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The Effect of Malapportionment on Voter Turnout: Evidence from Japan's Upper House Elections

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ABSTRACT: Malapportionment is a widely used tool of electoral manipulation in both authoritarian and democratic countries. Although its impact on electoral and policy outcomes has received considerable scholarly attention, the impact of malapportionment on electoral participation has been neglected. This is partly because it is difficult to isolate the effect of malapportionment on electoral participation from that of other factors. To the best of our knowledge, this study is the first to examine the effect of malapportionment on electoral participation. We avoid the methodological problem by taking advantage of the unique characteristics of Japan's upper house election laws. Using an original dataset on Japan's upper house elections and employing a differences-in-differences design, our results show that malapportionment increases voter turnout (by an average of 2.9 percentage points and up to 8.0 percentage points). This study therefore contributes to the literature on election laws and political participation by providing strong evidence for the effect of malapportionment on voter turnout and showing that some forms of electoral manipulation can increase voter turnout.

Keywords: malapportionment; value of a vote; electoral manipulation; electoral participation; voter turnout; Japan

INTRODUCTION

Fair and equal representation is the foundation of democracy. However, malapportionment violates such representation. Malapportionment is "the discrepancy between the shares of legislative seats and the shares of population held by geographical units" (Snyder and Samuels 2001, 652). Malapportionment contravenes the principle of "one person, one vote" and distorts the value of an individual's vote. Voters in electoral districts whose legislative seat share exceeds their population share are overrepresented in a legislature, while voters in districts whose legislative seat share falls below their population share are underrepresented. Like gerrymandering, malapportionment is a widely used tool of electoral manipulation in both authoritarian and democratic countries (Ong et al. 2017; Samuels and Snyder 2001). In some countries, political elites use malapportionment as a tool to distort election results in their favor, maintaining their rule by manipulating the allocation of seats to districts (Samuels and Snyder 2004).[1] In addition, malapportionment can also lead to policy bias. Several studies have found that more than their underrepresented counterparts, overrepresented voters receive a higher share of per capita benefits in the form of public expenditures or tax treatment than underrepresented voters (Ansolabehere et al. 2002; Ardanaz and Scartascini 2013; Hauk and Wacziarg 2007; Horiuchi and Saito 2003; Larcinese et al. 2013; Lee 2000; Lee and Oppenheimer 1999).

Curiously, however, previous research has neglected the effect of malapportionment on electoral participation. Malapportionment produces unequal representation and policy bias. It may also discourage underrepresented voters from turning out to vote. If this is the case, malapportionment poses a twofold problem. Not only do voters in underrepresented districts face less representation and policy loss, they may also be discouraged from participating in politics.

[1] For instance, country-level research shows that political rulers strategically allocate a higher ratio of seats to populations in their support base areas (typically conservative, rural areas) to weaken the opposition and bolster their own support (Samuels and Snyder 2004).

Although it may appear that the impact of malapportionment on electoral participation can be easily estimated by calculating the difference in voter turnout rate between underrepresented and overrepresented districts or voters, voter turnout is in fact determined by various socioeconomic, political, and institutional factors. Therefore, it is difficult to isolate the impact of malapportionment on voter turnout from that of other factors. In particular, it is methodologically difficult to control for the effects of institutional factors, such as redistricting, concurrent elections, and compulsory voting. First, most countries seek to reduce the degree of malapportionment through redistricting; however, this typically reduces voter turnout by raising voters' anxieties about whether their interests are represented (Pattie et al. 2012) and increasing their costs of acquiring information about parties and candidates (Hayes and McKee 2009, 2012; Hunt 2018; McKee 2008; Winburn and Wagner 2010). Consequently, when redistricting occurs, it is difficult to clarify whether changes in voter turnout are caused by changes in the degree of malapportionment or in electoral boundaries. Second, some countries hold several elections, such as those to the upper and lower houses or the national and local elections, simultaneously. Thus, circumstances such as the relative importance or competitiveness of one election may affect the voter turnout in another. Third, in some countries, voters are required by law to cast a vote. Compulsory voting makes it virtually impossible to measure voters' choice in deciding to vote or abstain.

To the best of our knowledge, this study is the first to examine the influence of malapportionment on electoral participation. Our study estimates the impact of disparities in the value of a vote across districts on voter turnout. We argue that citizens who are underrepresented through malapportionment will seek to remedy it through elections and therefore be more likely to vote and show that malapportionment increases voter turnout. Given their unique institutional characteristics, the elections to Japan's upper house present an ideal case for isolating (and thus estimating) the impact of malapportionment on electoral participation. The Japanese upper house has had a combination of 47 prefecture-wide districts and nationwide open-list proportional

representation (PR) since 2001. The number of members elected from each prefectural district ranges from one to six and single non-transferable vote is used. In particular, we focus on prefectural districts in the Japanese upper house elections for the following three reasons. First, Japan's upper house did not experience redistricting until 2016. Second, with the exception of simultaneous elections for the lower and upper houses in 1980 and 1986, as well as a few concurrent local elections, elections to the upper house have not coincided with other elections. Third, voters are not required by law to vote. Using a new dataset on Japan's seven upper house elections from 2001 to 2019 and employing a within-electoral district differences-in-differences design, this study reveals that voter turnout is an average of 2.9 percentage points and up to 8.0 percentage points higher in underrepresented districts than in overrepresented ones.

The study thus makes several key contributions to the literature on electoral laws and political representation and participation. It is the first to find evidence for the impact of malapportionment on electoral participation by using a quasi-experimental design. Furthermore, the study shows that some form of electoral manipulation, in this case malapportionment, can encourage voter turnout, while previous studies have revealed that electoral manipulation discourages voter turnout.

The remainder of the paper is organized into four sections. The first section develops a theory and hypothesis concerning the impact of malapportionment on electoral participation. The second section briefly describes malapportionment in Japan. The third section introduces the data and methods used to test the hypothesis. Finally, the fourth section tests the hypothesis by analyzing how the degree of malapportionment is associated with district-level voter turnout in Japan's upper house elections.

THEORY AND HYPOTHESIS

This section presents the theory that malapportionment *encourages* citizens to vote by extending the

theory of the effect of electoral manipulation on voter turnout because malapportionment is a typical example of electoral manipulation. Here, we rely on Simpser's (2013, 12) broad definition of electoral manipulation as "the gamut of normatively unacceptable tactics that can be utilized for potentially influencing elections."[2] Previous research has suggested that electoral manipulation decreases voter turnout because if citizens perceive that their vote is not fairly counted and that they are restricted from affecting election results, they will have less incentive to participate in elections (Birch 2010; McCann and Domínguez 1998; Norris 2011, 2014). For example, using the Comparative Study of Electoral Systems data, Birch (2010) shows that citizens who perceive that an election is conducted unfairly are less likely to vote. Meanwhile, Norris (2014) uses the World Value Survey data to indicate that citizens have the ability to accurately perceive the actual quality of elections and that those who feel that elections are unfair are less likely to cast a vote.

