Supermajority Rule in Bicameral Legislatures

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Abstract

This paper revisits the claim that supermajority rules and bicameral structure restrain excessive government spending and taxation. Our analysis suggests that supermajority rule has a countervailing effect in bicameral legislatures due to two factors: the geographic linkages across two chambers and the low price elasticity of demand for public goods. Using a panel of 49 American states over a period of 39 years (1970-2008), we find that Senate district fragmentation—the ratio of seats in the House relative to seats in the Senate—has a robust, positive impact on the tendency of a supermajority rule to inflate the budget. Our finding implies that a supermajority rule in bicameral legislatures can have a perverse effect on budget outcomes.

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1 Introduction

The early literature on legislatures emphasized that outcomes in bicameral legislatures depend on the ratio of seats in one chamber relative to seats in the other (e.g., Crain 1979; McCormick and Tollison 1981).[1] The argument was that the more unequal the sizes of the two chambers, the more costly (difficult) it would be to obtain simple majorities in both chambers.[2]

In practice, however, the legislators' preferences in the two chambers are not independent due to geographic overlap between chambers (Buchanan and Tullock 1962; Levmore 1992; Ansolabehere et al. 2003). For instance, representatives usually work with a senator in which their districts are geographically embedded, regardless of the party affiliation (Chen and Malhotra 2007; Chen 2010). A senator is more likely to support a bill if her House colleagues are included in a coalition (Buchanan and Tullock 1962; Ansolabehere et al. 2003). The geographic linkages across chambers indicate that coalition formations in the two chambers are interrelated.

This paper builds on the existing literature by bringing the role of bicameralism in the analysis of the supermajority rule. Supermajority rules on budget decisions are often claimed to reduce inefficient spending enacted under majority rule—by making the formation of a winning coalition more difficult (Tullock 1959; Buchanan and Tullock 1962; Knight 2000; Primo 2006). The rules will limit the majority tyranny, an inherent flaw in democracy (Bradbury and Johnson 2006). On the contrary, supermajority rules can increase pork spending if the dominant coalition requires additional members to achieve a supermajority (Shaviro 1997; Gabel and Hager 2000; Miller and Vanberg 2013). For instance, new marginal members will demand subsidies as a condition for joining the coalition, thereby increasing side payments and package deals (Lee et al. 2014; Lee 2015).[3]

Previous studies examined the effect of supermajority rule in a unicameral legislature in na-

[1] In the traditional view, a bicameral structure leads to less spending on parochial projects—similar to a supermajority rule in a unicameral structure—if the two chambers have different constituencies, and one chamber has a veto power over the other (Buchanan and Tullock 1962; Gilligan et al. 1989; Bradbury and Crain 2001, 2002; Crepaz and Moser 2004; Mueller 2005).

[2] For instance, the cost of achieving a simple majority is higher in a 100-member legislature divided into 66 representatives and 34 senators than in a legislature equally divided between House and Senate—if the additional cost of buying 8 more votes (34 - 26) in the House exceeds the saving from buying 8 less votes (18 - 26) in the Senate (McCormick and Tollison 1981).

[3] In a dynamic setting, supermajority rule can increase majority tyranny because the ruling supermajority is more likely to avoid future retaliation by the current minority—who has a smaller chance of achieving a supermajority in the future (Dixit et al. 2003).

ture (e.g., Knight 2000; Dixit et al. 2000; Bradbury and Johnson 2006; Lee 2015).[4] Bicameral legislatures, however, are empirical reality in many places, including 49 American states and most OECD countries. The dual-chambered structure critically influences budget allocation because of the strategic interaction and bargaining between two chambers (Riker 1992; Tsebelis and Money 1997; Bradbury and Crain 2001, 2002; Congleton 2006; Chen 2010; Hickey 2013; Dahl 2014).

A major finding of this paper is that the extension effect of a supermajority rule—that requires logrolling across additional members—increases with Senate district fragmentation—defined as the ratio of seats in the House relative to seats in the Senate. The basic intuition is simple: If supermajority rule increases the number of Senate districts needed to approve parochial expenditures, the number of House district projects located within the Senate coalition will also have to increase to secure passage of the budget.

In the context of the literature, our paper combines three different institutions that influence budgetary decision-making: coalition success rules, size of legislatures, and bicameral structure of legislature (i.e., Senate district fragmentation).[5] Different configuration of these institutional rules can lead to different budget outcomes (Raudla 2010; Ostrom 1988). Only a few studies have related supermajority rules and bicameral structure. Diermeier and Myerson (1999) claimed that bicameral separation induces legislative chambers to create supermajority rules—an internal procedural hurdle that functions like prices for new legislation that lobbyists pay for. Ansolabehere et al. (2003) showed that small-state biases in bicameral legislatures can emerge when there are supermajority rules in the upper chamber such as the cloture requirement in the U.S. Senate. Our study focuses on the supermajority rule on budget decisions that are applied to both legislative chambers.

We empirically test our hypothesis using a panel of U.S. state legislatures from 1970 to 2008. U.S. state legislatures provide a natural setting for testing the effects of supermajority rule in a bicameral legislature because they have independent fiscal authority as well as similar populations, electoral rules, and political institutions (Bradbury and Johnson 2006; Chen and Malhotra 2007).[6]

[4] Although some studies analyzed the effect of supermajority rule in bicameral chambers, the chambers were treated as independent unicameral legislatures with no veto powers. See Bradbury and Crain (2001) for a similar discussion in the context of the law of 1/n.

[5] For instance, Senate district fragmentation of 1 indicates a complete constituent homogeneity across chambers—that is, two chambers have equal bases of representation.

[6] Other bicameral legislatures with supermajority rules include the European Union and the democratic countries that require a supermajority to override an executive veto.

The U.S. states adopted some variant of a supermajority rule with sufficient time variance, and all but one state (Nebraska) have bicameral legislatures.

Our empirical methodology examines the causal effect of the adoption of supermajority rule on government size as the level of Senate district fragmentation changes (when we move across time and states). This requires adding interaction terms between a supermajority rule dummy (or actual supermajority thresholds) and Senate district fragmentation to the government size regressions. We identify exogenous variation in the supermajority rule by addressing what cause states to adopt a variant of the supermajority rule. Our empirical findings suggest that an increase in the ratio of House to Senate seats significantly increases the tendency of a supermajority rule to inflate the budget.

This paper is organized as follows. In Section 2, we offer a simple model of supermajority rules in bicameral legislatures. Section 3 presents an empirical investigation of the hypothesis suggested by the model. Section 4 concludes our discussion.

2 Model of Supermajority Rules in Bicameral Legislatures

This section shows how supermajority rule affects budget outcomes in bicameral legislatures. We follow previous models of distributive politics: Ansolabehere et al. (2003), Chen and Malhotra (2007), and Chen (2010) for geographical setup of districts; Baron and Ferejohn (1989), Primo (2006), and Knight (2008) for legislative bargaining; and Lee et al. (2014) and Lee (2015) for fiscal outcomes under different voting rules. To keep the model simple, we focus on district projects funded from a common tax base and do not specify other elements such as spillover effects and heterogenous preferences.[7]

2.1 Basic model

Consider a legislature that provides a district-specific project x at constant marginal cost p. Coalition success rule requires a α-majority ($\alpha \in [0.5, 1]$) to pass a spending bill. With an equal distribution of the tax burden across all districts, each of the coalition districts pays a α fraction of the cost of providing x, or $p \cdot \alpha$. In the case of simple majority rule ($\alpha = 0.5$), a coalition member

[7] We assume that there is no spillover in project benefits across districts (to focus on the case of distributive goods). See Besely and Coate (2003) and Lockwood (2002) for a local public good model with a degree of spillovers.

pays one-half of the marginal cost. We assume that all district legislators have the same preferences for x:

$$x = x(p \cdot \alpha), \quad x' < 0 \tag{1}$$

where $p \cdot \alpha$ reflects the effective price of x to the winning coalition. An increase in α increases the effective price. Intuitively, a more inclusive voting rule makes the formation of a winning coalition more costly (difficult) to the extant coalition members.

