

## Table of Contents

|  |    |
|--|----|
| 1. Introduction                            | 3  |
| 2. Problem Statement and Research Question | 3  |
| 3. Literature Review                       | 4  |
| 4. Methodology                             | 5  |
| 4.1 Analysis plan                          | 5  |
| 4.2 Dataset                                | 5  |
| 4.3 Statistical approach                   | 6  |
| 5. Findings and Discussion                 | 7  |
| 6. Conclusion                              | 12 |
| 7. Bibliography                            | 14 |
| 8. Statistics                              | 16 |
| 8.1 Correlation Matrices                   | 16 |
| 8.2 Plots                                  | 17 |
| 8.3 Tables                                 | 18 |

## 1. Introduction

Institutions such as state parliaments provide the foundation for decision-making within democratic political systems. Consequently, members of parliament ("MPs") and their cooperative behavior in the parliamentary decision-making process are essential for the political development of a democracy. Closely connected is the parliamentary accountability as described by Attina (1990), referring to "people ascribing responsibility for decisions and policies to their elected representatives and the parties therein organized". Kaskarelis (2010) found that the principal-agent problem is a common phenomenon observed in politics as decision-making responsibilities are assigned to MPs by voters. The "asset of the vote" can be used by politicians to favor their own pursuits instead of fulfilling the voter mandate (Kaskarelis, 2010). Because this accountability is a vital property of democratic institutions it is worthwhile to examine the cooperative behavior of MPs in their respective parliaments, potentially delineating political inefficiencies and assessing how political developments affect cosponsorships.

To investigate, this paper conducts a network analysis of the bill cosponsorship behavior of different MPs in the Swedish Parliament in three legislation periods between 2002 and 2014. After clarifying the problem, hypotheses and the corresponding research question, the paper provides a short literature review on past academic articles that are concerned with cooperative behavior within state parliaments. Subsequently, the methodology and relevant findings of the network analysis are presented and discussed. The paper concludes with the main results as well as limitations and avenues for future research.

## 2. Problem Statement and Research Question

As initially stated, members of parliament and their cooperative behavior in the parliamentary decision-making process influence the policy output of the parliamentary institution, leading to the conflict of politicians' own interests and the voter mandate, also described as the principal-agent problem. Hence, the issue is worthwhile to investigate to better understand the political decision-making process and the factors influencing it.

Three core hypotheses constitute the research body of this paper. As the political landscape is changing, its impact could be represented in MP behavior. Firstly, the authors expect that general political polarization decreases collaborative behavior between parties over time. As parties find decreasing consensus on issues, they collaborate less. Over time, collaborative behavior in the parliament thus decreases (**H1**). In this trend of polarization, there is less collaboration from centered parties towards those with extreme views, both right and left. However, this trend is stronger for conservative, right-wing parties because members of moderate parties do not want to be associated with far-right populist views (Rydgren, 2010) (**H2a**). This trend is weaker towards the far-left because such views are perceived as less extreme and therefore dangerous for the reputation of a party (**H2b**). Finally, parties with lower popularity/voter share engage more in collaborative behavior to strengthen their effective influence on policy output (**H3**). Besides membership in a party and corresponding party popularity, other demographic factors such as gender and age may influence who cosponsors with whom, which should be investigated.

Finally, the main research question of this paper is the following: "How do party membership, party popularity, and demographic characteristics influence members of the Swedish parliament in their bill cosponsorship activities?"

### 3. Literature Review

Past literature has already investigated several issues associated with political institutions and their contributions to the principal-agent problem.

An article written by Costello et al. (2012) examined how well democratic representation works within the European Union. The authors state that policy preferences are not one-dimensional, implying only a partial congruence between voters and MPs in Europe. Hence, they found a substantial gap between politicians and the electorate especially on the cultural dimension, implying a possible explanation for the success of populist parties as they aim to mobilize voters on precisely that by characterizing themselves as "close to the people".

Building upon these findings, Lee et al. (2004) investigated data on US House Representatives from 1946 to 1995, concluding that voters do not affect policies, but rather elect policies formed by politicians. Moreover, it was found that exogenous changes in the relative popularity of a candidate do not influence their political position. Closely connected are the results of Ågren et al. (2006), who analyzed the relationship between the preferences of citizens and the preferences of their elected representatives based on Swedish survey data. The authors mainly conclude that there is a major difference regarding preferences towards local public services. Thus, this result indicates that the representation of different socio-economic groups does not necessarily lead to a larger degree of representation of these groups' political agendas. A possible explanation for this interesting finding is the specific selection of politicians by parties as well as strategic voting induced by parts of the society. Since the authors analyzed Swedish data, these results provide a pivotal foundation for our network analysis and its implications in the following section.

Moreover, several academic articles delineate bill cosponsorship behaviors by specifically analyzing political cooperation between MPs within state parliaments. Fowler (2006) conducted a network analysis on the cosponsorship networks in the US House and Senate. One compelling finding is the significant occurrence of mutual cosponsorships, implying that bill authors who receive support tend to return the favor. This may already constitute a ground for political inefficiency, because decisions are based on mutual sympathy rather than objective preference.

As demographic factors such as gender and age can significantly influence cooperative behavior by MPs, past literature thoroughly covered this topic field. One prime example is the paper by Swers (2005) that analyzed sex differences in cosponsorship activity by investigating the 103d and 104th US congresses. Consequently, the author reveals that female legislators are more likely than their male colleagues to cosponsor legislation in four of the five issue areas examined, including education, children-and-family, women's health, and general health issues. Moreover, the paper concludes with the investigation that

Democratic and Republican women are more likely to take the lead in cosponsoring legislation on gender gap issues when they are in the majority party. Keeping these interesting results in mind, our analysis will incorporate regressions that capture the effect of sex on the number of cosponsorships in the three legislation periods of the Swedish parliament. Similar results would therefore further validate the significant impact of sex on cooperative behavior.

