 1988). Even bills which do not address the same substantive issues are often combined into one bill, especially in the Senate where the lack of a process-limiting and germaneness requirement allow for more flexibility during the floor process.

This more realistic view of the legislative development suggests a highly clustered latent space; bills (as fragments of incomplete text) are combined to produce winning coalitions and ensure gains from exchange, with the mark-up and amendment processes producing informative and often complex relationships between discrete legislative items

(Burstein, Bauldry & Froese 2005). Bills are little more than vehicles to which different policy changes are attached, and implies that *measures of success and failure may dramatically under-count the quantity of policy change if only bill passage is treated as a legislative success.* Many bills which fail to pass are connected through legislative language or policy content with other bills that do pass. Rather than defining legislation as falling into discrete categories, taking a latent space approach allows for a continuous measure of policy change and agenda size to be determined endogenously, by the legislative process itself.

To more concretely demonstrate the typical passage process for a substantively important bill, we focus on the chronology of H.R. 1552, which concerned a moratorium on internet taxation and was eventually enacted into law as P.L. 107-75 in 2001. As the time-line displayed in Figure 1 shows, seven different versions of the bill were introduced in the Senate and referred to committee, while three different versions were introduced in the House. Five of these seven bills were introduced by members of the standing committee with jurisdiction over the policy area (Commerce, Science, and Transportation), and are attempts to influence its content.

The House subcommittee which eventually took the lead in developing the legislation combined large sections of two different bills into one final version, which eventually passed both chambers. This process is relatively typical for a substantively important bill, but consider that the passage of P.L. 107-75 was straightforward given the uncontroversial nature of the bill; the final version of H.R. 1552 reported out of the House Judiciary Committee was passed by voice vote in both chambers. While each of the bills in this network are closely related to one another, some contain slightly different policy proposals regarding internet taxation. H.R. 1552 was significantly changed by the connected bills, a fact that is reflected in the language that was included in the final enrolled bill.

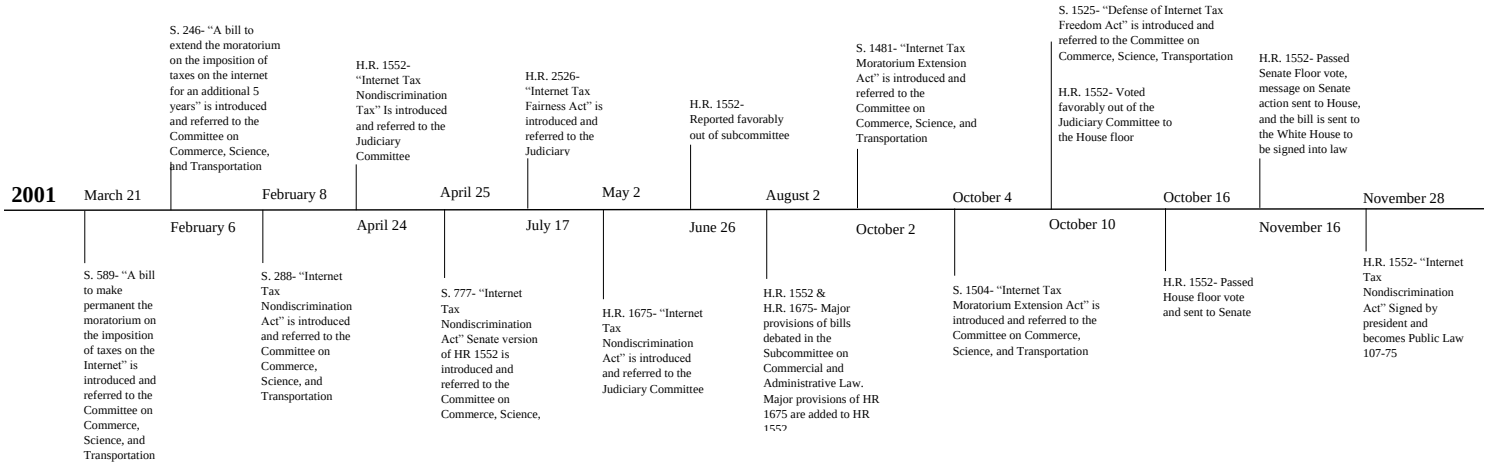


Figure 1: PL 107-75 (H.R. 1552) Passage Time-line

## Data: Connected Legislation

Our approach to measuring the quantity of policy contained within a bill and overall agenda size within Congress leverages the connections that exist between bills introduced in the post-reform period, from the 93rd through the 113th Congress (1973 to 2014). Our goal differs from related techniques such as text analysis, in that we are not interested in finding the origin of all policy ideas and not every bill with a particular policy idea will connect to all other bills with the same idea. Instead, we seek to measure the policy contribution produced by a set of bills, and how a particular vehicle unites policy from a set of legislative items. Using information on these connections, we begin with the most basic network measure: the degree of a bill, or the number of connections a bill has with other bills. We next use community detection algorithms to identify policy communities (sets of related bills addressing a similar policy agenda item), capturing information on the size of (number of bills in) said communities.

The data were compiled by the Congressional Research Service (CRS), which provided us with detailed information on what they term "related" legislation for the 93rd through 110th Congresses. Data from the 111th through 113th Congresses was scraped from the Sunlight Foundation's Github page.[4] A combination of human and machine coding classified the data. A team of lawyers working for CRS, divided by subject area, read and summarize each bill introduced during the course of a legislative session. The summaries produced by this process are the same summaries shown on Congress.gov. The CRS also uses a text analysis program that looks at both word frequency correlations and word sequence correlations to determine the extent to which bills match. However, according to CRS staff, the machine coding is imperfect and there is heavy reliance on the team of lawyers to classify bills because the text analysis program has difficulty with references to other laws embedded within the legislation. Each bill which is classified as connected to another bill has a linkage of either "identical," "companion," or "related"; we use these classifications to create connections between bills. We also note that in contrast

[4]The Sunlight Foundation's data lab recently closed down and bill tracking has been taken over by ProPublica at `https://projects.propublica.org/represent/`. There is no substantive difference between the earlier and later data. Early data was not publicly available until the online congressional database transitioned from THOMAS.loc.gov to Congress.gov in 2012. The Sunlight foundation compiled information on later congresses from Congress.gov.

to attempts by researchers to designate legislation as important, CRS only makes determinations about whether bills are connected to other bills using their well-established classification rules at the time of introduction, rather than after the bill has been enacted.

Bills are classified as *identical* when the text of the two bills matches exactly. Identical bills were much more common prior to a rules change which occurred in the 95th Congress. Congressional rules governing co-sponsorship dictated that no bill could have more than 25 cosponsors, so when a member wanted to sponsor a bill that already had 25 cosponsors, he or she would introduce an identical piece of legislation to indicate support. Even though the rules now allow for an unlimited number of cosponsors, members can (and do) introduce identical versions of a bill (it remains a valuable exercise for some members of Congress as a position-taking or credit-claiming exercise).

*Companion* bills are those that are identified in the Senate as identical or substantially similar to a bill introduced in the House. These bills are used to organize debate in the Senate, allowing the body to consider the same legislation being considered by the House without waiting for the House bill to be sent to the Senate.

*Related* bills represent efforts to influence the language of important pieces of legislation. These bills contain provisions that add policy content to a larger bill (the primary legislative vehicle). The goal of this type of bill is to gain adoption as an amendment in committee markup or floor debate. As our discussion of P.L. 107-75 suggests, related bills are the most common types of legislative connection in our dataset. These bills are identified by CRS as substantive in nature to other bills, and frequently make up the titles or sections of the large, substantively complex bills reported out of committee and sent to the floor.