Differentiating (1) with respect to α,

$$\partial x / \partial \alpha = p \cdot x' \quad (< 0). \tag{2}$$

Equation (2) formulates the original intuition of Buchanan and Tullock (1962)—a supermajority rule will reduce the size of redistributive project that can secure the support of only 50 percent of the legislature.[8] This standard formulation is unicameral in nature, however, and does not recognize the extension effect of supermajority rules—logrolling to attract additional members.

2.2 Bargaining in bicameral legislatures

Suppose that the legislature is divided into n Senate (or upper house) districts, and that a Senate district $j \in \{1, ..., n\}$ is divided into τ_j equally populated House (or lower house) districts, where $\tau_1 \leq ... \leq \tau_n$.[9] With single-member districts, Senate or House, the legislature consists of n senators and $T = \sum_{j=1}^{n} \tau_j$ representatives.

Spending projects are targeted at the House district level.[10] The jth senator supports the spending bill if more than half of her τ_j House districts (located within her Senate district) receive money. The idea is that a district project is valued by both the House member from that district and the senator in which the district is nested (Ansolabehere et al. 2003).

Given the coalition success rule, a proposal requires αn Senate votes and αT House votes to

[8] For instance, a simple majority can exploit the tax base of 49 percent of the polity, while a 3/4 majority rule limits the tax base to just 25 percent of the polity (Bradbury and Johnson 2006).

[9] We assume that $n \geq 3$ and $\tau_j \geq 1 \; \forall j$.

[10] Alternatively, projects can be targeted to a Senate district, and the benefits are divided equally among all House districts within the targeted district (e.g., Chen and Malhotra 2007). Our results do not change qualitatively under the alternative setup, although the current setup allows us to pinpoint the effects of supermajority rules in both chambers.

pass. Based on the previous studies (e.g., Persson et al. 1997; Chen and Malhotra 2007), we assume that forming a coalition is less costly for representatives who are geographically embedded within the same Senate district than for representatives from different Senate districts.[11]

The legislature selects a set of House district projects $X = (x_1, x_2, ..., x_T)$ using the following procedure: (1) A legislator is randomly recognized from the entire legislature to propose a project for each of T House districts, (2) if approved by both chambers, the proposal is implemented, and (3) if the proposal is not approved, another proposer is randomly recognized to make a new proposal.[12] The process continues until a proposal passes both chambers. This bargaining structure is a non-cooperative game with infinite periods and two stages in each period (Baron and Ferejohn 1989).[13]

We focus on stationary subgame perfect equilibrium, in which each legislator takes the same action in structurally identical subgames (Baron and Ferejohn 1989; Primo 2006). For simplicity, legislators are risk neutral, have the discount factor of one, cannot vote against true preferences (i.e., weakly dominated strategies are ruled out), and are not allowed to make amendments once a proposal have been made (i.e., the legislature operates under a closed rule). We also assume that side payments are allowed among coalition members.

2.3 Equilibrium

The agenda setter forms the cheapest possible coalition (Riker 1962; Knight 1998). Let $\tau = T/n$ denote the average number of House districts nested within a Senate district.

Lemma. *The minimal winning coalition consists of $\alpha n \tau$ House districts located within αn or more Senate districts.*

Proof See Appendix

Intuitively, senators and their House colleagues collaborate to form a supermajority coalition. A proposer builds a winning coalition of $\alpha n \tau$ ($\equiv \alpha T$) House districts, which are large enough to

[11] Chen and Malthotra (2007) suggested that representatives usually do not work with representatives in different Senate districts—even with geographically close representatives—due to logistical and other transaction costs. Similarly, Persson et al. (1997) noted that bargaining within a chamber is less costly than bargaining across chambers.

[12] A legislator recognized from either chamber can make project proposals (Chen 2010). A senator is recognized with probability $n/(n+T)$, and a representative with probability $T/(n+T)$.

[13] That is, a proposal is made in stage 1, and legislators in both chambers vote on the proposal in stage 2.

secure the required votes in the Senate—i.e., αn or more senators.[14] Note that the proposer chooses a smallest possible Senate coalition because a House coalition is cheaper to build within a Senate district than across Senate districts. In the simple case of $\tau_j = \tau, \forall j$, winning coalitions range from αn Senate districts $\times$ τ House districts (in each of αn Senate districts) to n Senate districts $\times$ $\alpha\tau$ House districts (in each of n Senate districts). The cheapest winning coalition consists of αn Senate districts $\times$ τ House districts.

The geographical setup in the Lemma assumes that House districts are *completely* nested within the Senate district. In some state legislatures, however, House district boundaries cut across Senate district boundaries. Appendix shows that the basic results hold in this case. Intuitively, a coalition of $\alpha n\tau$ House districts can nest at least half of House district fragments overlapping with each of αn coalition Senate districts.

Let G denote the total value of district projects. The stationary subgame perfect equilibrium is as follows: In every period, the agenda setter who is a representative offers $\alpha n\tau - 1$ House districts their continuation values—$G/n\tau$ per district—and keeps the remaining value for her own House district—$G \cdot ((1-\alpha)n\tau + 1)/n\tau$.[15] The agenda setter who is a senator offers $\alpha n\tau - \tau_k$ House districts their continuation values—$G/n\tau$ per district—where k is the agenda setter's Senate district, and keeps the remaining value for the τ_k House districts within her own Senate district—$G \cdot ((1-\alpha)n\tau + \tau_k)/n\tau$. The proposal is approved in the first period.

2.4 Impact of supermajority rule

The equilibrium results give the following:

Proposition. *The size of total expenditures G is given by:*

$$G = p \cdot \alpha \cdot n \cdot \tau \cdot x(p \cdot \alpha) \tag{3}$$

where $x(\cdot)$ is a representative's preference for x with $x' < 0$.

[14] Consistent with Ansolabehere et al. (2003), the marginal value of a senator is zero. The $\alpha n\tau$ House districts are large enough to win the αn Senate districts, if the proposer recruits relatively small Senate districts. This sometimes leads to a coalition of more than αn Senate districts. In addition, if the Senate district in which the proposer resides is too large, $\alpha n\tau$ House districts may not be large enough to cover all the House districts in the αn Senate districts, thus forcing the agenda setter to reduce the number of House-level projects in the coalition Senate districts.

[15] A coalition member's continuation value C is the expected payoff in any round: $(\alpha n\tau - 1)/n\tau \times C + 1/n\tau \times (G - (\alpha n\tau - 1)C) + (n\tau - \alpha n\tau)/n\tau \times 0$. This indicates that $C = G/n\tau$.

Proof See Appendix

The intuition behind the Proposition is that the agenda setter effectively maximizes the sum of the utilities of $\alpha n \tau$ coalition House districts—because the agenda setter shares in the projects of other coalition members through side payments. This is as if a randomly chosen coalition of $\alpha n \tau$ representatives is selected, and the coalition chooses G to maximize its aggregate utility (Battaglini and Coate 2008).

Equation (3) shows that the size of total expenditure G depends on the size of the winning coalition $\alpha n \tau$ and the effective price of pork projects to the coalition members $p \cdot \alpha$. Note that the sizes of the Senate n and the House $T(\equiv n\tau)$ affect the size of government indirectly through the coalition success rule α. Thus it is not the size of the legislatures but the size of the logrolling coalitions that determines the size of pork spending (Inman and Fitts 1990; Lee 2015).

To determine the impact of supermajority rule, Equation (3) can be differentiated with respect to α to obtain:

$$\frac{\partial G}{\partial \alpha} = p \cdot n \cdot \tau \cdot \left[\underbrace{x(p \cdot \alpha)}_{+} + \underbrace{p \cdot \alpha \cdot x'(p \cdot \alpha)}_{-} \right] \tag{4}$$

In Equation (4), a more inclusive rule has two offsetting effects on the size of government.[16] In the first term in the square brackets, α has a direct, positive impact on G because supermajority requires logrolling to attract additional House members. In the second term, α has an indirect, negative effect on G because more inclusive rules raise effective prices for the existing coalition members ($x'(\cdot) < 0$).

