# The Effect of Legislature Size on Public Spending

# A Meta-Analysis*

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25 May 2021

**Abstract**

In a seminal article, Weingast et al. (1981) argue that there is a positive relationship between legislature size and inefficiency in public expenditures. Their proposition is currently known as the "law of $1/n$" and has been widely debated in political science and public administration. However, recent studies have questioned the validity of the theory. In this letter, we estimate the first meta-analysis of the relationship between the number of legislators and public spending. Based on a sample of 29 articles, we find no robust evidence for the effect of legislature size on government budgets. Yet the aggregate results show significant heterogeneity. While earlier studies provide moderate support for the "law of $1/n$", papers using causal inference methods consistently find a negative relationship between seats and spending. The available evidence also indicates that proportional representation and mixed voting systems are no more likely to overspend than majoritarian ones.

**Keywords**: distributive politics; law of $1/n$; legislature size; meta-analysis; public spending

**JEL Classification Codes**: H21; H23; H50; H61

*The authors thank Guilherme Duarte, Robert Myles McDonnell, and David Skarbek for their constructive feedback. We also thank Cedric Antunes, Luis Castro, Giovanna França, Julia Oriente, and Lucas Mingardi for their excellent research assistance. Replication materials are available at https://github.com/danilofreire/distributive-politics-meta-analysis. We kindly acknowledge funding from the São Paulo State Science Foundation (FAPESP grant number 2018/00646-1).

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# 1 Introduction

Over the past decades, a large literature has examined the relationship between legislature size and public expenditure. Weingast et al. (1981) provided the general framework to analyse distributive politics. The authors argue that the larger the number of legislative districts ($n$), the smaller the share of tax burden each one will bear ($1/n$), thus legislators have an incentive to overspend in their districts and transfer the costs to the entire polity. Most early studies that empirically tested the "law of $1/n$", as the theory is currently known, indeed found a positive correlation between the number of legislature seats and different measures of government spending, although the effect was often limited to one house (e.g., Baqir 2002; Gilligan and Matsusaka 1995, 2001). Moreover, Primo and Snyder (2008) affirm that, due to spatial spillovers, a collection of small districts can supply public goods more efficiently than the central government. The authors conclude that a "reverse law of $1/n$" may hold, wherein a higher number of legislators in small constituencies decrease the overall public spending. Recent research has further questioned the validity of the "law of $1/n$". Since the wide range of empirical tests has produced conflicting results, scholars began to target the theoretical foundations of the law. Authors such as Crowley (2019) and Pecorino (2018) accurately point out that collective action problems have been overlooked, but their expanded models cannot account for all the institutional variation previous studies explore.

In this letter, we conduct the first meta-analysis that tests the generality of the "law of $1/n$". We select 30 articles that use quantitative methods to assess the impact of legislature size over government spending across several dimensions. Out of the 45 coefficients included in our article sample, 40% of them are positive and statistically significant, 22.2% are positive and statistically insignificant, 17.8% are negative and statistically insignificant, and 20% are negative and statistically significant. Although other studies aimed at solving this inconsistency, meta-analysis is the most appropriate tool, as it combines multiple outcomes into a single estimation and allows us to draw robust conclusions from the aggregated data (Cooper et al. 2019; Hedges and Olkin 1985). It can also identify potential sources of study heterogeneity, enabling researchers to assess threats to external validity and direct future efforts into more promising areas of academic inquiry (Doucouliagos and Ulubaşoğlu 2008).

We believe the scrutiny of the law expanded its initial scope in two directions. One group of scholars investigates the original institutional framework for the presence of coalitions, supermajorities, veto powers, and spending limits, which the theory disregards. They suggest these dynamics strongly influence the $1/n$ effect – specifically in U.S. majoritarian local legislatures, for which the law was conceived. Another sector of the scholarship overrides this institutional context. They find that the different political arrangements in national congresses, State legislatures, regional European governments, etc. produce more nuanced results. For instance, intergovernmental competition, the size ratio between assemblies, and strong executives demonstrated the effect of legislative size on public spending could be non-linear, asymmetrical, and even negative. While these trends evolved, causal inference tools became more sophisticated, allowing this inquiry to grow also in roubstness. We address all of these developments in this study. We coded five different moderators that translate methodological advances in time, the similarity of the empirical cases to the original Weingast et al. (1981) framework, and key theoretical issues to identify sources of variation in the literature.

Aggregate results show that legislative size has no significant impact on public spending. Our meta-analysis estimates are exactly half positive, and half negative. Meta-regressions suggest that our study sample is highly heterogeneous, and effects differ substantially according to study specifications. In the broadest aggregation models, unicameralism supports the positive effect predicted by the law of $1/n$. Since most unicameral cases in our sample refer to local governments (municipalities or districts), this result supports the theory strictly in its original institutional framework. It also indirectly endorses studies that find odd results in bicameralism. As follows, meta-regressions confirm previous findings that larger upper chambers spend more in terms of per capita expenditure than lower chambers (Gilligan and Matsusaka 1995, 2001). Moreover, non-majoritarian voting systems decrease government spending as a percentage of GDP, and they do not have a relevant impact on the other measures of public expenditure, following the idea that the $1/n$ effect grows weaker as the empirical cases distance from the original formulation of the law.