### Creating Bill Networks and Communities

To demonstrate how bills are connected to each other, Figure 2 shows two examples from the 107th Congress–H.R. 1836 and H.R. 10–and how they are nested within larger communities. H.R. 10, found at the top of the figure, was originally entitled, "The Comprehensive Retirement Security and Pension Reform Act," and was an important overhaul of the tax system in 2001. The Senate inserted language concerning railroad retirement and benefits into H.R. 10 and passed it as a separate bill. Meanwhile, the

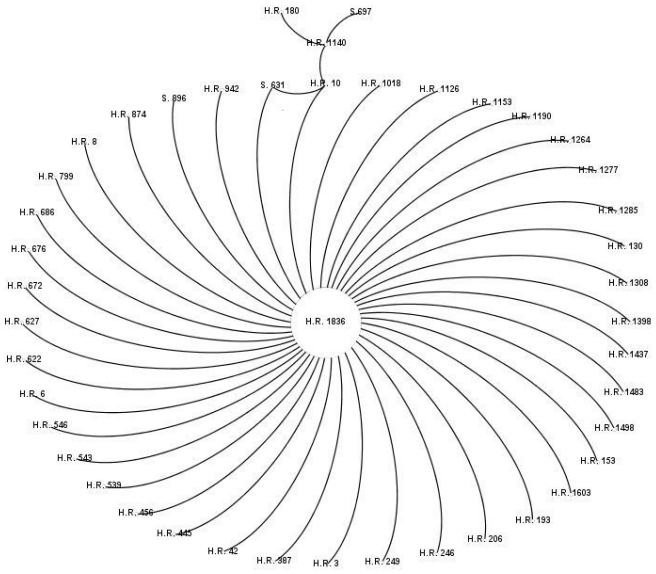


Figure 2: Bill Networks For H.R. 1836.

original language of H.R. 10 was included in H.R. 1836, which was eventually passed by both chambers and became P.L. 107-16, the landmark and controversial "Economic Growth and Tax Relief Reconciliation Act of 2001" (more commonly known as the "Bush Tax Cuts").[5] Forty-one other individual bills connect directly to H.R. 1836, while H.R. 10 has its own sub-network, itself connecting directly or indirectly to four other bills.

These network connections are common within congresses, as a significant number of bills have at least one connection to other bills. Figure 3 shows the percentage of all bills within a congressional term connected to at least one other bill, and demonstrates that at minimum, greater than 22% of bills have at least one connection. Note that the decrease in the 96th Congress is explained by the aforementioned rule change, which reduced the number of identical bills. However, the number of connected bills has begun to grow again more recently, with more than 40% of all bills having a connection in the 109th-113th Congresses. Isolates (bills which do not have any connections to other bills) are found by subtracting the percentages in Figure 3 from 100%.

[5]See Bartels 2005 and Lupia 2007 for a discussion of the substance of the bill.

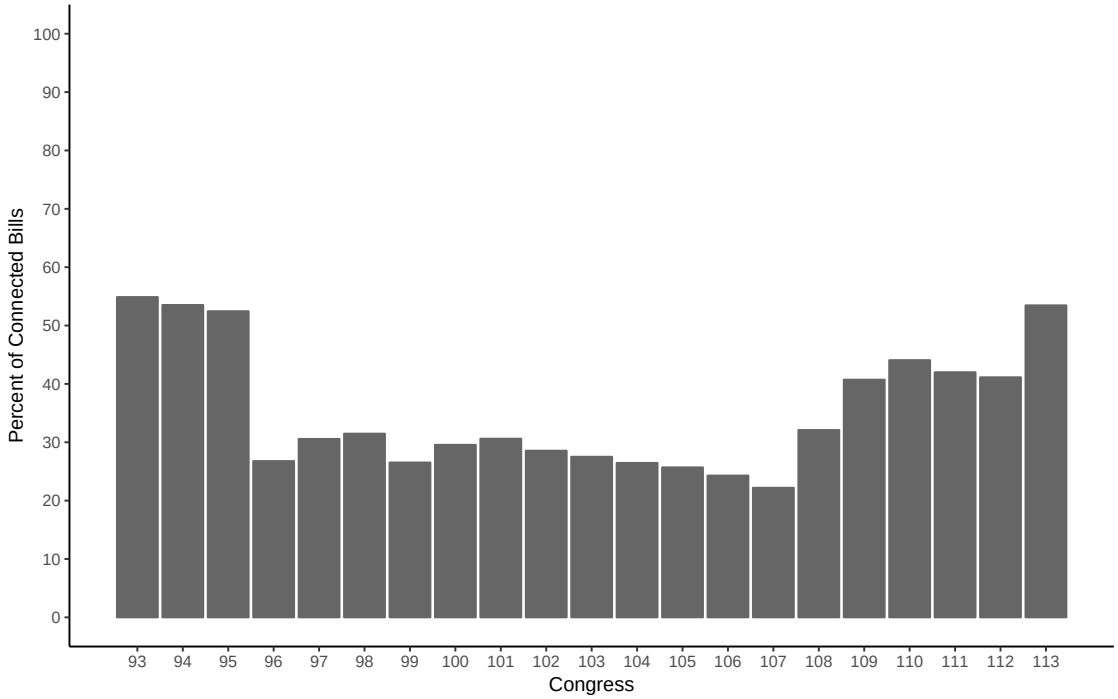


Figure 3: Proportion of Connected Bills by Congress, 1973-2014

We leverage the aforementioned connections between bills—related, identical, companion—to extract degree and policy "communities" in each Congress. The number of degrees of a bill, or the number of connections a bill has to other bills, is our measure of its importance (centrality) in the context of the network approach. Previous legislative studies using network analytic techniques have used degree as a measure of a particular node's importance in a network (Fowler 2005, Fowler 2006*a*, Fowler 2006*b*).[6]

Identifying communities to measure the size of the policy agenda and the quantity of policy change enacted (for those communities which become law) is more complicated. A community detection algorithm (CDA) works to identify communities; in our case, it finds all sets of bills which are more internally connected to each other than they are externally connected. The algorithm used here is an "edgewise" approach, which begins with a single community encompassing all bills, and iteratively removes bills and places them in new communities until external connectedness between communities is minimized. In so doing, the algorithm finds the community representation that maximizes internal connectedness

[6]See Appendix 1 for information on miscellaneous trade bills, which have a different data generation process and as a result, have a high number of degrees.

(modularity) and leaves only the collections of bills most likely to be grouped together by the underlying process that produced the ties. Specific details of the algorithm can be found in the original paper (Newman & Girvan 2004). *The resulting bill communities represent our estimates of latent legislative items on the congressional agenda*, or the latent demand for congressional action during a congressional term ("the denominator," according to Binder 1999). We contend that each community represents a measure of the distinct policy alternatives on a latent legislative agenda item; *the true policy agenda exists within the connections between related bills.*[7]