Note that the standard approach—the Buchanan-Tullock conjecture—focuses on the negative effect of a supermajority rule. In the context of our model, however, the extension effect—that increases the number of district projects—may dominate the budget outcome.

To see this, we rewrite Equation (4) as:

$$\frac{\partial G}{\partial \alpha} = p \cdot n \cdot \tau \cdot x \cdot [1 + \eta_{xx}] \tag{5}$$

where η_{xx} is the elasticity of demand for x with respect to the effective price to the winning coalition

[16] This result is similar to the budget outcomes under a supermajority rule (Lee et al. 2014; Lee 2015).

members $p \cdot \alpha$. Since previous studies have established that η_{xx} ranges between -0.3 to -0.5, it is readily seen from Equation (5) that Senate district fragmentation τ strengthens the tendency of supermajority rules to expand the budget.[17] Thus, our model predicts a positive association between Senate district fragmentation and the extension effect of supermajority rules.

In the previous studies, Senate district fragmentation is often claimed to reduce public spending. For instance, Chen and Malhotra (2007) have argued that an increase in Senate district fragmentation implies that each House district shares a smaller portion of the project benefits with a geographically overlapping Senate district. Thus, the agenda setter who is a representative may not find it worthwhile to propose a large spending project. In our model, the agenda setter keeps the bargaining surplus through side payments, effectively sharing in the projects of other coalition members. Thus the agenda setter proposes the spending projects of size G (in Equation (3)) even if an increase in House-to-Senate district ratio reduces the agenda setter's payoff from her own district. In addition, our paper focuses on the interaction between the supermajority rule and Senate district fragmentation, in which the coalition success rule α varies rather than being fixed at a simple majority.

Note that the agenda setter may want to build a larger-than-minimal winning coalition. The reasons include that (1) if uncertain about legislators' preferences, the agenda setter may add extra members to increase the chance of winning a supermajority (Riker 1962), and (2) if other vote buyers vie for the winning majority, the agenda setter may build a buffer to deter the competitors (Groseclose and Snyder 1996). In our context, the agenda setter may build a winning coalition of $\alpha^* n\tau$ House members, where $\alpha^* \geq \alpha$. In that case, G in Equation (3) can be treated as the lower bound of the budget size.

3 Empirical Evidence

This section provides an empirical analysis of the main hypothesis: that the Senate district fragmentation—measured by the ratio of seats in the House relative to seats in the Senate—increases the effect of an adoption of supermajority rules on government size.

[17]See Borcherding (1985), Reiter and Weichenrieder (1997), Brasington (2002), and Oates (1996, 2006) for the estimation of the price elasticity of demand for government services.

3.1 Variables and data

We used a panel of data collected over 39 years (1970-2008) in 49 U.S. states, not including Nebraska.[18] Dependent variables are total tax revenue, general expenditure, and nine categories of spending, including education, roads, public welfare, public safety, health, natural resources, police, sanitation, and utility.

Seventeen states have adopted a variant of supermajority rules to restrain taxation and government expenditures. In these states, a supermajority vote is required to pass the budget, to increase tax and expenditures, or to limit government expenditure growth to income or inflation growth unless a supermajority overrides (Bradbury and Johnson 2006). We use panel data because supermajority rules were adopted with sufficient time variance—typically in 10-year waves.[19] We focus on the adoption of supermajority rule because the requirements vary relatively little across states: a 2/3 rule (9 states), a 3/5 rule (5 states), and a 3/4 rule (3 states).

Among the 49 states, the average legislature size in 2008 was 39 seats in the Senate and 110 seats in the House.[20] Thus, the average Senate district fragmentation is about 2.8 House districts in 2008. Table 1 shows the supermajority requirements in various states and the mean number of seats in both chambers.

[Table 1 here]

The socioeconomic control variables are in line with previous studies on government growth (Bradbury and Johnson 2006; Lee et al. 2014; Lee 2015). Standard variables include income per capita (in $1,000), population (in 1,000s), percentage of the population over age 65, percentage of the population under age 18, and a dummy variable indicating whether the Republicans control a chamber. All these variables determine the nature of the demand side activities for government services.[21] Table A1 presents summary statistics for all the variables described in this section.

[18] Nebraska has a unicameral legislature.

[19] The waves include around 1970 (3 states), around 1980 (3 states), around 1990 (6 states), and around 2000 (4 states).

[20] During the sample period, 21 states changed the size of legislature, either House or Senate, at least once.

[21] Most of the socioeconomic data were obtained from the U.S. Census Bureau; the income per capita data were collected from the U.S. Bureau of Economic Analysis. Voter initiatives for constitutional amendment (one of our instrumental variables) were collected from the Book of the States.

3.2 Empirical model

We use a structural equation to determine the effects of a supermajority rule in bicameral legislatures. The specification is an augmented dummy endogenous variable model with multiplicative interactions:

$$G_{it} = \beta_0 + \beta_1 S_{it} + \beta_2 Ratio_{it} + \beta_3 S_{it} Ratio_{it} + \beta_4 U_{it} + \Phi X_{it} + \omega_i + \lambda_t + \zeta_{it} \quad (6)$$

$$S^*_{it} = \gamma_0 + \gamma_1 D_{it} + \gamma_2 Ratio_{it} + \gamma_3 U_{it} + \gamma_4 X_{it} + \theta_i + \mu_t + u_{it} \quad (7)$$

$$S_{it} = \begin{cases} 1 & \text{if} \quad S^*_{it} > 0 \\ 0 & \text{if} \quad S^*_{it} \leq 0 \end{cases}$$

where G_{it} is total revenue or government expenditures in state i at time t; S_{it} is a dummy variable for the supermajority rule; $Ratio_{it}$ is the ratio of House-to-Senate seats; U_{it} is the size of the Senate; X is a vector of control variables; ω_i and θ_i are the state-specific effects; λ_t and μ_t are the time effects; and ζ_{it} and u_{it} are the error terms. Note that $\beta_1 + \beta_3 Ratio$ is the marginal effect of the supermajority rule on the size of government. The sign of β_3 is predicted to be positive.[22]

In Equation (6), S_{it} is potentially correlated with ζ_{it} because the latent index function (7) shows that the adoption of the supermajority rule is a political decision that depends on the preferences of voters. For instance, a downward bias in the estimate of β_3 would occur if a state with a larger government is less likely to adopt a supermajority rule (Knight 2000).

To control for the endogeneity, the structural equation assumes that D_{it}, an instrumental variable, is independent of the error terms ζ_{it} and u_{it}. Thus, Equations (6) and (7) address both adoption of a supermajority rule and its causal effects on government expenditure, conditional on the ratio of House-to-Senate seats. We employ two instrumental variables taken from the previous literature (e.g., Knight 2000; Lee et al. 2014): the neighboring state effects (adoption of supermajority rules in neighboring states) and the legislative vote required to initiate a constitutional amendment. These instrumental variables satisfy the requirement of having an effect on the adoption of supermajority rules, but they have no direct influence on budget size. States with a neighboring supermajority state are more likely to adopt a supermajority rule, but characteristics

[22] We ignore the potential multicollinearity between S_{it} and $Ratio_{it}$ because the correlation between the two variables is low (-0.13).

of the neighboring states are not directly related with government size (Lee 2015).[23] For instance, 12 of the 17 states with a supermajority rule have neighboring border states with the supermajority rule. Regional spillover of various fiscal institutions (such as fiscal rules) is often the result of yardstick competition and learning process (Debrun et al. 2008; Keen and Lockwood 2010). In addition, 32 states require supermajority votes to initiate a constitutional amendment, including the adoption of a supermajority rule. This requirement makes the adoption of a supermajority rule more difficult, but constitutional amendment rules—being part of states' original constitutions—apply to all amendments, not just the adoption of supermajority rules (Knight 2000).