The meta-regressions also indicate that the $1/n$ effect found in earlier studies might be sensitive to more robust estimation methods. While papers that employ conventional linear regressions often find a positive relation between legislature size and government budgets, recent studies using modern methods of causal inference, specially those with regression discontinuity designs, provide consistent evidence for a negative relation (Crowley 2019; **?**; Höhmann 2017; Lewis 2019). This goes in contrast with the original theory and supports the existence of a "reverse law of $1/n$". In summary, our results are in line with previous findings that lend partial support to the law of $1/n$ (Chen and Malhotra 2007; **?**; Primo 2006). An assessment of the effects of collective action costs in these analyses is crucial to determine the full mechanism operating behind these results. Overall, our analysis does not provide robust support for the theory as originally conceived.

## 2 Methods

We compiled our study sample in three rounds. In the first search round, we gathered data from three large academic databases (Scopus, Microsoft Academic, and Google Scholar) and looked for studies that cited Weingast et al. (1981), as it is the foundational work in the literature on the "law of $1/n$". We then restricted our query to articles written in English and, to ensure that studies were comparable, we only included papers that used quantitative methods to investigate the relationship between legislature size and public spending[1]. After this stage, we identified the variables authors most commonly employ to measure government expenditure and legislature size, our dependent and independent variables, respectively. For government expenditure, our study sample uses (i) public expenditure as a share of GDP; (ii) public expenditure per capita; and (iii) the natural logarithm of public expenditure per capita as its main variables of interest[2]. In regards to legislature size, the variables are (i) lower chamber size; (ii) natural logarithm of lower chamber size; and (iii) upper house size[3].

In the second round, we did not require articles to cite Weingast et al. (1981) and used a keyword-based query on Google Scholar to broaden the scope of the first search. We again restricted the search to articles written in English which employed quantitative methods. In the third search round, we looked into the personal webpages of every author we had already included in our previous sample. The purpose of this manual search was to assess whether there was any working paper or unpublished manuscript which we might had missed in the previous queries. All papers we found in that last search had already been included in our sample. Combined, the three searches produced a dataset of 30 studies as of the 10$^{\text{th}}$ of March, 2021. Table 1 contains the full list of articles we analyse in this paper.

Table 1: Papers included in the meta-analysis, ordered by year of appearance

| Author(s) | Journal | Country | Dependent Variable | Method | Institutional Design | Electoral System |
|---|---|---|---|---|---|---|
| Stein et al. (1998) | Unpub | Multiple (26) | PCTGDP | OLS | Mixed | NM |
| Baqir (1999) | Unpub | USA | logExpPC | OLS | Unicameral | M |
| Bradbury and Crain (2001) | JPubE | Multiple (37) | PCTGDP | PANEL | Mixed | NM |
| Bradbury and Crain (2001) | JPubE | Multiple (37) | ExpPC | PANEL | Mixed | NM |
| Gilligan and Matsusaka (2001) | NTJ | USA | ExpPC | PANEL | Bicameral | M |
| Baqir (2002) | PC | USA | logExpPC | OLS | Unicameral | M |
| Ricciuti (2003) | Unpub | Multiple (23) | ExpPC | PANEL | Mixed | NM |
| Mukherjee (2003) | CPS | Multiple (110) | PCTGDP | PANEL | Mixed | NM |
| Lledo (2003) | Unpub | BRA | PCTGDP | PANEL | Unicameral | NM |
| Ricciuti (2004) | RivPE | Multiple (75) | PCTGDP | OLS | Mixed | NM |
| Matsusaka (2005) | SPPQ | USA | ExpPC | IV | Bicameral | M |

[1]Please refer to Section C in the Supplementary Material for a detailed description of the selection procedure. We include two PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagrammes (Liberati et al. 2009) showing the number of resulting papers after each review step.

[2]Since meta-analysis requires a single estimate per observation, we excluded articles that use interaction terms or quadratic specifications of our selected variables.

[3]There are a few important nuances concerning coding of these variables. For instance, unicameralism is captured both by lower chamber size ($n = 7$) and by log lower chamber size ($n = 5$). Since much of the literature estimates how institutional designs affect this relationship, ours and many other articles use both lower and upper chamber sizes as main explanatory variables. We did not find any articles that used the natural logarithm of upper chamber size.

