The Effect of Legislature Size on Public Spending

A Meta-Analysis*

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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

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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). Recent research has further questioned the validity of the "law of $1/n$". For instance, spending limits, bicameralism, or strong executives may reduce the inefficiency of pork barrel projects (Bradbury and Crain 2001; Chen and Malhotra 2007; Primo 2006). 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.

Our survey of the scholarship confirms this continuum of positive, insignificant, and negative results. Out of the 42 coefficients included in our article sample, 40.5% of them are positive and statistically significant, 21.4% are positive and statistically insignificant, 19% are negative and statistically insignificant, and 19% are negative and statistically significant. Given this diversity of empirical findings, a systematic review of the existing evidence may help us reach a meaningful conclusion about the effect of legislature size on public spending. Meta-analysis is the most appropriate method for this task. Meta-analysis combines the outcomes of multiple studies into a single estimation and allows scholars 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).

In this letter, we conduct the first meta-analysis that tests the generality of the "law of $1/n$". We have selected 29 articles that use quantitative methods to assess the impact of legislature size over government spending across several dimensions. We run two sets of models: the first group uses only the main estimates of each selected paper (42), while the second set includes all coefficients reported in our sample (142).[1] Our independent variables consist of three measures, namely the size of the lower chamber (n), its natural logarithm ($\log(n)$), and the number of members in the upper chamber (k). We evaluate their effect upon public expenditure

[1] Although there are 29 papers in our review, we include 42 coefficients in the restricted sample. This is because 13 articles report separate estimates for the impact of lower and upper house size on government expenditures. In the full model, we add every outcome reported in the papers, regardless of whether the coefficient comes from the main tables or from robustness checks. We discuss our sampling process in the Methods section and in the Supplementary Material.

per capita, the natural logarithm of public expenditure per capita, and government expenditure as a percentage of GDP. We then estimate if the results vary according to four potential sources of effect heterogeneity.

Aggregate results show that legislative size has no significant impact on public spending. However, the meta-regressions suggest that our study sample has high levels of heterogeneity, and effects differ substantially according to study specifications. We find that one reliable predictor of effect size is the research method employed in the original paper. 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. This goes in contrast with the original theory and supports the existence of a "reverse law of $1/n$". Additionally, we find that non-majoritarian voting systems decrease government spending as a percentage of GDP, which is also evidence against the theoretical expectations of the "law of $1/n$", and they do not have a relevant impact on the other measures of public expenditure. In summary, our analysis does not provide robust support for the theory as originally conceived, and causal inference models suggest that larger legislatures are associated with lower public spending.

2 Methods

We collected the study sample using three criteria. First, the study should cite Weingast et al. (1981) as their work is foundational to the distributive politics literature. Second, the study had to use quantitative methods to estimate the relationship between our variables of interest.[2] Third, the study should be written in the English language. We conducted a primary search using Scopus, Microsoft Academic, and Google Scholar, three large academic databases.[3]

After applying our exclusion criteria, the search produced a dataset of 29 studies as of the 21st of November, 2019. Table 1 contains the full list of articles from which we drew data. A PRISMA[4] flow diagram showing the number of resulting papers after each review step is available in the Supplementary Material.

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

Author(s)	Title	Journal	Year	Country	Method	Electoral System
E. Stein, E. Talvi & A. Grisanti	Institutional arrangements and fiscal performance: the latin american experience	Unpub	1998	Multiple (26)	OLS	NM

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

[3]See the Supplementary Material for code.

[4]The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement provides a checklist designed to improve the quality and transparency of study selection processes in meta-analyses. For more information on the PRISMA framework, see Liberati et al. (2009).

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Author(s)	Title	Journal	Year	Country	Method	Electoral System
R. Baqir	Districts, spillovers, and government overspending	Unpub	1999	USA	OLS	M
J. Bradbury & M. Crain	Legislative organization and government spending: cross-country evidence	JPubE	2001	Multiple (37)	PANEL	NM
T. Gilligan & J. Matsusaka	Fiscal Policy, Legislature Size, and Political Parties	NTJ	2001	USA	PANEL	M
R. Baqir	Districting and Government Overspending	PC	2002	USA	OLS	M
B. Mukherjee	Political Parties and the Size of Government in Multiparty Legislatures: Examining Cross-Country and Panel Data Evidence	CPS	2003	Multiple (110)	PANEL	NM
V. Lledo	Electoral systems, legislative fragmentation and public spending: a comparative analysis of brazilian states	Unpub	2003	BRA	OLS	NM
R. Ricciuti	Representing Interests: Legislature Size, Constituency Size and Government Spending in a Panel of Countries	Unpub	2003	Multiple (23)	PANEL	NM
R. Ricciuti	Legislature size, bicameralism and government spending: evidence from democratic countries	RivPE	2004	Multiple (75)	OLS	NM
J. Matsusaka	The Endogeneity of the Initiative: A Comment on Marschall and Ruhil	SPPQ	2005	USA	IV	M
D. Primo	Institutional constraints on government spending	E&P	2006	USA	PANEL	M
H. A. Erler	Legislative term limits and state spending	PC	2007	USA	PANEL	M
J. Chen & N. Malhotra	The law of k/n: the effect of chamber size on government spending in bicameral legislatures	APSR	2007	USA	PANEL	M
N. Fiorino & R. Ricciuti	Legislature size and government spending in Italian regions: Forecasting the effects of a reform	PC	2007	ITA	IV	NM