The ratio of House-to-Senate seats is treated as exogenous because (1) a larger budget is more likely to require more government employees rather than more legislators (Baqir 2002) and (2) the number of seats is typically determined as part of a state's original constitution—that is, constitutional links between seats and counties, and seats and population (Gilligan and Matsusaka 1995).[24]

3.3 Results

Table 2 reports the results of estimating Equations (6)-(7). Dependent variables are total revenue per capita.[25] As a benchmark fixed effects model, column 1 takes a basic revenue equation with the legislature sizes in both chambers (*Upper* and *Lower*) and standard control variables. Column 2 simply substitutes the Senate district fragmentation (*Ratio*) for the legislature size in the lower chamber (*Lower*). Column 3 includes the supermajority rule dummy—instrumented by the neighboring state effects and the constitutional amendment rules. Column 4 adds the interaction term that allows the impact of the adoption of supermajority rule to vary across time and states according to the Senate district fragmentation. Column 5 adds the interaction term of the supermajority rule dummy with the legislative size in the upper chamber. Finally, columns 6 and 7 substitute the actual supermajority requirements for the dummy variable for supermajority rule in columns

[23]The neighborhood adoption dummy is one if neighboring states have adopted a supermajority rule within 10 years.

[24]Although some states have amended their constitutions to alter the legislative size, these changes were motivated by all legislative matters, including efficiency in representation and other exogenous events (banking crises, political scandals, court decisions regarding equal population reapportionment, and statewide legislative reforms), not limited to budget allocation (Lee 2015).

[25]Total revenue and general expenditure are similar to the extent that most U.S. states have balanced budget requirements with no expectation of a bailout from the federal government (McKinnon and Nechyba 1997).

4 and 5.

Note that electoral districting appears to have little impact on total revenue if there is no consideration of the interaction with supermajority rules. Columns 1 through 3 show that the coefficients on *Lower*, *Upper* and *Ratio* are either small in magnitude or statistically insignificant. In column 3, the legislature size in the upper chamber, *Upper*, has a positive impact on total revenue, but the effect is not large. A one seat increase in *Upper* increases tax revenue by $25, or about 1.4 percent of the average per capita revenue. On the other hand, supermajority rule adoption has a robust, sizable impact on total revenue ($903, or about 77 percent of the mean total revenue).

More importantly for our purpose, columns 4 through 7 show the effects of adopting a supermajority rule, conditional on the Senate district fragmentation. One broad effect of introducing the interaction terms in S is that the coefficients on the simple supermajority rule become either negative or insignificant. On the contrary, the interaction effects, $S * Ratio$, are positive and statistically significant at the 1 percent level. This result confirms the hypothesis that Senate district fragmentation increases the revenue impact of a supermajority rule, the size of which we discuss below. In addition, the interaction terms in the upper chamber, $S * Upper$, are positive and significant—results that are consistent with the previous findings that the $1/n$ effect is robust only if combined with budgetary rules (Raudla 2000; Lee 2015).

[Table 2 here]

With interaction terms included, the marginal effects are often the most meaningful results. Figure 1 shows how the marginal effect of a supermajority rule on revenue varies with the level of Senate district fragmentation.[26] The figure features the 95 percent confidence interval for the supermajority rule-total revenue relation conditional on the value of the interacting variable (*Ratio*). Throughout the levels of *Ratio*, the point estimate of the supermajority rule is positive and mostly significant at the 5 percent level, as shown by the confidence interval above the zero line (Brambor et al. 2006). More importantly, the effect of the supermajority rule increases with the level of Senate district fragmentation. Thus, we find that Senate district fragmentation enables us to better pinpoint the relationship between supermajority rules and total revenue. More specifically,

[26] Figure 1 is based on the results in column 4.

a larger *Ratio* increases the number of House district projects required to form a winning coalition in the Senate.

[Figure 1 here]

In general, the effects of socioeconomic control variables are in line with common expectations. Income has a positive and significant impact on total revenue. Population does not exhibit a robust relationship with government size. In most columns, percentage of youth has a robust, negative association with government revenue, reflecting that the group is not included in the sphere of taxable population. Republican control in the lower chamber has a negative association with government revenue. Percentage of elderly and Republican control in the upper chamber are not statistically significant in most columns.

The first stage F-statistics and the Sargan statistics reported in Table 2 indicate that the instrumental variables sufficiently explain the adoption of supermajority rule without overidentifying the effect.[27]

[Table 3 here]

Table 3 reports the regression estimates for general expenditure per capita. Columns 1 through 3 show that electoral districting has a robust impact on general expenditure only if supermajority rules are counted in. In columns 4 through 7, all the interaction effects, $S * Ratio$, are positive and statistically significant. This again confirms the hypothesis that the extension effect of supermajority rules increases with the number of House districts within a Senate district.

Figure 2 presents the marginal effect of the supermajority rule on general expenditure conditional on the level of Senate district fragmentation. The picture that emerges is largely similar to that of total revenue in Figure 1. The point estimate of supermajority rule increases with the level of Senate district fragmentation.

[Figure 2 here]

Table 4 reports the regression estimates for nine categories of state government expenditures. Most coefficients on the interaction term, $S * Ratio$, are positive, and the relationship is statistically

[27] The first stage regressions reported in Table A2 show that the coefficients on the neighboring state effects and the constitutional amendment rules are statistically significant in most cases.

significant for four types of expenditure, including health, natural resource, sanitation, and utility. These goods are likely to be price-inelastic in demand due to a high degree of publicness. Our hypothesis that Senate district fragmentation increases the effect of supermajority rule depends on the assumption that the demand for government services are price-inelastic. Figure *A* provides the full marginal effects of adopting a supermajority rule for each expenditure item. In general, point estimates of the supermajority rule are increasing with the level of *Ratio*, and for six types of expenditures (roads, safety, health, natural resource, sanitation, and utility), the point estimate of the supermajority rule is statistically significant for at least some levels of *Ratio*. For three types of expenditures (education, welfare, and police), the marginal effects of a supermajority rule are statistically insignificant at all levels of *Ratio*, as indicated by the confidence interval containing the zero line. One potential reason for the insignificant effects is that the three types of services are not price-inelastic in demand because substitutes are readily available in the private market or beneficiaries are easily identified. For instance, education is a clear-cut case of private market substitution (e.g., private schools and homeschooling). Although not completely comparable, private security can substitute for police protection. In the case of welfare spending, the major beneficiaries tend to be identified as low-income families.

[Table 4 here]

Table 5 presents the regression estimates from alternative specifications of the empirical model. Panel *A* excludes Alaska and Hawaii because the states' revenue and expenditures are often considered outliers. Panel *B* employs pooled 2SLS models using variation in supermajority rules across states and years. Although pooled 2SLS results ignore the state fixed effects, the fixed effects cannot address the within-state temporal changes in attitudes towards tax and expenditure (Knight 2000; Lee 2015). In Panel *C*, we include only the states that allow line-item vetoes by governors. Executive veto power can reduce pork spending by shifting budgetary power from the legislature to the governor (Primo 2006). Hence, the executive veto functions as a constitutional check on logrolling-type goods similar to a supermajority rule (as originally understood). Throughout the panels, all the coefficients on the interaction terms are positive and statistically significant. This confirms the finding that Senate district fragmentation increases the impact of a supermajority rule on the size of government.

4 Concluding remarks

A supermajority rule is often claimed to restrain excessive government spending by limiting majority tyranny. Reflecting this claim, 17 American states have adopted some variant of supermajority rule with a purpose of restraining excessive spending and taxation. California voters, however, appear to disagree with the idea because they passed Proposition 39 in 2000 and Proposition 25 in 2010, both of which reduced the supermajority vote requirement.[28]

Previous literature has examined separately the effects of supermajority rule and bicameralism on budget outcomes. The two political institutions are not independent, however, because the formation of a winning coalition is related across the two chambers. Our study has shown that the extension effect of a supermajority rule—that adds more members to the logrolling coalition—increases with Senate district fragmentation—the ratio of seats in the House relative to seats in the Senate.

