A Quasi-Natural Experiment on Electoral Rules and Political Representation*

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Abstract: We combine roll call votes and referendum decisions on identically worded legislative proposals to identify the effect of electoral rules on the way Swiss Members of Parliament (MPs) represent their constituents' preferences. We exploit the fact that MPs in both Houses of Parliament are elected in the same electoral districts (the cantons). Yet, in the Lower House, MPs are elected using a proportional rule, while in the Upper House they are elected employing a majoritarian rule. We find that electoral rules matter strongly for political representation. The voting patterns of MPs are in line with three theoretical predictions regarding the influence of electoral rules on representation of constituents' preferences: 1) The probability that a proportional-elected MP accepts a legislative proposal closely follows the share of voters that accept the proposal in the referendum. 2) In contrast, for majority-elected MPs the probability of acceptance is strongly increasing in the share of voter acceptance if the latter is close to the 50% threshold. 3) The estimated probability that an Upper House MP votes "yes" as a function of the share of voters voting "yes" in the referendum has an S-shape form with an inflection point close to 50%.

Keywords: Electoral Rules, Voting, Political Representation, Behavior of Politicians

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I. INTRODUCTION

There is a vast formal theoretical literature on how electoral rules influence the way individual politicians represent their voters' preferences (see, e.g., Austen-Smith 2000, Austen-Smith and Banks 2000, 2005). Unfortunately, it is not simple to empirically test these theoretical predictions. One important difficulty is that, while politicians' decisions on a certain issue are usually observable (e.g. in roll call votes), voters' preferences must be indirectly inferred from general elections and/or opinion surveys. Moreover, it is often the case that citizens do not exactly choose between the same alternatives as their political representatives face when voting for a legislative proposal (see, e.g., Lax and Phillips 2009). Surveys employed to infer citizen's preferences rarely ask respondents about a specific issue in exactly the same way as it will be framed in a legislative proposal.

In order to overcome these problems, combining roll call votes and referendum decisions on identical issues is gaining growing interest in the literature (see, e.g., Gerber and Lewis 2004, Matsusaka 2010, 2017, Portmann et al. 2012, Hug and Martin 2012, Carey and Hix 2013, Brunner et al. 2013, Potrafke 2013, Giger and Klüver 2016, Barceló 2018, Stadelmann et al. 2017). Following this approach, we combine roll call votes and referendum decisions in Switzerland to empirically investigate the role of electoral rules on the way politicians represent their constituents' preferences. Specifically, we exploit the fact that in the Swiss Lower House MPs are elected using a proportional rule, while in the Swiss Upper House MPs are elected employing a majoritarian rule.

Several institutional features of Switzerland coalesce to offer a rare opportunity to isolate the effect of electoral rules on the connection between politicians' choices and voters' preferences. First, MPs for both Swiss Houses are elected in the same electoral districts, namely, the cantons. As a consequence, candidates for both Houses face exactly the same constituency. Second, there are many referenda in which Swiss voters cast their ballot to decide on a variety of issues, thereby revealing their preferences for specific policies. Moreover, referendum decisions are binding. Third, before each referendum, MPs from both Houses of Parliament vote on the matter. Crucially, MPs in parliament and voters in the referendum vote on identically-worded legislative proposals (see Portmann 2014 or Giger and Klüver 2016). These institutional features allow us to merge roll call votes and referendum decisions to identify the effect of voters' preferences on the probability that an MP votes "yes" under a proportional and majoritarian electoral rule.

We estimate the effect of the share of voters in an electoral district (Swiss canton) that vote "yes" in a referendum on the probability that an MP from each House votes "yes" on the identical legislative proposal. In accordance with the literature (see, e.g., Lijphart 1994, Cox 1997), we hypothesize that when MPs are elected using a proportion electoral rule, centrifugal forces prevail and the proportion of MPs of a district accepting (rejecting) a given proposal is approximately the same as the proportion of voters willing to accept (reject) the proposal (see Cox 1990)[1], while when MPs are elected using a majoritarian electoral rule, the MPs of a district will accept (reject) a proposal whenever a majority of the voters of the district are willing to accept (reject) the proposal (see Downs 1957)[2]. Thus, the probability that a proportional-elected MP votes "yes" is hypothesized to be linear in the share of voters voting "yes", while the probability that a majority-elected MP votes "yes" as a function of the share of voters voting "yes" follows an S-shape form with an inflection point at 50%. We provide a theoretical model of legislative elections and political representation that formally generates these results and substantiates the hypotheses.

Our empirical results show that electoral rules matter, and the voting patterns of voters and MPs closely correspond to our hypotheses. For the Lower House, where politicians are elected using a proportional rule, the probability that an MP votes "yes" follows the share of voters that vote "yes" in the referendum. In contrast, for the Upper House, where politicians are elected using a majoritarian rule, the probability that an MP accepts a proposal evinces a steep when the share of voters voting "yes" in the 35-65% range, i.e., relatively close to the 50% threshold. Moreover, the estimated probability that an MP votes "yes" as a function of the share of voters voting "yes" has an S-shape form with an inflection point close to 50%. These results are fully in line with theoretical predictions.

In order to corroborate our results, we perform numerous robustness checks. We show that when we restrict the sample to districts where only one or two MPs are elected for the Lower House, the estimations for proportional-elected MPs approach those for majoritarian-elected MPs. We check that our results persist if we only focus on those districts in which the majority of the voters is aligned with the nation as a whole. We also perform a Kolmogorow-Smirnow test for the equality of the distributions of the estimated probability that an MP votes "yes" for

[1] Under a proportional electoral rule, the parliamentary representation of each group of voters is proportional to its share in the constituency.

[2] In an ideal majoritarian system, the probability that an MP votes "yes" should be zero when the majority of voters rejects the proposal and one when the majority accept the proposal.

proportional-elected MPs and majoritarian-elected MPs. The test always rejects the equality of distributions implied by proportional and majoritarian rules. Finally, we compare our estimations for each electoral rule with ideal theoretical predictions. For proportional-elected MPs, empirical marginal effects are close to theoretical ideal marginal effects. A one percent point change in the share of voters who votes "yes" in the referendum is associated with a one percent point change in the probability that an MP of the district in the Lower House also votes "yes" in the same legislative proposal. For MPs in the Upper House, who are elected using a majoritarian rule, empirical marginal effects are smoother than the sharp theoretical marginal effects. Nevertheless, in line with theoretical predictions, only when the share of voters voting "yes" in the referendum approaches 50%, the association between the share of voters who votes "yes" and the probability that an Upper House MP votes "yes" becomes statistically significant and politically relevant.

Our paper is related to two strands of literatures. First, there is a theoretical and empirical literature on legislative elections (e.g., Austen-Smith and Banks 1988, 2005, Austen-Smith 1996, 2000, Myerson 1999, Baron and Diermeier 2001, Grofman 2004, Schofield and Sened 2006). At the theoretical level, our model captures the idea that in a proportional electoral system, unlike a majoritarian one, the distribution of politicians' preferences approximately reproduces the distribution of voters' preferences (see, e.g., Austen-Smith and Banks 2005, chapter 9). At the empirical level, our results contribute to this literature providing a stringent test of the role of electoral rules on political representation of voters' preferences[3].

Second, and closer to our work, is the more recent literature on electoral rules and congruence between representatives' choices and voters' preferences (see, among others, Blais and Bodet 2006, Budge and McDonald 2007, Powell 2000, 2009, Powell and Vanberg 2000, Golder and Stramski 2010, Dow 2011, Maaser and Stratmann 2018)[4]. For Switzerland, Hug and Martin (2012) and Portmann et al. (2012) study positions of Lower House members and show that members from single-member or smaller districts are on average closer to their respective median voter. However, Carey and Hix (2013) qualify these results and suggest a non-monotonic relationship between district magnitude and median voter representation.

[3] A growing literature does not directly look at political representation but at effects of electoral rules on redistribution and fiscal policy. Majority rule - as opposed to proportional representation - is usually shown be associated with more targeted redistribution and less public goods (e.g., Lizzeri and Persico 2001 or Funk and Gathmann 2013). Gagliarducci et al. (2011) provide micro evidence that majoritarian representatives target their constituency with the bills that they put forward.

[4] Golder and Ferland (2018) provide an excellent review of the literature on the link between electoral rules and congruence.

Stadelmann et al. (2017) study congruence of left, center and right party politicians under different electoral rules in the Swiss Lower and Upper House and find that party affiliations matter less for majority than for proportionally-elected politicians. Employing Golder and Stramski's (2010) definition of Many-to-Many Congruence[5], i.e., a relatively more collective vision of congruence (see Weissberg 1978), our results show that under a proportional electoral rule, congruence between the whole body of representatives and citizens is high, indeed, almost perfect. However, following a Many-to-One concept of congruence, i.e., a more dyadic vision of representation, our results show that the probability that individual MPs correspond to the preferences of citizens is higher if they are elected under a majoritarian rule. Thereby, our results contribute to the debate on ideological congruence (see, e.g., Powell 2009, Dow 2011, Ezrow 2011, Golder and Lloyd 2014).

The remainder of this paper is organized as follows. Section II develops a legislative election model that illustrates the connections between legislators' choices and voters' preferences under different electoral rules. Section III describes Switzerland's electoral and parliamentary institutions, and introduces our data and empirical model. Section IV presents the estimations and main empirical results. Finally, Section V discusses some of the implications of our results for the debate on ideological congruence and the design of electoral systems.

II. THEORETICAL CONSIDERATIONS

We begin developing a simple model that stresses the main institutional difference between the Swiss Lower and Upper House; namely, the electoral rules. We use the model to predict the political congruence between legislators and voters in each legislative branch.

Consider an electoral district inhabited by N^j voters, divided – without loss of generality – in two groups with different preferences over a collective decision x. Let $v^L(x) = -\left|x - x_L^j\right|$ and $v^R(x) = -\left|x - x_R^j\right|$ with $x_R^j > x_L^j$ be the utility function of left- and right-wing voters, respectively. Left- and right-wing voters' most preferred policy is x_L^j and x_R^j, respectively. The proportion of left-wing voters in the district is $p_L^j \in [0,1]$, while the rest are right-wingers. Two parties compete for the popular vote: The Left denoted L and the Right denoted R. L shares the

[5] Golder and Stramski (2010) define Many-to-Many Congruence as follows: "Congruence is high when the distributions of citizen and representative preferences are similar; it is perfect when the two distributions are identical." They define Many-to-One Congruence as "Congruence is high when the absolute distance between the median citizen and the representative is small."

same preferences as left-wing voters, while R has the same preferences as right-wing voters. Voters elect representatives for Parliament, which is composed by two chambers: The Lower and the Upper House. In the Lower House, the electoral district has $S_L^j \geq 2$ seats and representatives are elected using a proportional electoral rule. In the Upper House, the district has $S_U^j = 1{,}2$ seats, each of which is elected using a majoritarian electoral rule. Once elections are held and MPs assumed their seats, a legislative proposal is made to change x from the status quo position x_{SQ} to x_P. Each political representative in each chamber decides whether to accept or reject the proposal based on the closeness of the proposal to her preferences. Thus, the timing of events is as follows. 1) Voters cast their ballots to select politicians in both houses. 2) Elected MPs take position of their seats. 3) A legislative proposal is made to change the status quo and MPs vote on the proposal. If a proposal obtains the majority of both chambers it passes.

