congressbr: An R Package for Analyzing Data from Brazil's Chamber of Deputies and Federal Senate*

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Abstract

In this research note, we introduce congressbr, an R package for retrieving data from the Brazilian houses of legislature. The package contains easy-to-use functions that allow researchers to query the Application Programming Interfaces of Brazil's Chamber of Deputies and the Federal Senate, perform cleaning data operations, and store information in a format convenient for future analyses, making a previously-difficult task fast and convenient. congressbr downloads data on legislators, submitted and ratified law proposals, Senate and Chamber commissions, and other information of interest to social scientists across various fields. We outline the main features of the package and demonstrate its use with practical examples.

Keywords: Brazil, R, legislative studies, Chamber of Deputies, Federal Senate

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1 Introduction

Since the 1990s, Latin American countries have moved towards greater transparency and participation in politics (Fisher 1998; Hagopian and Mainwaring 2005; Munck 2004). As these states have become more democratic, they have devoted more attention to one of their citizens' most urgent demands: the oversight of administrative and legislative activity (Angélico 2012; Berliner and Erlich 2015; Mendez 2015; Michener 2010). However, citizens can only assess the quality of state governance effectively if they are provided with credible and comprehensive information. Hidden knowledge and hidden actions undermine the principal's ability to monitor the agent's behavior, and this problem is particularly acute in the public sphere (Downs and Rocke 1994; Miller 2005; Moe 1984; Niskanen 1971). Information asymmetries between policymakers and voters not only tilt electoral results in favor of incumbents, but also lead to sub-optimal outcomes in the provision of public goods. For instance, political actors can influence macroeconomic business cycles in ways unbeknownst to voters to increase their chances in future elections (Nordhaus 1975). Representatives may provide rent-seeking opportunities to special groups by introducing regulations that limit competition yet draw little attention from the general public (Tullock 1967). Similarly, civil servants can impose significant welfare losses to taxpayers by maximizing their agencies' budgets, as they have expert knowledge of the state cost functions and public finances (Migué et al. 1974; Niskanen 1971; Tullock 1965).

Brazil has implemented a number of measures designed to reduce such practices. One notable example is the creation of *orçamento participativo*, the participatory budgeting, which has fostered democratic control over public spending by encouraging citizens to engage in local fiscal administration (Baiocchi et al. 2008; Koonings 2004). The Brazilian government has also improved and reformed accountability institutions such as the Comptroller General (CGU) and the Accounting Tribunal (TCU), which have increased the accountability of elected officials in all levels of government (Praça and Taylor 2014; Souza 2001). A more recent development, however, is the use of modern Application Programming Interfaces (APIs) by Brazilian public agencies and government bodies. APIs are broadly defined as software protocols that allow machines to communicate with each other (Merriam-Webster 2017; PC Mag Encyclopedia 2017), and they have been largely responsible for the recent rise in digital ecosystems and the 'internet of things' (The Economist 2014; Wired 2013).

Although such initiatives deserve praise, the task of collecting and managing Brazilian administrative data remains beyond most users' abilities. Groups interested in public records – such as journalists, social scientists, lawyers, or members of non-governmental organizations – often do not have the computational skills required to interact with APIs. Even those who are familiar with that technology may find data cleaning a time-consuming task, and manual procedures for data preparation are generally burdensome and error-prone (Sandve et al. 2013). Consequently, many of the benefits of providing public information to Brazilian citizens may be lost if users do not have access to the data in a timely and convenient manner. Indeed, in Section 3 of this paper, we show how researchers can replicate a study, which took the authors many months of arduous data-collecting work to undertake, in a few minutes.

In this research note, we present `congressbr`, a package for the R statistical programming language (R Core Team 2015) that enables users to download data from the APIs of the Brazilian Federal Senate and Chamber of Deputies. With `congressbr`, we aim to fill some of this 'software gap' in the social sciences, and to lessen the workload normally necessary to collect such data. Although the same methods could be implemented in other languages, such as Python, Stata or C, we chose R because of its popularity in Political Science and its status as the *de facto* language of data analysis. There are currently over 12,500 user contributed packages available through the R network,¹ and methods commonly used in Political Science have been available in R for many years (e.g., Poole et al. 2008; Stuart et al. 2011; Zeileis et al. 2008). It is also free software, has comprehensive documentation, and easily facilitates replication (Baumer and Udwin 2015; Tippmann 2015). For newcomers to R, we have provided the code necessary to replicate the analyses herein in the Appendix.