Table 1: Bill Network Summary Statistics

| Congress | Bills Proposed | Related Bills | Communities | Avg. Community Size | Laws Passed | Laws from Comms. |
|---|---|---|---|---|---|---|
| 93 | 21557 | 11831 | 3210 | 3.69 | 644 | 304 |
| 94 | 19759 | 11831 | 3017 | 3.51 | 668 | 246 |
| 95 | 18042 | 9464 | 2769 | 3.42 | 734 | 312 |
| 96 | 11720 | 3138 | 1322 | 2.37 | 652 | 273 |
| 97 | 10572 | 3232 | 1015 | 3.19 | 413 | 205 |
| 98 | 9534 | 3001 | 948 | 3.17 | 479 | 239 |
| 99 | 8691 | 2306 | 771 | 2.99 | 387 | 187 |
| 100 | 8501 | 2513 | 786 | 3.20 | 516 | 252 |
| 101 | 9088 | 2782 | 861 | 3.23 | 428 | 243 |
| 102 | 9470 | 2704 | 925 | 2.94 | 420 | 219 |
| 103 | 7791 | 2144 | 748 | 2.87 | 365 | 201 |
| 104 | 6466 | 1711 | 601 | 2.86 | 308 | 170 |
| 105 | 7451 | 1915 | 726 | 2.64 | 362 | 188 |
| 106 | 8822 | 2084 | 952 | 2.21 | 547 | 256 |
| 107 | 8864 | 1968 | 855 | 2.31 | 343 | 208 |
| 108 | 8378 | 2689 | 1165 | 2.32 | 473 | 287 |
| 109 | 10475 | 4266 | 1830 | 2.34 | 465 | 267 |
| 110 | 10987 | 4842 | 2012 | 2.41 | 440 | 251 |
| 111 | 10552 | 4432 | 1844 | 2.41 | 366 | 214 |
| 112 | 10371 | 4266 | 1481 | 2.89 | 271 | 163 |
| 113 | 8837 | 4724 | 1626 | 2.92 | 282 | 190 |

Communities and degrees calculated using SNA (Butts 2008) and igraph (`igraph.org/r`) in *R 2.14.2.*. Number of communities, average community size, and laws passed out of a community per Congress exclude isolates.

Table 1 provides descriptive statistics. Columns 2 and 3 indicate the total number

[7]Thus, the sum of all community sizes is equal to the number of bills introduced in a congressional term.

of bills proposed in each Congress, and the total number of related bills. The number of related bills corresponds to the number of bills with a degree measure of at least one. By definition, subtracting the number of related bills from the total gives the number of bills which bear no connection to any other bills, or the total number of isolated proposals (communities of size one). For example, in the 93rd Congress the number of isolated proposals is: $21557 - 11831 = 9726$. The values in column 4 gives the number of communities per Congress (as found by the CDA), which as described above, are sets of internally connected bills; column 5 shows the average number of bills within each community. Column 6 shows the number of total laws passed in a given Congress, while column 7 shows the number of laws passed that emerged from a community of size two or greater. Note that the number of communities, the average size of communities, and the number of laws passed from communities exclude isolates (communities of size one).

One of our central claims is that communities represent an improved approach to the measurement of significant/substantive policy change proposals–we argue that they should be used to gauge total legislative productivity within particular Congresses. For example, in the 113th Congress, 190 of the 282 laws passed emerged from communities, while the remaining were from isolated bills which are often minor or non-substantive legislation; they are bills that are more ad-hoc in nature, and (by definition) bear no relationship to any other bills introduced. Two bills passed into law in the 110th Congress that were not connected to other bills include P.L. 110-310 and 110-305 (both designated post office names), and P.L. 110-39, which transferred certain funds from the Senate Gift Shop Revolving Fund to the Senate Employee Child Care Center. Clearly, these are not the types of substantive bills researchers are generally interested in when studying productivity.

We next create a simple count of the number of bills which go on to become law from each identified bill community. This is of crucial importance to validate our theoretical approach, for it is our contention that bill communities capture debate and discussion on an overall latent congressional policy agenda item. As a result, *relatively few laws should emerge from each community when policy agreement can be reached; otherwise, the number of policy enactments should be zero from each community.* And indeed, we find this to be the case. There are 159,486 communities which produced zero laws, and aside

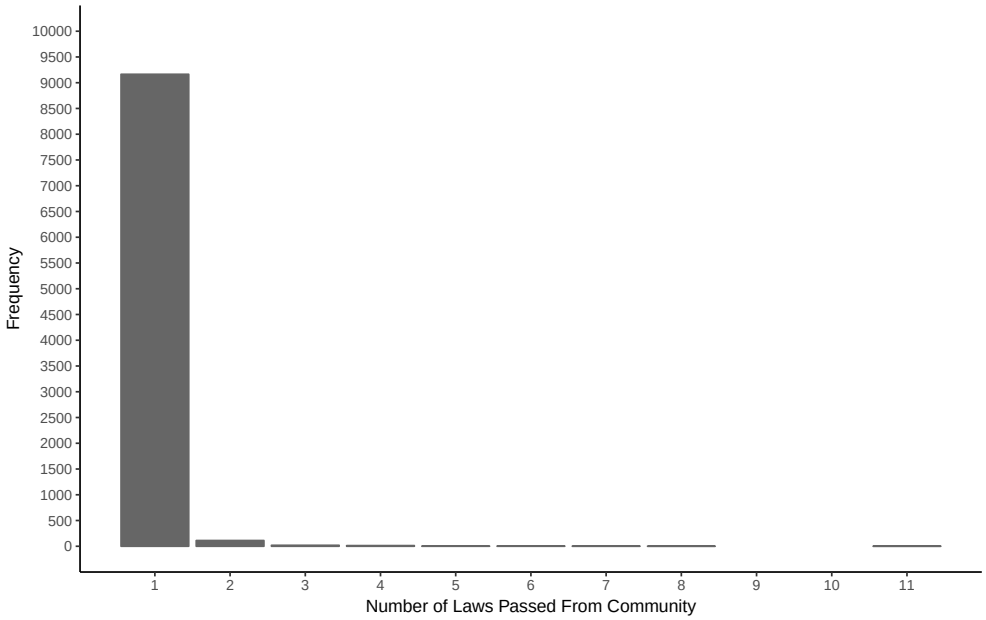


Figure 4: Communities Generally Produce Only One Law

from these "zero-law communities" (which are excluded from Figure 4), Figure 4 shows that *the overwhelming majority of bill communities produce one enacted law*, indicating that either a policy change is not made within the policy area, or a single legislative vehicle, which encompasses policy contained in other individual pieces of legislation, is passed. For those communities with at least one enactment, 98% were from one-law communities, and another 1.2% were from two law communities.[8] These result supports our contention that our CDA-based, network analytic approach effectively captures latent legislative agenda items.

The number of communities is an estimate of the total number of issues on the congressional agenda; that is, of the population of possible issues Congress could have addressed during a congressional term. The reader should note that the number of communities includes more legislation than other measures of the congressional agenda (e.g., Binder 1999) because this approach is not limited to policy items which received substantial media attention. If we limit our analysis to communities of size greater than five, we find that for most Congresses there are between 20 and 60, and these represent the most

[8]Within our dataset, there are 112 communities from which two laws emerge, 19 communities which produce three laws, 13 communities which produce four laws, three communities which produce 5 or 6 laws, two communities which yield 7 laws, and one community each that created 8 and 11 laws, respectively.

prominent latent policy agenda items. The number of communities is positively correlated with the number of laws ($\rho = .61$), as is average community size ($\rho = .33$). These relationships suggest that as the number of communities grows or as the average community size increases, there is an increasing likelihood of policy change. The number and size of communities also comports with existing evidence about the congressional agenda being limited by constraints on time, energy, and the ability of members' to process the large number of proposals which come before the body (Cox 2006, Hall & Taylor 1996, Jones 2001). In Appendix 2, we further elucidate the relationships between bills within communities, focusing on another example from the 110th Congress. Appendix 3 shows a histogram of frequency of community sizes for all communities in the data.

In the following sections, we offer more rigorous validation of our measures by showing that the centrality, or number of degrees (connections) a bill has to other bills, is closely related to existing measures of bill "importance." Following these validation analyses, we use our network measures to answer substantive questions about political conditions and legislative productivity. First, we predict bill passage, expecting bill degree will be positively related to the likelihood of passage (given that the more central a bill is, the more substantive policy change it contains as the legislative vehicle for the latent agenda item). We also show that the community size a bill is embedded in has a negative relationship to the likelihood it passes (holding bill degree constant), as it becomes less likely that any one bill becomes the vehicle for the entire community. These models also examine the substantive effect of gridlock conditions in Congress on the probability of enactment while accounting for bill degree and community size. These two factors effectively control for the quantity of legislative change contained within a bill.