As the parliamentary decision-making process heavily depends on the development of the political landscape in the corresponding country, referring to articles on the rise of populist parties is essential. Rydgren (2010) tries to explain why radical right-wing populist parties ("RPPs") have been successful in Denmark, but relatively failed in Sweden. The main explanation is that the immigration issue was highly politicized in Denmark, whereas in Sweden, socio-economic topics dominated the agenda. The political failure of RPPs is an essential feature of the development of Sweden's state parliament and can explain specific network analysis findings that this paper covers.

Conversely, Heinze (2017) examined the reasons for the successful journey of RPPs in Sweden as the author delineated the strategic reaction of established parties towards the rise of right-populist parties in nordic countries. The paper concluded that in all four countries (Finland, Denmark, Sweden, and Norway) mainstream parties initially reacted with disengage strategies, though the consistent exclusion of right-wing populists only happened in Sweden. It is worthwhile to investigate evidence of such exclusion of RPPs by centered parties in our network analysis.

## **4. Methodology**

### *4.1 Analysis plan*

Section 4 describes the data used, statistical methods employed and findings generated to investigate the three central hypotheses stated in section 2. Section 4.2 describes the source and contents of the dataset. Section 4.3 describes how a top-down approach to descriptive and inferential statistics as well as visual plots was used to delineate causal and significant relationships between variables.

### *4.2 Dataset*

In order to answer the research question, a sound database is essential. The dataset for subsequent analysis is compiled from data made publicly available by the Riksdagen, the Swedish parliament. It was assembled by Francois Briatte in 2015, who compiled the information using code in R which is open-sourced in Github (Briatte, n.d. A; Briatte, n.d. B; Briatte, n.d. C).

The three datasets each contain information about members of the Swedish parliament corresponding to one legislative period of four years. The nodes of the network are the different members of the parliament in the given legislative period, i.e. one node corresponds to one MP. The vertex attributes within our datasets are "Name" and "Color", where "Name"

refers to the name of the corresponding MP whereas color denotes the HEX code referring to the legend color of a specific party, which can be translated into party membership by using the legend provided by Briatte. The edges between the nodes depict that two members of the parliament cosponsored at least one bill together. Weights thus count how many times one MP cosponsored another, while the network is undirected. For more extensive information, Briatte's datasets are joined with information manually compiled from the Swedish Riksdagen on MP gender and age (Riksdagen, n.d.), thereby expanding the vertex attributes available. Thus, node attributes are name, party membership, age, and gender. In addition, voting results in % were compiled from the Swedish voting authorities.

#### *4.3 Statistical approach*

This paper uses a top-down approach in order to generate findings and conclusions from the data previously collected. We start with generating descriptive statistics to obtain initial insights into the dataset, after which inferential statistics may or may not confirm the significance of trends and relationships apparent from examining plots and descriptive statistics. The network datasets are transcribed into an igraph format using R. Afterwards, with the help of Excel and R, several statistical measures can be generated. We focus on common ones, like average degree, density, and diameter, because these allow for clear insight into the data without overcomplicating astray from the central information necessary. Thus, the measures already allow for some interesting conclusions about the validity of hypotheses, which will be discussed in section 5.

The central hypotheses of this paper may be tested by examining numerical data alone. However, the visual aspect of network analysis may not be underestimated, which is why a central part of our methodology is to plot the graphs and examine whether the trends apparent from descriptive statistics alone can be confirmed by examining network plots of the nodes and edges within the parliament cosponsorship. Thus, three plots were created, which can show strong trends, like new parties entering the parliament, party clusters separating from each other, and also visualize how parties increase or decrease their cosponsorship behaviour.

From examining the descriptive statistics and comparing them with the plots, key trends and developments became apparent. However, no clear conclusion can be made on the significance of these trends. Thus we introduce inferential statistics to allow for validation. In this process, we first run an ANOVA-test for difference in means between average degree of a node. Then, we run several univariate regressions on the list of nodes and their attributes to mainly examine the relation between degree and the factors political orientation of a party, popularity of a party, age, and sex of an MP.

To analyze the impact of political orientation on cosponsorship, a 10-point scale quantifying the political orientation of parties was set up. 0 is defined as far-left socialist, while 10 is right-wing nationalist. The intermediate 5 indicates a centered party. Liberals and conservatives are rated between 5 and 10. Conversely, social democratic parties are rated between 0 and 5. The ranking depicted in table 1 serves as a broad proxy for the political

orientation and should be interpreted cautiously, as it was conceived independently by the authors themselves.

*Table 1: Political parties and the corresponding political point scale based on orientation*

| Party               | Political Orientation | Points |
|---------------------|-----------------------|--------|
| Vänsterpartiet      | Left                  | 0      |
| Socialdemokraterna  | Social Democratic     | 3      |
| Miljöpartiet        | Center                | 5      |
| Independent         | n.a.                  | 5      |
| Folkpartiet         | Liberal               | 6      |
| Centerpartiet       | Liberal               | 6      |
| Moderaterna         | Conservative          | 8      |
| Kristdemokraterna   | Conservative          | 8      |
| Sverigedemokraterna | Right                 | 10     |

If generated regression coefficients have high significance they can explain large amounts of the variation in the degree variable, and thus serve as explanan for certain behaviour within the parliament. The findings of these analyses are shown in the following section.