Using data from American state legislatures for 1970 to 2008, we find that an increase in Senate district fragmentation indeed increases the tendency of a supermajority rule to inflate the size of government. This finding suggests that a combination of supermajority rules and bicameralism tends to worsen the fiscal commons problem.

Appendix

Proof of Lemma

The proof of Lemma is identical for proposers from both the Senate and the House. To secure passage of the budget, the recognized proposer must build a coalition that includes at least αn Senate districts and $\alpha n \tau$ House districts (since $T \equiv n\tau$). This proof shows that it is possible to build a minimal winning coalition entirely within the House, without having to give additional projects to obtain votes in the Senate—because a senator will support a bill that benefits more than half of her House districts. Let $k \in \{1, ..., n\}$ denote the Senate district within which the proposer resides. The minimal wining coalition in the Senate depends on three cases:

(1) $k \in \{1, ..., \alpha n\}$

[28] Proposition 39 reduced the required vote on local school bond measures from two-thirds to 55 percent; Proposition 25 reduced the vote requirement to pass the budget from two-thirds to a simple majority.

A coalition of $\alpha n\tau$ House districts contains all the House districts within at least αn Senate districts because

$$\alpha n\tau \geq \sum_{j=1}^{\alpha n} \tau_j \tag{A1}$$

Otherwise, $\tau < (\sum_{j=1}^{\alpha n} \tau_j)/\alpha n$, which contradicts the assumption that $\tau_1 \leq \tau_2 \leq ... \leq \tau_n$. Thus, a coalition of $\alpha n\tau$ House districts guarantees a minimal winning coalition in the Senate.

(2) $k \in \{\alpha n + 1, ..., n\}$ and $\tau_k \leq \alpha n\tau - \sum_{j=1}^{\alpha n-1} \tau_j$

A coalition of $\alpha n\tau$ House districts contains all the House districts within at least αn Senate districts because

$$\alpha n\tau \geq (\sum_{j=1}^{\alpha n-1} \tau_j) + \tau_k \tag{A2}$$

Thus, $\alpha n\tau$ House districts guarantee a minimal winning coalition in the Senate.

(3) $k \in \{\alpha n + 1, ..., n\}$ and $\tau_k > \alpha n\tau - \sum_{j=1}^{\alpha n-1} \tau_j$

Since $\alpha n \geq n/2$, we have $2\alpha n\tau \geq n\tau$. Noting that $n\tau$ is T, we obtain $2\alpha n\tau > \sum_{j=1}^{\alpha n-1} \tau_j + \tau_k$, from which

$$\alpha n\tau > \frac{1}{2}\big[(\sum_{j=1}^{\alpha n-1} \tau_j) + \tau_k\big] \tag{A3}$$

Thus, a coalition of $\alpha n\tau$ House districts contains at least half of House districts within each of αn Senate districts—guaranteeing a minimal winning coalition in the Senate.

Summing (1) through (3), the cheapest winning coalition consists of αn or more Senate districts and $\alpha n\tau$ House districts within the coalition Senate districts.

Case of House District Fragmentation

Let a_j denote the number of House districts fragments within the jth Senate district $\forall j \in \{1, ..., n\}$. Following Chen (2010), we assume that each of the a_j fragments within the jth Senate district contains the same population, and that if a House district is fragmented into more than one Senate districts, each fragment has the same population.[29] By definition, the geographic limits on a_j are

$$T/n \leq a_j \leq T \tag{A4}$$

[29]Thus, any one House district that overlaps with the Senate district j has $1/a_j$th of the Senate j's population.

where we assume that T/n is an integer.

Dividing (A4) by 2,

$$\tau/2 \leq a_j/2 \leq n\tau/2$$

Since $\alpha n\tau \geq n\tau/2$, a coalition of $\alpha n\tau$ House districts can win the support of any jth senator by giving projects to at least half of her House districts. The proposer then builds a minimal winning coalition using a method similar to that of Lemma 2. Thus, a coalition of $\alpha n\tau$ House districts guarantees a minimal winning coalition in the Senate.

Proof of Proposition

In equilibrium, the agenda setter selects $\alpha n\tau$ district projects of total value G that will maximize her payoff. Note that the agenda setter effectively shares in the projects of other coalition members because she keeps the bargaining surplus via side payments. This means selecting a set of projects $(x_1, x_2, ..., x_{\alpha n\tau})$ to maximize the sum of the utilities of all coalition House districts. A coalition House member's utility can be written as:

$$u_i = u(x_i) - \frac{(x_1 + x_2 + ... + x_{\alpha n\tau}) \cdot p}{n\tau}$$

where $u(x_i)$ is the value of x_i to the ith coalition House member.[30] Summing this across all $\alpha n\tau$ coalition House members, we have:

$$U = \sum_{i=1}^{\alpha n\tau} \Big[u(x_i) - x_i \cdot p \cdot \alpha\Big]$$

Maximizing U gives the first-order conditions: $u'(x_i) = p \cdot \alpha, \forall i \in (1, ..., \alpha n\tau)$. These imply that $x_i^* = x(p \cdot \alpha)$ for all i. Since each of $\alpha n\tau$ legislators gets x_i^*, the total government expenditures G can be written as $p \cdot \alpha \cdot n \cdot \tau \cdot x(p \cdot \alpha)$.

[30]By standard assumption, u is concave and increasing in x_i.

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Table 1: District Fragmentation of the Supermajority States, 2008

State	Supermajority required	Senate seats	House seats
Arizona (1992)	2/3	30	60
Arkansas (1934)	3/4	35	100
California (1979)	2/3	40	80
Colorado (1992)	2/3	35	65
Delaware (1980)	3/5	21	41
Florida (1971)	3/5	40	120
Kentucky (2000)	3/5	38	100
Louisiana (1966)	2/3	39	105
Michigan (1994)	3/4	38	110
Mississippi (1970)	3/5	52	122
Missouri (1996)	2/3	34	163
Nevada (1996)	2/3	21	42
Oklahoma (1992)	3/4	48	101
Oregon (1996)	3/5	30	60
Rhode Island (1992)	2/3	38	75
South Dakota (1978)	2/3	35	70
Washington (1993)	2/3	49	98
AVERAGE	0.66	37	89

Year of adoption in parentheses. Source: National Conference of State Legislatures.

Table 2: Effects of supermajority rule on total revenue

Dependent variable: Per capita total tax revenue

	Fixed Effects		Fixed Effects 2SLS				
	1	2	3	4	5	6	7
Lower	3.211*						
	(1.878)						
Upper	-5.082	1.851	24.45*	10.49	4.710	10.39	3.410
	(5.545)	(7.264)	(12.79)	(12.36)	(13.70)	(12.43)	(12.99)
Ratio		129.2	71.49	61.06	3.429	58.91	2.313
		(97.03)	(58.15)	(53.88)	(52.81)	(54.60)	(53.43)
S			902.7**	-1,039	-3,604**	-1,525	-5,402**
			(447.5)	(787.8)	(1,503)	(1,195)	(2,252)
S * Ratio				741.0***	988.3***	1,123***	1,507***
				(276.9)	(346.2)	(422.1)	(531.8)
S * Upper					59.51*		87.85*
					(30.95)		(46.00)
Income	111.8**	111.9**	118.9***	123.7***	129.9***	125.3***	131.7***
	(41.82)	(42.09)	(17.26)	(17.43)	(19.91)	(17.39)	(20.24)
POP	-69.00	-63.06	-381.4*	-11.78	443.3	0.366	469.8
	(221.2)	(221.0)	(199.7)	(222.9)	(296.3)	(219.1)	(295.9)
Elderly	-750.9	-769.3	-658.0	2,690	8,242**	2,999	8,166**
	(6,039)	(6,061)	(2,553)	(2,602)	(4,165)	(2,595)	(4,028)
Youth	-3,308	-3,365	-6,947***	-5,091***	-5,798***	-5,271**	-5,869***
	(4,448)	(4,471)	(2,145)	(1,974)	(2,091)	(2,061)	(2,124)
Repub (L)	-15.92	-17.91	-14.46	-90.55**	-111.4**	-94.59**	-114.5**
	(38.31)	(37.70)	(37.81)	(42.71)	(49.70)	(43.37)	(50.30)
Repub (U)	-1.429	0.010	6.459	-15.59	-30.17	-15.21	-32.80
	(30.70)	(30.77)	(44.82)	(45.06)	(47.97)	(45.42)	(48.53)
No. Obs.	1,911	1,911	1,911	1,911	1,911	1,911	1,911
Pseudo R^2	0.472	0.472	0.369	0.364	0.248	0.353	0.236
No. id	49	49	49	49	49	49	49
1st stage F statistic			10.26	9.96	11.36	10.06	11.47
Sargan test, $p <$			0.420	0.356	0.613	0.354	0.619