However, electoral manipulation takes various forms (e.g., Lehoucq 2003; Schedler 2002; Simpser 2013). It is possible that different types of electoral manipulation can have different effects on electoral participation. In particular, Greenstein and Harvey (2017) classify electoral manipulation into illegal and legal examples. Illegal electoral manipulation refers to "manipulating vote choice and election administration" (1198). This can include vote-buying, election violence that prevents opposition candidates from running or citizens from voting, and ballot-stuffing. By contrast, legal electoral manipulation refers to "creating and implementing public, formal rules that bias election results in the ruling group's favour" (1198). This can include restrictions on suffrage and voter registration, gerrymandering, and malapportionment.

While previous research has focused mainly on illegal manipulation and neglected the effect of legal manipulation on voter turnout, we argue that illegal and legal manipulation have opposite effects on electoral participation. We emphasize that illegal electoral manipulation cannot be

[2] In the context of this paper, the term "electoral manipulation" includes concepts such as "electoral fraud" and "electoral malpractice."

remedied through elections, whereas legal electoral manipulation can be remedied through elections. On one hand, as previous research shows, illegal manipulation will discourage citizens from participating in elections. Since illegal manipulation such as vote-buying, ballot stuffing, and election violence goes unchallenged by law in the first place, it cannot be legally remedied in response to election results. Citizens who call for remedies for illegal manipulation will engage in social protests rather than turning out to vote.

On the other hand, legal manipulation can be remedied by amending laws. For example, restrictions on suffrage and voter registration can be corrected by amending election laws to make voter registration easier. Similarly, gerrymandering and malapportionment can be remedied by amending election laws to redraw electoral districts fairly and allocate legislative seats to districts in proportion to population, respectively. Therefore, we suggest that legal manipulation, particularly malapportionment, has a different effect on electoral participation than illegal manipulation.

In particular, we argue that malapportionment increases electoral participation. We propose the following mechanism for this phenomenon, which involves three steps: 1) citizens' perceptions of electoral manipulation, 2) their demand for the correction of manipulation, and 3) their political participation to achieve this. Previous research suggesting that illegal electoral manipulation *decreases* electoral participation also proposes a mechanism involving three steps (Norris 2002, 2014). First, citizens accurately perceive the actual quality of the elections. Second, citizens who are dissatisfied with the quality of elections desire to improve it. Third, because illegal electoral manipulation prevents votes from being counted fairly and citizens from affecting election results, they are discouraged from participating in the election and some of them instead engage in direct protest.

Our mechanism linking malapportionment to increased voter turnout has the same first and second steps as that of previous research, and only the third step is different. First, citizens perceive malapportionment. Second, citizens who are dissatisfied with malapportionment desire to improve

it. Some evidence supports the first and second steps. For example, a cross-national analysis by Norris (2014: Ch 5), as stated above, showed that citizens are capable of making fairly accurate assessments about the quality of elections. Furthermore, in Japan, public opinion surveys conducted by the *Asahi Shimbun* found that 77% of the respondents answered that the Diet has not fully addressed the issue of malapportionment in March 2013[3] and that 86% of the respondents answered that vote-value disparity between districts in national elections should be reduced as much as possible in March and April 2013.[4] Third, citizens who desire to remedy malapportionment participate in elections to seek legal measures such as reapportionment and redistricting to remedy it. Under malapportionment, unlike illegal electoral manipulation, votes are counted fairly (if not equally) and citizens can affect election results. Furthermore, malapportionment can and has been remedied through legal measures such as reapportionment and redistricting (e.g., Ansolabehere and Snyder 2008; Hansen 2003; Johnston et al. 2001). For example, in the U.S. House of Representatives, seats are reapportioned to states according to the decennial census. In the U.K. House of Commons, redistricting is conducted every 8 to 12 years. By electing candidates who are electorally disadvantaged by malapportionment and thus seek to remedy it, citizens can promote a remedy for malapportionment.

Our mechanism is consistent with that of Ezrow and Xezonakis (2016), who indicated that citizens' satisfaction with democracy increases electoral participation. They noted that, "it is reasonable to associate dissatisfaction with a desire for change. And if citizens desire change, they will likely seek that change through multiple channels, including turning out for elections" (4). By

[3] This survey recruited 2,657 people, of whom 1,553 responded. Respondents were asked, "Do you think the Diet has fully addressed the issue of malapportionment?" In response, 12% answered "yes" and 77% "no." See *Asahi Shimbun*, March 19, 2013, for details.

[4] This survey recruited 3,005 people, of whom 2,194 responded. Respondents were asked, "Do you think vote-value disparity between districts in national elections should be reduced as much as possible?" In response, 44% answered "strongly agree"; 44% answered "somewhat agree"; 5% answered "somewhat disagree"; and 2% answered "strongly disagree." See *Asahi Shimbun*, May 2, 2013, for details.

extending their argument on dissatisfaction with democracy to dissatisfaction with disparities in the value of a vote, it is also reasonable to expect that dissatisfaction with malapportionment encourages citizens to make changes to unfair electoral processes and participate in elections. Indeed, it could still be argued that malapportionment, like illegal electoral manipulation, should discourage citizens from voting because underrepresented citizens could decrease their political efficacy and be less motivated to vote. However, as explained above, malapportionment is essentially different from illegal electoral manipulation for the two ways. First, malapportionment does not prevent votes from being counted fairly and citizens from affecting election results. Second, it can be remedied through elections. In other words, even if malapportionment occurs, citizens have a chance to influence election results and promote a remedy for it. Therefore, it is reasonable to expect that malapportionment will increase rather than decrease electoral participation.

In short, we present the theory that *malapportionment encourages citizens to vote*. We test this theory through aggregate-level analysis by comparing voter turnout between underrepresented and overrepresented districts. We suggest the following testable hypothesis:

> *Hypothesis 1*: Voter turnout is higher in underrepresented districts (i.e., those with a relatively higher population per legislative seat).

JAPAN'S UPPER HOUSE ELECTIONS

This hypothesis is tested using the case of Japan's upper house elections. In Japan's bicameral system, the lower house has had a combination of single-member districts (SMDs) and semi-open list PR since 1996. The upper house, meanwhile, has had a combination of prefectural districts and nationwide open-list PR since 2001.

Malapportionment is an important issue in contemporary Japanese politics. Serious malapportionment has occurred in SMDs in the lower house and prefectural districts in the upper

house. Figure 1 shows the disparity in vote value across districts in the lower and upper house elections since 2001. The values indicate the maximum vote-value disparity between districts, calculated by dividing the population per seat of the most underrepresented district by that of the most overrepresented district in each election. In Japan, this criterion is used by politicians, government councils, the media, and courts to discuss or judge malapportionment. The Supreme Court has ruled that the vote-value disparity in the 2009, 2012, and 2014 lower house elections and the 2010 and 2013 upper house elections amounted to a state of unconstitutionality, while that in the 2016 upper house election and 2017 lower house election was constitutional. "A state of unconstitutionality" indicates that the current disparities are almost unconstitutional but that the results of the elections are valid. However, if the disparities are not redressed within a reasonable period of time, they can be ruled as unconstitutional.