Our package is part of a larger movement that is bringing the data of Brazilian public institutions to citizens. For example, `electionsBR` (Meireles et al. 2016) makes *Tribunal Superior Eleitoral* data available for users of R, `GetHFData` (Perlin and Ramos 2016) downloads and prepares financial data from the São Paulo stock exchange, while Julio Trecenti has a number of R packages that interact with Brazilian government APIs, such as `sabesp`, which downloads and plots data from the São Paulo Water Management Company (Trecenti 2015), `cnpjReceita`, which retrieves information from the Brazilian Internal Revenue Service (Trecenti 2016), and `spgtfs/sptrans`, two packages

¹See: <https://cran.r-project.org/web/packages/>. R itself may also be downloaded and installed by following the instructions on its homepage, <https://cran.r-project.org/>. Access, both: May 2018.

that collect data from the São Paulo City Bus Management Service (Trecenti 2017). With specific regard to Political Science, there are various datasets that have been introduced and offered to the research community, Alvarez et al. (1996); Polity (2012); Linzer and Staton (2015); Lindberg et al. (2014) being good examples. The main contribution of this work is to present an easily-understood framework to download Brazilian legislative data directly into R. This same framework can also be useful as a guide to other researchers wishing to disseminate data from other countries in a similar manner, using publicly-available data from APIs such as those utilized with congressbr, which can help foster replication and reproducibility in Comparative Politics.

While the use of congressbr does require some basic knowledge of R, its functions are, we hope, simple and intuitive for researchers of all levels of programming experience. Moreover, the returned data are in a ‘tidy’ format (Wickham 2014), that is, all data are organized with variables as columns and cases as rows, no encoding incompatibilities, resulting in a final dataset that is as ‘humanly-readable’ as possible. This means that users can easily export the results and analyze them within R itself or with other software and spreadsheet applications.

The remainder of this research note is organized as follows. In section 2 we present the basic functionality of congressbr and demonstrate how scholars can easily obtain information about bills, members of congress and house committees. Section 3 demonstrates how to calculate commonly-used legislative statistics with the package, and section 4 shows an example of how to use congressbr to estimate ideal points without having to construct the data structures usually necessary for such analyses. Section 5 concludes.

2 Exploring the Brazilian Houses of Legislature

congressbr has a series of functions that search for the details of votes, individual legislators and commissions from the websites of the Brazilian Congress. Our goal is to simplify the process of obtaining online information that may be used in both qualitative and quantitative analyses. To make the functions easy to memorize, we have adopted a consistent naming pattern for the package. Every function for the Senate starts with `sen_` and all functions related to the Chamber of Deputies have the prefix `cham_`. As of version 0.1.2, there are over 40 functions in congressbr, and all of them have their associated descriptions in the package manual. In order to make this section

more concise, here we present the functions we believe researchers will utilize more often.

Firstly, a note on the sources of the data contained in `congressbr`. The Brazilian Congress is composed of two Legislative Houses: the Federal Senate and the Chamber of Deputies. The Senate has 81 members, 3 for each state, elected for 8-year terms by majoritarian election. The Chamber has 513 members, proportionally elected according to the size of each state, and both houses play similar roles in the legislative process. A legislator typically participates in commissions and in the plenary, proposing, discussing and voting on different issues and the national budget. Depending on the type of the issue, in order to be approved, it must be discussed successively in both Houses. Collecting data on the inner workings of such legislative bodies is a complex process and justifies reliance on official data.

Both the Brazilian Chamber of Deputies and Senate maintain APIs for the dissemination of data on bills, legislators, commissions, and the budget, among other topics. For those unfamiliar with the concept, APIs are protocols to facilitate the communication between different software programs. In the present case, Brazilian Legislative Houses provide documentation and protocols for downloading data from a structured server. One, for instance, could simply navigate to a certain URL, using the browser, to receive the data in common formats. Instead of having to download these data directly from the API, `congressbr` implements methods to connect directly to the APIs, collect the data and load it into the local R environment. The Chamber has two API services: one located at <http://www2.camara.leg.br/transparencia/dados-abertos/dados-abertos-legislativo>, and a newer API (<https://dadosabertos.camara.leg.br/>) released in 2017. `congressbr` connects to the older API only, as the latter is still undergoing construction work and has not yet reached a stable state. We do, however, intend to utilize the newer API once it is fully developed. Regarding the API of the Federal Senate, located at <https://www12.senado.leg.br/dados-abertos>, we have implemented all the methods available on the API. Both the APIs for the Chamber and Senate return data in XML and/or JSON format, and `congressbr` transforms the data requested to the data frame format, the common R data structure more suitable for handling tables. Since the package is hosted on the standard R network, CRAN (<https://cran.r-project.org>), to install and load it, we need only the following code:

```
install.packages('congressbr')  
  
library('congressbr')
```