All columns include fixed effects and time dummies. *Ratio* is the ratio of House-to Senate seats. S is a dummy variable that is 1 if a supermajority rule is present and 0 otherwise (columns 3 through 5); and is the actual supermajority requirements (columns 6 and 7). All dollar figures are in constant 2005 US dollars. Cluster-robust standard errors are reported in parentheses. ***p <0.01, **p <0.05, *p <0.1.

Table 3: Effects of supermajority rule on general expenditure

Dependent variable: Per capita general expenditure

	Fixed Effects		Fixed Effects 2SLS				
	1	2	3	4	5	6	7
Lower	2.804						
	(3.082)						
Upper	2.214	7.743	28.28**	25.39*	12.79	25.91*	11.78
	(12.69)	(11.56)	(13.69)	(14.41)	(11.15)	(14.65)	(10.61)
Ratio		79.96	27.49	-7.023	-12.88	-11.45	-13.43
		(120.1)	(57.18)	(56.98)	(49.82)	(58.09)	(49.97)
S			820.4*	-553.2	-2,277*	-759.6	-3,413*
			(484.0)	(884.0)	(1,224)	(1,358)	(1,828)
S * Ratio				673.6**	835.7***	1,028**	1,271***
				(316.3)	(314.4)	(487.8)	(481.4)
S * Upper					29.18		42.92
					(24.64)		(36.33)
Income	56.94***	56.56***	62.97***	70.41***	70.87***	72.77***	72.34***
	(11.01)	(11.07)	(15.81)	(16.03)	(16.94)	(16.30)	(17.21)
POP	-492.9	-481.9	-771.2***	-573.3**	-203.0	-561.0**	-181.0
	(329.7)	(330.7)	(216.1)	(252.1)	(238.1)	(250.8)	(236.5)
Elderly	-47.37	-35.80	65.38	3,157	6,020*	3,724	6,098**
	(6,695)	(6,709)	(2,137)	(2,297)	(3,172)	(2,316)	(3,021)
Youth	-3,787	-3,846	-7,101***	-6,967***	-5,786***	-7,306***	-5,845***
	(3,160)	(3,173)	(2,277)	(2,248)	(1,610)	(2,381)	(1,629)
Repub (L)	13.72	11.76	14.89	-52.79	-68.59	-58.20	-71.94
	(67.25)	(67.15)	(41.04)	(46.90)	(46.29)	(48.28)	(46.54)
Repub (U)	18.20	20.47	26.33	9.081	-1.848	10.06	-3.067
	(34.79)	(35.31)	(40.82)	(45.22)	(43.85)	(46.20)	(44.47)
No. Obs.	1,911	1,911	1,911	1,911	1,911	1,911	1,911
Pseudo R^2	0.826	0.826	0.785	0.747	0.765	0.736	0.762
No. id	49	49	49	49	49	49	49
1st stage F statistic			10.26	9.96	11.36	10.06	11.47
Sargan test, $p <$			0.367	0.426	0.363	0.498	0.384

All columns include fixed effects and time dummies. *Ratio* is the ratio of House-to Senate seats. S is a dummy variable that is 1 if a supermajority rule is present and 0 otherwise (columns 3 through 5); and is the actual supermajority requirements (columns 6 and 7). All dollar figures are in constant 2005 US dollars. Cluster-robust standard errors are reported in parentheses. ***p <0.01, **p <0.05, *p <0.1.

Table 4: Effects of supermajority rule on expenditure categories

Dependent variable: Per capita expenditures

	1	2	3	4	5	6	7	8	9
	education	roads	welfare	safety	health	natural res.	police	sanitation	utility
Ratio	175.1***	-29.10**	38.88**	-9.827***	-23.16***	12.32***	-3.429**	-21.21***	20.32***
	(25.08)	(11.46)	(17.48)	(3.756)	(4.687)	(3.715)	(1.348)	(4.510)	(5.184)
S	-335.5	-18.97	-247.7	43.41	-102.7	-159.5**	24.65	-2.526	-148.8**
	(285.8)	(151.2)	(215.0)	(61.60)	(74.98)	(64.66)	(16.97)	(53.46)	(68.23)
S * Ratio	73.65	78.39	46.92	26.46	43.74**	33.55**	-1.973	45.88**	49.24***
	(66.07)	(49.47)	(57.37)	(21.53)	(19.67)	(14.87)	(4.913)	(22.07)	(18.52)
No. Obs.	1,911	1,911	1,911	1,911	1,911	1,911	1,911	1,911	1,911
Pseudo R^2	0.747	0.005	0.872	0.667	0.646		0.326		0.103
No. id	49	49	49	49	49	49	49	49	49
1st stage F stat.	9.18	9.18	9.18	9.18	9.18	9.18	9.18	9.18	9.18
Sargan test, $p <$	0.000	0.580	0.000	0.768	0.250	0.104	0.009	0.772	0.002

Only the coefficients on the supermajority rule (S), the ratio of House-to Senate seats ($Ratio$), and the interaction terms are reported from the full equation. Control variables include the legislature size in the upper chamber, income, population, elderly and youth population, and Republican controls in the upper and lower chamber. S is a dummy variable that is 1 if a supermajority rule is present and 0 otherwise. All columns include fixed effects and time dummies. All dollar figures are in constant 2005 US dollars. Estimation methods: Fixed effects 2SLS. Cluster-robust standard errors are reported in parentheses. ***p <0.01, **p <0.05, *p <0.1.

Table 5: Alternative specifications

Dependent variable: Per capita total revenue for columns (1) and (2); Per capita general expenditure for columns (3) and (4)

	(1)	(2)	(3)	(4)
	Panel A: Alaska and Hawaii excluded			
Ratio	3.945	7.996	9.344	12.84
	(24.03)	(23.97)	(44.09)	(44.15)
S	-464.7	-594.1	-729.2	-993.0
	(608.9)	(893.0)	(886.7)	(1,315)
S * Ratio	335.1**	482.3**	298.1*	429.7*
	(133.9)	(196.1)	(166.1)	(248.2)
No. Obs.	1,833	1,833	1,833	1,833
	Panel B: Pooled 2SLS			
Ratio	-89.47***	-100.3***	-96.12***	-127.7***
	(7.569)	(8.254)	(14.41)	(14.25)
S	-1,078*	-3,320***	2,196	-930.2
	(604.7)	(1,017)	(1,587)	(2,334)
S * Ratio	341.8***	521.0***	678.6**	1,009***
	(127.6)	(187.7)	(269.9)	(351.1)
No. Obs.	1,911	1,911	1,911	1,911
	Panel C: Line-item veto present			
R	79.50	74.41	4.432	1.106
	(58.40)	(58.00)	(57.78)	(57.91)
S	-7,692	-10,704	-3,164	-4,468
	(5,002)	(7,206)	(3,818)	(5,607)
S * Ratio	1,368**	2,017**	1,012**	1,521**
	(536.3)	(787.6)	(436.1)	(651.3)
No. Obs.	1,677	1,677	1,677	1,677

Only the coefficients on the supermajority rule (S), the ratio of House-to Senate seats (*Ratio*), and the interaction terms are reported from the full equation. Control variables include the legislature size in the upper chamber, income, population, elderly and youth population, and Republican controls in the upper and lower chamber. S is a dummy variable that is 1 if a supermajority rule is present and 0 otherwise. All columns include fixed effects and time dummies. All dollar figures are in constant 2005 US dollars. Cluster-robust standard errors are reported in parentheses. ***p <0.01, **p <0.05, *p <0.1.