<Figure 1 about here>

Sources of malapportionment are both changes in the population and partisan manipulation of redistricting and reapportionment. In Japan, urban population has increased while rural population has decreased. This has widened disparities in the value of a vote between urban and rural districts. In order to reduce the disparities, it is necessary to decrease the number of seats in rural districts and increase the number of seats in urban districts. However, the Liberal Democratic Party (LDP), which has almost consistently been in power since 1955, has gained more support and votes in rural areas than in urban districts (e.g., Scheiner 2006). If the number of seats in rural districts were to be reduced, the LDP would have reduced the numbers of seats and some LDP legislators elected from rural districts would lose a seat. Therefore, the LDP and rural LDP legislators have opposed redistricting and reapportionment that would result in seats being lost in rural districts, which has hindered the remediation of malapportionment.

For example, in reaction to a Supreme Court ruling that the maximum vote value disparity of 4.77 in the 2013 upper house election was in an unconstitutional state, the Komeito, a coalition partner of the LDP, and the opposing Democratic Party of Japan sponsored a bill to conduct major redistricting and thereby reduce the maximum disparity to 1.97 in 2015. However, the LDP rejected this bill and instead enacted the revised Public Offices Election Law to conduct minor redistricting and reapportionment that only reduced the maximum disparity to 2.97 (*Asahi Shimbun*, July 15 and July 29, 2015) on July 28, 2015. In fact, Kensei Mizote, a leader of LDP upper house members and the Chairperson of the General Assembly of Party Members of the Upper House, stated, "it has always been in my mind that how much this electoral reform will electorally advantage or disadvantage our party and members" (*Asahi Shimbun*, July 31, 2015). In addition, this bill provides that fundamental electoral reform to remedy disparity in the value of a vote between districts was required to be continuously discussed and reach a conclusion by the upper house election of 2019 (Article 7 Supplementary Provisions). However, the ruling LDP and Komeito avoided fundamental reform and enacted the revised Public Offices Election Law on July 18, 2018, which carried out only minor reforms to increase the number of seats in the Saitama district with increasing populations without reducing the number of seats in districts with decreasing populations.

From 2001 to 2016, the upper house had a total of 242 members on six-year terms with half facing election every three years. Under this system, 146 members (73 members every three years) were elected from 47 prefectural districts (45 in 2016) and the remaining 96 members (48 members every three years) were elected from a nationwide PR seat. Japan conducted redistricting in the upper house for the first time in order to reduce disparities in the value of a vote before its elections in 2016. SMDs in Tottori and Shimane prefectures were merged, as were SMDs in Kochi and Tokushima prefectures. From 2019, 148 members (74 members every three years) are elected from 45 prefectural districts and the remaining 100 members (50 members every three years) are elected from a nationwide PR seat. The number of seats elected in each prefectural district varied from one

to six. Candidates can run for either a prefectural district or a PR seat. Voters cast two separate ballots: one for the prefectural district and another for the PR seat. There is no seat linkage between prefectural districts and a PR seat. In prefectural districts, votes cannot be pooled or transferred to another candidate.

There are wide variations in the distribution of district-level population per seat. From 2001 to 2019, on average, one legislative seat represents around 1,500,000 people in Japan. In the most overrepresented district, one seat represents no more than 600,000 people. Meanwhile, in the most underrepresented district, one seat represents no less than 3,000,000 people. Table A1 in Appendix 1 reports population, district magnitude, and voter turnout by district.

RESEARCH DESIGN

To test the hypothesis, this study uses panel data from all 47 prefectural districts voting in Japan's upper house elections and conducts a subnational comparison of voter turnout. Subnational comparison is preferred to cross-national comparison because the former can avoid the omitted variable bias from which the latter can suffer owing to the difficulty in controlling for country-specific socioeconomic, political, and institutional factors that can affect both malapportionment and voter turnout. In addition, when assessing the effect of malapportionment on voter turnout, individual-level and aggregate-level analyses are mutually complementary. On one hand, an individual-level analysis offers advantages, such as testing the mechanisms through which malapportionment affects voters' decision to vote or abstain. On the other hand, an aggregate-level analysis is advantageous in accurately estimating the overall effect size of malapportionment on voter turnout through balanced panel data and a fixed-effects model, thus controlling for unit (district)-fixed effects. The present study conducts aggregate-level analysis, leaving individual-level analysis for future research.

Hypothesis 1 is tested using the following ordinary least squares (OLS) model (Model 1):

$$Voter\ Turnout_{it} = \beta_0 + \beta_1\ Population\ per\ Seat_{it} + \beta_2\ District\ Magnitude_{it} + \gamma_i + \delta_t + \varepsilon_{it}, \quad (1)$$

The unit of analysis is district i in election year t. This model focuses on the seven upper house elections held in 2001, 2004, 2007, 2010, 2013, 2016, and 2019. Taking advantage of the panel nature of our data and using districts as the unit of analysis, this study employs a within-district differences-in-differences design. This model examines within-district changes in the value of a vote and voter turnout over time. District fixed effects (γ_i) and time fixed effects (δ_t) are included to control for district- and time-specific effects, respectively. The dependent variable is *Voter Turnout*$_{it}$.[5]

The key independent variable to test Hypothesis 1 is *Population per Seat*$_{it}$, which represents the population (in units of 1,000,000 people) per legislative seat. The more underrepresented the district is, the higher the value of *Population per Seat*$_{it}$. To measure the value of a vote (the degree of malapportionment) at the district level, some studies use the number of seats per person (e.g., Ansolabehere et al. 2002; Horicuhi and Saito 2003) while others use population per seat (e.g., Hauk and Wacziarg 2007). Both measurements are substantially similar. This study uses the population per seat ratio because, as stated above, it is typically used when malapportionment is discussed in Japan. Even within the same district, the population per legislative seat changes over time as a result of an increase or decrease in the number of seats elected per district (district magnitude) and a change in the population of the district. Figure A1 in Appendix 2 reports the difference between the maximum and minimum values of population per seat by district between the 2001 and 2019 elections. The average within-district change in population per seat was 422,004, and the largest

[5] Data on voter turnout rate were obtained from the website of the Ministry of Internal Affairs and Communications: http://www.soumu.go.jp/senkyo/senkyo_s/data/sangiin/ichiran.html

change was 1,165,120. Hypothesis 1 predicts *Population per Seat*$_{it}$ to be positive.