Users may familiarize themselves quickly with a certain House or Legislature by using `congressbr`. For those new to Brazilian politics, typing `statesBR` into the R console will return a table of Brazilian states by name and two-letter acronym, which is useful as many requests to the API may be filtered using these same two-letter acronyms. Likewise, `sen.parties()` will return a data frame of the parties in the Senate, including those that have been and gone.² A quick look at the resulting table tells us that a total of 47 parties have been present at one time or another in the Federal Senate. Given the bewilderingly large number of Brazilian parties, we suggest newcomers start here. Another useful function is `sen.senator.list()`. By default, it returns a data frame of the senators currently serving in the Senate. This table may be requested for a certain state, for periods other than the present legislature, and by whether the senator is *titular* or a *suplente* (stand-in deputy). This table contains the gender of the senator, meaning that an analysis of the breakdown of gender in the Federal Senate is as easy as typing `sen.senator.list()` and then using an appropriate summary function, for example with the `table()` function natively available in R, which will print the following to the R console (here we also include the R commands necessary to reproduce this table):

```
library(congressbr)
table(sen.senator.list()$gender)
```

Feminino	Masculino
13	68

The function `sen.senator.list()` also returns information on senators' party membership, mandate term and webpage and email information. For example, a journalist or an NGO member looking to quickly gather all the emails of the currently-serving senators would only have to use this function to extract this data in a matter of seconds. `congressbr` also contains a number of other functions that allow users to quickly familiarize themselves with the data. `sen.bills.list()`, for example, will return a table of the types of bills possible in the Senate, along with their numeric IDs and acronyms, whereas `sen.bill.sponsors()` produces a table of the sponsors of bills in the Federal Senate, showing that Senator Paulo Paim currently leads the way in the number of bills sponsored,

²As the features of the new Chamber of Deputies API come online, we intend to add them to the package. Currently, only the API of the Federal Senate has this level of detail.

a total of 310.³ The rich detail of the API of the Federal Senate means that we have been able to make a plethora of such functions available in `congressbr`: information on senators' mandates may be had with `sen_senator_mandates()`; `sen_plenary_leaderships()` returns data on leadership status in the plenary; mandate data may be had with `sen_senator_mandates()`, and `sen_budget()` returns a dataframe of information on the budget proposals that have passed through the House. For the full list of functions, we refer readers to the package documentation.

Another important aspect of the package is voting data. The voting behavior of legislators is an area of great interest both inside and outside of academia (e.g., Ames 1995; Attina 1990; Poole and Rosenthal 2000; Snyder Jr and Groseclose 2000). `congressbr` has two functions that describes voting patterns: 1) `cham_votes()`, which returns a data frame of votes in the Chamber of Deputies; and 1) `sen_votes()`, which does the same for the Senate. We should note, however, that these are not necessarily *nominal* votes, as some may be secret. In this case, the API simply records whether the legislator voted or not.

`cham_votes()` returns values such as the summary of the decision (returned as the variable named `decision_summary`), the guidelines given by the government and the opposition to the members of their respective coalitions (`GOV_orientation` and `Minoria_orientation`) and how political parties directed their deputies to vote. A researcher could choose to analyze, for instance, how the PSDB, the PSOL⁴ (the `PSDB_orientation` and `PSOL_orientation` variables, respectively), and other parties oriented their members on certain votes.