We solve the model by backward induction. Suppose that the status quo is x_{SQ} and there is a proposal x_P on the table. If $x_{SQ} > x_L^j$, then an L-representative will accept any proposal $x_P \in \left(x_{SQ}, 2x_L^j - x_{SQ}\right)$ and reject any other alternative[6]. If $x_{SQ} < x_R^j$, then an R-representative will accept any proposal $x_P \in \left(x_{SQ}, 2x_R^j - x_{SQ}\right)$ and reject any other alternative[7]. These decisions are perfectly aligned with what left- and right-wing voters would prefer regarding x_{SQ} vs. x_P, respectively. Therefore, left-wing voters always vote for party L and right-wing voters always vote for party R.

This implies that in the Lower House a proportion p_L^j of the seats of the district S_L^j will be occupied by L-representatives, while a proportion $1 - p_L^j$ will be occupied by R-representatives. Moreover, the proportion of Lower House representatives of a district that accept (reject) a proposal will coincide with the proportion of voters in the district that would be happy accepting (rejecting) the proposal. For example, if $x_L^j < x_{SQ} < x_R^j$ and $x_P \in \left(x_{SQ}, 2x_L^j - x_{SQ}\right)$, then a proportion p_L^j of voters and MPs of the district will vote "yes", and a proportion p_R^j of voters and MPs of the district will vote "no". Alternatively, we can interpret that the probability an individual Lower House MP votes "yes" is given by the share of voters voting "yes".

[6] Similarly, if $x_{SQ} < x_L^j$, then the L-representative will accept any proposal $x_P \in \left(2x_L^j - x_{SQ}, x_{SQ}\right)$.
[7] Similarly, if $x_{SQ} > x_R^j$, then the R-representative will accept any proposal $x_P \in \left(2x_H^j - x_{SQ}, x_{SQ}\right)$.

In the Upper House, if $p_L^j > 1/2$, then all the seats of the district will be taken by L-representatives, while if $p_L^j < 1/2$, all the seats of the district will be taken by R-representatives. Finally, if $p_L^j = 1/2$, each party will obtain all the seats with probability 1/2. This directly implies that when $p_L^j > 1/2$ or $p_L^j = 1/2$ and all the seats end in the hands of party L ($p_L^j < 1/2$ or $p_L^j = 1/2$ and all the seats end in the hands of party R) the decision made by the district representatives in the Upper House will be at least aligned with what left-wing (right-wing) voters in the district would prefer to do. Thus, it is the case that the decision made by the district representatives in the Upper House will be always aligned with the preferences of a majority of the voters in the district. Alternatively, we can interpret that the probability that an individual Upper House MP votes "yes" is either 0 or 1 with an inflection point at $1/2$.

The implications of this electoral model are straightforward: If representatives are elected using a proportional electoral rule, the proportion of representatives of a district accepting (rejecting) a given proposal is identical to the proportion of voters willing to accept (reject) the proposal. If representatives are elected using a majoritarian electoral rule, representatives of a district will accept (reject) a proposal whenever a majority of the voters of the district are willing to accept (reject) the proposal[8].

In the Supplementary Material, we extend the analysis to two policy dimensions as well as multiple voter groups and parties. Overall, we obtain analogous results for each electoral rule.

III. INSTITUTIONAL BACKGROUND, DATA AND EMPIRICAL MODEL

Institutional Setting

Switzerland's constitution of 1848 was influenced by similar ideas as the United States Constitution. It has a bicameral parliament comprised of a Lower House (National Council, "Nationalrat" in German) and an Upper House (Council of States, "Ständerat" in German). Members of both Houses decide on exactly the same laws and constitutional amendments and

[8] These predictions are in line with intuitive reasoning regarding representation in different electoral system: Centrifugal forces play a larger role for the proportional rule and representatives may focus on all voter groups over the electoral spectrum by representing positions at odds with the center of the distribution of their electoral district. In contrast, centripetal forces affect representation of voters by majority elected representatives as they have to gain a voter majority to be elected (see Cox 1990, Downs 1957, Duverger 1954, Lijphart 1994, Myerson 1999). Moreover, according to our theoretical model contamination effects of mixed electoral systems (see Ferrara et al. 2005) do not influence voter representation since Upper and Lower House members are elected independently and decide independently of each other (for a similar argument applied to Switzerland see Blais et al. 2011).

the Houses have the same legislative powers. Both houses may start the deliberation process of legislative proposals – which House begins depends on the Houses' workloads but is otherwise random – and, after passing legislative proposals back and forth between Houses, majorities of both Houses are required for a final approval. Thus, there is no systematic order in the sequence of final roll calls of the two Houses, making strategic interactions during final votes unlikely. Moreover, both Houses share identical electoral districts (the 26 Swiss Cantons), i.e., the electoral districts are always the cantons for both houses. We, therefore, use the terms "canton" and "electoral district" interchangeably. Elections for the two Houses take place every four years at the same date.

The Lower House has 200 members who are elected under a proportional electoral rule with open party lists. Parliamentary seats for the 26 electoral districts of the Lower House are allocated according to the districts' national population shares. Proportional representation usually requires that each district has more than one representative (see Persson and Tabellini 2000)[9]. There are six districts with only one representative for the Lower House. In these cantons, the proportional electoral rule collapses to the plurality rule. Excluding members of these cantons does not change our results for other members of the Lower House. Analyzing them separately suggests that Lower House MPs from these cantons behave very similarly to majority elected Upper House MPs, as is to be expected theoretically.

The Upper House has 46 members who are elected under a majoritarian rule[10] (two round majority-plurality rule). For historical reasons, 20 cantons (the so called "full" cantons) are represented each by two members of the Upper House and voters have two distinct votes, i.e., they can cast one vote for each of the two seats available. 6 cantons (the so called "half" cantons) are represented each by one member to the Upper House and voters have one vote. Apart from the electoral system, formal election requirements and prerogatives in the two Houses are identical (see Portmann 2014).

The difference in the electoral systems suggests that the proportionally elected members of the Lower House will be more prone to focus on all voter groups across the electoral spectrum, while the majority elected members of the Upper House will cater for district median voters. These incentives inherent in the electoral systems coincide with the roles stipulated in the Swiss

[9] More-proportional systems tend have a ratio of seat share for parties to vote shares for parties closer to 1 (see Section II or Taagepra and Shugart 1989, Lijphart 1994, Cox 1997). Thus, it is sensible associate more representatives with more proportionality as is the case for Switzerland.

[10] In the Canton of Jura and the Canton of Neuchâtel the two members of the Upper House are elected under a proportional system. Omitting them does not affect our results or interpretations.

constitution (see Swiss Federal Constitution, Articles 149 and 150). Lower House members are supposed to represent the people while Upper House members are supposed to represent the cantons. Thus, any difference between the decisions of the two Houses might emerge because elected politicians are incentivized by the electoral system to behave differently or because different electoral systems lead to a different selection of politicians[11]. The strength of the Swiss institutional setting is that it captures both channels through which electoral systems affect policy outcomes, but still avoids the problems of cross-country research on electoral systems. Other forces, such as the party ideology of politicians, may also affect their voting behavior. However, Switzerland is known as a comparatively consensual democracy with weak party discipline in both Houses. Nevertheless, we explicitly control for party affiliations[12]. Final roll call votes take place at the end of a parliamentary session. In the Lower House, roll calls are recorded by an electronic voting system. There was no electronic voting system for the Upper House until 2014. Since the winter of 2006 a camera records the sessions of the Lower House, which allows to identify the individual voting behavior of its members (see Stadelmann et al. 2014a, Stadelmann et al. 2017 or Benesch et al. 2018).

Parliamentary decisions do not necessarily turn into law. Swiss citizen may challenge those decisions in a referendum by collecting 50,000 signatures (approximately 1% of the electorate). Thus, parliamentary decisions face the constant threat of a referendum. Between 5 to 10% of laws are in effect subject to such facultative referenda. Citizens can also advance proposals for constitutional amendments through initiatives by collecting 100,000 signatures. Thus, signature requirements for challenging laws and advancing initiatives are low. Moreover, for all constitutional changes referenda are mandatory (see, e.g., Portmann 2014 and Hessami 2016). Referendum decisions are also binding. Crucially, both, voters in referenda and MPs in Parliament, decide on identically worded legislative proposals. In the case of initiatives, the vote of MPs serves as an official recommendation sent to voters. Thus, decisions of MPs and their constituents are observable and can be directly compared.

[11] The categorization of these channels is Duverger's (1954) distinction between mechanical and psychological effects of electoral systems (see Blais et al. 2011 highlighting the relevance of mechanical effects). Based on Swiss candidate surveys Ladner (2014) shows that members of the Upper House do not claim to be more moderate than members of the Lower House.

[12] Majoritarian systems tend to be associated with lower party discipline than proportional systems with party lists as in the former candidates are directly elected. Thus, party discipline could be considered an additional outcome variable in future studies.

At the time of decision in parliament, MPs have to predict voter's preferences as referenda take place after politicians have decided[13]. Direct democracy itself does not provide MPs with additional information on constituents' preferences on specific issues prior to the referendum, certainly, not differentially for Lower and Upper House MPs. Instead, they can employ surveys or their personal knowledge to predict voters' preferences, which is part of the standard decision process followed by Swiss MPs and, more generally, by legislators in most countries.

All relevant political actors use the time window between the parliamentary decision and the corresponding referendum to influence voters (see, among others, Kriesi 2005 for Switzerland and Steenbergen et al. 2007 for France and the Netherlands). Hence, congruence between politicians' decisions and constituents' preferences can be the result of voters' influence – mediated by the electoral system – on politicians as well as politicians' influence on voters. The advantage of our setting is that we analyze politicians elected under both electoral systems regarding identical parliamentary decisions and compare them to the same voter decisions. Thus, everything that impacts voters' decisions such as party cues or campaigning does void comparisons between the two Houses such that differences in political representation due to electoral systems can be identified.

Finally, referendum decisions present measures of revealed preferences for policies as they permit voters to judge legislative proposals and rank them against the status quo (see, among others, Noam 1980, Schneider et al. 1981, Frey 1994, Matsusaka 2010). Combining referendum decisions with those of MPs is a natural way of evaluating politicians' behavior relative to their voters' preferences (see Brunner et al. 2013, Giger and Klüver 2016, Barceló 2018, Matsusaka 2017).

Dataset

Our dataset consists of 58 referenda and the corresponding legislative proposals by proportional-elected MPs in the Lower House and majority-elected MPs in the Upper House. Referendum decisions took place between 2008 and 2014 and the corresponding parliamentary decisions were carried out during 2007 and 2014. Our dataset starts with the first legislative decision registered on camera which was subject to a referendum. All roll calls are recorded but our sample is naturally restricted to those legislative decisions which are also presented to

[13] Understanding the black box of how politicians' ability and willingness to predict voters' preferences has started with Erikson et al. (1975) and is still subjects of research today (see, e.g., Huder et al. 2011, Fisher and Herrick 2013, Butler et al. 2017).

the electorate in a referendum. For the period of analysis, we include the whole universe of referenda. For constitutional proposals we also observe the universe of final roll calls. The legislative proposals in our dataset include a broad range of topics covering social, economic, health, gender, family, migration and cultural issues.

The number of individual MPs serving in the Lower House during the sample period was 358. Overall, they made a total of 10,581 individual decisions[14]. In the Upper House, there were 85 MPs who carried out a total of 2,214 individual decisions. Thus, the total number of individual legislative decisions with corresponding referenda is high, which allows a precise and reliable statistical analysis. Although, we can only include decisions in our sample on which MPs and voters cast ballots, because of the permanent threat of a referendum, incentives to represent voters should not significantly vary based on whether a referendum follows a decision in parliament or not. Certainly, the voting sequence does not differentially affect representation incentives for Lower and Upper House MPs.