## 5. Findings and Discussion

Before interpreting results, a development in the basic structure of the Swedish landscape is important to understand. Between 2002-2010, new political parties and movements, which were not very old and whose foundations date back 10 to 15 years, started to become popular in the political landscape of Sweden. These changes started to challenge the ideological left-right scale which was previously established (Elgenius & Wennerhag, 2018). In the datasets, we can see that the Swedish Social Democratic Party, which had a hegemonic position until the periods we examined, started to lose this position. Prior, the hegemonic position of the Swedish Social Democratic party had been not making radical mobilization possible by serving as a "shield" (Rydgren, 2018). Therefore, this provided room for radical right-wing mobilization, which is reflected by the increasing popularity of the Sverigedemokraten (Rydgren, 2010).

Table 2 allows for interesting insights into the datasets, supported by correlations in table 8.1.1.

Table 2: Descriptive statistics for three legislation periods

| <i>Measure</i>              | <b>2002 - 2006</b> | <b>2006 - 2010</b> | <b>2010 - 2014</b> | <b>Δ 2002-2010</b> |
|-----------------------------|--------------------|--------------------|--------------------|--------------------|
| <i>Number of Nodes</i>      | 395                | 390                | 387                | - 2.03%            |
| <i>Number of Edges</i>      | 6094               | 5363               | 4691               | - 23.02%           |
| <i>Average age</i>          | 67.9               | 63.3               | 58.7               | - 13.55%           |
| <i>%female</i>              | 46.7%              | 47.4%              | 44.9%              | - 3.85%            |
| <i>Mean Degree</i>          | 30.85              | 27.50              | 24.24              | - 21.43%           |
| <i>Median Degree</i>        | 29                 | 25                 | 21                 | - 27.59%           |
| <i>Standard Dev. Degree</i> | 17.72              | 19.35              | 18.41              | + 3.89%            |
| <i>Density</i>              | 0.078              | 0.071              | 0.063              | - 19.23%           |
| <i>Average path length</i>  | 3.18               | 3.46               | 4.71               | + 48.11%           |
| <i>Global efficiency</i>    | 0.36               | 0.34               | 0.24               | - 33.33%           |
| <i>Diameter</i>             | 11                 | 23                 | 12                 | + 9.09%            |

The number of nodes, i.e. MPs, has decreased slightly over the years, while the simultaneous decrease in the number of edges of 23% is disproportionate and implies that the average number of co-sponsorships by an MP has decreased. This observation is depicted in Graph 1 showing the degree evolution of the Swedish parliament in three box plots corresponding to the legislation periods. The increase of outliers over time could be explained by certain politicians becoming more and more influential in their parties. Cosponsorship, in general, became less prevalent over the observed period. An ANOVA-analysis of the trend confirms the high significance, as shown in table 2. There is strong support for H1.

Graph 1: Average Degree per MP in boxplots by legislation

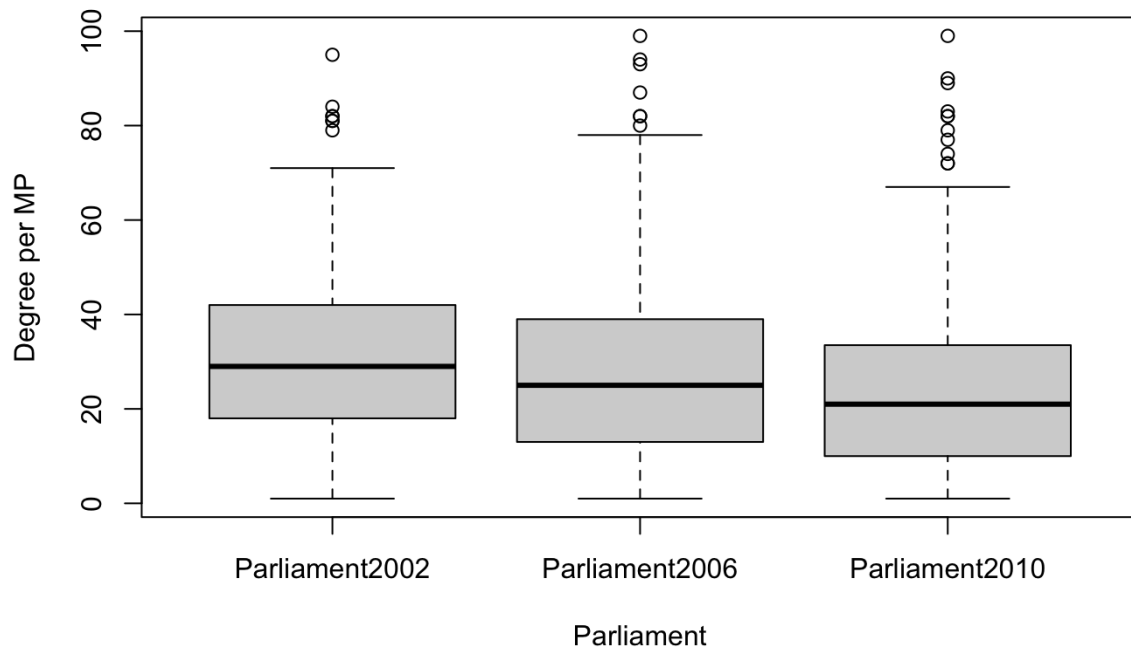


Table 3: Single-Factor ANOVA analysis for difference in means between degree samples