The function requires that users provide the type, number and year of the bill in question. The type parameter accepts four entries: 'PL' for law proposal (*projeto de lei*), 'PEC' for constitutional amendments (*projeto de emenda constitucional*), 'PDC' for legislative decree (*decreto legislativo*) and 'PLP' for supplementary laws (*projeto de lei complementar*). Unfortunately, a particular bill can have more than one roll call, and the API does not provide a way to readily identify these repeated roll calls. We have therefore provided the variable `rollcall_id` in the returned data frame, which is a unique identity number (ID) for each roll call. For instance, we can retrieve information about proposition 1992/2007 with the command `cham_votes(type = "PL", number = 1992, year = "2007")`. This will return a table of 2056 observations on 31 variables. The second column,

³This number is correct as of late May 2018.

⁴The Brazilian Social Democracy Party, in Portuguese, *Partido da Social Democracia Brasileira*, and the Socialism and Liberty Party (*Partido Socialismo e Liberdade*), respectively.

decision_summary, contains a useful summary of the vote. We can access it with some simple R code:⁵

```
vote_table <- cham_votes(type = "PL", number = 1992, year = "2007")  
vote_table$decision_summary[[1]]
```

This will print out the following: [1] "Aprovada a Subemenda Substitutiva Global oferecida pelo Relator da Comissao de Seguridade Social e Familia, ressalvados os destaques. Sim: 318; nao: 134; abstencao: 02; total: 454.", telling us that bill 1992/2007 was approved by 318 votes to 134. The table returned also shows that the government directed deputies to vote *yea*, while several parties, from both the right and left sides of the political spectrum, ordered their members to vote *nay*.

We could also see how many legislators voted against their party on this vote. Taking the PT⁶ as an example, the following R code tells us eight PT deputies voted against their party (note we use the `filter()` function from the `dplyr` package (Wickham et al. 2017)). We exploit the unique rollcall ID and simply filter the data:

```
install.packages('dplyr'); library(dplyr)  
pt <- vote_table %>%  
  mutate(legislator_party = legislator_party) %>%  
  filter(rollcall_id == "PL-1992-2007-1",  
         legislator_party == "PT")  
table(pt$legislator_vote)
```

The result of which gives us eight against the party and sixty-eight with.

The function that downloads votes from the Senate, `sen_votes()`, works similarly. It provides variables that pertain to the time of the vote, its number, ID, year, description and the result of the roll call. Information on individual senators (their party, name, ID, gender and the state they represent) is also returned. This function has an argument, `binary`, which if `TRUE`, transforms the recorded (nominal) votes from *yea* to 1 and *nay* to 0, which is useful for any following quantitative analysis. Please note that dates are in 'yyyymmdd' format, that is, to query the API for votes on the

⁵For readers not familiar with R, `vote_table` is the object we have created in R's memory (a data frame), `$` indicates we are accessing the `decision_summary` column, and `[[1]]` refers to the first line of this column.

⁶The Worker's Party, *Partido dos Trabalhadores*.

8th of September 2016, we type: `sen_votes("20160809")`. This returns a table of 405 rows and 16 columns. Supposing we named this object 'sen', typing the line `unique(sen$vote_round)` into the R console shows us that, on this day, bills went through up to five separate rounds of voting.

The package also contains some ready datasets. The dataset `'sen_nominal_votes()'`, for instance, returns a dataframe of votes in the Federal Senate. `'cham_nominal_votes()'` returns all the votes, by legislator, for the Chamber of Deputies from 1991 to 2017 with a few other columns – attributes such as party, state, bill ID, among others. We here use this dataset to calculate some simple statistics. Figure 1 shows the number of parties in the Chamber of Deputies by year.⁷ Readers may note the high level of party fragmentation in Brazil, and that this fragmentation has grown worse in the last fifteen years.

Figure 1: Number of Parties by Year in the Chamber of Deputies, 1991–2017.

Analysts can also use `congressbr` for collecting details on individual legislators and on commissions, both rich sources of information. Details on individual senators can be obtained with the `sen_senator()` function. For example, `sen_senator(id = 391)`⁸ will return details on Senator Aécio Neves, and will show us that he was born in March 1960 in Belo Horizonte and that he joined the

⁷R code for all plots are included in Appendix A.

⁸The ID numbers of the senators, originally provided by the Senate itself, are given by the `sen_senator_list()` function.

PMDB⁹ in 1988. Similar information for other senators is easily available, and is useful not only for qualitative analyses but for also adding description to quantitative work.

The Senate API also contains information on coalitions and commissions. The function `sen_commissions()` will return a table of details on the commissions in the Senate. (For reasons of space, only columns three and four are shown here.)