Our main dependent variable of interest is the decision of proportionally-elected and majority-elected MPs on legislative proposals in Parliament (MP votes yes). This is a binary indicator which takes the value of 1 if an MP accepts a proposal (votes "yes") or 0, if an MP rejects the proposal (votes "no"). Our main independent variable of interest is how voters in the electoral districts of their MPs decide on identically-worded proposals. This variable is measured as the share of voters in the district deciding "yes" (*Voter yes share*) in the corresponding referendum. In our sample, the variable *Voter yes share* lies between a minimum of 8.7% and a maximum of 94.3% of voters accepting referendum.

The sample consists of 31 initiatives, 12 mandatory referenda (including four parliament initiated constitutional counter proposals to initiatives) on constitutional issues initiated by parliament, and 15 facultative referenda on laws proposed by parliament. We control for the type of referendum by including referendum-specific fixed effects in our estimations below.

About 22.6% of initiatives are accepted by Swiss voters with a national average yes share of 39.0%, acceptance of voters of legislative proposals by parliament is 74.1% with a national average yes share of 57.8%. The mean of *Voter yes share* is 47.5% over the whole sample of observations, while the median value is 46.7%. Thus, the sample of observations is well

[14] 11,600 = 58 legislative proposals times 200 MPs serving at one time in the Lower House would correspond to the maximum number of observable individual decisions, but MPs may be absent or abstain from voting in final roll calls.

balanced around the 50% benchmark, which is also the relevant threshold for a referendum to be accepted or rejected.

Empirical Model

Due to the clarity of our institutional setting, the empirical model is straightforward. We estimate a logistic model explaining the dependent variable *MP votes yes* with the variable *Voter yes share* and a control for referendum-specific fixed effects:

$$P((MP\ votes\ yes)_{ir} = 1) = \Lambda(\beta(Voter\ yes\ share)_{ir} + \gamma_r)$$

The unit of observations is an MP i voting in a referendum r. Λ denotes the logistic function, i.e., $\Lambda(x) = \exp(x)/(1 + \exp(x))$. The coefficient β regulates the impact[15] of the *Voter yes share* in referendum r on the probability that politician i votes "yes". This coefficient is our main measure of interest. γ_r represents referendum-specific fixed effects. Referendum-specific fixed effects take account of all differences between referenda and the corresponding legislative decision including salience, closeness, signature support, referendum type[16], and any other potentially unobserved factors related to referenda.

IV. RESULTS

MPs and Voters under Proportional and Majoritarian Electoral Rules

Table 1 presents our main empirical results in a logistic model for the relationship between *Voter yes share* on the probability of a proportional-elected MP voting "yes" (specifications 1-3) and of majority-elected MPs voting "yes" (specifications 4-6). Specification (2) and (3) as well as (5) and (6) distinguish themselves from specification (1) and (4) only by accounting for district (i.e. canton) and party group fixed effects, respectively[17].

As the share of voters accepting a referendum increases, both types of MPs are more likely to vote "yes". The coefficient β is statistically significant and positive in all the specifications. The estimated β is smaller for proportional-elected MPs than for majority-elected MPs, which influences the effect of changes in *Voter yes share* on the probabilities that MPs vote "yes".

[15] The actual variable *Voter yes share* is realized in the referendum. Thus, the interpretation of the association is to be in terms of a change in *Voter yes share* on the corresponding probability of an MP to vote "yes".
[16] For initiatives, signatures are collected prior to the vote in parliament. Thus, for initiatives MPs of both Houses have some initial information for potential support. We control for this by including referendum-specific fixed-effects. All initiatives in our sample have been rejected by a majority of MPs in both Houses.
[17] Fixed effects estimations do not require assumptions regarding the expected value of the coefficients for the fixed effects and such estimations are consistent even if the true model is a random-effects model (see Cameron and Trivedi 2005).

The lower part of Table 1 shows the effect of a discrete change from 10% to 90% in the *Voter yes share* on the probability of MPs voting "yes". For proportional-elected MPs this probability increases by 67-69%-points, while for majority-elected MPs it increases by 98-99%-points. Thus, an 80%-points increase in the share of voters accepting a referendum in a district is associated to a similar jump in the probability of their proportional-elected representatives to vote "yes", while it is associated with an almost certain yes-vote for their majority-elected representatives. This corresponds closely to our theoretical expectations for each electoral rule. Also in line with theoretical predictions, a small change in the share of voters accepting a referendum from 47.5 to 52.5% is associated with an increase in the probability to vote "yes" of about 5%-points for proportional-elected MPs, but about 15%-points for majority-elected MPs.

Table 1: Estimated MPs Decisions as a Function of Voters' Decisions

	(1)	(2)	(3)	(4)	(5)	(6)
	baseline	district FEs	party FEs	baseline	district FEs	party FEs
Dependent variable	*MP votes yes*					
Sample	Proportional (Lower House)			Majoritarian (Upper House)		
Voter yes share	4.0775***	4.2001***	4.0754***	11.7908***	12.2819***	11.8359***
	(0.3230)	(0.3303)	(0.3154)	(0.9910)	(1.0175)	(0.9722)
Intercept	-2.0169***	-2.1259***	-2.0437***	-5.7913***	-6.1105***	-6.0616***
	(0.1917)	(0.2085)	(0.1917)	(0.6508)	(0.7197)	(0.7178)
Referendum fixed effects	yes	yes	yes	yes	yes	yes
District fixed effects	no	yes	no	no	yes	no
Party fixed effects	no	no	yes	no	no	yes
n. Obs.	10581	10581	10581	2124	2124	2124
(pseudo) R2	0.2686	0.2701	0.2688	0.6605	0.6704	0.6688
Brier score	0.2003	0.2000	0.2002	0.1126	0.1095	0.1100
Discrete change of voter yes share from 10% to 90%	0.6726***	0.6858***	0.6724***	0.9822***	0.9854***	0.9824***
	(0.0352)	(0.0353)	(0.0346)	(0.0067)	(0.0058)	(0.0074)
Discrete change of voter yes share from 47.5% to 52.5%	0.0509***	0.0524***	0.0509***	0.1459***	0.1523***	0.1461***
	(0.0040)	(0.0042)	(0.0039)	(0.0113)	(0.0120)	(0.0151)

Notes: ***, **, and * indicate a mean significance level of <1%, 1-5%, and 5-10%, respectively. Logit models are estimated and robust standard errors are reported.

The effect of the difference in the estimated β under different electoral rules is illustrated in Figure 1. The figure plots the predictions of the probability of MPs voting "yes" as a function of *Voter yes share* based on the logistic models (1) and (4), respectively. Figure 1(a) shows that proportional-elected MPs exhibit a probability to vote "yes" that is roughly proportional to *Voter yes share*. In contrast, the acceptance probability of majority-elected politicians only

tends to react to *Voter yes share* in the 35-65% range, i.e., relatively closer to the 50% threshold. While the curvature for proportional-elected MPs is almost linear, for majority elected MPs it is S-shaped with an inflection point close to 50%.

In Figure 1(b), we predict the effect of a 1%-point change in *Voter yes share* on the probability of MPs voting "yes". The figure shows again a clear difference between the proportional and majoritarian rules. The same change in the share of voters accepting a referendum translates into different probabilities of MPs voting "yes" in Parliament for each electoral rule. Figure 1(a) and 1(b) are consistent with theoretical expectations for the respective electoral rules.

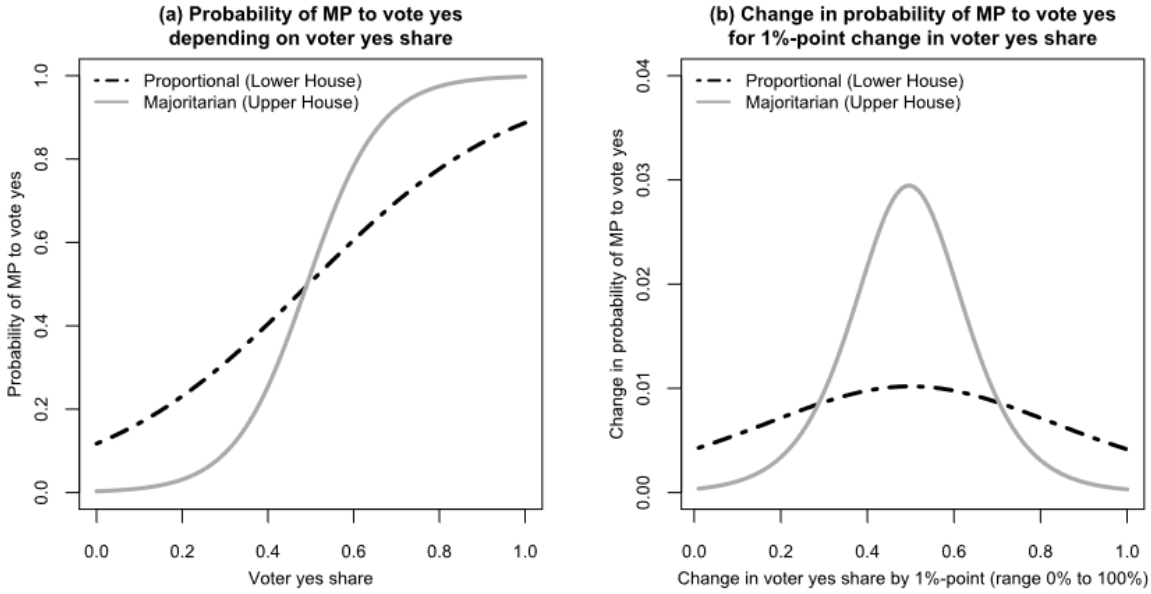

Figure 1: Voters and MPs' Decisions for each Electoral Rule

We perform several robustness checks. Figure 2(a) presents predictions based on specifications (2) and (4) of Table 1. Results are not affected when accounting for district fixed effects, which insures that they are not driven by heterogeneity between districts (see, e.g., Gerber and Lewis 2004). Figure 2(b) presents predictions based on specifications (3) and (6) of Table 1. Controlling for party fixed effects does not alter the results either.

In Figure 2(c) we restrict the analysis to districts where only one or two MPs are elected for the Lower House (estimations relegated to Supplementary Material). In such cases, the proportional rule almost collapses to a plurality rule (see Hug and Martin 2012 and Portmann et al. 2012) such that there should be only minor differences between the results for the Lower and the Upper Houses. Indeed, the estimation results for Lower House MPs from districts with one or two MPs tend to correspond to the estimation results for majoritarian-elected MPs, as

expected theoretically[18]. Note that using this restricted sample reduces the number of MPs to 21. Finally, Figure 2(d) is based on a subsample of districts where citizens vote in line with the majority of the country (estimations relegated to Supplementary Material). It might be speculated that MPs behave differently to their constituents when the preferences of them are aligned with those of the nation. However, we observe that the systematic differences between the two electoral rules remains.