Next, we predict the passage of lawmaking communities. Since communities capture components of the overall latent congressional policy agenda, this allows us to capture the quantity of legislation enacted into law. We focus on divided government, divided chambers, and interchamber distance, all of which are expected to affect legislative gridlock by reducing the quantity of policy enacted. The aforementioned literature has generated conflicting findings, but generally we expect that divided government, divided chambers, and greater interchamber distance should reduce the probability a bill is enacted (con-

trolling for its network centrality and community size). Relatedly, we expect that the same gridlock conditions will reduce the average size of communities enacted into law, and the number of communities enacted into law.

## Validating the Network Measures

To validate our approach, we begin by drawing comparisons with familiar measures of bill importance: Mayhew's list of "significant" enactments (Mayhew 1991), and Clinton and Lapinski's (2006) measure of law importance. Specifically, we compare each of these sources to the degree measure (as a bill-level measure of importance). The number of degrees which connect a bill to all other bills introduced is a measure of the bill's centrality in the network; those which are connected to a large number of other bills are viewed as significant, as they are related to policy provisions from the other bills. Recall our argument: such bills are more likely to become the legislative "vehicle" for other provisions contained in different bills and inform the quantity of policy contained within a particular bill. Thus, we expect our measure of bill degree to track closely with measures of legislative importance, though we argue our measure is more comprehensive and less subjective than *post hoc* evaluations of legislative importance.

These initial comparisons are important because not every bill is constructed or passed in the way described above. Some bills are introduced quickly by the leadership and other bills are substantially changed through the amending process. Still, even bills pushed by the leadership often have extensive bill networks as members introduce other bills seeking to influence the main bill, or from legislation introduced by committee members who work with the leadership to produce legislation. For example, H.R. 1, the 2017 Republican tax cut bill, which was widely characterized as leadership-written[9] has 25 related bills despite the leadership quickly pushing it through the chamber.[10] With respect to the use of amendments to change legislation, this is usually not an effective way to change policy in the House given that chamber's rules, though it may be in the Senate. Still, many amendments, especially important ones—such as when the Senate majority leader strikes

[9]See, for example, "GOP leaders reach tax deal, cutting corporate tax rate to 21% and top individual rate to 37%." Lisa Mascaro, *The Los Angeles Times*, December 13, 2017. Accessed at `http://www.latimes.com/politics/la-na-pol-gop-tax-plan-20171213-story.html` on January 12, 2018.

[10]This bill is not included in our data as the 115th Congress is still in progress.

all language after the title from the House version of the bill—are often introduced as stand-alone bills and will be identified as connected to the legislation in question.

There are 175 laws identified by Mayhew as significant from the 93rd-110th Congresses (his data excludes bills not enacted). The average number of degrees in Mayhew's laws (mean=8.70) is significantly greater than the average number in non-Mayhew laws (mean=0.57). The most connected bill in our data is H.R. 4242 (97th Congress), with 273 degrees. The bill known as the "Economic Recovery Tax Act of 1981" became law in 1981 and was also identified by Mayhew as significant. Among other changes, the law reduced individual tax rates and allowed all working taxpayers to establish IRAs.

While the overlap with Mayhew's analysis supports our approach, it is important to note that using degree also allows us to capture other bills that did not attract enough attention to be identified by Mayhew. For example, Mayhew did not identify the most important Senate bill in our data, H.R. 2739 (enacted in 2008.) The bill entitled, "Consolidated Natural Resources Act of 2008", included authorizations for the Department of Energy, the Bureau of Land Management, the Bureau of Reclamation, the United States Geological Survey, and the National Park Service, while also making changes to public lands regulations. The bill was relatively uncontroversial, especially in the Senate, but demonstrates that non-controversial legislation can also be substantively important: it has 107 connections to other bills.

Our second metric of bill importance uses the Clinton & Lapinksi (2006) measure for all laws through the 103rd Congress; this was developed using an item response approach, and depends on contemporaneous and retrospective law evaluations.[11] The most important Clinton-Lapinski law is also the aforementioned "Economic Recovery Tax Act of 1981." The second most important law in their dataset is H.R. 1900 from the 98th Congress, which has a degree measure of 20, while the third most important Clinton-Lapinski law is H.R. 4961, which has a degree measure of 61 (both significantly higher than the degree mean of 1.45). In Appendix 4, we predict logged degree for all bills and public laws using CQ article lines, Clinton-Lapinski significance, and Mayhew identified bills (plus bill-level controls). Each is a significant and positive predictor of logged bill degree. These analyses also suggest that bills with high degree values, or

[11]The Clinton-Lapinski data does not measure law importance after the 103rd Congress.

nested within larger communities, are not generated through the bundling of numerous minor bills. This is consistent with other research that suggests bills that are packaged together (e.g., omnibus bills) are more salient and controversial than minor bills, which usually have no trouble passing as stand-alone entities (Krutz 2000).

To reiterate: a strength of our approach is that it does not rely on retrospective evaluations of importance, or media attention, all of which may produce distorted views of legislative productivity. While our data overlap significantly with extant work, *we add value by identifying additional legislation.* Of the 20 most connected laws in our data, 8 were also identified by Mayhew. Additionally, our data allow us to identify bills that did not become law, providing a clearer picture of the congressional agenda and overall policy success than does counting the number of "important" bills passed. These initial results suggest that using degree is a valid measure of the relative importance, salience, or significance of legislation (whatever term we might wish to use); it is also one that accounts for other bills which may be overlooked by contemporaneous or retrospective evaluations.

## Predicting Bill Passage and Legislative Productivity

We now use our network measures to answer substantive questions about bill passage and legislative productivity. We first hypothesize that bills with larger degree measures (more connections with other bills) are more likely to pass because they are the vehicle through which legislation is enacted (degree is logged in our analyses due to the skewed nature of the variable). We also expect the size of the bill community to exhibit the opposite relationship—as community size increases, the probability of any one bill within the community being enacted into law decreases. This is an additional test of whether the classification of bills into communities is a meaningful distinction of policy items.

Additional measures used to predict *individual bill passage* include both bill-level and congress-level variables. In addition to bill degree and community size, CQ article lines, as developed by the Policy Agendas Project (Baumgartner & Jones 2013), are included as a measure of the level of salience or controversy around a bill. This variable tracks closely with conceptions of importance, and has an advantage over both the Mayhew

laws and the Clinton-Lapinski item response value: it is measured for all bills and exists through the 111th Congress (bills with higher values on this measure are more salient to the media and as a result, should be more likely to become law). Because of the large number of zeros and its skewed nature, we recode the CQ lines variable to run ordinally.[12] The final bill-level control notes whether a bill was sponsored by the chair of a committee, as this may influence movement through the legislative process (Adler & Wilkerson 2005, Anderson, Box-Steffensmeier & Sinclair-Chapman 2003, Cox & Terry 2008, Volden & Wiseman 2009).