| SUMMARY   |        |       |        |          |          |              |
|---|--------|-------|--------|----------|----------|--------------|
|   | Groups | Count | Sum    | Average  | Variance |              |
|   | 2002   | 396   | 12235  | 30.89646 | 313.7639 |              |
|   | 2006   | 392   | 10780  | 27.5     | 372.6957 |              |
|   | 2010   | 390   | 9418   | 24.14872 | 338.6513 |              |
|   |        |       |        |          |          |              |
|   |        | Df    | Sum Sq | Mean Sq  | F value  | Pr(>F)       |
| year  |        | 2     | 8947   | 4474     | 13.1     | 2.37e-06 *** |
| Residuals   |        | 1175  | 401396 | 342      |          |              |
| ---   |        |       |        |          |          |              |
| Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1 |        |       |        |          |          |              |

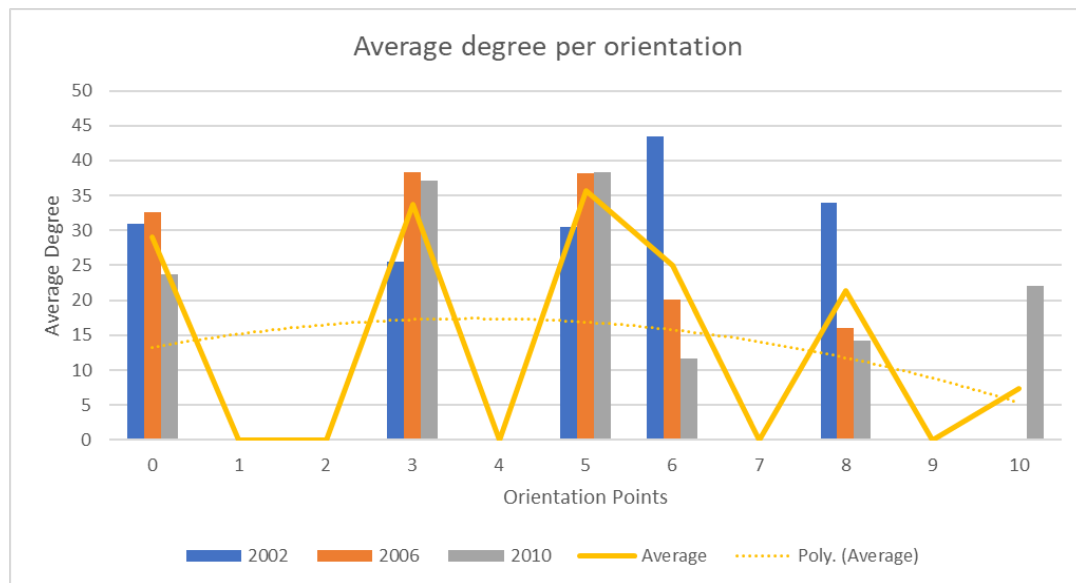
Appendix 8.2 contains plots of the three networks. The graphs became less dense over time as the members of different parties isolated themselves more, reflecting the trend of decreasing density and cosponsorship identified in table 3. Most strikingly, the 2010 parliament is significantly more separated compared to the previous two, implying that MPs mainly cosponsored bills of MPs of the same party. The new RPP "Sverigedemokraten" ("Sweden Democrats") stands out as its members are isolated and did not cosponsor with other parties, relating to H2a. The hub structure of the network, caused by nodes i.e. MPs clustering in their respective parties, makes the networks resemble a scale-free style.

The "Alliance for Sweden" (2006-2014), a coalition of four center-right parties (The Moderate Party, The Centre Party, The Christian Democrats, The Liberals), and their attitude against radical right-wing parties in the relevant period play a central role in explaining the findings. It must be noted that parties in the "Alliance for Sweden" tended to avoid actions that will threaten the coalition between the parties, and tended to focus on safer issues that would create less discussion among them. Thus, they generally ignored issues such as immigration (Rydgren, 2018). Consequently, the implication of this situation is that right-wing parties were hesitant to propose and collaborate on bills targeting issues related to the right political spectrum. Moreover, they formed a block against the radical right-wing party (Sweden Democrats) by refusing to cooperate with the Sweden Democrats and following the cordon sanitaire policy (Heinze, 2017). This behavior is clearly evident from the network analysis and plots, where the Sverigedemokraten is isolated. It should also be noted that in this period, the refusal to collaborate with the radical right-wing party was adopted not only by the center-right parties but also by the left parties (Heinze, 2017).

Thus from the established literature H2a expects that right-wing parties are less attractive for cosponsorship because of negative stigma and association with views that are unacceptable to the moderate public. The regression results of political orientation on MP degree in tables 8.3.7, 8.3.8, and 8.3.9 reveal interesting and significant findings. Furthermore, Graph 2 visualizes the average degree per party based on orientation points.



*Graph 2: Average degree of MPs by membership in parties by political orientation*



In the first legislation period, parties to the conservative end of the political spectrum tended to cosponsor more, as implied by the positive regression coefficient; this is driven by conservative parties (5 and 8 points), and not right-wing extremist ones. However, this trend heavily inverted in the following two periods, where left parties cosponsored more. In this context, especially the change from positive to negative coefficient is striking. This may be explained by the trend in Swedish politics, where center-left parties isolate themselves from the right (cf. Heinze, 2017). Finally, average degree for the Sverigedemokraten (10 points) was comparatively high, which is explained by the members cosponsoring each other (cf. Graph 8.2.3) as expected in a scale-free network.