We can also see which senators serve on certain commissions. For example, the function `sen_commissions_senators(code = "CCJ")` will return the senators who serve on the *Comissão de Cidadania e Justiça*, the Commission on Citizenship and Justice. Temporary coalitions may also be of interest. `sen_coalitions()` will return a table of the coalitions on the Senate, including specific ID numbers for each coalition. These ID numbers can then be used to get more detailed information on that particular group. For example, 200 is the ID of the *bloco moderador*¹⁰. With `sen_coalition_info(code = 200)`, we can get more complete information on the bloc, for example, on its date of formation, which was the second of January, 2015.

Commission Name	Commission Purpose
CPI dos Supersalários	Investigar os pagamentos de remuneração a servidores e empregados públicos em desacordo com o teto constitucional, bem como estudar possibilidades de restituição desses valores ao erário pelos beneficiários.
CPI do BNDES	Investigar irregularidades nos empréstimos concedidos pelo BNDES no âmbito do programa de globalização das companhias nacionais, em especial a linha de financiamento específica à internacionalização de empresas, a partir do ano de 1997; bem como investigar eventuais irregularidades nas operações voltadas ao apoio à administração pública, em especial a linha denominada BNDES/Finem Desenvolvimento Integrado dos Estados.
CPI dos Maus-tratos	Investigar as irregularidades e os crimes relacionados aos maus-tratos em crianças e adolescentes no país.

Table 1: The output of function `sen_commissions()`.

The APIs of the Chamber and in particular the Federal Senate are rich in details such as these, and more detailed information may be found in the package documentation.¹¹ We hope that

⁹The Brazilian Democratic Movement Party, *Movimento Democrático Brasileiro*.

¹⁰The *bloco moderador*, or moderating bloc, is an informal coalition of five center-right parties (the Brazilian Labor Party (PTB), the Social Christian Party (PSC), the Christian Worker's Party (PTC), the Brazilian Republican Party (PRB), and the Party of the Republic (PR)). Its main task is to coordinate voting behavior among these parties.

¹¹An index of this documentation may be found by typing `help(package = "congressbr")` into the R console.

congressbr can help scholars interested in qualitative studies of the Brazilian houses of legislature to more easily access this data, regardless of computer programming experience.

3 Producing Legislative Statistics

congressbr also allows researchers to produce ready and direct summaries of legislative data. Much of the political science literature on the Brazilian Houses of Legislature has frequently utilized certain summaries of behavior (e.g., Figueiredo and Limongi 1995, 1999), and we hope that the package can help such political scientists create these summaries more easily.

For example, during the 1990s, the practice of empirically analyzing the Brazilian legislature began to grow in popularity and sophistication. Figueiredo and Limongi (1995), pioneers in this area, studied party cohesion in the Congress, and had to collect their data by hand, a time-consuming and labor-intensive process. They then used these data to analyze patterns of legislative votes, discovering that parties in the Brazilian Chamber are quite cohesive, contrary to previous findings in the literature. congressbr allows researchers to replicate these findings in a matter of minutes by collecting data from the API and employing a few R functions. For example, an important statistic, employed by the authors and often used in the Political Science literature to measure party cohesion, is the Rice Index (Rice 1928; Desposato 2005).¹² Calculating this measure consists of taking the absolute value of the subtraction between the number of *yea* votes and *nay* votes, and dividing this by the absolute number of votes. In mathematical terms:

$$Rice = \frac{|yea - nay|}{yea + nay} \quad (1)$$

To do this in R, one can write a simple function, where votes is a numeric vector of recorded votes (traditionally coded as 1 and 0 for *yea* and *nay*, respectively):

```
rice <- function(votes){  
  votes <- votes[!is.na(votes)]  
  denominator <- length(votes)  
  numerator <- abs(2*sum(votes) - denominator)
```

¹²Although there are number of methods for analyzing roll call data, such as the Optimal Classification (OC) method (Poole and Rosenthal 2000), Principal Component Analysis (Potthoff 2018), or Variational Bayes (Imai et al. 2016), we employ the Rice index to make our results comparable with Figueiredo and Limongi (1995).

```

numerator/denominator
}

```

This function can then be used to calculate the Rice Index for the vote data that is returned from the functions in `congressbr`.¹³ Figure 2 shows the historical evolution of the Rice Index for the three major parties in the Chamber of Deputies — the PMDB, the PT, and the PSDB — using votes downloaded with `congressbr`. The result is consistent with the view of Brazilian political history found in the literature. The PT has always been a party whose members are known for being staunch defenders of its ideology, whereas the PMDB, on the other hand, are well-known ‘kingmakers’, who excel at building coalitions and are not famed for ideological purity. The PSDB can be considered somewhere in-between.