Table 1: Papers included in the meta-analysis, ordered by year of appearance

| Author(s) | Journal | Country | Dependent Variable | Method | Institutional Design | Electoral System |
|---|---|---|---|---|---|---|
| Primo (2006) | E&P | USA | ExpPC | PANEL | Bicameral | M |
| Erler (2007) | PC | USA | ExpPC | PANEL | Bicameral | M |
| Erler (2007) | PC | USA | PCTGDP | PANEL | Bicameral | M |
| Chen and Malhotra (2007) | APSR | USA | ExpPC | PANEL | Bicameral | M |
| Fiorino and Ricciuti (2007) | PC | ITA | ExpPC | IV | Unicameral | NM |
| MacDonald (2008) | PC | USA | logExpPC | OLS | Unicameral | M |
| Schaltegger and Feld (2009) | JPubE | CHE | ExpPC | PANEL | Unicameral | NM |
| Coate and Knight (2011) | AEJ | USA | logExpPC | OLS | Unicameral | M |
| Pettersson-Lidbom (2012) | JPubE | FIN & SWE | logExpPC | RDD | Unicameral | NM |
| Maldonado (2013) | SSQ | Multiple (92) | PCTGDP | OLS | Mixed | NM |
| Baskaran (2013) | EJPE | DEU | ExpPC | IV | Unicameral | NM |
| Kessler (2014) | JPE | USA | ExpPC | PANEL | Unicameral | M |
| Bjedov et al. (2014) | PC | CHE | ExpPC | PANEL | Unicameral | NM |
| Bjedov et al. (2014) | PC | CHE | PCTGDP | PANEL | Unicameral | NM |
| Lee (2015) | PC | USA | ExpPC | IV | Bicameral | M |
| Lee (2016) | PC | USA | ExpPC | IV | Bicameral | M |
| Drew and Dollery (2017) | UAR | AUS | logExpPC | PANEL | Unicameral | NM |
| Höhmann (2017) | PC | DEU | logExpPC | RDD | Unicameral | NM |
| Lee and Park (2018) | PC | USA | ExpPC | PANEL | Bicameral | M |
| De Benedetto (2018) | Unpub | ITA | logExpPC | RDD | Unicameral | NM |
| Crowley (2019) | SEJ | USA | ExpPC | PANEL | Bicameral | M |
| Lewis (2019) | SCID | IDN | logExpPC | RDD | Unicameral | NM |

**Notre:** Country codes follow the ISO 3166-1 alpha-3 international standard.
**Journals:** Unpub=Unpublished, JPE=Journal of Political Economy, EJPE=European Journal of Political Economy, PC=Public Choice, JPubE=Journal of Public Economics, JPriE=Journal of Private Enterprise, APSR=American Political Science Review, SEJ=Southern Economic Journal, UAR=Urban Affairs Review, SCID=Studies in Comparative International Development, SSQ=Social Science Quarterly, SPPQ=State Politics and Policy Quarterly, CPS=Comparative Political Studies, RivPE=Rivista di Politica Economica, E&P=Economics and Politics, NTJ=National Tax Journal.
**Methods:** OLS=Ordinary least squares, IV=Instrumental variables, Panel=Panel data/fixed effects, RDD=Regression discontinuity design, M=Majoritarian, NM=Non-majoritarian (mixed or proportional representation).
**Dependent Variables:** ExpPC=Per capita expenditure, logExpPC=Natural logarithm of per capita expenditure, PCTGDP=Expenditure as a percentage of GDP.

Our study sample reflects the development of the literature. Although the "law of $1/n$" was first formulated in 1981, the empirical assessment of the theory only started a few years later, as dates of publishing range from 1998 to 2019. Most studies focus on the United States (14), but our sample also contains papers on Australia (1), Brazil (1), Germany (2), Indonesia (1), Italy (2), and Switzerland (2). Eight articles use cross-national data and analyse from 2 to 110 countries. Early studies used OLS and panel data methods to estimate the results, while studies from 2012 onward have also applied causal inference designs, such as instrumental variables and regression discontinuity models.

Regarding the dependent variables included in the sample, 16 studies employ public expenditure per capita, 9 papers use its natural logarithm, and 8 of them analyse the impact of legislature size on public expenditures as a percentage of GDP. This indicates that the area has refined the original formulation of $1/n$ and tested the impact of larger legislatures on different measures of government spending. Our independent variables of interest are lower chamber size (26), the natural logarithm of lower chamber size (7), and upper chamber size (12).

We also coded five moderators that may help us understand the heterogeneity in the reported results. We included them in our meta-regressions alongside an indicator for the type of independent variable used in the original study. The additional moderators are: 1) publication year; 2) paper publication in an academic journal; 3) estimation method; 4) institutional design; 5) electoral system. Since the literature on the "law of $1/n$" is notably diverse, we included only moderators that either refer to important theoretical questions, such as the effect of the electoral system on public spending, or to essential characteristics of the publications themselves. Although more moderators exist in the literature (e.g., data aggregation level), they do not appear as often as necessary for their inclusion in the meta-regressions. Table 2 shows the descriptive statistics of the moderator variables.