Regarding control variables, a large number of studies have investigated factors affecting voter turnout. As shown in the reviews and meta-analyses of Blais (2006), Cancela and Gey (2016), Gey (2006), Smets and van Ham (2013), Smith (2018), and Stockmer (2017), previous studies have identified the institutional, political, and socioeconomic determinants of voter turnout. Major institutional factors include electoral systems (e.g., majoritarian vs. proportional systems and district magnitude), registration requirements, compulsory voting, concurrent elections, and the importance of the election (e.g., unicameralism vs. bicameralism and first-order vs. second-order elections). Major political factors include campaign expenditures, election competitiveness, and political fragmentation (e.g., the [effective] number of parties in the election). Finally, major socioeconomic factors include population size, population stability (e.g., mobility or growth), population homogeneity (e.g., income inequality and the proportion of minority groups), past turnout, and economic developments or conditions.

Some of these factors may be covariates influencing both the dependent variable, voter turnout, and the key independent variable, the degree of malapportionment. However, through its differences-in-differences design, Model 1 can control for time-invariant district characteristics. The only within-district time-variant factor relevant to Japan's upper house is district magnitude. Several previous studies have shown that higher district magnitude leads to higher voter turnout as proportionality in the translation of votes into legislative seats increases as district magnitude grows (e.g., Banducci et al. 1999; Jackman 1987; Jackman and Miller 1995; Karp and Banducci 1999; Karp et al. 2007; Powell 1986). In Japan's upper house, the number of seats allocated to each district changes according to shifts in prefectural populations, and the district magnitude ranges from one to six. We included *District Magnitude*$_{it}$, which is the number of seats elected from a district. See Table A3 in Appendix 3 for a model including other possible control variables. Table A4 in Appendix 4 reports the summary statistics of the variables.

RESULTS

Table 1 presents the results. Redistricting affects voter turnout (Hayes and McKee 2009, 2012; Hunt 2018; McKee 2008; Winburn and Wagner 2010) and also changes population per seat in a district. As stated above, in 2016, Tottori and Shimane districts and Tokushima and Kochi districts were merged into one district, respectively. Therefore, in order to eliminate the impact of redistricting, the model in Column 1 drops the four redrawn districts of the 2016 and 2019 elections from the analysis, the model in Column 2 drops the four redrawn districts, and the model in Column 3 drops all the observations for the 2016 and 2019 elections. Column 1 is the main model because it includes the most observations.

In Columns 1, 2, and 3, *Population per Seat*$_{it}$ is significant and positive at the 0.01 level or higher. The greater the degree of underrepresentation, the more likely it is that the voters turn out to vote. Figure 2 indicates the predicted values of the dependent variable, *Voter Turnout*$_{it}$, in the model in Column 1 when changing the values in *Population per Seat*$_{it}$ from 0.6 (600,000 people) to 3.0 (3,000,000 people; from the approximate minimum to maximum values) and holding other variables at their means. The solid lines represent the predicted values of *Voter Turnout*$_{it}$, while dashed lines denote the 95 per cent confidence intervals. This figure shows that a 1,000,000 increase in population per seat increases voter turnout by 6.9 percentage points as the relationship between *Population per Seat*$_{it}$ and *Voter Turnout*$_{it}$ is linear. This model uses district fixed-effects and, thus, examines within-district variation over time. As stated above, the average within-district change in population per seat was 422,004, and the largest change was 1,165,120. Malapportionment increases voter turnout by an average of 2.9 percentage points (6.907 * 0.422) and up to 8.0 percentage points (6.907 * 1.165). Considering that the average and standard deviation of voter turnout in the seven upper house elections are 56.3% and 5.4%, respectively (see Table A2 in Appendix 3), malapportionment substantially increases voter turnout. Hypothesis 1 is strongly supported.

<Table 1 and Figure 2 about here>

CONCLUSION

Malapportionment violates fair and equal representation. Although previous scholarship has examined electoral and policy bias caused by malapportionment, these works have ignored the impact of malapportionment on electoral participation. Using a new dataset of Japan's seven upper house elections from 2001 to 2019, this study has revealed that malapportionment increases voter turnout by an average of 2.9 percentage points and up to 8.0 percentage points.

This study thus makes several important contributions to our understanding of malapportionment, electoral manipulation, and electoral participation. First, it provides evidence on the impact of malapportionment on electoral participation. By taking advantage of the unique institutional characteristics of Japanese upper house elections (such as almost no redistricting, very few concurrent elections, and no compulsory voting) and using a within-district differences-in-differences design, we isolate and estimate the impact of malapportionment on voter turnout. While malapportionment distorts election results and policy outcomes, we find that it encourages rather than discourages citizens from voting. Second, though previous research has revealed that electoral manipulation makes citizens suspect that their vote is not fairly counted, thereby *decreasing* voter turnout, the findings of this study suggest that electoral manipulation has different effects depending on its type. Our findings imply that legal electoral manipulation such as restrictions on suffrage and voter registration, gerrymandering, and malapportionment can encourage citizens to participate in elections to correct it, while illegal manipulation such as vote-buying, election violence, and ballot-stuffing can discourage electoral participation. Further research is needed to test whether different types of electoral manipulation have different effects on citizens' electoral participation.

Several problems remain. First, although we postulate the mechanism through which malapportionment will encourage citizens to participate in elections in order to elect candidates and parties seeking to correct it and amend election laws, this mechanism is not directly tested. This is because the primary goal of this study is to estimate the causal effect of malapportionment on voter turnout by taking advantage of panel data from 47 districts and conducting aggregate-level analyses that allow controlling for district-specific effects. In order to elucidate this mechanism, future research should conduct individual-level analyses, particularly those using an experimental design. Second, our analysis focuses only on a single country, Japan, because we aim to take advantage of subnational comparison that allows for controlling for country-specific effects. However, a single-country study suffers from a limitation with regard to its generalizability. Testing the findings of this study using the case of other countries will assess and increase its generalizability.

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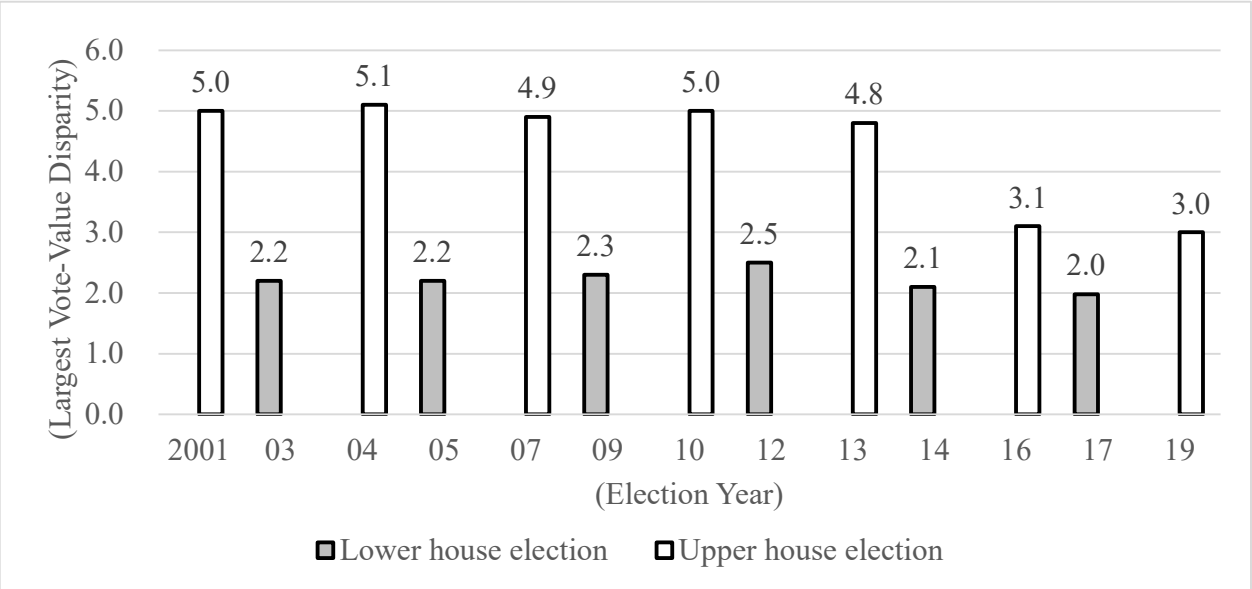
FIG. 1. MALAPPORTIONMENT IN JAPAN