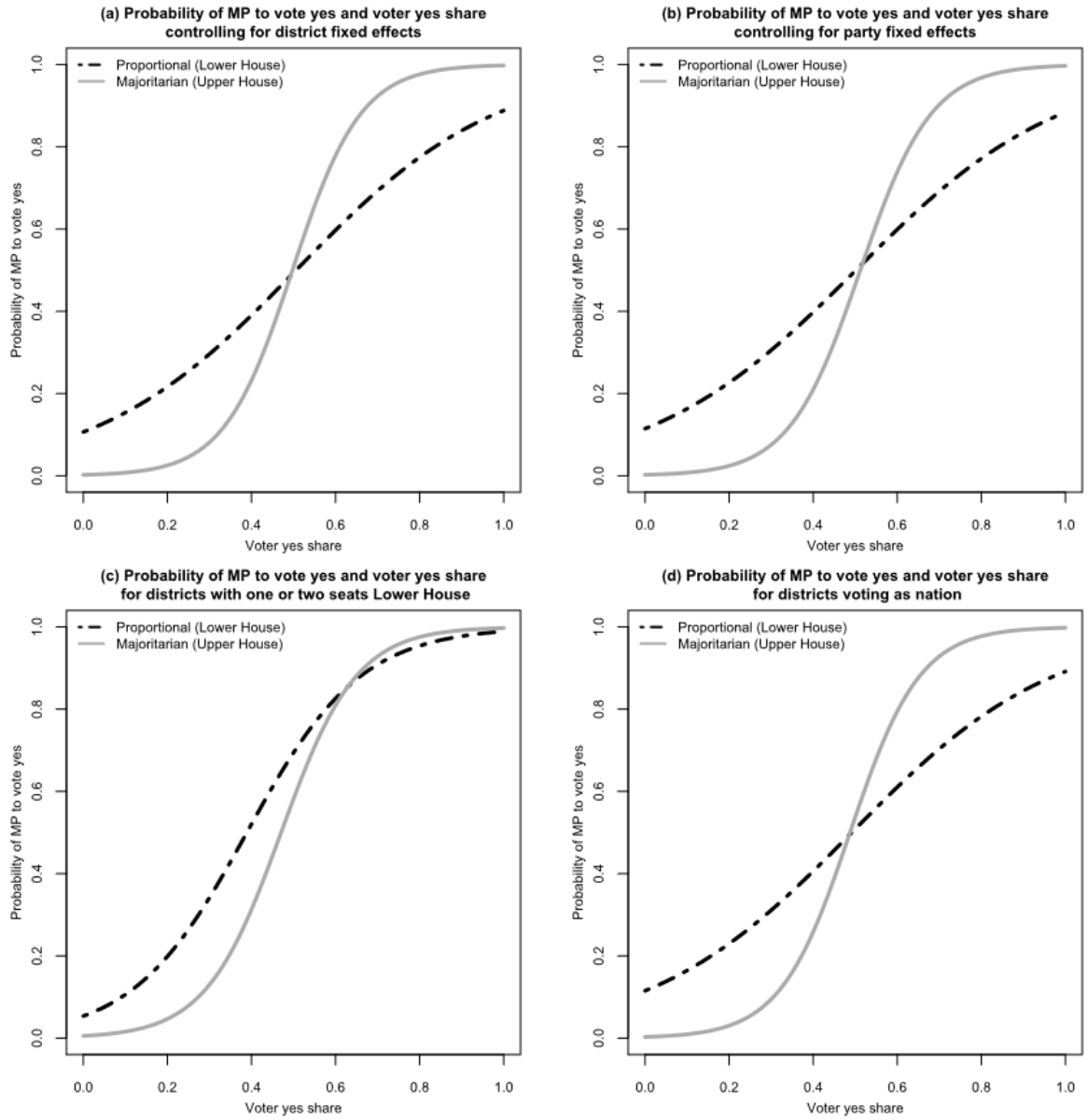

Figure 2: Voters and MPs' Decisions for each Electoral Rule (Robustness Checks)

[18] Unfortunately, we do not have enough observations to estimate the relationships restricting the sample to only single-member districts with proportional-elected MPs. For those cases, we would expect a total coincidence between the proportional and majoritarian rules.

In the Supplementary Material, we present further robustness checks based on multi-level logistic regressions with random-effects for referenda, districts and parties. All results are not affected (qualitatively or quantitatively) by the choice between random- or fixed-effects. Moreover, we employ weighting strategies to account for narrow referendum outcomes and our interpretations regarding electoral rules remain unchanged. Similarly, analyzing a subsample of elderly MPs and those that are new to the respective House does not affect observable differences regarding political representation of MPs from the two Houses. Finally, excluding any fixed- and/or random-effects and employing *Voter yes share* as the single explanatory variable also yields similar results.

Establishing Differences between Proportional and Majoritarian Rules

Next, we provide robust empirical evidence that the impact of *Voter yes share* is statistically different for the proportional and majoritarian electoral rules. In order to do so, we merge the dataset for proportionally and majority-elected MPs, employ an identifier for proportional-elected MPs and interact this identifier with *Voter yes share*. Then, the interaction term identifies if proportional-elected MPs have a statistically significantly different β than majority elected MPs. For a given value of the intercept, a lower β implies a smaller curvature of the predicted probabilities from the logit model. Indeed, we find that β is statistically significantly smaller for proportional-elected MPs than for majority-elected MPs (estimations relegated to Supplementary Material). The same holds when we split the sample at the 50% threshold, i.e., when we look at voters rejecting the referendum and voters accepting the referendum, separately. Thus, changes in voters' preferences translate differently into changes in the MPs choices depending on whether MPs are elected by a proportional or a majoritarian rule.

We also perform a Kolmogorow-Smirnow test for the equality of the empirical distributions in Figure 1(a) (see Supplementary Material). We employ only 100 draws of each distribution, so the test has a relatively high chance of failing to reject the equality of the empirical distributions. Nevertheless, the Kolmogorow-Smirnow test always rejects the equality of distributions implied by proportional and majoritarian rules. This also holds when looking only at the part of the distributions where *Voter yes share* is below (above) 50%, i.e., when the proportional rule predicts "yes" probabilities above (bellow) the majoritarian rule.

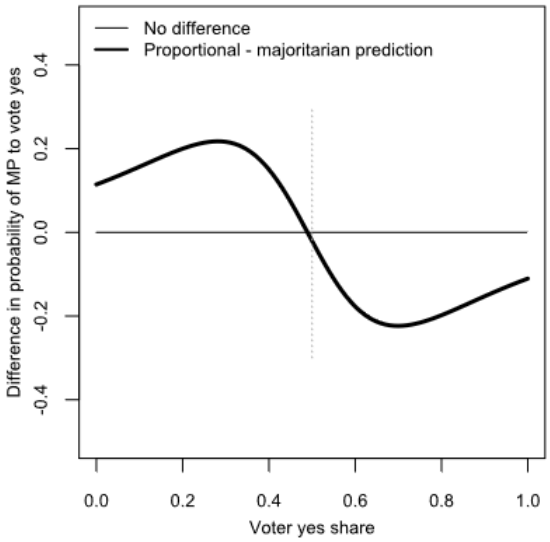

Figure 3: Differences in MPs Predicted Decisions as a Function of Voters Decisions

Finally, Figure 3 illustrates the differences between the proportional and the majoritarian rule regarding the prediction of whether an MP votes yes. It plots the empirical differences between the predictions of the two distributions shown Figure 1(a) which stem from Table 1, columns (1) and (4). It is interesting to note that the inflection point is almost perfectly at the 50% threshold, corresponding to theoretical predictions. Below 50%, the proportional rule predicts a higher probability that an MP votes "yes", while above this threshold the majoritarian rule predicts a higher probability that an MP votes "yes".

Differences between Empirical Distributions and Theoretical Ideal Outcomes

Figures 4(a) and 4(b) show theoretical ideal outcomes for each electoral rule and confront them with the corresponding empirical estimations[19]. Under a proportional electoral rule, if MPs are perfectly representing voters' preferences, the probability an MP votes "yes" should be equal to the share of voters agreeing with the legislative proposal in the referendum. Under a majoritarian rule, the theoretical ideal probability that an MP votes "yes" should be zero if less than 50% of the voters agree with the legislative proposal and one if more than 50% of the voters agree with the proposal in the referendum (see Section II). As shown in Figure 4, although not exactly identical, each empirical estimation tends to approach its ideal benchmark,

[19] We use the estimations from specifications (1) and (4) in Table 1, but results do not change if we employ other specifications in Table 1 or any of the specifications presented in the Supplementary Material.

especially when considering that predictions for Voter yes share below 10% and above 90% are mostly out of sample. More formally, for proportional-elected MPs, a Kolmogorow-Smirnow test for the equality between the estimated distribution and the ideal benchmark reveals that equality cannot be rejected (p-value = 0.4740 for 100 draws and p-value = 0.1561 for 1000 draws). On the contrary, for majority-elected MPs, equality of the estimated distribution and its ideal benchmark can be statistically rejected (p-value = 0.000 for 100 draws)[20].

An alternative way to compare theoretical ideal outcomes with the observed voting patterns is to contrast the empirical marginal effects of voters' decisions on MPs decisions with theoretical ideal marginal effects. In the Supplementary Material, we predict how changes in *Voter yes share* are associated with changes in the probability of an MP voting "yes" in the respective Houses. For proportional-elected MPs, empirical marginal effects closely follow theoretical ideal marginal effects. Any percentage point change in *Voter yes share* is associated with the *same* quantitative change in the probability of an MP voting "yes". For majoritarian-elected MPs, empirical marginal effects are smoother than theoretical ideal marginal effects. Nevertheless, in line with theoretical predictions, only when approaching the 50% threshold, the association between *Voter yes share* and the probability of an MP voting "yes" becomes strong.

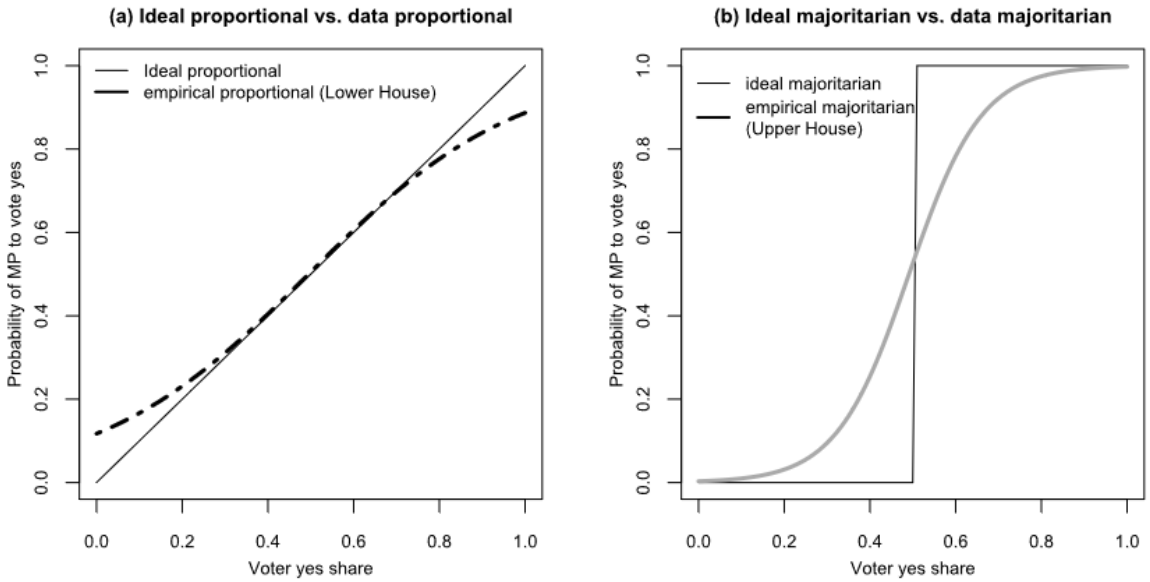

Figure 4: Empirical Distributions versus Theoretical Ideal Outcomes

[20] See the Supplementary Material for the Kolmogorow-Smirnow tests.