Table 2: Descriptive Statistics of Moderators

| | [ALL]<br>N=162 | Other Coefficients<br>N=117 | Main Sample<br>N=45 |
|---|---|---|---|
| Independent Variables: | | | |
| K | 47 (29.0%) | 35 (29.9%) | 12 (26.7%) |
| logN | 33 (20.4%) | 26 (22.2%) | 7 (15.6%) |
| N | 82 (50.6%) | 56 (47.9%) | 26 (57.8%) |
| Electoral system: | | | |
| Maj | 73 (45.1%) | 51 (43.6%) | 22 (48.9%) |
| Non-Maj | 89 (54.9%) | 66 (56.4%) | 23 (51.1%) |
| Estimation method: | | | |
| OLS | 49 (30.2%) | 40 (34.2%) | 9 (20.0%) |
| PANEL | 83 (51.2%) | 58 (49.6%) | 25 (55.6%) |
| IV | 19 (11.7%) | 12 (10.3%) | 7 (15.6%) |
| RDD | 11 (6.79%) | 7 (5.98%) | 4 (8.89%) |
| Year | 2008 (6.15) | 2007 (5.96) | 2009 (6.54) |
| Published work: | | | |

Table 2: Descriptive Statistics of Moderators *(continued)*

| | [ALL] | Other Coefficients | Main Sample |
|---|---|---|---|
| No | 17 (10.5%) | 11 (9.40%) | 6 (13.3%) |
| Yes | 145 (89.5%) | 106 (90.6%) | 39 (86.7%) |
| Institutional Design: | | | |
| Bicameral | 49 (30.2%) | 32 (27.4%) | 17 (37.8%) |
| Mixed | 50 (30.9%) | 38 (32.5%) | 12 (26.7%) |
| Unicameral | 63 (38.9%) | 47 (40.2%) | 16 (35.6%) |

A key methodological issue we had to address concerns the potential violation of an important assumption in a meta-analysis, that of effect size independence (Cheung 2014, 2019; Veroniki et al. 2016). In our study sample, authors frequently use similar datasets, and almost all papers fit more than one model with similar variables, what suggests that the assumption does not hold. We use two procedures to tackle this problem. First, we created two sets of study coefficients to reduce the impact of multicollinearity in our estimations. The first group includes only the most rigorous models from each paper, that is, those estimated with the largest *n*, most control variables, and fixed effects if the authors added them. If the article employed a regression discontinuity design, we chose the coefficient from the optimal bandwidth or from the intermediate one. This sample encompasses 45 estimates, as 13 articles analysed two dependent or independent variables of interest[4]. Our second sample, in contrast, contains all the 162 effect sizes reported in the 30 papers. Here we focus on the results for our restricted sample as we consider them more robust, but the findings are very similar when we use the extended set.

Our second procedure consists of employing multilevel random effect models (Cheung 2014; Matthes et al. 2019) in all of our estimations. We add two extra levels to the regular meta-analysis, one including a unique publication ID for each paper, and another indicating the data source used in the original study. By adding these two levels, we account for within- and between-study variation, thus removing these sources of effect size dependency. More information about the multilevel models can be found in Section H of the Supplementary Material.

## 3 Results

Resumir resultados das meta-análises. Incluir regressões com todos os coeficientes na tabela de meta-regressions. Incluir frases com "highlights" na sub-seção de meta-regressions. Trocar parágrafo introdutório e o de binomial z-tests pela nova versão do Danilo (que não subiu pro repo).

[4]The papers that used more than one dependent or independent variable of interest are Baqir (1999); Bjedov et al. (2014); Bradbury and Crain (2001); Chen and Malhotra (2007); Crowley (2019); Erler (2007); Gilligan and Matsusaka (2001); Lee (2016); Lee and Park (2018); Maldonado (2013); Primo (2006); Ricciuti et al. (2003); Ricciuti (2004).

## 3.1 Binomial Z-Tests

The "law of $1/n$" states that more legislators increase government expenditure. Here we employ three methods to assess the empirical validity of that relationship. First, we run a binomial one-proportion z-test to determine whether the study coefficients have a positive or negative sign. Then, we fit 9 random-effect models using the `meta` (Balduzzi et al. 2019) and the `dmetar` (Harrer et al. 2019) packages for the `R` statistical language (R Core Team 2019). We estimate the true effect size variance ($\tau^2$) with a Restricted Maximum Likelihood Estimator, which the literature considers the most precise for continuous dependent variables (Veroniki et al. 2016). Lastly, we run a series of meta-regressions to test possible sources of result heterogeneity. To recapitulate, our independent variables of interest are lower chamber size, the natural logarithm of lower chamber size, and upper chamber size. The dependent variables are public expenditure per capita, the natural logarithm of public expenditure per capita, and government expenditure as a percentage of GDP. Since the outcomes have different scales, we treat them separately in our models.

The binomial z-test evaluates whether the coefficient of our independent variables are positive or negative. The null hypothesis here states that the sign of the coefficient is equally likely to be positive or negative. We start with lower house size. Our results indicate that there is no correlation between the number of legislators in the lower house and public expenditure (successes = 13, trials = 26, $p_{success}$ = 0.5, 95% CI = [0.299; 0.701], $p$-value = 1). Note that the "law of $1/n$" suggests that there is a positive association between both. The binomial test for the natural logarithm of lower chamber size also shows a non-statistically significant result (successes = 5, trials = 7, $p_{success}$ = 0.714, 95% CI = [0.29; 0.963], $p$-value = 0.453). In contrast, we find a positive result for the number of legislators in the upper house, which is in line with the mainstream literature (successes = 10, trials = 12, $p_{success}$ = 0.833, 95% CI = [0.516; 0.979], $p$-value = 0.039).