Specifically, well-established and centered parties formed a block against the newly entered RPP and diverged from cooperating with parties associated with the right political spectrum. As depicted in Graph 2, this observation holds true, especially for the Social Democrats, Vänsterpartiet, and Miljöpartiet who visibly dissociated themselves from the other parties. In a way, the increasing popularity of the Sweden Democrats prohibited established parties from cosponsoring in their usual way, with the previously prevalent conservative parties.

The previous results imply that the more left on the spectrum a party is, the more it cosponsors. Graph 1 however shows that this relation does not hold indefinitely. The polynomial best-fit trendline of average degree is hill-shaped. Ergo, cosponsorship is most prominent around parties in the political center, and tends to increase for parties slightly left of the center. Notably however, the negative trend of cosponsorship towards the extremes is stronger for the political right than for the political left, supporting both hypotheses H2a and H2b. Apparently, even though extreme parties are commonly less favored partners for collaboration, left parties are relatively preferred.

Through cosponsorships, MPs can influence the style and content of a bill. Thus, H3 expects that smaller parties with few MPs in the parliament aim to increase their input on

policy output by cosponsoring and thus affecting more bills than MPs of more established parties would. The regression of MP degree on party popularity (% votes) reveals interesting and highly significant insights summarized in Table 4.

*Table 4: Estimated coefficient and significance of votes as a predictor by legislation*

| <b>Legislation Period</b> | <b>Estimated Coefficient of "Votes" Variable</b> | <b>P-value</b> |
|---------------------------|--|----------------|
| 2002-2006                 | -36.686  | 1.1e-09        |
| 2006-2010                 | 38.499   | 8.55e-07       |
| 2010-2014                 | 26.609   | 0.000673       |

In the first legislation periods, smaller parties did indeed engage in cosponsorship significantly more than their larger counterparts. Strikingly, however, this trend inverted strongly following 2006, where the regressions reveal a significantly positive association of degree with % votes. Concluding, there is no significant evidence supporting H3, which is thus discarded.

Analyzing political development in the past can explain this observation as the rise of RPPs and their mobilization has significantly influenced the cooperative behavior of especially well-established parties such as the Social Democrats (Heinze, 2017). Bigger parties blocked the emergence of right-leaning parties and therefore got more active in their political influence on bills. This could explain the interesting result of the analysis concerning H3.

Finally, the phenomenon observed by Swers (2005), namely that women engage more in cosponsorship than men, is significant in the Swedish parliament. Evidently in Tables 5 and 8.3.1 - 8.3.3, female MPs engage significantly more in cosponsorship than their male counterparts throughout all observed periods. Combining the implications by Swers (2005) and Rydgren (2010), the result could be explained by the predominant socio-economic agenda in Sweden which includes topics that are prioritized higher by women. In addition, there is no significant relation between cosponsorship and age of an MP, implying that age alone does not affect how an MP cosponsors in the observed data.

*Table 5: Estimated coefficient and significance of female variable as predictor by legislation*

| <b>Legislation Period</b> | <b>Estimated Coefficient of "Female" Variable</b> | <b>P-value</b> |
|---------------------------|---|----------------|
| 2002-2006                 | 4.425   | 0.013          |
| 2006-2010                 | 6.456   | 0.00089        |
| 2010-2014                 | 4.695   | 0.012          |

Literature on politics in Sweden, therefore, provides a possible explanation for why total collaboration in the parliament significantly decreased. The striking decline in cosponsorships induced by right-leaning parties is the major factor for this result.

Further findings can be explained by the Swedish political landscape. For H2a, the significant result described in Graph 2 i.e. that the average degree of MPs by political orientation decreases sharply for right-wing parties can be explained by the center right-wing parties (“Alliance for Sweden”) attempting to avoid being associated with the radical right-wing party (Sweden Democrats). Concerning H2b, Graph 2 also depicts the fact that the rate of cooperation in left-oriented parties does not decrease as sharply as the right-wing parties, which can be explained by the situation in the political landscape of Sweden, as left-leaning parties had less risk of being associated with radical Sweden Democrats compared to center right-wing parties. Thus, our findings imply that the moderate and left political spectrum moved closer together in collaboration to exclude the Sweden Democrats which are taking their political popularity from the Folkpartiet. This development is significant and constitutes the central finding of our paper. It may be generalizable to other national parliaments.

## **6. Conclusion**

This paper examined how the popularity of a party over legislation periods influences members of parliament in their bill cosponsorship behavior. Using three network datasets on bill cosponsorship, it analyzed the implications of party membership, age, and gender for cosponsorship behavior.

The findings of the statistical analyses allow significant conclusions about the hypotheses. First, there is a significant decreasing trend in the level of cosponsorship and collaboration reflected by a steadily decreasing number of cosponsorships and a decrease in network density. Second, there is a significant tendency away from cosponsoring with right-wing parties. Though in the first legislation period the trend was inverted, a strong change occurred after 2006, reflecting a significant change in cosponsorship behavior. Third, though extreme parties are avoided in cosponsorship, the antipathy is weaker towards the left. Fourth, the hypothesis that small parties cosponsor more only holds in the first legislation period, after which the relationship heavily inverses. This change in direction is similar to the change in right-wing cosponsorship. This may support the view that small parties do not influence policy output disproportionately, maintaining the voter mandate and not causing substantial principal-agent conflicts. Finally, as found in other state parliaments (Swers, 2005), women engage more in cosponsorship than their male colleagues.