We also include a number of chamber/congress-level characteristics (given the substantial literature linking these factors to legislative productivity): the number of moderates in each chamber, divided government, divided chambers, and the distance between the chamber medians as defined by "common space" DW-NOMINATE scores. Moderates, defined here as having DW-NOMINATE scores between -.25 and .25 (consistent with Poole and Rosenthal, 1997), increase the ability of the chambers to compromise and enact legislation (Binder 1999). Finally, the number of communities within a congress and Stimson's measure of public mood are included to capture the size of the policy agenda and public demand for legislative change (Binder 2003, Stimson 1999), respectively.[13]

Table 2 presents estimates for four mixed-effects logit specifications, incorporating the aforementioned variables.[14] Model 1 restricts the predictors to bill degree and community size, while model 2 includes all relevant variables with divided government; model 3 replaces divided government with divided chambers, and model 4 replaces interchamber distance with divided chambers.[15] *Across all specifications, the number of degrees for a bill is a positive and significant predictor of the likelihood a bill becomes law.* In short, bills which are highly connected are more likely to become law, indicating that bills exist within networks and that their connectedness (degree centrality) is an important indicator

[12]The variable takes on a value of zero for zero lines, one if CQ lines is greater than zero but less than or equal to the mean number of lines, two if the number of CQ lines is greater than the mean and less than the 90th percentile, three for the 90th to 95th percentile, four for the 96th through 99th percentile, and five for greater than the 99th percentile.

[13]As noted, a rules change in the 96th Congress removed the limit on co-sponsorship, resulting in fewer bills introduced as a result of a decline in the number of identical bills introduced by members. The random intercepts in the multi-level model empirically account for this rules change.

[14]Appendix 5 shows similar results for communities in which more than one bill becomes law.

[15]Divided government and divided chambers are correlated; they are sensitive to the inclusion of one another (because all instances of divided chambers also constitute divided government).

Table 2: Mixed-Effects Logit Models of Bill Enactment

| Independent Variables | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| **Bill-Level Vars.** | | | | |
| Bill Degrees (logged) | 0.848* | 0.514* | 0.515* | 0.515* |
| | (0.028) | (0.036) | (0.036) | (0.036) |
| Bill Community Size (logged) | −0.146* | −0.257* | −0.257* | −0.256* |
| | (0.015) | (0.017) | (0.017) | (0.017) |
| CQ Lines (logged) | | 0.908* | 0.907* | 0.907* |
| | | (0.012) | (0.012) | (0.012) |
| Bill Sponsored by Committee Chair | | 0.677* | 0.677* | 0.678* |
| | | (0.028) | (0.028) | (0.028) |
| **Congress-Level Vars.** | | | | |
| No. of Communities (x 100) | | −0.001 | −0.001 | −0.000 |
| | | (0.001) | (0.001) | (0.001) |
| Public Mood | | 0.017 | 0.015 | 0.020* |
| | | (0.011) | (0.010) | (0.011) |
| No. Senate Moderates | | 0.024* | 0.044* | 0.044* |
| | | (0.013) | (0.013) | (0.015) |
| No. House Moderates | | −0.003 | −0.006* | −0.006* |
| | | (0.002) | (0.002) | (0.002) |
| Divided Government | | −0.100 | | |
| | | (0.064) | | |
| Divided Chambers | | | −0.229* | |
| | | | (0.084) | |
| Interchamber Distance | | | | −1.165* |
| | | | | (0.536) |
| Constant | −3.070* | −4.464* | −4.609* | −4.862* |
| | (0.049) | (0.719) | (0.649) | (0.715) |
| Random Effects Parameters | | | | |
| Var(Congress) | 0.042* | 0.013* | 0.010* | 0.012* |
| | (0.014) | (0.005) | (0.004) | (0.005) |
| AIC | 72,954.346 | 66,709.709 | 66,705.747 | 66,707.747 |
| N | 206,720 | 206,720 | 206,720 | 206,720 |

*p<0.05. The dependent variable is whether or not a bill became public law. Entries are mixed-effects logit coefficients with standard errors in parentheses, 93rd-111th Congresses.

of eventual passage. Substantively (in model 2), an increase of one degree increases the probability a bill becomes law by about 25.7% (95% CI: 20.5% to 29.2%), all else equal.[16]

As expected, the size of the community a bill is located in *decreases* the probability of enactment for a particular bill. Larger communities contain more bills, so the probability any one is enacted into law declines, providing additional evidence that communities represent meaningful connections between sets of bills. A one unit increase in community size (the variable is logged because of its skewed nature) decreases the probability a bill becomes law by about 8.33% (95% CI: -7.4% to -9.25%; model 2). Mean community size is 5 bills, so moving from a community of one to an average community size decreases the probability a bill becomes law by about 42%.

Other covariates emerge as statistically significant and in the expected direction. The more attention a bill receives from CQ, the more likely it is to be enacted into law—an expected result as these bills are the most controversial and well-known legislative items. The same is true if the bill is sponsored by a committee chair. At the congress-level, the number of Senate moderates is positively related to the likelihood a bill becomes law, while in models 3 and 4, the number of House moderates has a negative relationship to enactment. Senate moderates have long been seen as necessary to overcoming that chamber's super-majoritarian rules, while House moderates may make it more difficult to achieve legislative success in the modern House because they are less likely to delegate to the leadership (Aldrich 1995, Rohde 1991).

Most importantly, these results inform previous work on legislative productivity: divided government does not have a significant effect on whether a bill becomes law, while divided chambers and greater interchamber distance both reduce the probability. Substantively, divided chambers reduce the probability of enactment by 20.5% (95% CI: -6.7% to -32.2%), while the effect of interchamber distance is a reduction of 29.5%, moving from minimum interchamber distance to the maximum value (95% CI: -12.2% to -63.2%).

[16]There are 416 bills out of 206,720 which are identified as related to a bill, though which were introduced after the related bill became law. The exclusion of these bills from the models does not alter our results. See Appendix 5 for additional details on how CRS identifies related bills from previously introduced bills, and commentary on potential implications for our data.

## A Second Look at Productivity: Focusing on Communities

In the previous analyses we considered the factors that predict bill-level success, and found that interchamber differences reduce the probability a bill becomes a law (controlling for overall legislative connectivity and centrality). In this section we re-focus our attention on communities and revisit standard findings in the legislative productivity literature. Our major theoretical claim is that by measuring the connections between individual bills, we better capture the quantity of policy produced (as compared to traditional measures of individual bill passage). Specifically, here we look to predict the *overall quantity* of legislative productivity. This requires us to predict the size of the communities enacted, thus we limit the sample to those communities where at least one bill within the community became law.[17] It may not be the case that the bill passed into law contains all the policy provisions within the community, but our previous analyses suggest that community size does well capturing the overall policy change made by bills within the community.

The models again include variables at both the bill- and congress-levels. Because the unit of analysis is now *communities*, we average bill characteristics across them such that a higher number for a bill-level variable indicates that more bills within that community had that characteristic. For example, an average for the variable "bill sponsored by the committee chair" indicates the proportion of bills in that community sponsored by the chair. We use an average rather than a count because this scales the number of bills with a particular characteristic by the size of the community. The congress-level variables are constant within a community, so no average is taken for those.

The set of models in Table 3 predict community size (again, for those with at least one bill that became law), using standard predictors of legislative productivity. The vast majority of values for community size are less than ten, but the variable is heavily right-skewed (with some values over 150). Because of this, the models are multi-level mixed effects negative binomial regressions.[18] The same independent variables are used from the

[17] As shown in Figure 4, though not always the case, it is by far most common for only one law to pass out of a community.

[18] Regression diagnostics indicated that using a negative binomial model fits the data better than logging the dependent variable and using mixed effects regression. The models are replicated in Appendix 6 using logged community size as the dependent variable.

previous models, and we focus particular attention on the effects of divided government, divided chambers, and interchamber distance, consistent with previous literature.