## 3.2 Meta-Analysis

We then proceed to the meta-analysis. We matched the house size variables with our measures of government spending and created a theoretical $3 \times 3$ matrix. Out of the 9 possible variable combinations, we found only 7 in the article pool. Our sample includes no papers that analyse the relationships between the log lower chamber size and public expenditure per capita or between upper chamber size and the logarithm of public expenditure per capita. We standardized effect sizes by drawing the coefficients and standard errors from the articles. When the latter were not directly available, we used t-statistics to retrieve them.

Figure 1: Forest plots of the relationship between legislature size and government spending (reduced sample)

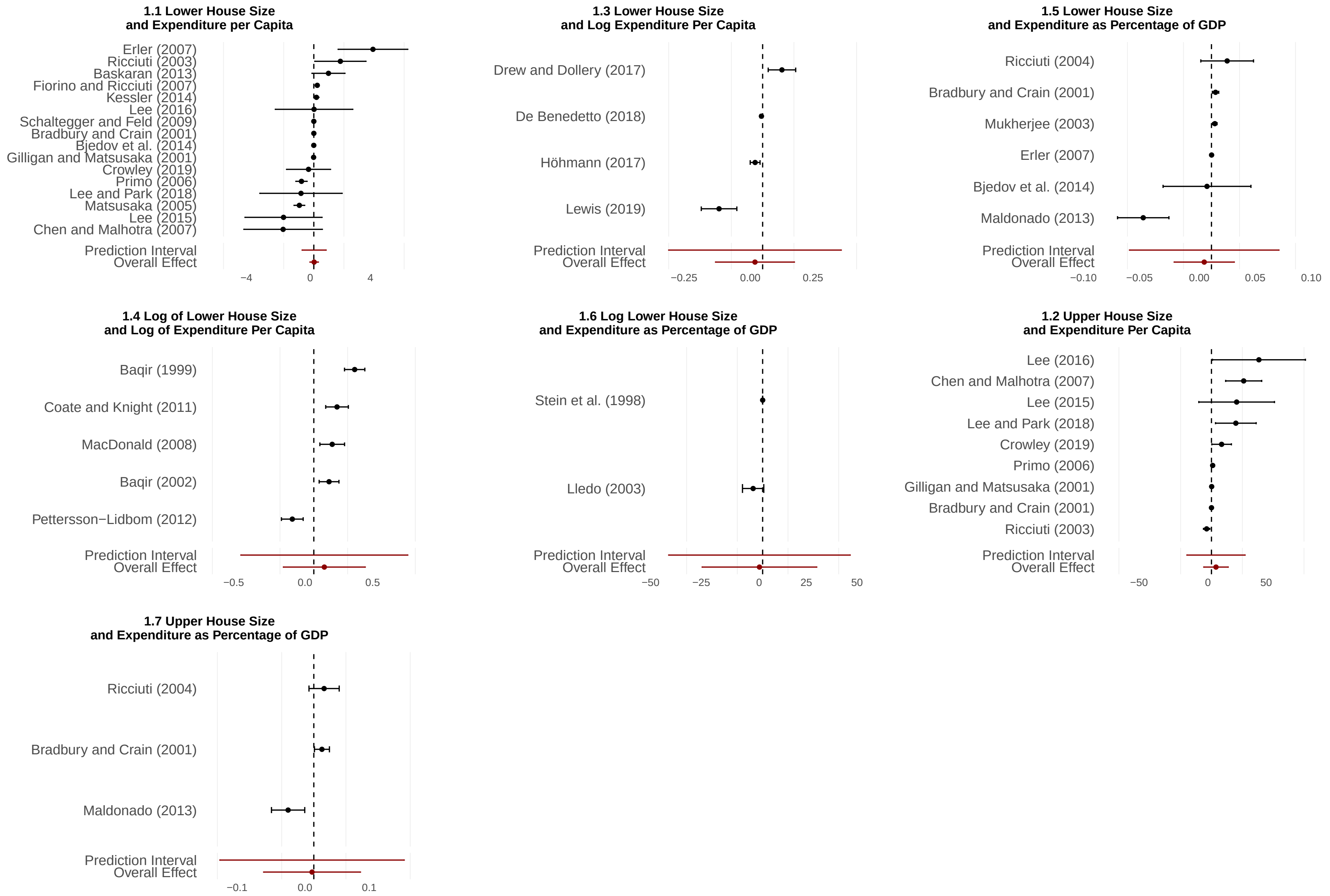


Figure 1 shows the forest plots for our restricted sample, which includes only the 45 main coefficients of the 30 selected papers. On the left side of the plots are the name of the study authors and the paper publication year. For unpublished studies, we included the first year the paper was available online. The bars in the middle show the reported effect sizes and the vertical lines indicate their average, weighted by standard errors. The length of the lines represent the precision of the estimates. The red line at the bottom of the figures displays the aggregate coefficients plus their respective confidence intervals.