There are limitations to the findings of this paper. The analyses are centered around three consecutive legislation periods in the Swedish parliament. Generalizations on cosponsorship behavior thus can only be made towards other governments and parliaments in a limited way. Several confounding variables, like a deviation in Swedish politics away from

international trends, may limit the applicability. Moreover, recent trends following the year 2014 are not reflected in this analysis. Relevant events are the European continent being impacted by a large wave of African-Asian immigration following 2015, or growing awareness of the climate crisis. Especially the stark immigration into Sweden has had a great impact on the country (Krzyżanowski, 2018), giving rise to populist parties. Hence, implications may be weaker for politics following the observed period.

Further research in the direction of voter-politician interest alignment, policy output congruence, and implications of bill cosponsorship in the political process is viable. This paper revealed significant trends which are observable in the Swedish parliament during the chosen timeframe. It would be interesting to compare several parliaments in this style, relating the findings to the local political situation, and draw more generalizable conclusions. Finally, Table 8.3.11 includes MP-specific statistics about measures of network centrality. An in-depth analysis of the reasons for the position of specific MPs can be worthwhile to identify personal trends and reasons.

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## 8. Statistics

### 8.1 Correlation Matrices

Table 8.1.1 Correlation between relevant statistics per party

| Correlation Matrix 2002-2006 |         |        |               |             |              |            |
|------------------------------|---------|--------|---------------|-------------|--------------|------------|
|                              | % votes | # MPS  | Total # Edges | Mean Degree | Mean Between | Mean Close |
| % votes                      | 1.000   |        |               |             |              |            |
| # MPS                        | 0.997   | 1.000  |               |             |              |            |
| Total # Edges                | 0.966   | 0.971  | 1.000         |             |              |            |
| Mean Degree                  | -0.457  | -0.462 | -0.262        | 1.000       |              |            |
| Mean Between                 | 0.266   | 0.285  | 0.463         | 0.495       | 1.000        |            |
| Mean Close                   | -0.250  | -0.265 | -0.102        | 0.766       | 0.734        | 1.000      |

| Correlation Matrix 2006-2010 |         |        |               |             |              |            |
|------------------------------|---------|--------|---------------|-------------|--------------|------------|
|                              | % votes | # MPS  | Total # Edges | Mean Degree | Mean Between | Mean Close |
| % votes                      | 1.000   |        |               |             |              |            |
| # MPS                        | 0.998   | 1.000  |               |             |              |            |
| Total # Edges                | 0.901   | 0.920  | 1.000         |             |              |            |
| Mean Degree                  | 0.344   | 0.381  | 0.565         | 1.000       |              |            |
| Mean Between                 | -0.128  | -0.097 | -0.092        | 0.542       | 1.000        |            |
| Mean Close                   | -0.015  | 0.024  | 0.166         | 0.856       | 0.831        | 1.000      |

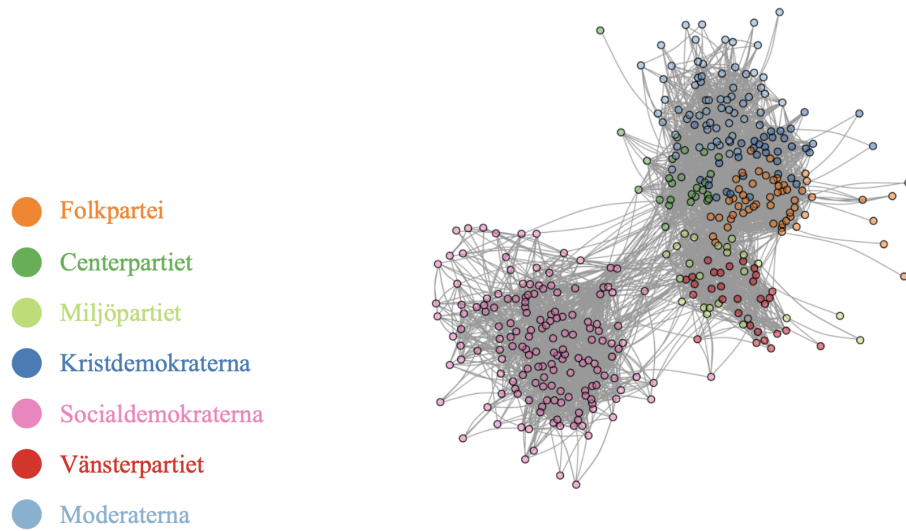
| Correlation Matrix 2010-2014 |         |        |               |             |              |            |
|------------------------------|---------|--------|---------------|-------------|--------------|------------|
|                              | % votes | # MPS  | Total # Edges | Mean Degree | Mean Between | Mean Close |
| % votes                      | 1.000   |        |               |             |              |            |
| # MPS                        | 0.995   | 1.000  |               |             |              |            |
| Total # Edges                | 0.820   | 0.870  | 1.000         |             |              |            |
| Mean Degree                  | 0.253   | 0.310  | 0.642         | 1.000       |              |            |
| Mean Between                 | -0.252  | -0.247 | -0.204        | -0.052      | 1.000        |            |
| Mean Close                   | -0.242  | -0.237 | -0.180        | 0.016       | -0.522       | 1.000      |

