Extended Abstract: Revealing the Anatomy of Vote Trading

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Summary. Cooperation in the form of vote trading, also known as logrolling, is central for law-making processes, shaping the development of democratic societies. Despite being broadly covered in the theoretical politico-economic literature [1–8], empirical evidence of logrolling is scarce and limited to highly specific situations because existing methods are not easily applicable to broader contexts. We have developed a general and scalable methodology for revealing a network of vote traders, allowing us to measure logrolling on a large scale. Analysis on more than 9 million votes spanning 40 years in the U.S. Congress reveals a higher logrolling prevalence in the Senate and an overall decreasing trend over recent congresses, coincidental with high levels of political polarization. Our method is applicable in multiple contexts, shedding light on many aspects of logrolling and opening new doors in the study of hidden cooperation.

Method. Building on previous empirical work on logrolling [9, 10], we develop a simple theoretical framework in which a traded vote is a deviation from a legislators’ inherent political position in the context of a narrow vote outcome. In line with this theory, our method is then developed based on four well accepted theoretical principles:

1. Incentives to trade votes are stronger the narrower vote outcomes are.
2. If a legislator trades a vote, then he or she votes in the opposite direction to what would be predicted, i.e. the legislator deviates from his or her preferred position.
3. A deviation is considered a potential trade if it is directed to benefit a legislator with a clear interest in passing the bill that is being voted on.
4. Directed deviations are considered traded votes only if they are reciprocal and mutually profitable.

In a first step, we apply the Bayesian approach suggested by [11] to compute a legislator’s typical policy position based on a vast set of roll call votes that were decided with a large margin (thus, in the absence of incentives to trade votes). Second, by looking at those individuals who vote against their typical position in bills that are passed by a narrow margin, we identify potential vote traders. Specifically, if a legislator’s predicted decision on a specific bill is ‘no’ but the real decision was ‘yes’, we code the vote as a deviation. Third, we employ data on bills’ (co-)sponsorships in order to capture which legislators have strong preferences for what bills. Then, steps two and three are

[1] Full paper available in arXiv 1611.01381v1
combined in order to construct the directed deviations network (DDN). In order to do so, we check for each coded deviation of each legislator $i$ which legislator $j$ sponsored the bill in favor of which $i$ deviated from his typical voting behavior, and draw a directed link from $i$ to $j$. Formally, the DDN is a multi-graph represented by the adjacency matrix $W$ where the entry $W_{ij} > 0$ if $i$ deviates one or more times in benefit of $j$, and $W_{ij} = 0$ otherwise.

Some of these deviations are the result of idiosyncratic shocks in the legislators’ decisions. However, some others may be the result of vote trading. When two legislators engage in vote trading, a reciprocal pattern of directed deviations emerges, namely we would observe edges $(i, j)$ and $(j, i)$. If $i$ and $j$ are persistently engaging in vote trading, this pattern strengthens through the weight of their connections. In order to distinguish those links in the DDN that are the result of reciprocal behavior from those that come from random deviations, we need a measure of reciprocity and a method that accounts for the underlying mechanism of voting behavior of legislators.

We refine the well-established reciprocity index for directed weighted networks developed by [12]. Our refinement corrects for an inflation bias present in the context of vote trading, and we validate it via Monte Carlo simulation. This correction yields the ratio

$$r = \frac{2R}{\sum_i^N \sum_{j \neq i}^{N} W_{ij}},$$

(1)

where $R$ is the number of legislators that trade at least one vote, and $W_{ij}^\leftrightarrow = \min [W_{ij}, W_{ji}] = W_{ji}^\leftrightarrow$ is the reciprocated weight between legislators $i$ and $j$.