The first line of graphs reports the results for lower chamber size. In the first model, which correlates lower chamber size and expenditure per capita, we find a standardised mean difference (SMD) of -0.044 and a standard error of 0.211 (studies = 16, 95% CI = [-0.494; 0.405], $p$-value = 0.836 , prediction interval = [-1.224; 1.135]). Therefore, we cannot reject the null hypothesis that the effect size is zero. The $I^2$ statistic, which quantifies the degree of heterogeneity among studies, is equal to 86.95%. $I^2$ values above 75% indicate very high study heterogeneity (Higgins et al. 2019).

We see similar results when we compare lower chamber size with log expenditure per capita. In this model, the average effect size is -0.031 and the standard error is 0.051 (studies = 4, 95% CI = [-0.192; 0.131], $p$-value = 0.59, prediction interval = [-0.499; 0.438]; $I^2$ = 91.73%). The coefficient is statistically indistinguishable from zero.

In our restricted sample, larger lower house size also does not increase government spending as a percentage of GDP (studies = 6, SMD = -0.006, SE = 0.011, 95% CI = [-0.034; 0.021], $p$-value = 0.571, prediction interval = [-0.079; 0.066], $I^2$ = 88.35%). In the extended sample the effect is negative, but it is also statistically insignificant.

XXXXX We find a positive effect in our extended sample and the coefficient is statistically significant at the 10% level (coefficients = 26, SMD = 0.009, SE = 0.003, 95% CI = [0.002; 0.015], $p$-value = 0.008, prediction interval = [-0.02; #0.038], $I^2$ = 99.23%). The result supports the "law of $1/n$", but the evidence is moderate as the prediction interval include zero.

Next, we present the meta-analyses using the logarithm of lower house size. We start with the relationship between this variable and the logarithm of expenditure per capita. The result is positive, but the coefficient is not significant, and the prediction interval encompasses zero (studies = 5, SMD = 0.113, SE = 0.075, 95% CI = [-0.097; 0.322], $p$-value = 0.209, prediction interval = [-0.462; 0.687], $I^2$ = 94.32%). Results in the full sample are also null.

Our model that correlates log lower chamber size with public expenditures as a percentage of GDP fails to reach conventional levels of statistical significance (studies = 2, SMD = -1.576, SE = 2.223, 95% CI = [-29.82; 26.668], $p$-value = 0.607, prediction interval = [NA; NA], $I^2$ = 67.5%). The extended sample also gives us a null result.

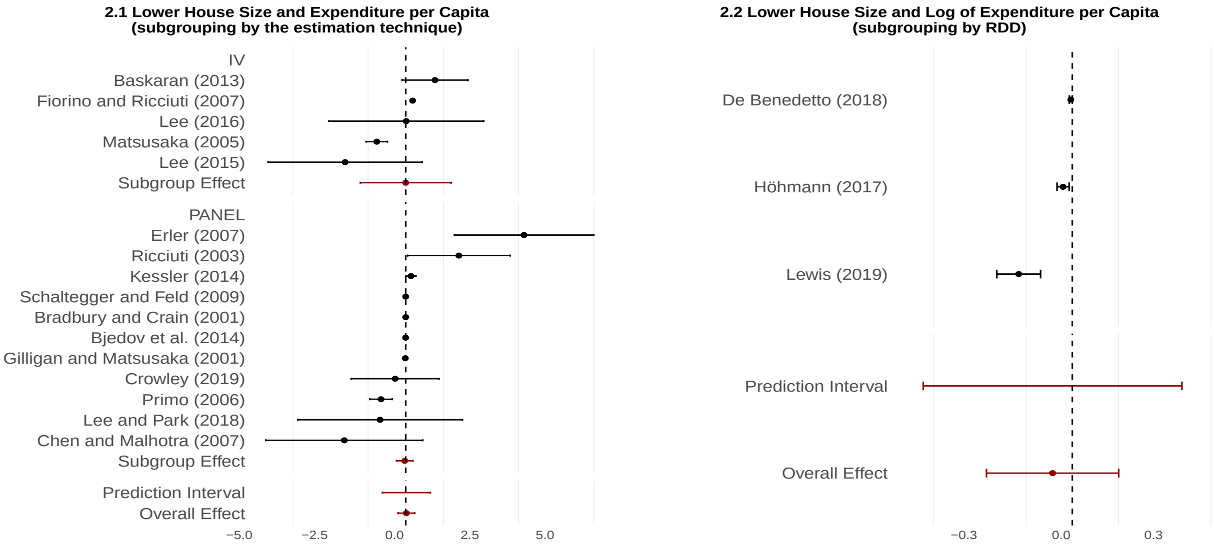
The third set of models uses upper house size as the main independent variable. We find a positive correlation between this variable and expenditure per capita but the coefficient is not significant (studies = 9, SMD = 6.68, SE = 3.914, 95% CI = [-2.345; 15.705], $p$-value = 0.126, prediction interval = [-16.774; 30.134], $I^2$ = 80.7%). But as with the other models, the prediction interval again includes zero. When we run the same analysis in the extended sample, we see a significant coefficient for the estimate, yet the prediction interval also contains zero (coefficients = 34, SMD = 4.788, SE = 1.299, 95% CI = [2.145; 7.431], $p$-value < 0.001, prediction interval = [-5.752; 15.328], $I^2$ = 83.85%).