Figure 2: The Rice Index for Major Parties in the Chamber of Deputies, 1990-2010.

4 Spatial Models of Voting Behavior

Another important application of legislative data is for use with spatial models of legislative voting (Poole 2005; Clinton et al. 2004). Analyses with spatial models usually focus on ‘ideal points’, i.e.,

¹³Other simple statistics can be similarly easily constructed in the R language for use with the data provided by `congressbr`.

the positions legislators take relative to one another on a scale formed by their voting records. Examples of such ideal-point analyses with Brazilian legislative data include Desposato (2006) and McDonnell (2017). These types of analyses can be easily carried out with `congressbr`. For the facilitation of these types of large- n nominal vote studies, we have included two datasets of nominal votes in the package, one for each legislative house, beginning in 1991 through to early 2017. The following example uses the Senate dataset, which may be loaded into R with the command `data("senate_nominal_votes")`. The votes have been coded 1 for *yea* and 0 for *nay* and abstentions.

A popular way to model voting behavior utilizes Bayesian Item-Response Theory (IRT) (Bafumi et al. 2005; Clinton et al. 2004; Martin and Quinn 2002). Bayesian IRT models estimate the probability of a *yea* vote ($y = 1$) as a latent regression:

$$P(y = 1) = \Phi(\beta_j \mathbf{x}_i - \alpha_j), \quad (2)$$

where $\mathbf{x}_i$ is the ideal point of senator i , and β_j and α_j are the *discrimination* and *difficulty* parameters of bill j .¹⁴ The ideal points of the senators may be estimated in various ways in R; researchers can use probabilistic programming languages such as JAGS (Plummer et al. 2003) and Stan (Stan Development Team 2016), or specific R functions for ideal-point analysis, such as `ideal()` from the `pscl` package (Jackman 2015) or the IRT modeling functions from `MCMCpack` (Martin et al. 2011).

For longer periods, or for when change over time is of primary interest, a dynamic ideal point model may be more suitable (Martin and Quinn 2002). Here we take a subset of the data for speed, convenience, and to avoid complications with modeling the data over time.

Ideal point analysis requires that the data be in a particular format. We have provided a convenience function, `vote_to_rolldata()`, for this purpose. By default it returns data suitable for use with `ideal()`, but it may also be used to structure the data in a format suitable for other R packages and the programming languages mentioned above.¹⁵ We can then use this format to run the analysis and plot the results,¹⁶ for this example, we used the `MCMCirt1d` function from

¹⁴For more on this model, see Jackman (2001). The discrimination and difficulty parameters are analogous to the slope and intercept in regular regression models.

¹⁵Users may type `?vote_to_rolldata` in the R console for details on how to create different data formats.

¹⁶The results of analyses like these can be further explored in R and users may plot the information in many ways. For instance, scholars may be interested in the senators' names, party affiliations and state, for example.

MCMCpack.¹⁷ This workflow then has three simple stages: a) load or download the data with `congressbr`, b) utilize the `vote_to_rollcall()` function on the data, and c) run an analysis using the IRT software the researcher has chosen.

We here present an example of this workflow. Figure 3 shows the changes in ideal points for selected senators from an analysis of the Dilma Rousseff and Michel Temer administrations (we select only a few senators to avoid clutter in the plot). The left-hand side of the figure shows the senators' ideal points as they were when Dilma Rousseff was president. Left-wing supporters of her administration are to be found on the negative end of the scale at the bottom of the plot, while the other senators, although all except Romario were part of her coalition, can be found some distance away from their left-wing colleagues, clearly showing the disharmony in the Rousseff administration.¹⁸

On the right-hand side of the plot, we see evidence of the strong support some of these senators (Neves, Calheiros, Malta, Romario and Jereissati) gave to the Temer government, whereas those who were part of the Rousseff coalition (Calheiros, for example), offered no such support to Dilma Rousseff. The two Senators that opposed the impeachment process and maintained their support for Rousseff, Senators Grazziotin and Farias, display a notably different voting history. Also of note is the increased polarization seen after the impeachment, with the ideal points of both groups respectively condensing together, typifying closer coalitions.