Note: The values indicate the largest vote-value disparity between districts, calculated by dividing the population per seat of the most underrepresented district by that of the most overrepresented district.

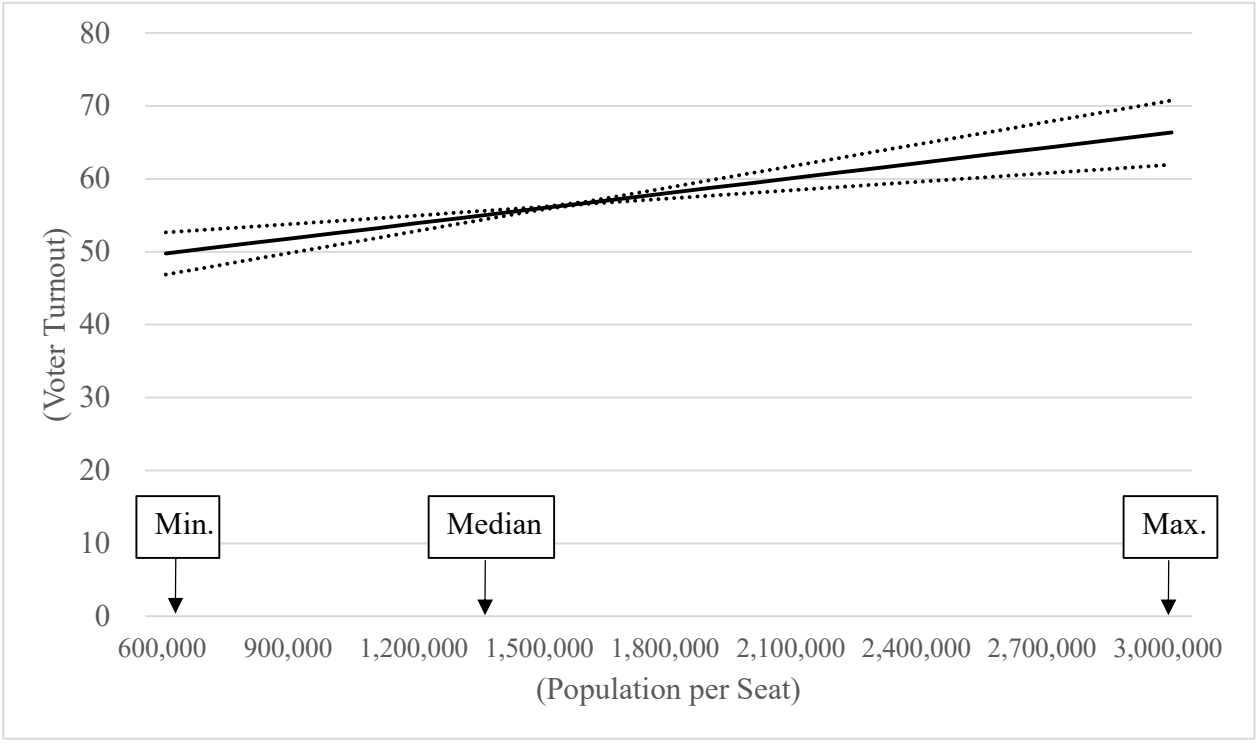
TABLE 1. EFFECT OF MALAPPORTIONMENT ON VOTER TURNOUT

	Column 1	Column 2	Column 3
		Coefficient (Standard Error)	
Population per Seat $_{it}$	6.907***	6.796***	9.209**
	(1.550)	(1.557)	(2.857)
District Magnitude $_{it}$	6.484***	6.395***	9.524***
	(1.254)	(1.250)	(2.436)
Constant	37.510***	36.916***	29.574***
	(4.202)	(4.323)	(8.043)
District Fixed Effects	✓	✓	✓
Year Fixed Effects	✓	✓	✓
R^2	0.806	0.802	0.729
Number of Observations	321	278	235
	Four districts that were redrawn in 2016 and 2019 were dropped.	Four redrawn districts were dropped.	Observations for 2016 and 2019 were dropped.

Note: Standard errors are clustered by district.

***: $p < 0.001$, **: $p < 0.01$

FIG 2. EFFECTS OF POPULATION PER SEAT ON VOTER TURNOUT



Note: The solid line indicates the predicted values of voter turnout, and the dashed lines indicate the 95 percent confidence intervals.