Table A1: Summary statistics

	mean	standard deviation	minimum	maximum
Total revenue	1799	750	616	11907
General expenditure	3364	1507	1308	15712
Education	1219	439	366	3901
Roads	364	192	120	2086
Welfare	676	382	94	2300
Public safety	123	73	22	635
Health	112	76	9	650
Natural resource	82	79	13	924
Police	34	21	1	209
Sanitation	13	24	0	361
Utility	26	76	0	1018
Legislature size (Senate)	39	11	19	67
Legislature size (House)	112	56	39	400
Senate seats/House seats	3.0	2.2	1.7	16.7
Supermajority rule	0.201	0.401	0	1
Income per capita	27295	6201	13217	52396
Population	5011346	5462022	302583	3.66E+07
Percentage over 65	0.117	0.023	0.022	0.182
Percentage under 18	0.279	0.036	0.204	0.400
Republicans control (Senate)	0.373	0.484	0	1
Republicans control (House)	0.343	0.475	0	1
Neighboring effects	0.311	0.463	0	1
Legislative vote for constitutional amendment	0.610	0.092	0.5	0.8
Line-item veto	0.880	0.325	0	1

Table A2: 2SLS 1st stage regressions

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	S	S	$S * R$	S	$S * R$	S*Upper
Neighbor	0.041***	0.029	-0.247*	-0.159***	-0.672***	-6.172***
	(0.010)	-0.042	(0.138)	(0.064)	(0.172)	(2.061)
Amendment	0.582	-1.457*	-2.652*	-17.891***	-31.222***	-542.326***
	(0.432)	-0.757	(1.521)	(2.690)	(5.826)	(106.218)
Ratio*Neighbor		0.005	0.129**	0.011	0.145	-0.048
		-0.015	(0.054)	(0.015)	(0.054)	(0.534)
Ratio*Amendment		0.614***	1.329***	0.876***	1.794***	30.160***
		-0.199	(0.415)	(0.207)	(0.437)	(7.556)
Upper*Neighbor				0.004***	0.010***	0.203***
				(0.001)	(0.002)	(0.036)
Upper*Amendment				0.271***	0.472***	8.334***
				(0.044)	(0.097)	(1.764)
Upper	-0.0254***	-0.025***	-0.046***	-0.177***	-0.312***	-5.467***
	(0.006)	0.006	(0.014)	(0.025)	(0.052)	(1.038)
Ratio	0.0719***	-0.270***	-0.529**	-0.3999***	-0.759***	-12.992***
	(0.022)	-0.105	(0.221)	(0.110)	(0.236)	(4.025)
Income	-0.00690**	-0.007**	-0.0287***	-0.008***	-0.0311***	-0.339***
	(0.003)	-0.003	(0.007)	(0.003)	(0.007)	(0.109)
Pop	0.343***	0.348***	0.476***	0.404***	0.592***	7.532***
	(0.0513)	-0.057	(0.136)	(0.057)	(0.137)	(1.988)
Elderly	-0.0477	-0.079	-5.444**	-0.386	-6.107**	-86.682**
	(1.065)	-1.079	(2.749)	(1.082)	(2.759)	(36.153)
Youth	3.910***	3.915***	7.673***	3.651***	7.142***	137.815***
	(0.591)	-0.591	(1.322)	(0.595)	(1.330)	(23.932)
REP (L)	-0.005	-0.006	0.015	-0.002	0.024	0.141
	(0.018)	-0.018	(0.046)	(0.018)	(0.047)	(0.671)
REP (U)	-0.007	-0.008	0.079	-0.004	0.085	-0.272
	(0.020)	-0.02	(0.051)	(0.020)	(0.051)	(0.715)
No. Obs.	1,911	1911	1911	1911	1911	1911
R^2	0.270	0.271	0.241	0.283	0.248	0.258

Column (1) refers to the 1st stage regressions in models (3) in Table 2. Columns (2) and (3) refer to model (4) in Table 2; columns (4) through (6) refer to model (5) in Table 2. Cluster-robust standard errors are reported in parentheses. ***p <0.01, **p <0.05, *p <0.1.

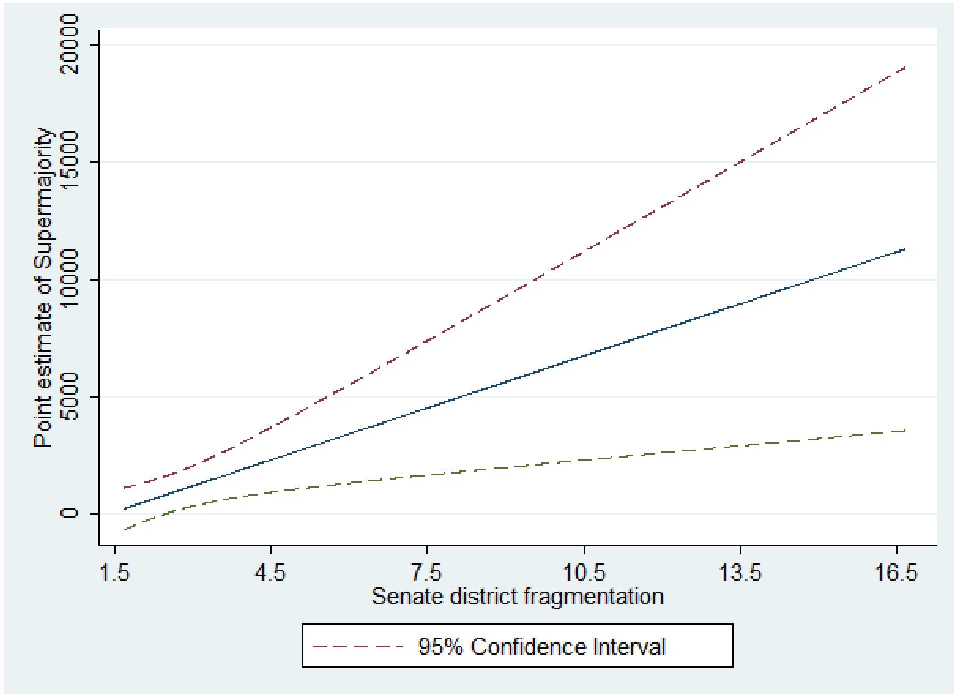


Figure 1: Revenue effect of supermajority rules with Senate district fragmentation