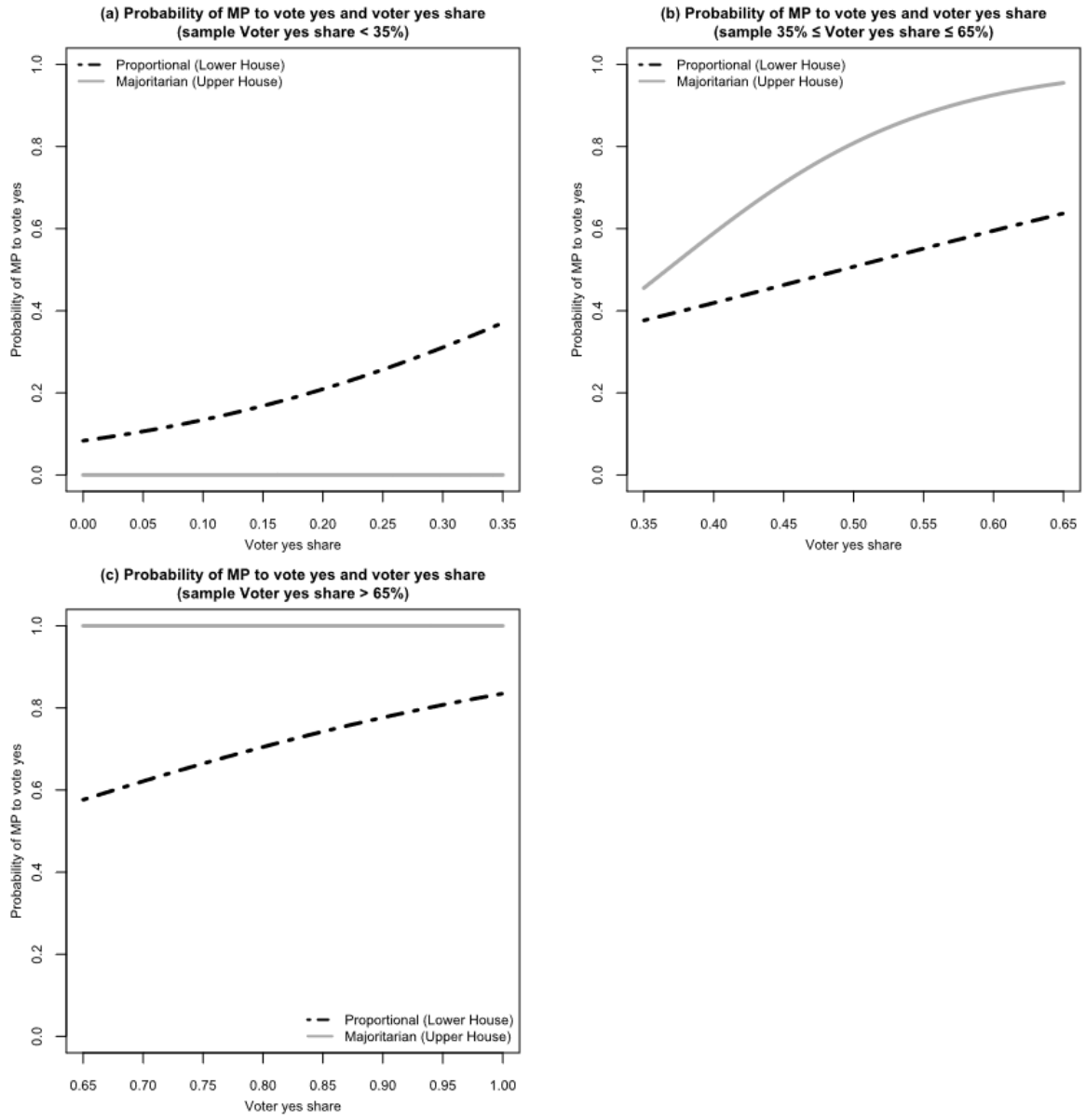

Figure 5: Contrasting Empirical Data and Ideal Electoral Outcomes

Finally, we split our sample into three subsets. The first subset considers only observations for which *Voter yes share* is below 35%; the second subset observations for which *Voter yes share* is between 35% and 65%, and the third one observations for which *Voter yes share* is above 65%. For each of these subsets, we estimate our empirical model including referendum fixed effects (see Supplemental Material). In Figure 5 we plot the predictions for the probability of an MP to vote "yes" as a function of *Voter yes share* for the three subsets of observations. The results are striking and correspond to theoretical predictions. Throughout, the choices of proportional-elected MPs tend to closely correspond in an almost linear way to changes in

Voter yes share. On the contrary, majority-elected MPs have a probability of voting "yes" almost equal to zero when analyzing the sample of observations where *Voter yes share* is below 35% (Figure 5(a)); they have a probability of voting "yes" very close to one when analyzing the sample of observations where *Voter yes share* is above 65% (Figure 5(c)); and their probability of voting "yes" increases continuously if *Voter yes share* lies between 35 and 65%.

V. DISCUSSION

Electoral rules affect the way individual politicians represent their constituents' preferences. We hypothesize that the probability that a proportional-elected MP accepts a legislative proposal is linearly associated to the share of voters who support the proposal. The probability that a majority-elected MP accepts a legislative proposal only reacts to the majority of voters who support the proposal. We provide a theoretical model which generates these predictions and empirical evidence on how electoral rules affect the way Swiss Members of Parliament (MPs) represent their constituents' preferences. Swiss voters reveal their preferences in referendum decisions and we observe roll call votes of proportional- and majority-elected MPs on identically worded legislative proposals. The voting pattern of MPs is fully in line with theoretical predictions regarding the influence of electoral rules on representation.

Our results contribute to the debate on ideological congruence. A controversy surrounding electoral systems and voter congruence has attracted attention over the last years and the debate focusses on potential merits of each system regarding ideological congruence (see, e.g., Powell and Vanberg 2000, Powell 2009, 2011, Ezrow 2011, Golder and Ferland 2018). The proportional conception of democracy advocates for the representation of diversity, i.e., the full spectrum of positions in the society. The majoritarian conception stresses that politicians respond to the will of the majority of their electoral district.

We believe it is useful to distinguish two dimensions of analysis in this debate. First, there is a positive dimension. Does each electoral system deliver what we expect of it in terms of congruence? Our empirical evidence strongly suggests an affirmative answer. The proportional rule induces high levels of Many-To-Many congruence (for each district and, hence, for the nation as a whole) such that the diversity of preferences is closely represented. The majoritarian rule induces high levels of congruence between the majority of voters and their representative within each district. Thus, electoral systems perform as they are supposed to. Whether the identified differences in congruence are due to different electoral incentives induced by the

system or electoral selection by voters might be explored in the future by looking at politicians who change from the Lower to the Upper House.

Second, there is a normative dimension. Which electoral system is better? This requires a normative metric that would allow us to compare different electoral systems. If the notions of congruence proposed by Golder and Stramski 2010 are also taken as normative metrics, then our empirical results will logically favor the proportional rule when we employ the Many-To-Many congruence metric and the majoritarian rule when we employ the Many-To-One congruence metric. For any other welfare criteria, it is always possible to use our estimations to compute the score of each electoral rule[21].

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[21] Stadelmann et al. (2014b) highlight the importance of district magnitude under proportional rule (see also Carey and Hix 2011, Carey and Hix 2013) with a different measure of congruence more in line with collective than dyadic representation (see Weissberg 1978).

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SUPPELENTARY MATERIAL

A Quasi-Natural Experiment on Electoral Rules and Political Representation

This Supplement contains all the results discussed, but not presented, in the main text.

Theoretical Analysis: Extension to Two Policy Dimensions and Multiple Parties

Consider an electoral district inhabited by N^j voters, divided in four groups (LL, LH, HL and HH) with different preferences over two collective decisions (x, y). Let $v(x, y, x^j, y^j) = -(x - x^j)^2 - (y - y^j)^2$ be the utility function of a voter whose most preferred policy is (x^j, y^j), where $x^j \in \{x_L^j, x_H^j\}$, $x_H^j > x_L^j$, $y^j \in \{y_L^j, y_H^j\}$ and $y_H^j > y_L^j$. The proportion of voters in district j with utility function $v(x, y, x^j, y^j)$ is $p^j(x^j, y^j) \in [0,1]$. Naturally, $\sum_{yj} \sum_{xj} p^j(x^j, y^j) = 1$. There are four political parties denoted by LL, LH, HL and HH. Each party has the utility function of the group with the same label. For example, all candidates from the LL party have preferences $v(x, y, x^j, y^j) = -(x - x_L^j)^2 - (y - y_L^j)^2$ and candidates from the LH party have preferences $v(x, y, x^j, y^j) = -(x - x_L^j)^2 - (y - y_H^j)^2$. Moreover, all parties offer a complete list of candidates for each legislative chamber and all candidates in the same party are identical. The electoral rules employed to select MPs in the Lower and Upper Houses as well as the timing of events are as in the one-dimensional model presented in Section II of the manuscript. The only exception is how we model electoral competition for the Upper House (see the details below).

As with the one-dimensional model, we find a solution through backward induction. Consider a legislative proposal to modify the collective decision x. Suppose that the status quo is x_{SQ} and there is a proposal x_P on the table. If $x_{SQ} > x_L^j$, then an LL-representative and an LH-representative will accept any proposal $x_P \in (x_{SQ}, 2x_L^j - x_{SQ})$ and reject any other

alternative.[1] These decisions are perfectly aligned with what LL and LH voters would prefer regarding x_{SQ} vs. x_P. If $x_{SQ} < x_H^j$, then an HL-representative and an HH-representative will accept any proposal $x_P \in \left(x_{SQ}, 2x_H^j - x_{SQ}\right)$ and reject any other alternative.[2] These decisions are perfectly aligned with what HL and HH voters would prefer regarding x_{SQ} vs. x_P. The exact same logic applies to a legislative proposal to change y.

For the Lower House MPs are elected using a proportional electoral rule. As a consequence, a voter cannot do better than voting for the party that shares her preferences. This will send to the Lower House at least some representatives whose preferences are completely aligned with the voter's preferences. Thus, in the Lower House, a proportion $p^j\left(x_L^j, y_L^j\right)$ of the seats of the district S_L^j will be occupied by LL-representatives, $p^j\left(x_L^j, y_H^j\right)$ by LH-representatives, $p^j\left(x_H^j, y_L^j\right)$ by HL-representatives, and $p^j\left(x_H^j, y_H^j\right)$ by HH-representatives. Moreover, the proportion of Lower House representatives of a district that accept (reject) a proposal will perfectly coincide with the proportion of voters in the district that would be happy accepting (rejecting) the proposal. For example, if $x_L^j < x_{SQ} < x_R^j$ and $x_P \in \left(x_{SQ}, 2x_L^j - x_{SQ}\right)$, then a proportion $p^j\left(x_L^j, y_L^j\right) + p^j\left(x_L^j, y_H^j\right)$ of voters and MPs of the district will accept the proposal, and a proportion $p^j\left(x_H^j, y_L^j\right) + p^j\left(x_H^j, y_H^j\right)$ of voters and MPs of the district will reject it. Thus, all theoretical results presented in the manuscript generalize to two dimensions and four parties. Indeed, for the Lower House, our theoretical results are general, as we can apply the exact same logic to any number of groups and policy dimensions.