Table 3: Mixed Effects Negative Binomial Models Predicting Legislative Quantity Enacted into Law

| Independent Variables | (1) | (2) | (3) |
|---|---|---|---|
| **Bill-Level Vars.** | | | |
| Average CQ Article Lines (Ordinal) | −0.020 | −0.020 | −0.020 |
| | (0.013) | (0.013) | (0.013) |
| Average Sponsored by Committee Chair | −0.048 | −0.048 | −0.049 |
| | (0.032) | (0.031) | (0.032) |
| **Congress-Level Vars.** | | | |
| Divided Gov. | 0.128 | | |
| | (0.073) | | |
| Divided Chambers | | 0.298* | |
| | | (0.092) | |
| Interchamber Distance | | | 1.423* |
| | | | (0.596) |
| Average No. House Moderates | 0.003 | 0.007* | 0.007* |
| | (0.002) | (0.002) | (0.002) |
| Average No. Senate Moderates | −0.004 | −0.023 | −0.014* |
| | (0.014) | (0.014) | (0.016) |
| No. of Communities | −0.012* | −0.013* | −0.014* |
| | (0.002) | (0.002) | (0.002) |
| Public Mood | 0.029* | 0.032* | 0.025* |
| | (0.012) | (0.011) | (0.012) |
| Constant | −0.297 | −0.071 | 0.227 |
| | (0.818) | (0.710) | (0.806) |
| Random Effects Parameters | | | |
| Var(Congress) | 0.018* | 0.013* | 0.016* |
| | (0.005) | (0.005) | (0.006) |
| AIC | 37878.030 | 37861.043 | 37860.634 |
| N | 8,815 | 8,815 | 8,815 |

*p<0.05. The dependent variable is community size. Communities are only included where at least one bill became law. Entries are mixed-effects negative binomial coefficients with standard errors in parentheses, 93rd-111th Congresses.

In models 1 and 2, the measures of gridlock have significant and *positive* effects on

the size of the communities enacted into law. That is, during divided chambers, and during periods of greater interchamber distance, the communities enacted into law are larger than when the chambers are ideologically similar. This is the opposite effect one would expect if these conditions reduce the quantity of policy passed. Substantively, the negative binomial model predicts that during periods of divided chambers, enacted communities are 35% larger (95% CI: 12.6% to 61.3%). Similarly, model 3 shows that an increase in interchamber distance from the minimum to the mean increases community size enacted by about 69% (95% CI: 6.3% to 272%). These results are consistent with claims that *when Congress is able to agree* to pass legislation during periods of high interchamber distance, the quantity (here, conceptualized as bills coming from larger communities) of legislation passed may actually be larger than during periods of unified or ideologically similar chambers. Note that there is no significant effect for divided government, indicating that all else equal, it has no effect on the size of communities enacted into law.

Neither of the two bill-level covariates are statistically significant in any of the models. Many of the congress-level variables are statistically significant, and emerge in the expected direction for community size. The number of House moderates increases community size in models 2 and 3, by about 37% for a one standard deviation increase in the number of moderates (95% CI: 10.7% to 69%). Interestingly, in model 3 the number of Senate moderates has a negative effect on community size for enacted bills. This finding, along with those in Table 2, suggest that Senate moderates make it easier to pass legislation, but reduce the policy size of those bills which are enacted. The public mood variable is also positive and significant in each of the three models, suggesting—consistent with the theory—that as the public demands more policy change, community size increases. The effect in model 3 is an increase of about 8.25% for a one standard deviation increase in mood liberalism (95% CI: 0.5% to 16.37%). Finally, the number of communities is negative in all models, suggesting that more communities tend to have smaller sizes, resulting in less comprehensive enactments. Each additional ten communities within a Congress decreases the overall size by about 1.35% percent (95% CI: 0.94% to 1.8%).

**Community Passage and Political Conditions**

The above results provide evidence that larger community sizes are enacted during periods of House-Senate differences, but in the following section we address whether or not the House and Senate address fewer policy items on the agenda during these periods. In short, do political conditions affect the ability of Congress and the president *to agree* on legislation, large or small? To answer this question, we use the total number of communities enacted by congressional session and control for various congress-level predictors (including the total number of communities within a Congress, which accounts for the size of the latent congressional agenda). These models are similar to those predicting law enactment, but here we determine what factors affect the enactment of at least one law from a community. Because these variables are at the congress-level, there are only 21 observations (93rd Congress-113th Congresses), producing limited statistical power; accordingly, we employ a limited number of variables.[19] A t-test of the number of communities enacted in divided government (vs. unified government), and in divided chambers (vs. unified chambers) shows evidence that divided chambers results in a reduction.[20] The mean number of communities enacted in unified chambers is 481.7, while in divided chambers it is 348.8 (a statistically significant difference at $p<.02$). There is no similar effect for divided government.

Table 4 suggests that divided chambers and interchamber differences ($p<.061$) reduce the number of communities enacted, controlling for the size of the agenda. The mean number of communities enacted in a congressional term is 443.7 and the standard deviation 136.48. Thus, moving from divided to unified government will increase the number of communities by about .83 of a standard deviation, a substantively large effect (95% CI: .31 to 1.36 of a standard deviation). The results are similar for greater interchamber distance; moving from maximum interchamber distance to minimum interchamber distance will increase the number of communities enacted by slightly more than one standard deviation (95% CI: .02 to 2.07 of a standard deviation). Other results are consistent with expectations. In all three models, the number of communities—a control variable

[19]The small number of observations is standard practice when predicting legislative activity at the Congress-level. Binder (1999), for example, has 22 observations.

[20]The 97th through the 99th Congresses had divided control of the chambers, as did the 107th after James Jeffords of Vermont began caucusing with the Democrats six months into the congressional session.

for the number of items on the congressional agenda—increases the number of enacted communities. In model 2, the number of Senate moderates is also positively related to more community enactments, though the variable is not significant in models 1 and 3.

Table 4: Regression Models of Number of Communities Enacted by Congress

| Independent Variables | (1) | (2) | (3) |
|---|---|---|---|
| Divided Gov. | −48.06 | | |
| | (41.93) | | |
| Divided Chambers | | −113.81* | |
| | | (36.59) | |
| Interchamber Distance | | | −307.30# |
| | | | (151.29) |
| No. House Moderates | −0.02 | −1.24 | −0.66 |
| | (0.87) | (0.83) | (0.87) |
| No. Senate Moderates | 3.91 | 11.02# | 5.95 |
| | (5.17) | (5.50) | (5.48) |
| No. of Communities (x 100) | 4.27* | 4.37* | 4.64* |
| | (1.14) | (0.85) | (0.92) |
| Public Mood | −1.57 | −2.84 | −1.46 |
| | (6.43) | (5.44) | (5.72) |
| Constant | 117.63 | 123.90 | 98.88 |
| | (354.94) | (346.41) | (328.18) |
| Adjusted $R^2$ | 0.65 | 0.78 | 0.71 |
| N | 21 | 21 | 21 |

*p<0.05. The dependent variable is the number of communities enacted within a Congress. Entries are regression coefficients in with robust standard errors in parentheses.