APPENDIX 1. POPULATION, DISTRICT MAGNITUDE, AND VOTER TURNOUT BY DISTRICT

TABLE A1. POPULATION, DISTRICT MAGNITUDE, AND VOTER TURNOUT BY DISTRICT

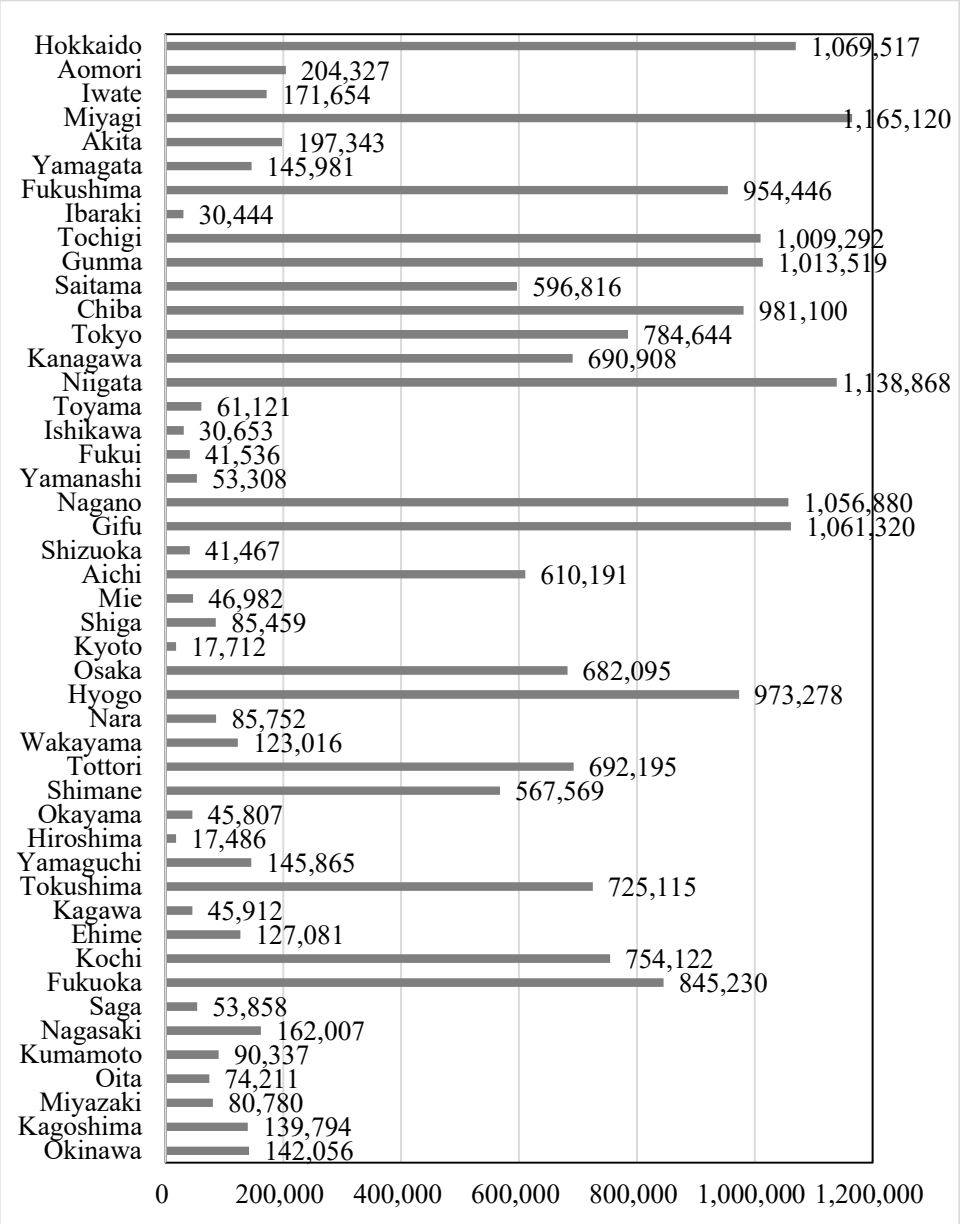
	2001			2004			2007			2010		
	Population	DM	Turnout	Population	DM	Turnout	Population	DM	Turnout	Population	DM	Turnout
Hokkaido	5,675,309	2	58.47	5,650,573	2	61.74	5,600,705	2	62.4	5,520,894	2	61.89
Aomori	1,497,036	1	51	1,479,358	1	53.91	1,445,592	1	53.88	1,405,535	1	54.55
Iwate	1,421,796	1	65.98	1,405,060	1	63.33	1,377,666	1	63.4	1,345,007	1	60.36
Miyagi	2,347,166	2	55.55	2,350,026	2	53.92	2,340,485	2	55.79	2,329,344	2	53.34
Akita	1,197,566	1	60.73	1,173,722	1	65.32	1,143,829	1	67.7	1,108,237	1	65.05
Yamagata	1,241,364	1	63.14	1,225,990	1	61.75	1,204,099	1	67.29	1,176,759	1	63.97
Fukushima	2,133,396	2	60.88	2,116,210	2	60.34	2,089,439	2	61.57	2,051,626	2	61.63
Ibaraki	2,995,583	2	50.18	2,991,804	2	50.07	2,986,115	2	54	2,979,139	2	55.11
Tochigi	2,003,283	2	53.85	2,006,717	2	50.99	2,006,363	1	56.66	2,000,774	1	56.59
Gunma	2,019,726	2	58.74	2,022,780	2	58	2,016,236	1	54.6	2,004,786	1	58.55
Saitama	6,898,219	3	52.61	6,980,889	3	52.6	7,042,044	3	56.35	7,123,084	3	55.83
Chiba	5,920,398	2	50.87	6,001,032	2	51.87	6,058,248	3	55.14	6,149,799	3	54.85
Tokyo	11,818,845	4	53.27	12,082,143	4	56.08	12,361,736	5	57.87	12,609,912	5	58.70
Kanagawa	8,425,783	3	55.45	8,600,109	3	54.48	8,741,025	3	56.32	8,885,458	3	55.56
Niigata	2,476,900	2	61.78	2,455,996	2	63.25	2,425,683	2	64.58	2,391,091	2	60.99
Toyama	1,124,414	1	58.78	1,118,661	1	57.62	1,110,713	1	64.96	1,097,736	1	64.86
Ishikawa	1,176,601	1	59.54	1,175,071	1	56.81	1,169,249	1	62.9	1,162,950	1	59.86
Fukui	828,039	1	60.95	824,824	1	61.02	818,443	1	63.25	809,465	1	65.26
Yamanashi	886,077	1	63.05	882,678	1	61.81	875,621	1	63.65	864,210	1	64.04
Nagano	2,204,498	2	62	2,200,896	2	61.5	2,184,596	2	65.04	2,161,572	2	64.72
Gifu	2,109,804	2	58.88	2,106,917	2	59.36	2,100,413	2	61.47	2,083,118	2	59.75
Shizuoka	3,764,054	2	61.64	3,773,140	2	57.94	3,775,367	2	58.41	3,769,685	2	57.37
Aichi	6,935,031	3	54.27	7,027,499	3	54.55	7,145,614	3	59.12	7,237,612	3	57.46
Mie	1,858,890	1	60.59	1,857,773	1	62.28	1,857,090	1	60.58	1,849,703	1	60.85
Shiga	1,334,621	1	58.16	1,353,893	1	58	1,371,577	1	60.32	1,386,570	1	60.82
Kyoto	2,563,205	2	55.55	2,565,424	2	54.6	2,562,282	2	56.37	2,551,706	2	53.71
Osaka	8,628,601	3	53.33	8,651,977	3	53.18	8,665,105	3	55.81	8,683,035	3	56.35
Hyogo	5,537,365	2	55.63	5,566,566	2	55.11	5,580,497	2	56.61	5,586,182	2	54.41
Nara	1,448,533	1	59.04	1,439,040	1	57.75	1,425,308	1	60.77	1,411,715	1	59.11
Wakayama	1,087,614	1	58.93	1,073,434	1	58.43	1,053,896	1	59.34	1,032,779	1	59.38
Tottori	617,078	1	66.68	614,650	1	64.17	606,695	1	67.67	595,331	1	65.77
Shimane	762,144	1	68.61	752,534	1	68.87	739,080	1	71.81	723,182	1	71.70
Okayama	1,957,529	1	55.51	1,957,269	1	58.61	1,951,420	1	59.17	1,939,449	1	56.97
Hiroshima	2,872,196	2	57.78	2,869,555	2	53.69	2,867,423	2	56.91	2,856,308	2	53.51
Yamaguchi	1,528,944	1	59.86	1,512,333	1	62.31	1,489,176	1	62.02	1,464,275	1	61.91
Tokushima	831,241	1	57.24	823,304	1	54.6	811,678	1	58.47	796,897	1	58.24
Kagawa	1,033,248	1	54	1,029,356	1	55.2	1,023,074	1	58.84	1,012,755	1	57.71
Ehime	1,508,842	1	58.32	1,496,929	1	56.37	1,479,775	1	61.91	1,457,950	1	57.56
Kochi	817,869	1	58.39	809,554	1	57.3	792,419	1	58.4	772,401	1	58.49
Fukuoka	4,979,227	2	54.39	5,010,859	2	54.84	5,030,311	2	54.83	5,038,574	2	56.07
Saga	882,639	1	60.36	877,040	1	62.03	868,562	1	62.86	859,400	1	63.05
Nagasaki	1,527,398	1	59.57	1,511,064	1	60.14	1,482,146	1	61.54	1,450,027	1	61.30
Kumamoto	1,870,416	1	62.24	1,862,895	1	59.61	1,852,073	1	63.11	1,833,757	1	61.91
Oita	1,234,429	1	64.54	1,227,107	1	64.57	1,218,066	1	63.04	1,206,976	1	62.96
Miyazaki	1,184,535	1	62.36	1,177,455	1	62.14	1,167,509	1	56.79	1,152,514	1	56.77
Kagoshima	1,783,231	1	57.44	1,769,932	1	62.87	1,751,510	1	60.67	1,722,405	1	58.36
Okinawa	1,334,122	1	58.36	1,362,128	1	54.24	1,387,518	1	60.32	1,406,176	1	52.44