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Author(s)	Title	Journal	Year	Country	Method	Electoral System
L. MacDonald	The impact of government structure on local public expenditures	PC	2008	USA	OLS	M
J. Bradbury & E. F. Stephenson	Spatially Targeted Government Spending and Heterogeneous Constituent Cost Shares	JPriE	2009	USA	OLS	M
C. Schaltegger & L. Feld	Do large cabinets favor large governments? Evidence on the fiscal commons problem for Swiss Cantons	JPubE	2009	CHE	PANEL	NM
P. Pettersson-Lidbom	Does the size of the legislature affect the size of government? evidence from two natural experimentss	JPubE	2012	FIN & SWE	RDD	NM
B. Maldonado	Legislatures, Leaders and Leviathans	SSQ	2013	Multiple (92)	OLS	NM
T. Baskaran	Coalition governments, cabinet size, and the common pool problem: evidence from the german states	EJPE	2013	DEU	IV	NM
A. Kessler	Communication in federal politics: universalism, policy uniformity, and the optimal allocation of fiscal authority	JPE	2014	USA	PANEL	M
T. Bjedov, S. Lapointe & T. Madiès	The impact of within-party and between-party ideological dispersion on fiscal outcomes: evidence from Swiss cantonal parliaments	PC	2014	CHE	PANEL	NM
D. Lee	Supermajority rule and the law of 1/n	PC	2015	USA	IV	M
D. Lee	Supermajority rule and bicameral bargaining	PC	2016	USA	PANEL	M
D. Höhmann	The effect of legislature size on public spending: evidence from a regression discontinuity design	PC	2017	DEU	RDD	NM

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

Author(s)	Title	Journal	Year	Country	Method	Electoral System
J. Drew & B. Dollery	The price of democracy? political representation structure and per capita expenditure in victorian local government	UAR	2017	AUS	PANEL	NM
D. Lee & S. Park	Court-ordered redistricting and the law of 1/n	PC	2018	USA	PANEL	M
G. Crowley	The law of 1/n revisited: distributive politics, legislature size, and the costs of collective action	SEJ	2019	USA	PANEL	M
B. Lewis	Legislature size, local government expenditure and taxation, and public service access in indonesia	SCID	2019	IDN	RDD	NM

Note: 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, 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). Country codes follow the ISO 3166-1 alpha-3 international standard.

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 (1), and Switzerland (2). Five articles use cross-national data and analyse from 2 to 110 countries. Early studies used OLS and panel data methods to estimate the results, whereas the use of regression discontinuity designs is a recent addition to the literature, as the first paper to apply it was published in 2012.

Regarding the dependent variables included in the sample, 16 studies employ public expenditure per capita, 7 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 $1/n$ suggested by Weingast et al. (1981) and tested the impact of larger legislatures on different measures of government spending. Our independent variables of interest are n, lower chamber size (24), ($\log(n)$), the natural logarithm of lower chamber size (6), and k, which represents upper chamber size (12).

We also coded four 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 (n, $\log(n)$, or k). The additional moderators are: 1) publication year; 2) paper publication in an academic journal; 3) electoral system; 4) estimation method. Since the literature on the "law of $1/n$" is notably diverse, we were restricted to include only the 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 (ie., data aggregation level), they do not appear as often as required for the meta-regressions. Table 2 shows the descriptive statistics of the moderator variables.