## Discussion and Conclusion

A principal contribution of these network-derived measures is that they provide us with an estimate of the "denominator" (Binder, 2003). Indeed, with this approach it is

a simple task to characterize overall legislative productivity within a specific Congress. To do so, one can construct a variable which is the proportion of total community size enacted out of the sum total of community size. That is, the denominator is the total size of all communities within a Congress (equal to the number of bills introduced) and the numerator is the total size of communities for which at least one bill was enacted. The result is a measure of the overall productivity of a congressional term, accounting for the size of the latent congressional agenda. As Figure 5 shows, productivity peaked during the Reagan and Bush administrations, despite divided government. Productivity was highest during the 100th Congress (1987-1989), which commentator David Brody noted in the Washington Post in October of 1988:

> "Congress passed laws mandating a major redirection of U.S. trade policy and approved creation of a free-trade zone with Canada. It rewrote the basic welfare law, approved the largest expansion of Medicare in 23 years to cover catastrophic illnesses and ratified the most sweeping U.S.-Soviet arms agreement of recent decades. Despite the conservative political climate, it strengthened two major civil rights statutes and the federal ethics standards, expanded federal programs for the homeless, for drug addicts and AIDS victims, improved environmental programs and provided new protections for workers facing mass layoffs."[21]

The 113th Congress, commonly cited as unproductive, performs well by our measure. This is explained by the size of the denominator; the congressional policy agenda was not very large in the 113th (see Table 1), so Congress had success addressing its limited set of issues. "Important" legislation passed in the 113th include Hurricane Sandy relief, a reauthorization of the Violence Against Women Act, and reauthorization of the Undetectable Firearms Act of 1988. The 111th by comparison, looks less productive but it was working from a much larger congressional agenda. Clearly, our approach to studying legislative productivity gives us another way to characterize Congress in the post-reform period. What should we take away from this network-analytic approach to understanding

[21]The 100th Congress: One of the Most Productive in Decades. Broder, David. The Washington Post, October 26, 1988. Accessed at: `http://articles.chicagotribune.com/1988-10-26/news/8802100600_1_capitol-hill-seats-100th-congress` on October 22, 2017.

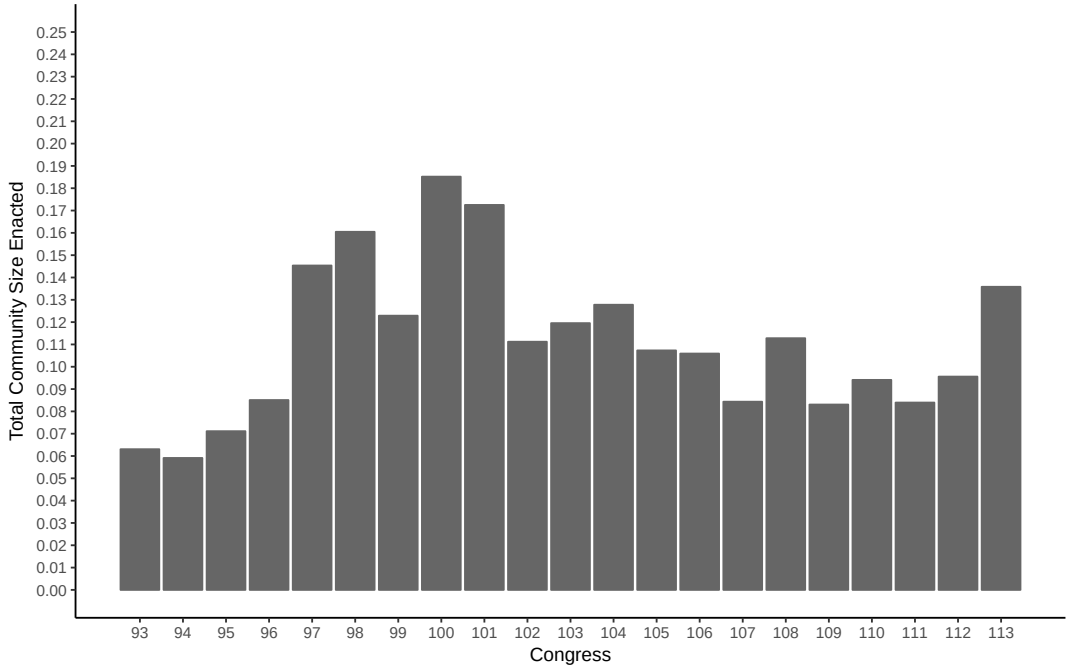


Figure 5: Legislative Productivity by Congress

Bars represent the proportion of the sum of community sizes from all communities with at least one bill enacted into law, divided by the sum of community sizes within a congress.

the business of the institution, and how does it square with previous explanations?

First, our empirical results point to House-Senate differences, as measured by ideology scores and a divided chambers variable, as increasing the number of policy areas which are off-limits to congressional action. Conversely, for those areas on which preferences allow for policy change (i.e., where the status quo lies outside the gridlock interval), an increase in average community size suggests that policy shifts may be quite dramatic and consequential. In fact, when a policy is subject to change under these conditions, we suspect that changes will be more dramatic under conditions of divided chambers as compared to unified government. That is, Congress is more likely to prioritize depth over breadth–perhaps seeing a rare opportunity for significant change (and attendant electoral rewards)–spending more resources on achieving large policy changes, as measured by bill communities. These results generally comport with standard spatial models which account for the location of pivotal actors relative to the status quo, but also show evidence of the multi-dimensionality of policymaking.

Second, our findings also comport with previous research from the states on one

party control promoting laws which are district-oriented, particularistic, and generally more parochial (Gamm & Kousser 2010, Key 1949). During periods of intense two-party competition, members and parties prefer to address broader legislation that improves the perception of the party, while during periods of one-party rule members prefer to improve their own reelection prospects and differentiate themselves from their co-partisans (rather than members of the other party).

Third and most crucially, our results provide empirical support and validation of new measures of the latent legislative agenda. Communities represent agenda items introduced and addressed by Congress, with larger communities denoting more legislative attention being given to particular agenda items. Notwithstanding the critical insights of prior work, extant measures of policy change too often confound the number of bills passed with overall legislative productivity, and measures of the importance of laws are too blunt. Bill degree provides a measure of the importance of a bill, in near real-time, that is independent of media attention, does not require researchers to make subjective evaluations, and is freely available online. One of our key findings—that divided government produces an increase in the average size of bill communities (while also decreasing the number of communities addressed)—is not apparent when examining only bills enacted. Our approach to tracing the legislative process provides a reconceptualization of productivity and policymaking within the modern Congress, as well as an array of measures for scholars to use in adjudicating between existing theoretical frameworks.

# Appendices

## Appendix 1

## Complications Arising from Miscellaneous Trade (MTB) Legislation

Miscellaneous trade bills were produced using a special process in Congress. These bills are introduced by members of Congress on behalf of U.S. importers who seek to reduce or suspend tariffs on some imports. Typically, the committees with jurisdiction over trade, House Ways and Means and Senate Finance, solicit the introduction of these bills from members, which are then included in a larger MTB package. The individual bills must meet certain requirements and are reviewed by the U.S. International Trade Commission and U.S. Customs and Border Protection. (See "CRS Report: Miscellaneous Tariff Bills: Overview and Issues for Congress, 2012" available here: `https://fas.org/sgp/crs/misc/RL33867.pdf`, and an updated version of the report from 2016 available here: `http://nationalaglawcenter.org/wp-content/uploads/assets/crs/RL33867.pdf`.)

According to CRS, this practice began in the 97th Congress, with at least one MTB bill passing in most, though not all Congresses. It appears that CRS began tracking the individual bills as related legislation, but stopped doing so after the 102nd Congress, likely because of the growth in the number of individual bills introduced. CRS estimated that about 1,800 bills were introduced in the 112th Congress . The result is that a number of bills from the 97th through 102nd Congresses with very large degree and community size measures are MTBs. Fortunately, the CRS reports referenced above include a list of MTB legislation. Using this list, we created an indicator for an MTB bill and re-estimated the models without these bills. Their inclusion does not affect the results as there are only 23 bills out of more than 225,000. Further, we keep these in the dataset because though the individual bills are not tracked in later Congresses, the CRS does track related bills that are procedurally important to the MTB. For example, in the 109th Congress, H.R. 4, "The Pension Protection Act" is related to MTB H.R. 4944, as the bills were combined.