For the Upper House the analysis is more complicated because MPs are elected using a majoritarian electoral rule. Thus, for minority voters it might not make sense to vote for their party if such vote is a complete waste. In order to deal with this issue, we assume that electoral competition for the Upper House concentrates between the two parties that represent the two largest group of voters in the district measured by $p^j\left(x^j, y^j\right)$. The idea is that minority voters know that their party has no chance of winning the election and, hence, they decide to vote for the majority party closer to their preferences. This leads to two possible

[1] Similarly, if $x_{SQ} < x_L^j$, then an LL-representative and an LH-representative will accept any proposal $x_P \in \left(2x_L^j - x_{SQ}, x_{SQ}\right)$.

[2] Similarly, if $x_{SQ} > x_R^j$, then an HL-representative and an HH-representative will accept any proposal $x_P \in \left(2x_H^j - x_{SQ}, x_{SQ}\right)$.

situations. First, the two largest groups are located along one policy dimension.[3] For example, if $p^j(x_L^j, y_L^j) = 0.40$, $p^j(x_H^j, y_L^j) = 0.35$, $p^j(x_L^j, y_H^j) = 0.15$, and $p^j(x_H^j, y_H^j) = 0.10$, the two largest group of voters are located along the x dimension. Second, the two largest groups differ in both policy dimensions. For example, if $p^j(x_L^j, y_L^j) = 0.40$, $p^j(x_H^j, y_L^j) = 0.15$, $p^j(x_H^j, y_L^j) = 0.10$, and $p^j(x_H^j, y_H^j) = 0.35$, the two largest groups are LL and HH. In any case, the best a voter belonging to a small group can do is to support the largest party with policy preferences closer to her.

Suppose that the two largest groups are located along the x dimension. Without loss of generality, assume that the two largest groups are LL and HL (formally, $min\{p^j(x_L^j, y_L^j), p^j(x_H^j, y_L^j)\} > max\{p^j(x_H^j, y_L^j), p^j(x_H^j, y_H^j)\}$) and LL combined with LH is larger than HL combined with HH (formally, $p^j(x_L^j, y_L^j) + p^j(x_L^j, y_H^j) > 1/2$). Figure S.1 Panel (a) illustrates this situation. Then, for the Upper House, only parties LL and HL will obtain a positive share of the votes (LH voters will vote LL and HH voters will vote HL). Indeed, party LL will win the election and, therefore, all the seats of the district in the Upper House will be taken by LL-representatives. In such an environment, consider a legislative proposal to modify collective decision x. The decision made by the district representatives in the Upper House will be at least aligned with what LL and LH voters in the district would prefer to do. Since $p^j(x_L^j, y_L^j) + p^j(x_L^j, y_H^j) > 1/2$, LL and LH voters constitute a majority of the voters in the district. Next, consider a legislative proposal in the y dimension. The decision made by the district representatives in the Upper House will be at least aligned with what LL and HL voters in the district would prefer to do. Since LL and HL are the largest group of voters, it must be the case that $p^j(x_L^j, y_L^j) + p^j(x_H^j, y_L^j) > 1/2$. Thus, LL and HL voters constitute a majority of the voters in the district. In conclusion, when the two largest groups are located along one policy dimension, for any legislative proposal, the decision made by the district representatives in the Upper House will be aligned with the preferences of a majority of the voters in the district.

Suppose that the two largest groups of voters differ in both policy dimensions. Without loss of generality, assume that the largest groups are LL and HH (formally,

[3] If more than two parties are the biggest one, only two parties are randomly selected to compete in the election.

$min\{p^j(x_L^j, y_L^j), p^j(x_H^j, y_H^j)\} > max\{p^j(x_L^j, y_H^j), p^j(x_H^j, y_L^j)\}$), that LL combined with LH is larger than HH combined with HL (formally, $p^j(x_L^j, y_L^j) + p^j(x_L^j, y_H^j) > 1/2$); and $y_H^j - y_L^j < x_H^j - x_L^j$. Figure S.1 Panels (b) and (c) illustrate this case. Then, for the Upper House, only parties LL and HH will obtain a positive share of the votes (LH voters will vote LL and HL voters will vote HH). Indeed, party LL will win the election and, therefore, all the seats of the district in the Upper House will be taken by LL-representatives. In such an environment, consider a legislative proposal to modify collective decision x. The decision made by the district representatives in the Upper House will be at least aligned with what LL and LH voters in the district would prefer to do. Since $p^j(x_L^j, y_L^j) + p^j(x_L^j, y_H^j) > 1/2$, LL and LH voters constitute a majority of the voters in the district. Next, consider a legislative proposal in the y dimension. The decision made by the district representatives in the Upper House will be at least aligned with what LL and HL voters in the district would prefer to do. If $p^j(x_L^j, y_L^j) + p^j(x_H^j, y_L^j) > 1/2$, then LL and HL voters constitute a majority and, hence, the decision made by the district representatives in the Upper House will be aligned with the preferences of a majority of the voters in the district (see Figure S.1 Panel (b)). On the other hand, if $p^j(x_L^j, y_L^j) + p^j(x_H^j, y_L^j) < 1/2$, then it is possible that the district representatives in the Upper House prefer to accept a legislative proposal that a majority of the voters in the district would reject (see Figure S.1 Panel (c)). For example, suppose that $y_P > y_{SQ} \in (y_L^j, y_H^j)$. In this case, the district representatives in the Upper House will accept the proposal, while a majority of the voters (groups LH and HH) will prefect to reject the proposal. Note, however, that there is an upper bound in the misalignment between Upper House representatives and the majority of the voters. Indeed, the largest possible majority for which Upper House representatives might not be aligned with is bounded from above by:

$$UB = \max\{p^j(x_L^j, y_H^j) + p^j(x_H^j, y_H^j)\}$$

$$\text{subject to: } p^j(x^j, y^j) \in [0,1]$$

$$p^j(x_L^j, y_L^j) + p^j(x_H^j, y_L^j) + p^j(x_L^j, y_H^j) + p^j(x_H^j, y_H^j) = 1$$

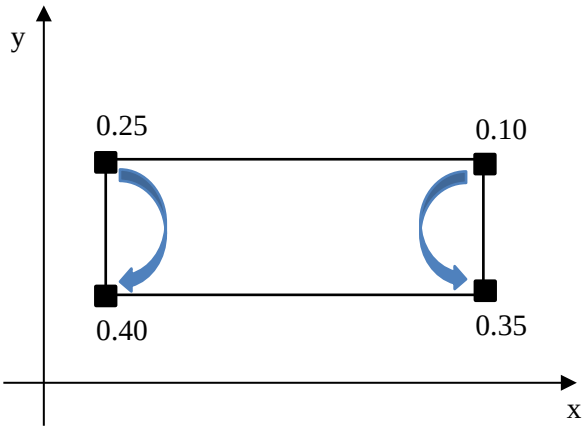
$$min\{p^j(x_L^j, y_L^j), p^j(x_H^j, y_H^j)\} \geq max\{p^j(x_L^j, y_H^j), p^j(x_H^j, y_L^j)\}$$

$$p^j(x_L^j, y_L^j) + p^j(x_L^j, y_H^j) \geq 1/2$$

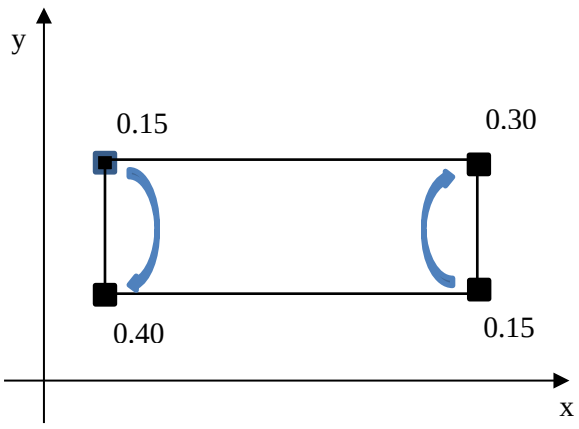
$$p^j(x_L^j, y_L^j) + p^j(x_H^j, y_L^j) \leq 1/2$$

The objective function is the proportion of voters who prefer to reject the proposal $y_P > y_{SQ} \in (y_L^j, y_H^j)$. The first two restrictions are transparent. The third restriction states that LL and HH are the two among the largest group of voters. The fourth restriction states that LL combined with LH is at least as large as HH combined with HL. The fifth restriction LL combined with HL is not larger than HH combined with LH. The solution to this linear optimization problem is given by: $p^j(x_L^j, y_L^j) = p^j(x_L^j, y_H^j) = 0.25$, $p^j(x_H^j, y_L^j) = 0$, and $p^j(x_H^j, y_H^j) = 0.5$, which implies that $UB = 0.75$. In conclusion, when the two largest group of voters differ in both policy dimensions, for legislative proposals in one of the policy dimensions, the decision made by the district representatives in the Upper House will be always aligned with the preferences of a majority of the voters in the district. For legislative proposals in the other policy dimension, the decision made by the district representatives in the Upper House might not be aligned with the preferences of a majority of the voters in the district. However, this only happens when the distribution of preferences in the district is such that in one of the policy dimensions a majority of voters is aligned with the position of the winner, but in the other dimension, a majority of voters is aligned with the position of the loser. Moreover, even when this occurs, there is a limit on the misalignment given by $UB = 0.75$. That is, it is not possible than more than 75% of the voters of the district prefer to reject a proposal and the Upper House representatives of the district are willing to accept the proposal. For our empirical analysis, this might help explaining why the estimated probability that an Upper House MP votes "yes" as a function of the share of voters voting "yes" in the referendum has an S-shape form with an inflection point close to 50%.

(a) Two largest groups along the x dimension



(b) Two largest groups differ in both dimensions
(winner represents a majority in both dimensions)



(c) Two largest groups differ in both dimensions (winner represents a majority only in the x dimension)

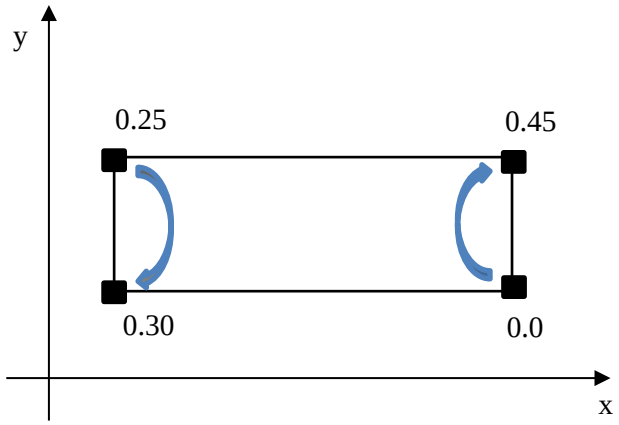


Figure S.1: Two-Dimensional Model

In principle, the approach we use for the two-dimensional model can also be applied to any number of groups and policy dimensions. Indeed, if one group is greater than 1/2 of the voters of the district, then it is always the case that the decisions of Upper House MPs will be at least aligned with what a majority of the voters of the district would like to do. When none of the groups represents more than 1/2 of the population of the district, however, the analysis gets more complicated. In particular, as in the two-dimensional model, it is possible that some of the decisions made by the MP of the district are not aligned with what the majority of the voters of the district would like to do.