Table 2: Descriptive Statistics of Moderators

	Main Coefficients	Other Coefficients	All Coefficients
	N=42	N=100	N=142
Independent Variables:			
K	12 (28.6%)	33 (33.0%)	45 (31.7%)
N	24 (57.1%)	55 (55.0%)	79 (55.6%)
logN	6 (14.3%)	12 (12.0%)	18 (12.7%)
Year	2009 (6.56)	2008 (5.82)	2008 (6.04)
Published work:			
Yes	36 (85.7%)	93 (93.0%)	129 (90.8%)
No	6 (14.3%)	7 (7.00%)	13 (9.15%)
Electoral system:			
Majoritarian	22 (52.4%)	46 (46.0%)	68 (47.9%)
Non-Majoritarian	20 (47.6%)	54 (54.0%)	74 (52.1%)
Estimation method:			
OLS	11 (26.2%)	36 (36.0%)	47 (33.1%)
PANEL	23 (54.8%)	51 (51.0%)	74 (52.1%)
IV	5 (11.9%)	7 (7.00%)	12 (8.45%)
RDD	3 (7.14%)	6 (6.00%)	9 (6.34%)

Since most selected articles have more than one effect size, the observations in our dataset are not independent. To reduce the impact of multicollinearity, we estimate the models using two sets of study coefficients. The first group includes only the most rigorous model 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 42 estimates, as 13 articles analysed two dependent or independent variables of interest (Baqir 1999; Bjedov et al. 2014; Bradbury and Crain 2001; Chen and Malhotra 2007; Crowley 2019; Lee 2016; Lee and Park 2018; Maldonado 2013; Primo 2006; Ricciuti et al. 2003). Our second sample, in contrast, contains all the 142 effect sizes reported in the 29 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. We discuss eventual differences in the next section. Please refer to the Supplementary Material for further information about our sampling process and for the complete results.

3 Results

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 (τ^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 (n), the natural logarithm of lower chamber size ($\log(n)$), and upper chamber size (k). 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 n, lower house size. Our results indicate that there is no correlation between the number of legislators in the lower house and public expenditure (successes = 11, trials = 24, $p_{\text{success}} = 0.458$, 95% CI = [0.256; 0.672], p-value = 0.839). Note that the "law of $1/n$" suggests that there is a positive association between both. The binomial test for $\log(n)$ also shows a non-statistically significant result (successes = 5, trials = 6, $p_{\text{success}} = 0.833$, 95% CI = [0.359; 0.996], p-value = 0.219). In contrast, we find a positive result for the number of legislators in the upper house (k), which is in line with the mainstream literature (successes = 10, trials = 12, $p_{\text{success}} = 0.833$, 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 3×3 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 $\log(n)$ and public expenditure per capita or between k and the logarithm of public expenditure per capita.