TABLE A1. (continued) POPULATION, DISTRICT MAGNITUDE, AND VOTER TURNOUT BY DISTRICT

	2013			2016			2019		
	Population	DM	Turnout	Population	DM	Turnout	Population	DM	Turnout
Hokkaido	5,465,451	2	54.41	5,401,210	3	56.78	5,304,413	3	53.76
Aomori	1,372,010	1	46.25	1,338,465	1	55.31	1,292,709	1	42.94
Iwate	1,314,180	1	57.53	1,289,470	1	57.78	1,250,142	1	56.55
Miyagi	2,318,692	2	50.75	2,324,466	1	52.39	2,303,098	1	51.17
Akita	1,076,205	1	56.19	1,043,015	1	60.87	1,000,223	1	56.29
Yamagata	1,155,942	1	60.76	1,129,560	1	62.22	1,095,383	1	60.74
Fukushim	1,980,259	1	54.52	1,953,699	1	57.12	1,901,053	1	52.41
Ibaraki	2,997,072	2	49.66	2,970,231	2	50.77	2,936,184	2	45.02
Tochigi	2,010,934	1	49.69	1,998,864	1	51.38	1,976,121	1	44.14
Gunma	2,023,382	1	51.75	2,005,320	1	50.51	1,981,202	1	48.18
Saitama	7,272,304	3	51.21	7,323,413	3	51.94	7,377,288	4	46.48
Chiba	6,240,455	3	49.22	6,265,899	3	52.02	6,311,190	3	45.28
Tokyo	13,142,640	5	53.51	13,415,349	6	57.5	13,740,732	6	51.77
Kanagaw	9,083,643	4	54.47	9,136,151	4	55.46	9,189,521	4	48.73
Niigata	2,361,133	2	55.82	2,319,435	1	59.77	2,259,309	1	55.31
Toyama	1,094,827	1	50.23	1,080,160	1	55.61	1,063,293	1	46.88
Ishikawa	1,163,089	1	54.98	1,157,042	1	56.88	1,145,948	1	47.00
Fukui	810,552	1	53.78	799,220	1	56.5	786,503	1	47.64
Yamanash	863,917	1	56.65	849,784	1	58.83	832,769	1	51.56
Nagano	2,165,604	2	57.72	2,137,666	1	62.86	2,101,891	1	54.29
Gifu	2,102,879	1	52.97	2,076,195	1	57.74	2,044,114	1	51.00
Shizuoka	3,809,470	2	51.09	3,770,619	2	55.76	3,726,537	2	50.46
Aichi	7,462,800	3	52.65	7,509,636	4	55.41	7,565,309	4	48.18
Mie	1,871,619	1	57.82	1,850,028	1	59.75	1,824,637	1	51.69
Shiga	1,419,426	1	52.96	1,419,863	1	56.52	1,420,080	1	51.96
Kyoto	2,587,129	2	52.05	2,574,842	2	51.16	2,555,068	2	46.42
Osaka	8,873,698	4	52.72	8,865,502	4	52.23	8,848,998	4	48.63
Hyogo	5,660,302	2	53.02	5,621,087	3	53.74	5,570,618	3	48.60
Nara	1,405,453	1	55.54	1,387,818	1	56.89	1,362,781	1	49.53
Wakayam	1,016,563	1	54.94	994,317	1	55.29	964,598	1	50.42
Tottori	588,508	1	58.88	1,280,703	1	56.28	566,052	1	49.98
Shimane	713,134	1	60.89	1,280,703	1	62.2	686,126	1	54.04
Okayama	1,946,083	1	48.88	1,933,781	1	50.86	1,911,722	1	45.08
Hiroshima	2,873,603	2	49.99	2,863,211	2	49.58	2,838,632	2	44.67
Yamaguch	1,447,499	1	50.35	1,419,781	1	53.35	1,383,079	1	47.32
Tokushim	785,001	1	49.29	1,510,116	1	46.98	750,519	1	38.59
Kagawa	1,010,707	1	52.08	1,002,173	1	50.04	987,336	1	45.31
Ehime	1,440,117	1	49.4	1,415,997	1	56.36	1,381,761	1	52.39
Kochi	755,994	1	49.89	1,510,116	1	45.52	717,480	1	46.34
Fukuoka	5,105,427	2	49.36	5,122,448	3	52.85	5,131,305	3	42.85
Saga	853,341	1	52.51	842,457	1	56.69	828,781	1	45.25
Nagasaki	1,427,133	1	54.04	1,404,103	1	55.89	1,365,391	1	45.46
Kumamot	1,825,361	1	52.3	1,810,343	1	51.46	1,780,079	1	47.23
Oita	1,199,401	1	53.15	1,183,961	1	58.38	1,160,218	1	50.54
Miyazaki	1,141,559	1	49.82	1,128,078	1	49.76	1,103,755	1	41.79
Kagoshim	1,701,387	1	50.42	1,679,502	1	55.86	1,643,437	1	45.75
Okinawa	1,437,994	1	53.43	1,461,231	1	54.46	1,476,178	1	49.00

APPENDIX 2. CHANGES IN POPULATION PER SEAT BY DISTRICT BETWEEN THE 2001 AND 2019 ELECTIONS

FIG. A1. CHANGES IN POPULATION PER SEAT BY DISTRICT BETWEEN THE 2001 AND 2019 ELECTIONS



Note: The values denote the difference between the maximum and minimum values of population per seat in each district between the 2001 and 2019 elections.