Our last estimation analyses the relationship between upper chamber size and government spending as a percentage of GDP. The coefficient is not statistically significant, indicating a null effect (studies = 3, SMD = -0.003, SE = 0.018, 95% CI = [-0.079; 0.074], $p$-value = 0.891, prediction interval = [-0.428; 0.423], $I^2$ = 85.79%). The result is very similar in the extended sample.

In a nutshell, we do not find strong evidence in favour of the "law of $1/n$". While some models do show a positive and statistically significant result, none of the prediction intervals are totally positive or negative. The studies also have considerable heterogeneity, what indicates that the original coefficients do not point consistently towards the same direction.

One reason why we have not detected any strong effects may be due to the identification strategy authors use in their models. On the one hand, OLS and panel data models require too many controls to make units comparable, and they are vulnerable to omitted variable bias or post-treatment bias (Cinelli and Hazlett 2020; Pearl 2015). On the other hand, estimation methods such as instrumental variables and regression discontinuity designs have become popular because of their high internal validity (Angrist and Pischke 2008). Figure 2 shows the disaggregated effects for two sets of models that employ causal estimation techniques. They measure the impact of lower house size on expenditure per capita (left) and on the natural logarithm of expenditure per capita (right).

Figure 2: Forest plots of the relationship between legislature size and government spending with regression method heterogeneity (restricted sample)




Papers that employed instrumental variables show some interesting variation: out of the four coefficients listed, two are positive and two are negative. Two of these four coefficients are significant, again one positive and one negative. The subgroup analysis presents a SMD which is negative but insignificant. In contrast, all papers that use regression discontinuity designs show negative and statistically significant results. Since only three papers in our sample use RDDs, we are cautious about predicting an overall negative relation, but they do indicate that better identification strategies yield a zero-to-negative impact of legislature size on expenditure, in support of the reverse "law of $1/n$".

### 3.3 Meta-Regressions

In this section, we run a series of meta-regressions with covariates that may account for differences across the selected papers. The first variable indicates whether the study uses lower chamber size, log lower chamber size, or upper chamber size as a main explanatory variable. We included the individual effect sizes for upper and lower chamber sizes when papers analyzed both. The second variable shows the study publication year, which we included to capture temporal variation in the study coefficients. We also add a dummy variable to assess whether published articles report effect sizes that are higher or lower than those from working papers. The fourth variable measures whether studies focusing on non-majoritarian electoral systems report coefficients that are smaller or larger than those from majoritarian countries. The fifth covariate is a categorical variable indicating the statistical procedure used in the original models (panel data, instrumental variables, OLS, or regression discontinuity design). In our last variable, we separate coefficients that use samples from unicameral or bicameral systems, and code papers using polities with different institutional designs as “mixed”.

Table {tabregressions} presents the meta-regression results for our restricted and extended samples. Each column represents one of the three measures of public spending we discuss in this paper. To reduce the risk of false positives in our analyses, we use permutation tests to calculate significance levels for the meta-regressions (Higgins and Thompson 2004).

The first two models show the results for public expenditure per capita. No variable reaches conventional levels of statistical significance in the restricted sample. In the extended sample, we find that models that use lower chamber size as an independent variable have lower effects when compared to upper chamber size. This suggests that an additional member in the lower house has a smaller impact on public spending than a member in the upper house. Moreover, the results for the extended sample point out that recent studies find larger effects than older ones.

The third and fourth columns use the natural logarithm of expenditure per capita as the dependent variable. None of the covariates are statistically significant in our smaller sample, but two moderators are negatively associated with the outcome in our larger study pool. They both refer to estimation methods. Studies that employ panel/fixed effects or regression discontinuity designs (RDDs) have lower coefficients for log expenditure per capita if we take OLS as the reference category.

Two variables are statistically significant in the last set of meta-regressions, which include public expenditures as a percentage of GDP as the dependent variable. Both in our restricted and in our extended samples, recent studies have smaller coefficients than early papers, which stands in contrast with our previous models. Non-majoritarian voting systems are also associated with lower levels of public spending, what is against the theoretical expectations of the "law of $1/n$". The results, however, do not replicate in the first set of estimations.

Overall, our results suggest that study coefficients are highly sensitive to research design choices. The same study samples may produce different outcomes depending on the response variables scholars decide to analyse. Moreover, we find evidence that results vary considerably if the study employs different measures of legislature size or use causal research methods. The impact of factors such as the electoral system or year of publication also appear to be conditional on the selected model.