To avoid the introduction of hundreds or thousands of trade bills, Congress changed the process in 2016. U.S. importers are now required to submit their request to the

U.S. International Trade Commission, which reviews the request and determines if it is appropriate to include in the MTB legislation. See: https://www.usitc.gov/press_room/news_release/2016/er091411657.htm. This gives us confidence that extending the data into future Congresses will not be affected by MTBs.

## Appendix 2

## An Example of the Relationship Between Bills Within a Community

To further elucidate the relationship between bills within a community, Table A.1 again returns to the 110th Congress, displaying the nine bills which are members of the 110-136 community. Three of the bills, H.R. 1585, S. 1547, and H.R. 4986 were salient/controversial and received substantial coverage in CQ, while four bills have more than one degree of connection to the other bills in the community. However, only one bill actually became law: H.R. 4986.

Table A.1: Bills in the P.L. 110-181 Bill Community

| Bill Number | CQ Article Lines | Degrees | Introduction Date | Public Law Number | Community |
|---|---|---|---|---|---|
| H.R. 1585 | 1659 | 6 | 3-20-2007 | NA | 110-136 |
| S. 1547 | 1620 | 4 | 6-5-2007 | NA | 110-136 |
| S. 1548 | 0 | 2 | 6-5-2007 | NA | 110-136 |
| S. 986 | 0 | 2 | 3-26-2007 | NA | 110-136 |
| H.R. 4986 | 1659 | 2 | 1-16-2008 | 110-181 | 110-136 |
| S. 179 | 0 | 1 | 1-4-2007 | NA | 110-136 |
| S. 1549 | 0 | 1 | 6-5-2007 | NA | 110-136 |
| S. 1550 | 0 | 1 | 6-5-2007 | NA | 110-136 |
| S. 1944 | 0 | 1 | 8-2-2007 | NA | 110-136 |

Note that the community number is a counter and does not have a relationship to bill or law numbe

# Appendix 3

## Histogram of Community Sizes in the Dataset

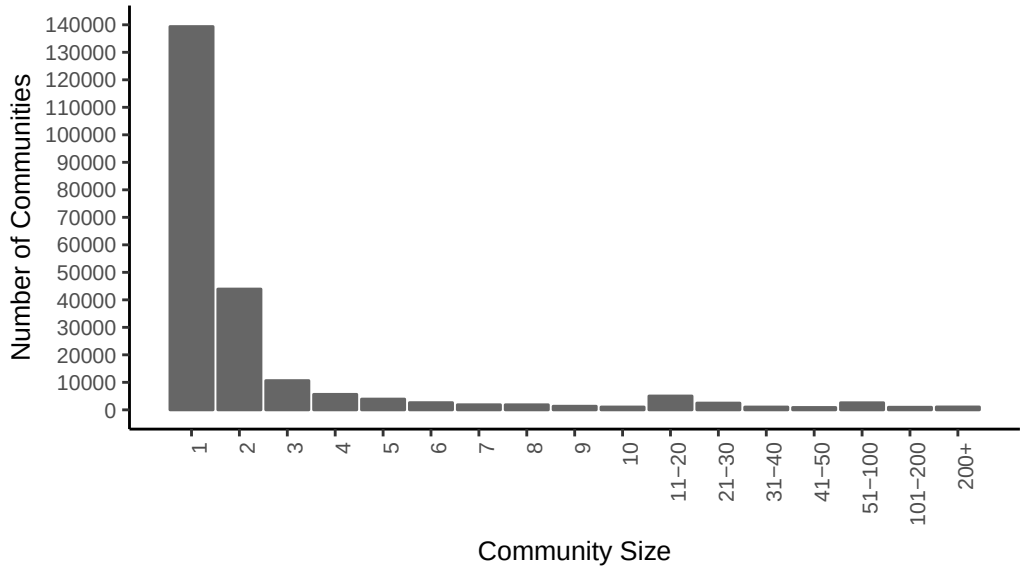


Figure 6: Distribution of Community Sizes

Bars are the number of communities within each range labeled on the x-axis.

# Appendix 4

## Predicting the Degree (Centrality) of a Bill

Table A.2: Regression Models of Bill Degree

| Independent Variables | (1) | (2) |
|---|---|---|
| CQ Article Lines Logged (Ordinal) | 0.54* | 0.35* |
| | (0.01) | (0.12) |
| Bill Sponsored by Committee Chair | 0.06* | 0.38# |
| | (0.01) | (0.21) |
| Public Law | 0.27* | |
| | (0.02) | |
| Clinton-Lapinski Significance | | 0.73* |
| | | (0.23) |
| Mayhew Law | | 9.92* |
| | | (0.70) |
| Constant | 0.76* | 0.94# |
| | (0.01) | (0.48) |
| Fixed effects | Included | Included |
| Adjusted $R^2$ | 0.03 | 0.09 |
| N | 206,720 | 4,99 |

#p<0.1; *p<0.05. The dependent variable is the number of logged degrees for a bill. Model 1 includes all bills, model 2 includes only public laws. Entries are regression coefficients with robust standard errors in parentheses. Varying intercepts for Congress are included in all models.

**Appendix 5**

## How CRS Identifies Previously Introduced Bills

There is some question about whether CRS updates bills that have already been introduced to indicate that they are connected to a newly introduced bill. A representative from CRS told us that they do, but Wilkerson et. al. 2015 suggest CRS does not, and the small number of observations above, indicating connections to previously introduced bills, suggest that CRS is inconsistent. For our purposes, however, whether CRS updates previously introduced bills is irrelevant. Our data is not directional, thus when a bill is introduced and it is deemed related to a previously introduced bill, those bills are connected in our data. Whether the first bill introduced indicates it is connected to the second introduced bill on Congress.gov does not matter because we will capture the relationship between the two bills through the related designation for the second bill.

# Appendix 6

## Alternative Specification for Table 3

Table A.3: Mixed Effects Regression Models Predicting Legislative Quantity Enacted into Law (Logged Community Size)

| Independent Variables | (1) | (2) | (3) |
|---|---|---|---|
| **Bill-Level Vars.** | | | |
| Average CQ Article Lines (Ordinal) | 0.031* | 0.032* | 0.032* |
| | (0.007) | (0.007) | (0.007) |
| Average Sponsored by Committee Chair | 0.033 | 0.034 | 0.033 |
| | (0.018) | (0.018) | (0.018) |
| **Congress-Level Vars.** | | | |
| Divided Gov. | 0.036 | | |
| | (0.030) | | |
| Divided Chambers | | 0.090* | |
| | | (0.031) | |
| Interchamber Distance | | | 0.487* |
| | | | (0.183) |
| Average No. House Moderates | 0.000 | 0.001 | 0.001 |
| | (0.001) | (0.001) | (0.001) |
| Average No. Senate Moderates | 0.000 | −0.007 | −0.007 |
| | (0.005) | (0.005) | (0.005) |
| No. of Communities (x 100) | −0.003* | −0.003* | −0.003* |
| | (0.001) | (0.001) | (0.001) |
| Public Mood | 0.012* | 0.012* | 0.010* |
| | (0.004) | (0.004) | (0.004) |
| Constant | −0.030 | 0.026 | 0.151 |
| | (0.287) | (0.241) | (0.257) |
| Random Effects Parameters | | | |
| Var(Congress) | 0.029 | 0.027 | 0.039 |
| | (0.01) | (0.01) | (0.01) |
| AIC | 16892.355 | 16885.855 | 16886.903 |
| N | 8,815 | 8,815 | 8,815 |

*p<0.05. The dependent variable is community size. Communities are only included where at least one bill became law. Entries are mixed-effects negative binomial coefficients with standard errors in parentheses.

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