Table 8.1.2: Political orientation and its correlation with MP degree

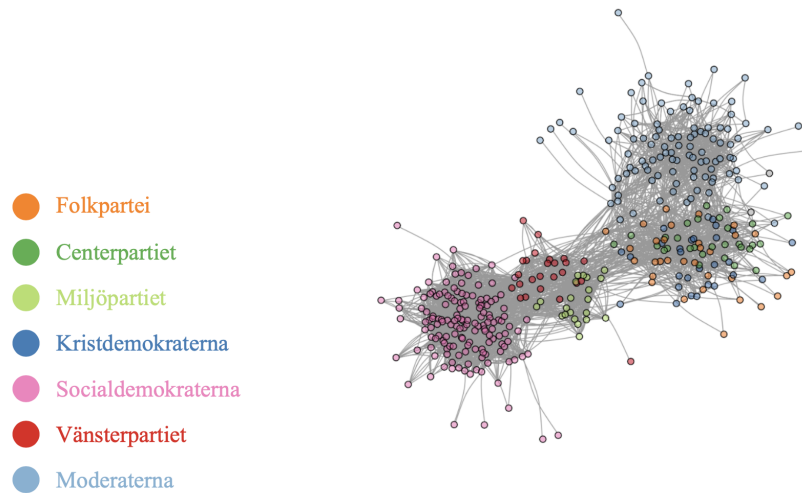
| 2002-2006 |          |      |
|-----------|----------|------|
|           | Points   | 2002 |
| Points    | 1        |      |
| 2002      | 0.357803 | 1    |
| 2006-2010 |          |      |
|           | Points   | 2006 |
| Points    | 1        |      |
| 2006      | -0.74304 | 1    |
| 2010-2014 |          |      |
|           | Points   | 2010 |
| Points    | 1        |      |
| 2010      | -0.52288 | 1    |

## 8.2 Plots

Graph 8.2.1: Cosponsorship network for the legislation period 2002-2006

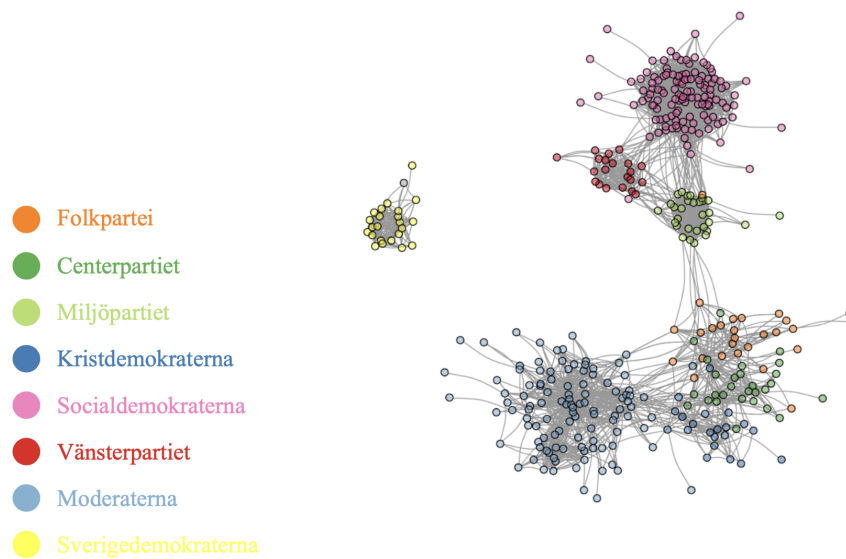


Graph 8.2.2: Cosponsorship network for the legislation period 2006-2010





Graph 8.2.3: Cosponsorship network for the legislation period 2010-2014



### 8.3 Tables

Table 8.3.1: Regression of node degree on female gender in legislation period 2002

```
> summary(lmfemaledegree)
```

```
call:
```

```
lm(formula = degree ~ female, data = data2002)
```

```
Residuals:
```

```
      Min       1Q   Median       3Q      Max
-32.254 -13.254  -1.254   11.852   61.746
```

```
Coefficients:
```

```
              Estimate Std. Error t value Pr(>|t|)
(Intercept)    28.829      1.211   23.798  <2e-16 ***
female          4.425      1.772    2.496   0.013  *
```

```
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
Residual standard error: 17.6 on 394 degrees of freedom
```

```
Multiple R-squared:  0.01557,    Adjusted R-squared:  0.01307
```

```
F-statistic: 6.232 on 1 and 394 DF,  p-value: 0.01295
```

*Table 8.3.2: Regression of node degree on female gender in legislation period 2006*

```
Call:
lm(formula = degree ~ female, data = match2006)

Residuals:
    Min       1Q   Median       3Q      Max
-29.892 -14.892  -2.437   11.699   69.563

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)    24.437      1.328   18.404 < 2e-16 ***
female          6.456      1.928    3.349 0.00089 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 19.06 on 390 degrees of freedom
(4 observations deleted due to missingness)
Multiple R-squared:  0.02795,    Adjusted R-squared:  0.02546
F-statistic: 11.22 on 1 and 390 DF,  p-value: 0.0008903
```

*Table 8.3.3: Regression of node degree on female gender in legislation period 2010*

```
Call:
lm(formula = degree ~ female, data = data2010)

Residuals:
    Min       1Q   Median       3Q      Max
-25.737 -14.042  -3.737    8.958   72.263

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)    22.042      1.246   17.683 <2e-16 ***
female          4.695      1.861    2.523  0.012 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 18.28 on 388 degrees of freedom
(6 observations deleted due to missingness)
Multiple R-squared:  0.01614,    Adjusted R-squared:  0.01361
F-statistic: 6.367 on 1 and 388 DF,  p-value: 0.01202
```