## 4 Discussion

Discussion: 1 - ok 2 - ok, só corrigir 3 - como nossos resultados "resolvem" as questões da teoria a linha que avalia o desenho institucional está certa dessa forma. sobre a galera que escreve sobre as dinâmicas internas de competição e coalisão, podemos inferir que essas dinâmicas influenciam muito mais do que legislature size. Juntar a lit review com nosso ultimo paragrafo falando sobre as recomendações de para onde deve avançar a literatura. "Apesar de ela ser extensa, vemos que ainda poderiam ser explorados A B C". 4 - ultimo paragrafo vira o que é o terceiro. uma das sugestões é aumentar o numero de replicações, etc, de como a disciplina como um todo deve avançar, sobre como construimos conhecimento na disciplina.

In this article, we assess the empirical validity of the "law of $1/n$". Based on a sample of 30 publications on the topic, our meta-analyses show that there is no strong evidence that an increase in the number of legislators has a significant effect on public expenditures. If such effect exists, it is likely driven by an increase in the size of the upper legislature, as suggested by several studies in the literature (Baqir 2002; Bradbury and Crain 2001; Bradbury and Stephenson 2003; Chen and Malhotra 2007; Gilligan and Matsusaka 2001; Primo 2006). Instead, we find better evidence for the "reverse law of $1/n$", which posits that larger legislatures lead to lower government spending. This is mainly because studies using regression discontinuity designs, a method that has robust internal validity, consistently indicate a negative relationship between lower house size and the logarithm of expenditure per capita (Höhmann 2017; Lewis 2019; Pettersson-Lidbom 2012).

The meta-regressions show that study characteristics have a considerable influence on reported results. Electoral system affects the relationship between legislature size and public expenditure, but the results are not replicable in all estimations. Publication year generates conflicting findings in our models. Nevertheless, the meta-regressions confirm that RDDs produce negative effects more frequently than OLS regressions.

The literature explores many mediating and alternative explanations for how or why the number of legislators in a chamber relates to their choice of commmon pool resource use. Crowley (2019) argues that a variable that better translates how large legislatures decrease the efficiency of public spending is fragmentation, which also expresses the and that its effect is actually non-linear. Other studies echo this argument and develop other frgamentation mechanisms that explain relationships that are linear and non-linear. For instance, when it comes to district fragmentation, Baqir (1999) and Drew and Dollery (2017) support the "law of $1/n$"'s positive effect on public spending when one considers the amount of districts that share a common pool of resources. Many studies demonstrate how partisan fragmentation is a bigger predictor of increased spending, and analyze how majorities and veto powers respectively boost and curtail these effects (Baqir 2002, cite all the papers). These findings dialogue directly with Weingast et al. (1981)'s *norm of universalism* within US legislatures, which is the assumption that, when drawing from common pool resources, chambers will always approve of any singular legislators' projects.

Applying the "law of $1/n$" in contexts too far removed from the US attests against it, as, for instance, public spending more strongly correlates to cabinet than legislature size in Swiss cantons and Malaysian (states or municipalities?), where decision-making power is concentrated in the executive.

Why is there no clear-cut evidence in favour or against the "law of $1/n$"? A plausible reason may be that there are few incentives for the pure accumulation of knowledge in the social sciences, at least when compared to the benefits scholars may accrue when they challenge or add features to existing theories (Geddes 2003). This leads to a reduced number of replication studies in the field, although we have seen some positive changes in this respect, such as EGAP's *Metaketa Initiative*.[5]

For instance, in our sample, papers added supermajority rules (Lee 2015, 2016), redistricting (Baqir 2002; Lee and Park 2018), party ideology (Bjedov et al. 2014), coalition sizes (Baskaran 2013), term limits (Erler 2007), bicameralism (Ricciuti et al. 2004), and the interplay between upper and lower houses (Chen and Malhotra 2007) to the main theory, but a comprehensive procedural replication of the findings using different samples is yet to be written.

The addition of new features has the benefit of enriching the original theory with useful details, although it has the disadvantage of not providing a conclusive test to the "law of $1/n$".

Our analyses suggest three areas for further research. First, our study sample did not include articles that evaluate the association between the log lower chamber size and public expenditure per capita or between upper chamber size and log expenditure per capita. New work on that area might clarify some of the inconsistencies we find here. Second, despite the inclusion of several moderators in our models, aggregate results still show considerable heterogeneity. Domestic factors such as party dynamics or gerrymandering (Lee 2015; Mukherjee 2003; Gilligan and Matsusaka 2006) may prove useful in this regard. Finally, we highlight the need for more causal inference studies in the literature. Whenever possible, authors should leverage natural and quasi-experiments to assess whether the current results hold when tested with such research designs. These suggestions may help scholars and policy-makers to reach an optimal balance between sound fiscal policy and the demands for increased political representation.

[5] See `https://egap.org/our-work/the-metaketa-initiative` for further information.

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