By itself, $r$ is insufficient to understand if the observed level of reciprocity is statistically significant. In order to assess this, we test the alternative hypothesis that voting deviations are the result of random errors rather than intentional behavior to benefit other legislators, i.e. every vote is modeled as an independent Bernoulli random variable. We generate computational simulations of voting outcomes in order to produce an ensemble of DDNs, computing (1) for each of these ‘null’ networks. The average over this ensemble of estimators is $\bar{r}_0$, and following [12] we then construct the logrolling index

$$\ell = \frac{r - \bar{r}_0}{1 - \bar{r}_0}.$$  

(2)

Positive values of $\ell$ indicate that legislators tend to deviate in a reciprocal fashion suggesting vote-trading activity. Based on the jackknife-procedure suggested by [12] we compute confidence intervals for $\ell$, in order to calibrate the method, and then remove non-reciprocal links from the DDN. This leaves us with the vote trading network (VTN), revealing the structure of vote trading.

**Results.** In a first application of our method we study the structure and prevalence of vote trading in the U.S. Congress. In order to do so, we construct a large-scale database that includes detailed micro-data on all federal legislators, roll call votes, and (co-)sponsorships in the United States over
We find evidence for vote trading in both chambers, with a higher \( \ell \) in the U.S. Senate. This finding is in line with the qualitative and theoretical literature on logrolling which stresses the importance of long tenureships in order to have stable trade relationships. The extracted VTNs give first empirical insights on the anatomy of vote trading in American national politics. Table 1 summarizes the results based on the extracted VTNs. Interestingly, there is a substantial part of bipartisan trades, indicating that hidden collaboration in the form of vote trading might be a mechanism to overcome policy of obstruction due to stringent party politics.

Table 1: VTN summary statistics

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Senate</th>
<th>House</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average reciprocity</td>
<td>0.019 ± 0.008</td>
<td>0.008 ± 0.002</td>
</tr>
<tr>
<td>Legislators</td>
<td>140 (37.14%)</td>
<td>538 (31.17%)</td>
</tr>
<tr>
<td>Bills</td>
<td>71 (68) [1]</td>
<td>320 (217) [1]</td>
</tr>
<tr>
<td>Bills</td>
<td>810 (0.07%)</td>
<td>4,114 (0.05%)</td>
</tr>
<tr>
<td>Average degree</td>
<td>11.57</td>
<td>15.29</td>
</tr>
<tr>
<td>Average trading partners</td>
<td>5.27</td>
<td>7.41</td>
</tr>
<tr>
<td>Highest degree (partners)</td>
<td>74 (32)</td>
<td>136 (67)</td>
</tr>
<tr>
<td>Average trades per partnership</td>
<td>2.20</td>
<td>2.07</td>
</tr>
<tr>
<td>Average years between trades</td>
<td>4.78</td>
<td>4.21</td>
</tr>
<tr>
<td>Most central party (votes traded)</td>
<td>Democrat (416)</td>
<td>Democrat (2,737)</td>
</tr>
<tr>
<td>Democrat trades</td>
<td>157</td>
<td>1,874</td>
</tr>
<tr>
<td>Republican trades</td>
<td>143</td>
<td>522</td>
</tr>
<tr>
<td>Bipartisan trades</td>
<td>510</td>
<td>1,718</td>
</tr>
</tbody>
</table>

Average reciprocity is the mean of \( \ell \) in its positive and statistically significant region. We report its average 95% confidence interval. The average number of years between trades was calculated by averaging the difference between the dates of all possible exchanges of each dyad from the DDN. This was necessary because in reality we do not know which precise vote was traded for which other.

While far from conclusive, our results present first insights into vote trading as a means to potentially overcome political obstruction generated by increasing ideological polarization. However, such hidden cooperation in the presence of increasing polarization seems to be only possible up to a certain point of ideological cleavage. Insights in this direction are important in informing the design of democratic institutions. More broadly, the ability to detect and measure hidden cooperation such as logrolling might reveal important insights about the dynamics underpinning hidden human cooperation in general.

\(^2\)Our data covers the period from 1973 to 2014. All raw data on roll calls and bill sponsorship were provided by [13]. The Civic Impulse LLC. supplies information extracted from official US government websites as JavaScript Object Notation (JSON) data files via their webservice [www.govtrack.us]. All data are freely accessible through GovTrack’s application programming interface.
References