Restricting the Sample to Districts with Only One or Two MPs and Where Nation Votes as District

Table S.1 reports the coefficients used to derive Figure 2(c) and Figure 2(d) in the manuscript. Specification (1) and (2) use a restricted sample of districts with only one or two MPs in the Lower House. The results show that the magnitude of the coefficient increases for proportionally elected politicians in specification (1) and remains similar compared to Table 1 in the manuscript for majority-elected politicians. Thus, for small districts, the proportional electoral rule tends to converge to the majoritarian rule. In specifications (3) and (4) we focus on a subsample of referenda where both, the majority of voters of nation and the majority of voters in a district, either accept or reject the decision such that the preferences are aligned. We observe that the coefficient magnitudes are almost identical to the Table 1.

Table S.1: Results for Districts with One or Two MPs & Where Nation Votes as District

	(1)	(3)	(3)	(4)
Dependent variable	*MP votes yes*			
Sample	Proportional & 1 or 2 MPs	Majoritarian & 1 or 2 MPs	Proportional & Nation=District	Majoritarian & Nation=District
Voter yes share	7.3803***	11.1654***	4.1485***	12.0524***
	(1.4391)	(2.2036)	(0.4076)	(1.3500)
Intercept	-2.8704***	-5.2545***	-2.0398***	-5.8774***
	(0.8479)	(0.9111)	(0.2077)	(0.7028)
Referendum fixed effects	yes	yes	yes	yes
n. Obs.	531	535	9531	1872
(pseudo) R2	0.4506	0.7222	0.2773	0.6792
Brier score	0.1627	0.1006	0.1985	0.1083

Notes: ***, **, and * indicate a mean significance level of <1%, 1-5%, and 5-10%, respectively. Logit models are estimated and robust standard errors are reported.

Multi-level Logistic Regression with Random-Effects

Table S.2 and the corresponding Figure S.1 present results from a cross-classified multilevel logistic regression using the glmer function in R. Specifications (1)-(3) show results for proportionally-elected politicians while specifications (4)-(6) show results for majority-elected politicians.

We observe that the coefficients for the variable Voter yes share is quantitatively almost identical to those presented in Table 1, specification (1) and (4) in the manuscript. Figure S.1 illustrates the now common pattern of differences between the proportional and the majoritarian rule. Specification (1) and (4) of Table S.2 account for random effects for referenda and districts, specifications (2) and (6) account for random effects for referenda and MPs, and finally specifications (3) and (6) additionally add district and party fixed effects. The coefficient of the variable Voter yes share changes only marginally over the specifications for the respective electoral rules.

Table S.2: Multi-level Logistic Regressions with Random-effects.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	*MP votes yes*					
Sample	Proportional (Lower House)			Majoritarian (Upper House)		
Voter yes share	4.0775***	4.2001***	4.0754***	11.7908***	12.2819***	11.8359***
	(0.3230)	(0.3303)	(0.3154)	(0.9910)	(1.0175)	(0.9722)
Intercept	-2.0169***	-2.1259***	-2.0437***	-5.7913***	-6.1105***	-6.0616***
	(0.1917)	(0.2085)	(0.1917)	(0.6508)	(0.7197)	(0.7178)
Random effect variance: Referendum-level	0.9102	0.9102	0.9125	4.6537	4.7017	4.8990
Random effect variance: District-level	0.0000	-	0.0000	0.03004	-	0.0000
Random effect variance: MP-level	-	0.0000	-	-	0.0637	-
District fixed effects	No	no	yes	no	no	yes
Party fixed effects	No	no	yes	no	no	yes
n. Obs.	10581	10581	10581	2124	2124	2124
BIC	12580.3	12580.3	12813.1	1738.2	1737.7	1903.7

Notes: ***, **, and * indicate a mean significance level of <1%, 1-5%, and 5-10%, respectively. Multi-level logistic regressions with random-effects are estimated.

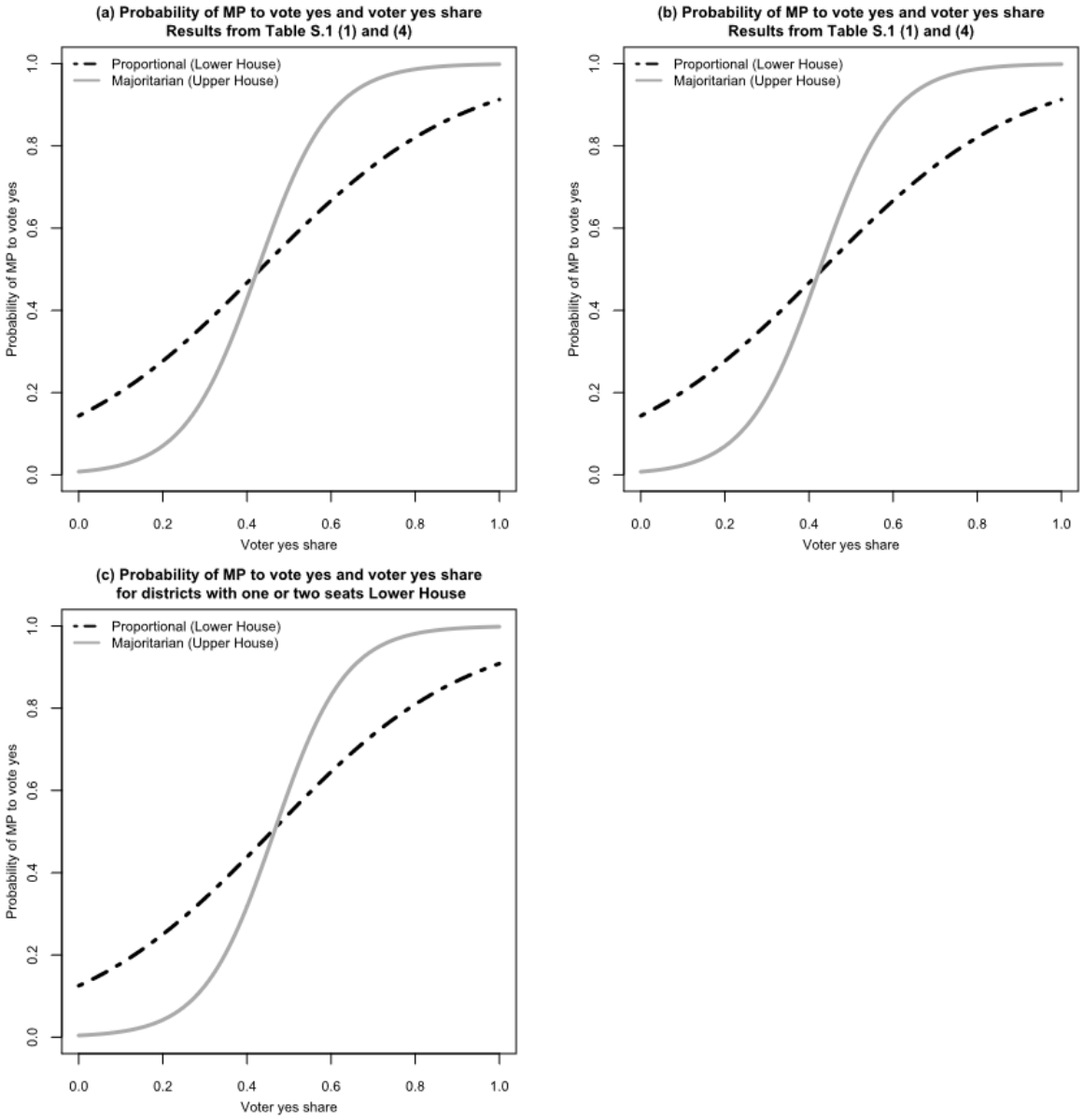


Figure S.2: Voters and MPs' Decisions for each Electoral Rule – Results from Multi-level Logistic Regressions

Weighting for Narrow Referendum Results and Subsets according to MP Characteristics

Figure S.3, panels (a) and (b) plot the results of Table 1, column (1) and (3) when two different weighting strategies for the observations are applied in the logistic regression. The first strategy takes the absolute difference between the *Voter yes share* and 50% as weights. The second strategy takes the squared difference between the *Voter yes share* and 50% as weights. By employing these weighting strategies, we investigate whether our interpretations for the electoral rules differ when putting less weight on narrow referendum results, e.g. close to the 50% benchmark. Panel (a) and (b) in Figure S.3 show that different weighting strategies lead to similar interpretations as provided in Figure 1 in the manuscript. The observable difference between electoral rules is not influenced by different weighting strategies of the observations in the baseline logistic regressions.

Additionally, Figure S.3, panels (c) and (d) shows the results for two subsets of MPs. While there are not term limits for MPs, it might be argued that elderly MPs who may not intend to run again for office face fewer incentives to correspond to the preferences of their voters, i.e. for proportional and majority-elected politicians, the link between the Voter yes share and the probability of vote yes might be weaker. Panel (c) plots results for a subset of MPs who are above the median age of all MPs. The difference between electoral rules is still clearly observable. Panel (d) looks at a subset of politicians who are newly elected to the respective House of Parliament and served there for at most two years. Again, we observe a clear difference between newly proportionally and newly majority-elected MPs. For majority-elected MPs we observe a tendency to accept a proposal if more than 40% of voters accept the proposal.

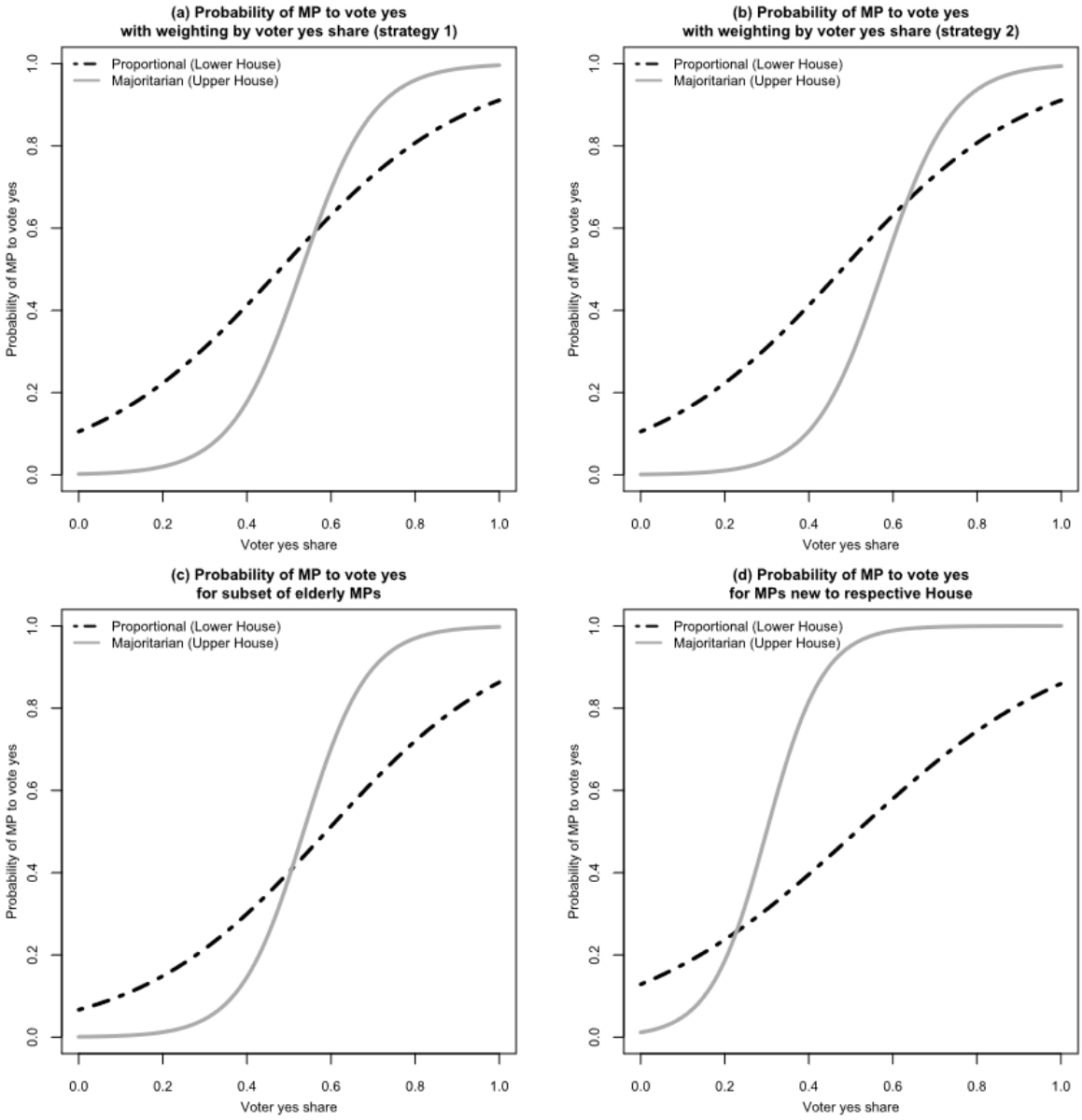


Figure S.3: Voters and MPs' Decisions for each Electoral Rule – Weighting for Narrow Referendum Results (a, b) and Subsets for MP Characteristics (c, d)