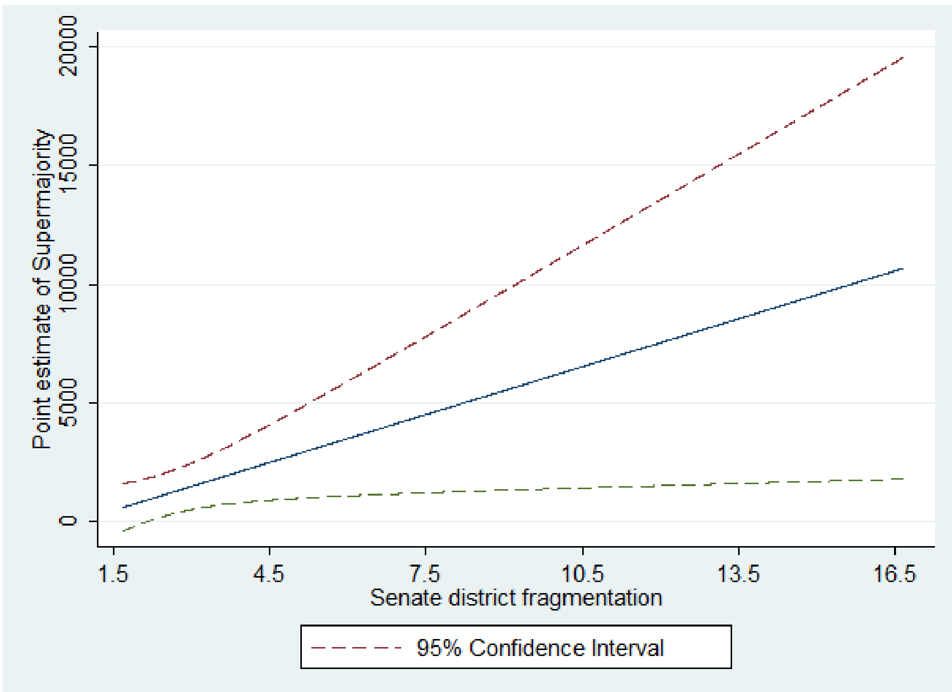
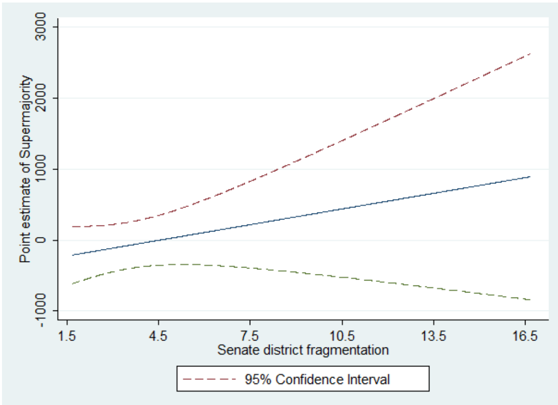
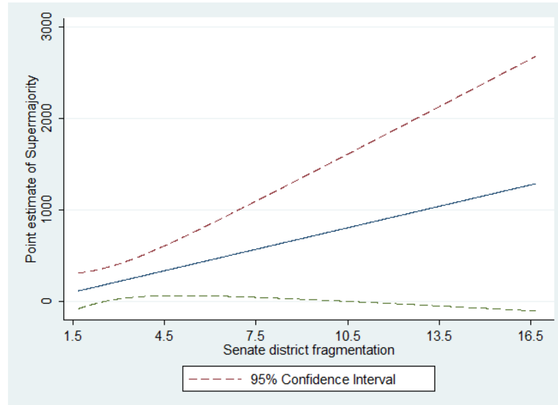


Figure 2: Expenditure effect of supermajority rules with Senate district fragmentation

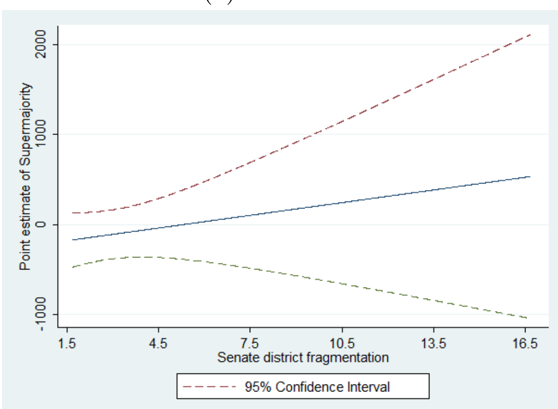
Figure A: Effect of supermajority rules with Senate district fragmentation



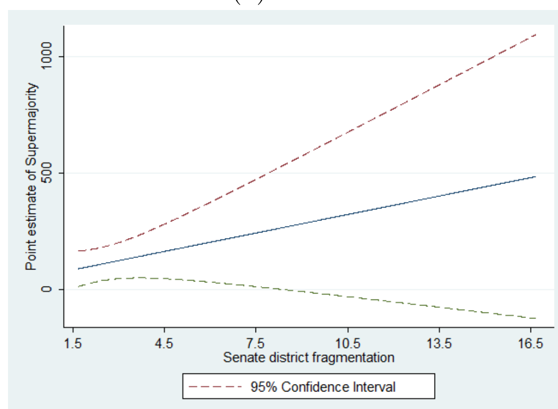
(a) Education



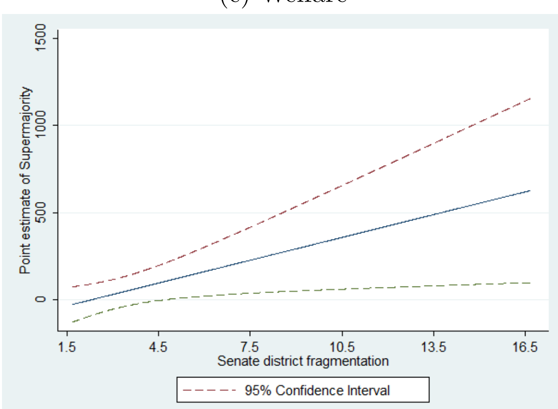
(b) Roads



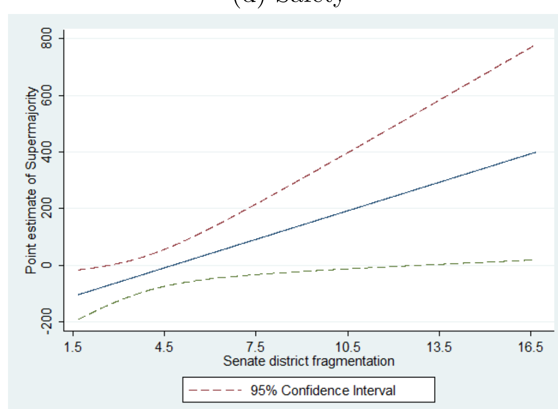
(c) Welfare



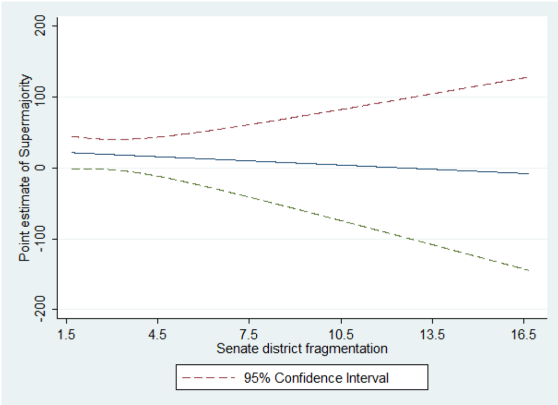
(d) Safety



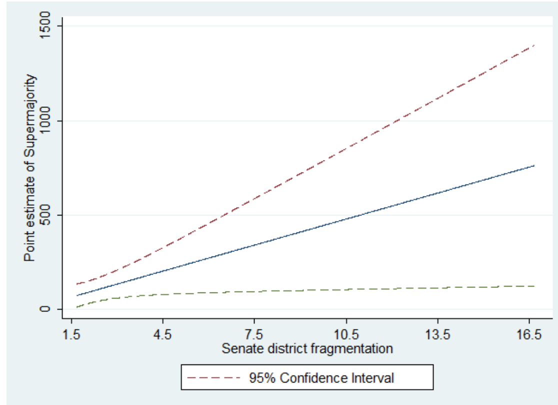
(e) Health



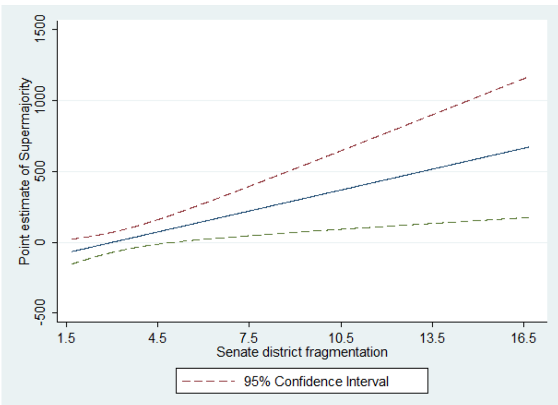
(f) Natural resource



(g) Police



(h) Sanitation



(i) Utility