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

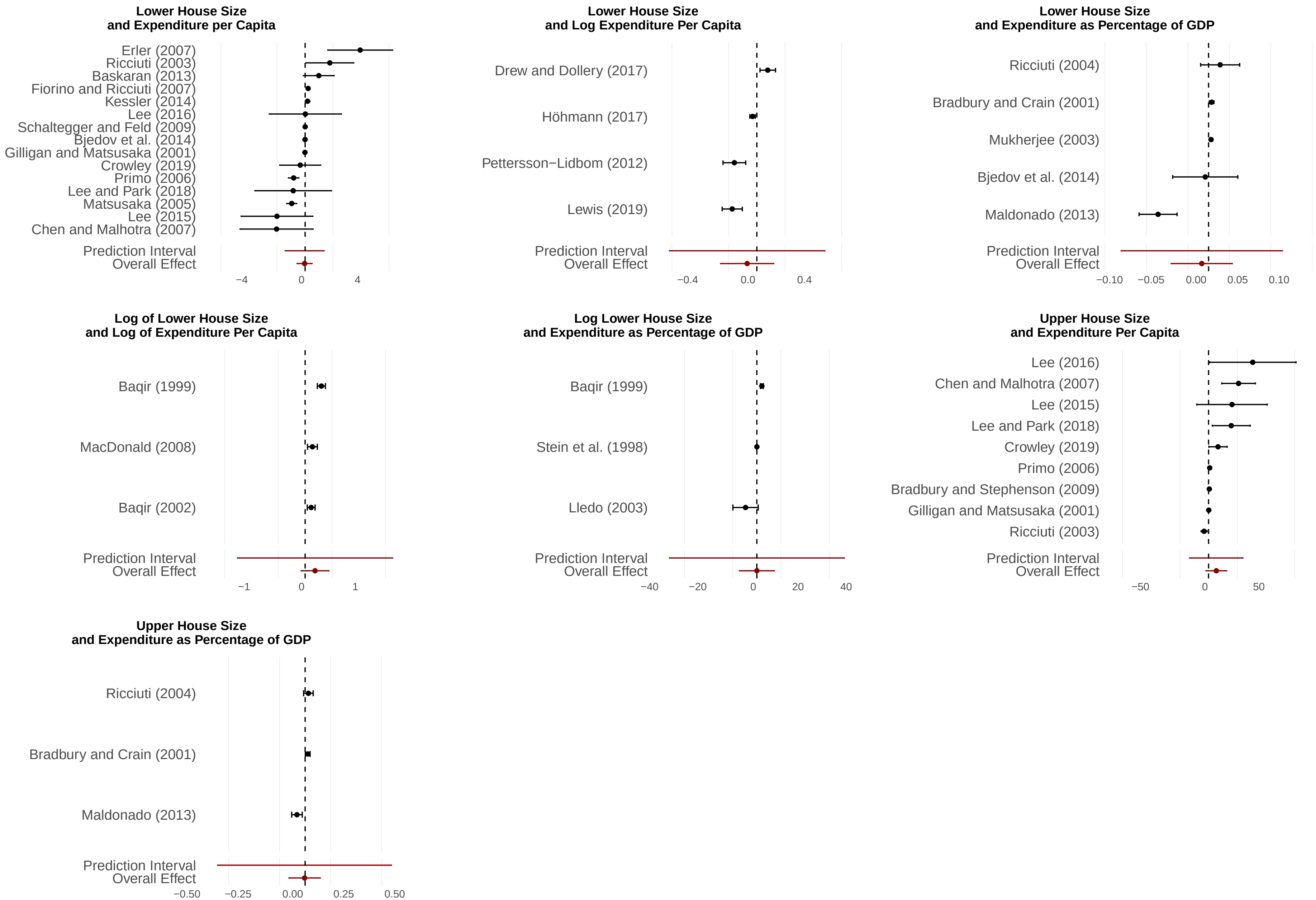


Figure 1 shows the forest plots for our restricted sample, which includes only the 42 main coefficients of the 29 selected papers. On the left side of the plots are the name of the study authors and the paper publication year. For unpublished studies, we included the first year the paper was available 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 column of the graph reports the results for n, lower chamber size. In the first model, which correlates n and expenditure per capita, we find a standardised mean difference (SMD) of -0.037 and a standard error of 0.248 (studies = 15, 95% CI = [-0.569; 0.494], p-value = 0.882 , prediction interval = [-1.424; 1.349]). 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 93.49%. I^2 values above 75% indicate very high study heterogeneity (Higgins et al. 2019).

We see similar results when we compare n with log expenditure per capita. In this model, the average effect size is -0.069 and the standard error is 0.059 (studies = 4, 95% CI = [-0.256; 0.119], p-value = 0.328, prediction interval = [-0.618; 0.481]; I^2 = 92.52%). 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 = 5, SMD = -0.008, SE = 0.013, 95% CI = [-0.045; 0.029], p-value = 0.567, prediction interval = [-0.105; 0.089], I^2 = 87.08%). We find a positive effect in our extended sample and the coefficient is statistically significant at the 10% level (coefficients = 21, SMD = 0.008, SE = 0.004, 95% CI = [0; 0.016], p-value = 0.058, prediction interval = [-0.026; 0.042], I^2 = 98.48%). 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 $\log(n)$, the logarithm of lower house size, as the main explanatory variable. We start with the relationship between $\log(n)$ and the logarithm of expenditure per capita. The result is positive and statistically significant at 10%, but the prediction interval encompasses zero (studies = 3, SMD = 0.184, SE = 0.06, 95% CI = [-0.074; 0.443], p-value = 0.092, prediction interval = [-1.258; 1.627], I^2 = 85.9%). Although the coefficient has the predicted sign, we should interpret the finding with caution as it does not replicate in our sample of 142 effect sizes.

Our model that correlates $\log(n)$ with public expenditures as a percentage of GDP fails to reach conventional levels of statistical significance (studies = 3, SMD = 0.02, SE = 1.677, 95% CI = [-7.196; 7.237], p-value = 0.991, prediction interval = [-36.206; 36.247], I^2 = 96.13%). The extended sample also gives us a null result.

The third set of models uses k, upper house size, as the main independent variable. We find a positive correlation between k and expenditure per capita but the coefficient is not significant (studies = 9, SMD = 6.727, SE = 3.883, 95% CI = [-2.227; 15.681], p-value = 0.121, prediction interval = [-16.485; 29.939], I^2 = 81.25%).