¹⁷We ran the function for 50,000 iterations, with a burn-in of 2,500 iterations. Senators Agripino (not shown) and Grazziotin were used as constraints (positive and negative, respectively). For more on constraints and identification in these models, see Rivers (2003).

¹⁸The use of negative numbers for left-wing legislators is for convenience to keep the ideal points on the left side of zero, and for ease of interpretation. The absolute values of the ideal points do not signify anything; rather, it is the distance between legislators that is important.

Figure 3: Differences in Senators' Ideal Points between Dilma Rousseff and Michel Temer Administrations

Ideal points such as these can be produced quickly and easily from the voting records provided by congressbr. Data from the two houses may also be combined as in McDonnell (2017) to facilitate interesting comparisons over time and across the institutions. As may be seen from the R code in the Appendix, visualization of the results of this analysis produces the most verbose code – the actual requesting of data and its pre-processing before modeling necessitate comparatively few lines of R code.

5 Conclusion

We have introduced the congressbr package for R in this short research note. The purpose of making such a package is to put useful and interesting political science data in the hands of researchers. Our goal is to provide a suite of easy-to-use functions that even the novice R user can understand and use to produce analyses of Brazilian politics. This opens up the analysis of such data to more scholars than was previously possible, as studies such as those cited in the text have often been restricted to those with significant programming experience, or to those with the time and resources to collect data by hand.

In future versions of the package, we plan to include functions that download and standardize data from other levels of the Brazilian political structure, such as state and municipal legislatures. We believe that researchers will have their work greatly simplified with such an array of legislative

data available with the use of only a few simple functions. We also believe congressbr can act as a useful guide for other researchers who wish to build similar packages for disseminating the data available in other countries. These types of APIs are usually quite similar in design, and as such, the format used by congressbr can be used for other similar APIs that make social science data available. As the source code of congressbr is freely available, researchers can copy the parts applicable to their case.

In the meantime, we hope users find congressbr useful for their research. Feedback and suggestions are greatly appreciated.

A R Code

This appendix provides the full R code to replicate the analyses and plots included in the article.

A.1 Number of Parties

```
data('cham_nominal_votes')

head(cham_nominal_votes)

cham_nominal_votes %>%
  dplyr::mutate(year = lubridate::year(vote_date)) %>%
  dplyr::distinct(year, legislator_party) %>%
  dplyr::count(year) %>%
  ggplot2::ggplot(ggplot2::aes(x = year, y = n)) +
  ggplot2::geom_col() +
  ggplot2::theme_bw() +
  scale_x_continuous(breaks=1991:2017) +
  ggplot2::theme(axis.text.x = ggplot2::element_text(angle = 90, hjust = 1)) +
  scale_y_continuous(breaks = 0:33)
```

A.2 Rice Index and Plot

```
# if necessary, install the packages (delete '#' from the following lines):
# install.packages("tidyverse"); install.packages("lubridate")
# install.packages('congressbr')

library(congressbr)

library(dplyr)

library(lubridate)

library(ggplot2)
```

```

data("cham_nominal_votes")

head(cham_nominal_votes)

rice <- function(votes){
  votes <- votes[!is.na(votes)]
  denominator <- length(votes)
  numerator <- abs(2*sum(votes) - denominator)
  numerator/denominator
}

cham_rice_index <- cham_nominal_votes %>%
  filter(!is.na(legislator_vote)) %>% # Filtering out NA votes
  mutate(year = year(vote_date)) %>% # Getting the year of each rollcall
  group_by(rollcall_id, year, legislator_party) %>%
  summarise(rice = rice(legislator_vote))

cham_rice_index <- cham_rice_index %>%
  group_by(year, legislator_party) %>%
  summarise(rice = mean(rice))

## create plot:
ggplot(cham_rice_index %>%
  filter(legislator_party %in% c("PT", "PMDB", "PSDB")),
  aes(x = year, y = rice, linetype = legislator_party)) +
  geom_line() +
  facet_wrap(~legislator_party, nrow = 3) + theme_minimal()