Establishing Differences between Proportional and Majoritarian Rules

Panel (a) of Table S.3 provides empirical evidence that the impact of the *Voter yes share* is statistically different, depending on the electoral rule. As stated in the manuscript, we merge the dataset for proportionally and majority-elected MPs, employ an identifier for proportionally-elected MPs and interact this identifier with *Voter yes share*. The coefficient of efficient of the interaction term is statistically significant and negative. This also holds when splitting the sample at the 50% threshold. Thus, the curvature of the predicted probabilities from the logit model is smaller for proportionally-elected politicians than for majority-elected ones. Put differently, the relationship between the Voter yes share and the probability that an MP votes yes, increases significantly more for majority-elected MPs compared to proportionally-elected MPs around the 50% threshold.

Table S.3: Differences between Proportional and Majoritarian Rules

Panel (a) Identifying differences between proportional and majoritarian rule with an interaction term

	(1)	(3)	(3)
Dependent variable		*MP votes yes*	
Sample	Both Houses	Both Houses & Voter yes share < 50%	Both Houses & Voter yes share ≥ 50%
Voter yes share	7.6561***	8.5521***	6.9612***
	(0.4159)	(0.7896)	(1.0938)
Proportionally-elected MP	1.5254***	1.6700***	2.1377***
	(0.1639)	(0.2831)	(0.5858)
Proportionally-elected MP * Voter yes share	-3.4063***	-3.8976***	-4.2861***
	(0.3412)	(0.7769)	(0.9428)
Referendum fixed effects	yes	yes	yes
n. Obs.	12705	7195	5510
(pseudo) R2	0.1904	0.2055	0.1692

Panel (b) Kolmogorow-Smirnow for equality of empirical distributions

Sample	100 draws from each empirical distribution	50 draws from each empirical distribution & Voter yes share < 50%	50 draws from each empirical distribution & Voter yes share ≥ 50%
p-value	p=0.0000 (two sided test)	p=0.0000 (Proportional < Majoritarian)	p=0.0000 (Proportional > Majoritarian)

Notes: ***, **, and * indicate a mean significance level of <1%, 1-5%, and 5-10%, respectively. Logit models are estimated and robust standard errors are reported.

Panel (b) of Table S.3 provides Kolmogorow-Smirnow tests for the equality of the empirical distributions of Figure 1(a) in the manuscript. All these tests always reject the equality of the distributions implied by proportional and majoritarian rules even when drawing only 100 observations.

Differences between Empirical Distributions and Theoretical Ideal Outcomes

Table S.4 provides the coefficient estimates for the Figure 5 in the manuscript. The discussion of these estimations is done in the manuscript.

Table S.4: Differences between Empirical Distributions and Theoretical Ideal Outcomes

	(1)	(3)	(3)	(4)	(5)	(6)
Dependent variable	*MP votes yes*					
System	Proportional			Majoritarian		
Sample	Voter yes share <35%	35≤ Voter yes share ≤65%	Voter yes share >65%	Voter yes share <35%	35≤ Voter yes share ≤65%	Voter yes share >65%
Voter yes share	5.3356***	3.5578***	3.7527**	13.9072***	10.7877***	5.1669
	(0.8395)	(0.5617)	(1.6035)	(3.0927)	(1.5310)	(5.0238)
Intercept	-2.3965***	-1.7493***	-2.1308*	-14.2935***	-3.9546***	7.9985**
	(0.3071)	(0.3857)	(1.1456)	(0.8994)	(1.1758)	(3.4748)
Referendum fixed effects	Yes	yes	yes	yes	yes	yes
n. Obs.	3161	5421	1999	640	1077	407
(pseudo) R2	0.182	0.1975	0.2446	0.5440	0.6072	0.5977

Notes: ***, **, and * indicate a mean significance level of <1%, 1-5%, and 5-10%, respectively. Logit models are estimated and robust standard errors are reported.

In Table S.5 we estimate a linear probability models (OLS) of Table S.4. Although, the dependent variable is binary and the independent variable is distributed theoretically on the interval [0,1] (empirical distribution is on the interval [0.087, 0.943]), the interpretation of the results is similar to that of Table S.4 and Figure 5 in the manuscript. In particular, we observe that there is always a positive and statistically significant association between the *Voter yes share* and the dependent variable *MP votes yes*. The coefficient is relatively close to 1 in specifications (1) and (2) implying a 1-to-1 relationship between the *Voter yes share* and *MP votes yes* for proportionally-elected politicians (corresponding to theory). The relationship is with a statistically significant coefficient of 0.4658 somewhat lower for the sample of observations where the *Voter yes share* is above 65%. For majority elected politicians we do not observe a statistically significant relationship between the *Voter yes share* and *MP votes yes* for the subsamples where the *Voter yes share* is below 35% (specification 4) or above 65% (specification 6) corresponding to our theoretical considerations. If the *Voter yes share* lies beteen 35% and 65% (specification 5), we observe a positive statistically significant coefficient which is even statistically significantly larger than 1. Thus, for majority-elected politicians an increase in the *Voter yes share* close to the 50% benchmark is associated with a more than proportional increase on in the probability of an MP to vote yes in the Upper House.

Table S.5: Linear Probability Models for Proportionally and Majority-Elected Politicians

	(1)	(3)	(3)	(4)	(5)	(6)
Dependent variable	*MP votes yes*					
System	Proportional			Majoritarian		
Sample	Voter yes share <35%	35≤ Voter yes share ≤65%	Voter yes share >65%	Voter yes share <35%	35≤ Voter yes share ≤65%	Voter yes share >65%
Voter yes share	1.0273***	0.7794***	0.4658**	0.4471	1.4281***	0.3283
	(0.1574)	(0.1211)	(0.1973)	(0.7085)	(0.1913)	(0.3370)
Intercept	0.0031	0.1091	0.2979**	0.0655	0.0194	0.7718***
	(0.0588)	(0.0900)	(0.1456)	(0.1424)	(0.2398)	(0.2344)
Referendum fixed effects	Yes	yes	yes	yes	yes	yes
n. Obs.	3161	5421	1999	640	1077	407
(pseudo) R2	0.1407	0.1429	0.1475	0.4270	0.482	0.4474

Notes: ***, **, and * indicate a mean significance level of <1%, 1-5%, and 5-10%, respectively. Linear probability (OLS) models are estimated and robust standard errors are reported.

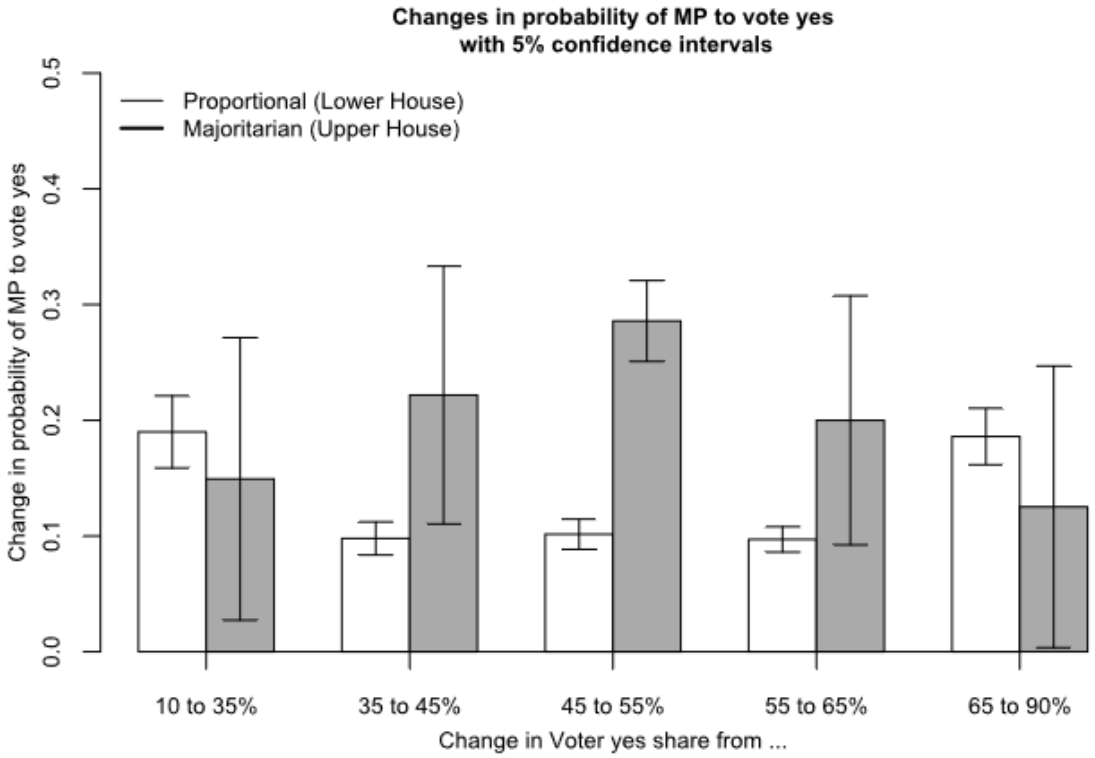


Figure S.4: Contrasting ideal electoral systems with empirical data

In Figure S.4, we predict how different changes in the *Voter yes share* are associated with changes in the probability of an MP to vote yes for proportionally and majority-elected MPs. The prediction is based on the estimations presented in Table 1, specifications (1) and (4). For the proportional rule any percentage point change in the *Voter yes share* is closely associated with the same quantitative change in the probability of an MP to vote yes, e.g. a

change in the Voter yes share from 35 to 45% is associated with a change in the probability to of an MP to vote yes by about 10%-points. In contrast, only when approaching the 50% threshold, the association becomes strong for the majoritarian rule, e.g. when changing the *Voter yes share* from 10 to 35%, the change in the probability of an MP to vote yes is about 15%-points but with a high standard error, while changing the *Voter yes share* from 45 to 55% is associated with a change in the probability of an MP to vote yes by about 30%-points. This figure closely corresponds to the results of Figure 1(b) in the manuscript where changes in the *Voter yes share* of 1%-points are represented.