APPENDIX 3. ROBUSTNESS CHECK

Table A2 provides a robustness check. The model in Column 1 is the same as that in Column 1 of Table 1. The models in Columns A1 and A3 use the log of *Population per Seat*$_{it}$ instead of *Population per Seat*$_{it}$ as a key independent variable. The models in Columns A2 and A3 use the log of *Turnout*$_{it}$ instead of *Turnout*$_{it}$ as a dependent variable. The model in Column A4 includes additional control variables. Table A3 provides details of the variables.

In Column A1, *LN (Population per Seat*$_{it}$*)* is statistically significant at the 0.01 level and positive. A one percent increase in population per seat increases voter turnout by 9.5 percentage points. In Column A2, *Population per Seat*$_{it}$ is statistically significant at the 0.01 level and positive. A one million increase in population per seat increases voter turnout by 12.4 percent. In Column A3, *LN (Population per Seat*$_{it}$*)* is statistically significant at the 0.01 level and positive. A one percent increase in population per seat increases voter turnout by 17.1 percent. In Column A4, *Population per Seat*$_{it}$ is statistically significant at the 0.01 level and positive. A one million increase in population per seat increases voter turnout by 6.2 percentage points. Therefore, when we use alternative dependent or independent variables or include additional control variables, the results are almost the same as in Column 1. The results are robust.

TABLE A2. ALTERNATIVE INDEPENDENT AND DEPENDENT VARIABLES AND ADDITIONAL CONTROL VARIABLES

	Column 1	Column A1	Column A2	Column A3	Column A4
Devendent Variable	*Turnout* $_{it}$	*Turnout* $_{it}$	*LN (Turnout* $_{it}$*)*	*LN (Turnout* $_{it}$*)*	*Turnout* $_{it}$
			Coefficient (Standard Error)		
Population per Seat $_{it}$	6.907***		0.124***		6.157***
	(1.550)		(0.0280)		(1.274)
LN(Population per Seat $_{it}$*)*		9.508***		0.171***	
		(2.210)		(0.0409)	
District Magnitude $_{it}$	6.484***	5.101***	0.114***	0.0898***	6.067***
	(1.254)	(0.938)	(0.022)	(0.0173)	(1.054)
Electoral Competition $_{it}$					1.409***
					(0.241)
Number of Candidates $_{it}$					−0.062
					(0.051)
Incumbent $_{it}$					−0.229
					(0.262)
LDP LH Election Results $_{it}$					−0.001
					(0.006)
Incumbent Governor Win $_{it}$					0.025
					(0.250)
Prefectural Expenditure $_{it}$					0.005
					(0.003)
Intergovernmental Transfers $_{it}$					−0.003
					(0.004)
LN (Population Density $_{it}$*)*					1.374
					(2.629)
LN (College Entrance Rate $_{it}$*)*					2.472
					(4.841)
LN (Unemployment Rate $_{it}$*)*					−0.079
					(0.289)
Constant	37.510***	46.965***	3.693***	3.863***	29.779
	(4.202)	(2.141)	(0.0747)	(0.0395)	(17.345)
District Fixed Effects	✓	✓	✓	✓	✓
Year Fixed Effects	✓	✓	✓	✓	✓
R^2	0.806	0.809	0.808	0.811	0.825
Number of Observations	321				
	Four districts that were redrawn in 2016 and 2019 were dropped.				

***: $p < 0.001$

TABLE A3. LIST OF VARIABLES

Variable	Definition	Source
LN (Turnout $_{it}$)	The log of voter turnout	Ministry of Internal Affairs and Communications http://www.soumu.go.jp/senkyo/senkyo_s/data/sangiin/ichiran.html
LN(Population per Seat $_{it}$)	The log of the population (in units of 1,000,000 people) per legislative seat	Ministry of Internal Affairs and Communications http://www.stat.go.jp/data/k-sugata
Electoral Competition $_{it}$	Coded 1 if some candidates in a district are rated as "competitive" by the *Asahi Shimbun*	*Asahi Shimbun* , July 24, 2001, July 5, 2004, July 27, 2007, July 9, 2010, July 19, 2013, July 8, 2016, and July 6, 2019
Number of Candidates $_{it}$	The number of candidates running in a district	*Asahi Shimbun* , July 24, 2001, July 5, 2004, July 27, 2007, July 9, 2010, July 19, 2013, July 8, 2016, and July 6, 2019
Incumbent $_{it}$	Coded 1 if some candidates in a district are incumbents	*Asahi Shimbun* , July 24, 2001, July 5, 2004, July 27, 2007, July 9, 2010, July 19, 2013, July 8, 2016, and July 6, 2019
LDP LH Election Results $_{it}$	The LDP's seat share in a prefecture in the last lower house election	*Asahi Shimbun* , June 26, 2000, November 10, 2003, September 12, 2005, August 31, 2009, December 17, 2012, December 15, 2014, and October 23, 2017
Incumbent Governor Win $_{it}$	Coded 1 if an incumbent won in the last gubernatorial election in a prefecture	*Asahi Shimbun* , the day after each gubernatorial election
Prefectural Expenditures $_{it}$	Total annual prefectural expenditures per capita	Ministry of Internal Affairs and Communications https://www.soumu.go.jp/iken/kessan_jokyo_1.html
Intergovernmental Transfers $_{it}$	Annual fiscal transfers from the central government to a prefecture	Ministry of Internal Affairs and Communications https://www.soumu.go.jp/iken/kessan_jokyo_1.html
LN (Population Density $_{it}$)	The log of the population density (in units of 1,000,000 people) of the prefecture of a district	Ministry of Internal Affairs and Communications http://www.stat.go.jp/data/k-sugata
LN (College Entrance Rate $_{it}$)	The log of the college entrance rate of the prefecture of a district	Ministry of Education, Culture, Sports, Science and Technology https://www.e-stat.go.jp/stat-search/files?page=1&toukei=00400001&tstat=000001011528
LN (Unemployment Rate $_{it}$)	The log of the unemployment rate of the prefecture of a district	Ministry of Internal Affairs and Communications https://www.stat.go.jp/data/roudou/pref/index.html

APPENDIX 4. SUMMARY STATISTICS OF THE VARIABLES

TABLE A4. SUMMARY STATISTICS OF THE VARIABLES

	N of Obs.	Mean	S. D.	Min.	Max.
Voter Turnout $_{it}$	321	56.323	5.386	41.790	71.810
Population per Seat $_{it}$	321	1.551	0.588	0.589	3.021
Distirict Magnitude $_{it}$	321	1.583	0.936	1	6