```

A.3 Ideal Point Analysis and Plot

```

# if necessary, install the packages (delete '#' from the following line):
# install.packages("congressbr"); install.packages("tidyverse"); install.packages("MCMCpack")

```

```

# load packages:

library(MCMCpack); library(congressbr); library(tidyverse)


# load data:

data("senate_nominal_votes")


# create a dataframe 'sen' and filter it:

sen <- senate_nominal_votes %>%

  filter(vote_date >= "2013-02-01", !is.na(senator_id)) %>%

  mutate(legislature = ifelse(vote_date >= "2016-05-15", "Temer", "Dilma"),

    sen_id = paste(senator_name, legislature, sep = ":"),

    senator_vote = as.numeric(senator_vote))


# create 'roll call matrix' for IRT model:

votes <- vote_to_rollcall(votes = sen$senator_vote,

  legislators = sen$sen_id,

  bills = sen$bill,

  ideal = FALSE, Stan = FALSE)


# run the analysis with MCMCpack:

mcmc_votes <- MCMCirt1d(votes, burnin = 2500, mcmc = 50000, thin = 10,

  verbose = 1000, seed = 1234, drop.constant.items = T,

  theta.constraints =

    list(`Jose Agripino:Dilma` = "+",

      `Vanessa Grazziotin:Dilma` = "-"))


# create summary:

mc <- summary(mcmc_votes)

```

```

# extract ideal points ("theta"):

thetas <- as_tibble(mc$statistics[, 1:2]); colnames(thetas) <- c("mean", "SD")

id <- unlist(dimnames(votes)[1])

# create the dataframe we'll use for plotting:

legis <- tibble(mean = thetas$mean, id = id) %>%

  separate(id, into = c("name", "legislature"), sep = ":", drop = F) %>%

  filter(name %in% c("Renan Calheiros", "Aecio Neves", "Lindbergh Farias",

                    "Vanessa Grazziotin", "Tasso Jereissati", "Romario",

                    "Magno Malta"))

# create plot:

legis %>%

  {ggplot(.) +

    geom_line(aes(x = legislature, y = mean, group = name), color = "black", size = 1.5) +

    geom_point(aes(x = legislature, y = mean, group = name), color = "black", size = 5,

               shape = 21, , fill = "white") +

    theme_minimal(base_size = 11) + ylab("Ideal Point") +

    scale_color_brewer(palette = "Dark2") + xlab("President") +

    geom_text(data = subset(., legislature == "Dilma" & name == "Renan Calheiros"),

              aes(x = legislature, y = mean, group = name, label = name),

              size = 4, hjust = 1.1) +

    geom_text(data = subset(., legislature == "Dilma" & name == "Aecio Neves"),

              aes(x = legislature, y = mean, group = name, label = name),

              size = 4, hjust = 1.1) +

    geom_text(data = subset(., legislature == "Dilma" & name == "Lindbergh Farias"),

              aes(x = legislature, y = mean, group = name, label = name),

              size = 4, hjust = 1.1) +

    geom_text(data = subset(., legislature == "Dilma" & name == "Vanessa Grazziotin"),

              aes(x = legislature, y = mean, group = name, label = name),

              size = 4, hjust = 1.1) +
  }

```

```

geom_text(data = subset(., legislature == "Dilma" & name == "Tasso Jereissati"),
          aes(x = legislature, y = mean, group = name, label = name),
          size = 4, hjust = 1.1) +
geom_text(data = subset(., legislature == "Dilma" & name == "Romario"),
          aes(x = legislature, y = mean, group = name, label = name),
          size = 4, hjust = 1.1) +
geom_text(data = subset(., legislature == "Dilma" & name == "Magno Malta"),
          aes(x = legislature, y = mean, group = name, label = name),
          size = 4, hjust = 1.1, vjust = -.35) +
theme(legend.position = "none",
      panel.grid.minor.y = element_blank(),
      panel.grid.major.x = element_blank(),
      plot.title = element_text(size = 16)
) +
labs(title = "Changes in ideal points, Dilma & Temer Presidencies",
     subtitle = "Selected senators") +
annotate("text", label = sprintf("\u2190 Government"), y = -0.2, x = "Temer",
        angle = 90) +
annotate("text", label = sprintf("Opposition \u2192"), y = 1.15, x = "Temer",
        angle = 90)
}

```

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