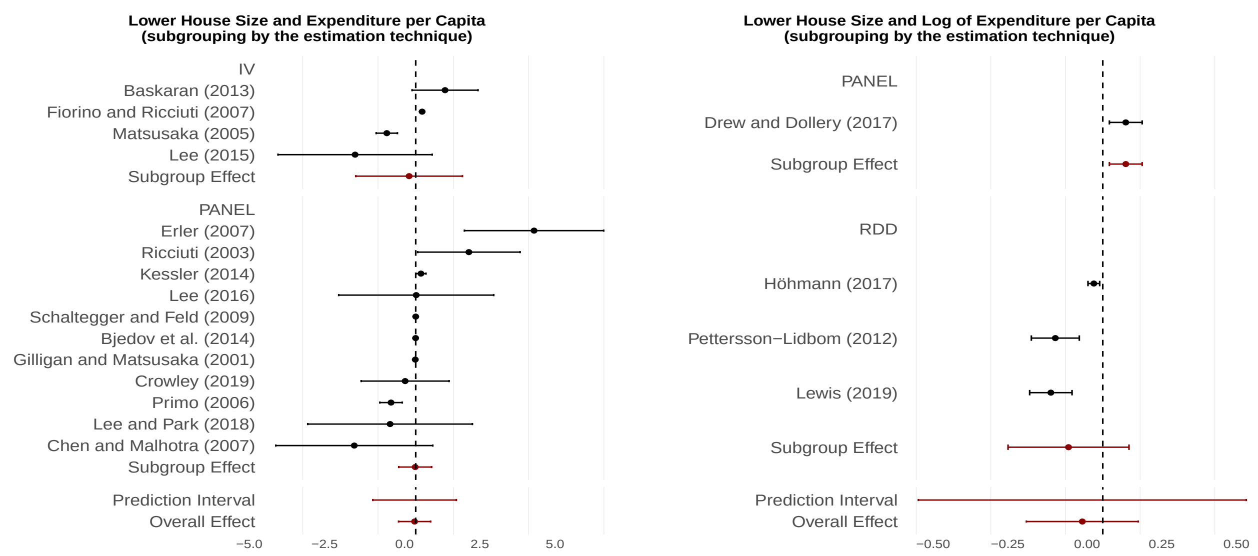
But as with the other models, the prediction interval again includes zero. When we run the same analysis in the extended sample, we see a significant coefficient for the estimate, yet the prediction interval also contains zero (coefficients = 31, SMD = 6.063, SE = 1.47, 95% CI = [3.062; 9.065], p-value < 0.001, prediction interval = [-5.609; 17.736], I^2 = 80.03%).

Our last estimation analyses the relationship between k 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 n, $\log(n)$ or k as its main explanatory variable. 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. Our last covariate is a categorical variable indicating the statistical procedure used in the original models (panel data, instrumental variables, OLS, or regression discontinuity design).

Table 3: Meta Regression Results

	Expenditure Per Capita		Log Expenditure Per Capita		Gov. Spending % GDP	
	Restricted	Extended	Restricted	Extended	Restricted	Extended
Independent Variable: N	-1.042	-3.747	-0.281	-0.058	-0.005	0.005
	(1.762)	(0.942)***	(0.162)	(0.073)	(0.018)	(0.006)
Independent Variable: $\log(N)$					-0.016	-0.012
					(0.036)	(0.016)
Year	0.032	0.15	0.004	0.004	-0.004	-0.003
	(0.119)	(0.075)*	(0.013)	(0.006)	(0.002)*	(0.001)***
Published: No	-1.463	-2.312	0.2	0.103		
	(2.601)	(1.721)	(0.127)	(0.065)		
Non-Majoritarian (PR & Mixed)	0.415	0.781			-2.059	-2.172
	(1.496)	(1.03)			(0.38)***	(0.175)***
Method: Panel	0.501	0.421	0.188	-0.252	0.002	-0.004
	(2.794)	(1.158)	(0.093)	(0.068)***	(0.02)	(0.006)
Method: IV	-0.068	-0.04				
	(3.193)	(1.134)				
Method: RDD				-0.285		
				(0.062)***		
Intercept	-64.631	-298.435	-7.363	-8.296	9.976	8.71
	(239.986)	(150.565)*	(25.458)	(12.037)	(3.945)*	(2.052)***

Note: The restricted and extended samples include 42 and 142 study coefficients, respectively. We report the results from the permutation tests. Reference categories: Independent Variable = k; Published = Yes; Non-Majoritarian (PR & Mixed) = $Majoritarian$; Method = OLS. Significance codes: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

Table 3 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 n as an independent variable have lower effects when compared to k. 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

In this article, we assess the empirical validity of the "law of $1/n$". Based on a sample of 29 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 k, 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.

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 $\log(n)$ and public expenditure per capita or between k 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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