Table 8.3.4: Regression of MP degree on the % votes received by their party, 2002

```
> summary(lmvotes)

Call:
lm(formula = degree ~ votes, data = data2002)

Residuals:
    Min       1Q   Median       3Q      Max
-36.465 -10.618  -1.552   10.448   58.099

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   39.171     1.575   24.878 < 2e-16 ***
votes        -36.686     5.875   -6.244 1.1e-09 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 16.92 on 394 degrees of freedom
Multiple R-squared:  0.09004,    Adjusted R-squared:  0.08774
F-statistic: 38.99 on 1 and 394 DF,  p-value: 1.104e-09
```

Table 8.3.5: Regression of MP degree on the % votes received by their party, 2006

```
Call:
lm(formula = degree ~ votes, data = match2006)

Residuals:
    Min       1Q   Median       3Q      Max
-31.212 -13.840  -2.808   12.180   66.788

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   18.742     1.990    9.418 < 2e-16 ***
votes         38.499     7.695    5.003 8.55e-07 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 18.74 on 390 degrees of freedom
Multiple R-squared:  0.06031,    Adjusted R-squared:  0.0579
F-statistic: 25.03 on 1 and 390 DF,  p-value: 8.55e-07
```

Table 8.3.6: Regression of MP degree on the % votes received by their party, 2010

```
Call:
lm(formula = degree ~ votes, data = data2010)

Residuals:
    Min       1Q   Median       3Q      Max
-25.713 -14.301  -2.301   7.955  72.287

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   18.555      1.888   9.829 < 2e-16 ***
votes         26.609      7.843   3.393 0.000763 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 18.16 on 388 degrees of freedom
(6 observations deleted due to missingness)
Multiple R-squared:  0.02881, Adjusted R-squared:  0.02631
F-statistic: 11.51 on 1 and 388 DF, p-value: 0.0007631
```

Table 8.3.7: Regression of MP degree on the political orientation of the party, 2002

```
> summary(lmorientation)

Call:
lm(formula = degree ~ orientation, data = data2002)

Residuals:
    Min       1Q   Median       3Q      Max
-33.114 -12.523  -2.114   11.443   62.522

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  24.5681      1.9276  12.746 < 2e-16 ***
orientation   1.3183      0.3576   3.686 0.00026 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 17.44 on 394 degrees of freedom
Multiple R-squared:  0.03333, Adjusted R-squared:  0.03088
F-statistic: 13.59 on 1 and 394 DF, p-value: 0.0002598
```

*Table 8.3.8: Regression of MP degree on the political orientation of the party, 2006*

```
Call:
lm(formula = degree ~ orientation, data = match2006)

Residuals:
    Min       1Q   Median       3Q      Max
-44.586 -11.242  -3.021  10.086  64.086

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  45.5861     1.9536   23.33  <2e-16 ***
orientation  -3.5573     0.3445  -10.33  <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 17.13 on 390 degrees of freedom
(4 observations deleted due to missingness)
Multiple R-squared:  0.2147,    Adjusted R-squared:  0.2127
F-statistic: 106.6 on 1 and 390 DF,  p-value: < 2.2e-16
```

*Table 8.3.9: Regression of MP degree on the political orientation of the party, 2010*

```
Call:
lm(formula = degree ~ orientation, data = data2010)

Residuals:
    Min       1Q   Median       3Q      Max
-35.461 -12.461  -3.633  11.209  67.367

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  40.4607     1.9510   20.739  <2e-16 ***
orientation  -2.9425     0.3173   -9.274  <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 16.67 on 388 degrees of freedom
(6 observations deleted due to missingness)
Multiple R-squared:  0.1815,    Adjusted R-squared:  0.1793
F-statistic: 86.01 on 1 and 388 DF,  p-value: < 2.2e-16
```

*Table 8.3.10: Voting results per party by legislation period*

| Political Party     | 2002 - 2006 | 2006 - 2010 | 2010 - 2014 |
|---------------------|-------------|-------------|-------------|
| Socialdemokraterna  | 40%         | 35%         | 31%         |
| Moderaterna         | 15%         | 26%         | 30%         |
| Sverigedemokraterna | 1%          | 3%          | 6%          |
| Kristdemokraterna   | 9%          | 7%          | 6%          |
| Centerpartiet       | 6%          | 8%          | 7%          |
| Vänsterpartiet      | 8%          | 6%          | 6%          |
| Folkpartiet         | 13%         | 8%          | 7%          |
| Miljöpartiet        | 5%          | 5%          | 7%          |
| Independent         | 2%          | 2%          | 1%          |

Table 8.3.11: Outstanding MPs per measure given

| <i>Measure</i>                               | <b>2002 - 2006</b>                         | <b>2006 - 2010</b>                          | <b>2010 - 2014</b>                           |
|--|--|---|--|
| <i>MP with the highest degree</i>            | Birgitta Carlsson (95, Centerpartiet)      | Monica Green (99, Socialdemokraterna)       | Kersting Engle (99, Socialdemokraterna)      |
| <i>MP with the highest betweenness</i>       | Martin Andreasson (5382.29, Folkpartiet)   | Monica Green (7999.36, Socialdemokraterna)  | Staffan Danielsson (16386.19, Centerpartiet) |
| <i>MP with the highest closeness</i>         | Martin Andreasson (0.001068, Folkpartiet)  | Monica Green (0.001008, Socialdemokraterna) | Tony Wiklander (0.03, Sverigedemokraterna)   |
| <i>MP with the highest eigenvector value</i> | Katrine Pålsson-Ahlgren (1, Kristedemokr.) | Lars Ohly (1, Vänsterpartiet)               | Eva Olofson (1, Vänsterpartiet)              |