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Referendum Design, Quorum Rules and Turnoutⁱ

LUÍS AGUIAR-CONRARIAⁱⁱ

PEDRO C. MAGALHÃESⁱⁱⁱ

Abstract

In this article, we focus on the consequences of quorum requirements for turnout in referendums. We use a rational choice, decision theoretic voting model to demonstrate that participation quorums change the incentives some electors face, inducing those who oppose changes in the status quo and expect to be in the minority to abstain. As a result, paradoxically, participation quorums decrease electoral participation. We test our model's predictions using data for all referendums held in current European Union countries from 1970 until 2007, and show that the existence of a participation quorums increases abstention by more than ten percentage points.

JEL codes: D72; C25; C20

Keywords: Referendum Design; Voter turnout

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1. Introduction

“What is the principle of wisdom, if not to abstain from all that is odious to God?”

Pope Benedict XVI, in a speech made in June 8th 2005, four days before a referendum on *in vitro* fertilization in Italy.

In a June 2005 referendum, which would have allowed a change in the legislation regulating *in vitro* fertilization, most Italian voters ended up following the Pope’s advice. Although about 90% of those who did vote supported the proposed changes, turnout was a mere 26%, below the 50% imposed by the Italian participation quorum rule, under which the results of these sorts of referendums are deemed invalid. As a consequence, *in vitro* fertilization techniques remained restricted to heterosexual couples and embryos were still made holders of human rights, which meant that research on embryos and their cryogenic preservation remained banned. The role of the Catholic Church was seen as crucial for this outcome and Cardinal Camillo Ruini, the president of the Italian bishop’s conference – with the help of the Pope himself - did his best to make sure that all those who opposed changes in the law abstained rather than voted “No”.¹

Quorum rules such as those prevailing in the Italian system imply that the outcome of a given referendum is not exclusively determined by which option obtains the support of a majority of the actual voters. Instead, this simple majority requirement is coupled with specific thresholds regarding the share of the overall electorate that needs to participate or vote for any of the specific options. If there is a *participation quorum*, like in the Italian case above, changing the status quo (typically, a victory for the “Yes” option) requires the support of the majority of the voters and that a given percentage of registered voters take part in the vote. Conversely, if there is an *approval quorum*, changing the status quo requires the support of the majority of the voters and that such majority represents a certain percentage of the total electorate. Far from being a peculiarity of the Italian system, quorum rules in referendums are, in fact, relatively common in many established democracies. The most famous historical example is that of the 1919 Constitution of the German Weimar Republic, which established a 50% participation quorum for referendums. Today, 14 European Union member-states establish either participation or

approval quorum rules for national referendums and initiatives. In most states of the German Federation, state and municipal referendums are valid only if an approval quorum is reached. Some American states, such as Wyoming and Minnesota (approval quorums) or Massachusetts, Mississippi, and Nebraska (turnout quorums) have similar restrictions. And quorum rules can also be found in places as diverse as Colombia, Belarus, Venezuela and Taiwan (Suksi 1993; Verhulst and Nijeboer 2007; Kaufmann et al. 2008).

The adoption of quorum rules is typically seen as a way of avoiding distortions in outcomes resulting from low turnout (LeDuc 2003: 172) and as a safeguard against minority exploitation of voter apathy (Qvortrup 2005: 173). But not all agree on the wisdom of such rules. Studies of the Italian case have suggested that participation quorums have turned abstention into a additional course of action for opponents of the referendum proposals (Uleri 2002). And in its “Code of Good Practice on Referendums”, the European Commission for Democracy through Law, known as the Venice Commission, argues that, under participation quorum rules, minorities “need only desert the ballot box in order to impose their viewpoint”, a fact that, furthermore, tends to increase abstention (Venice Commission 2007: 22-23).

However, although the literature on voter turnout is quite extensive (for reviews, see Dhilon and Peralta 2002 and Blais 2006), there is surprisingly very little academic work on cross-national differences in voter turnout in referendums and even less theoretical or empirical work on the consequences of such a common phenomenon as quorum rules. One exception is Côte-Real and Pereira (2004), who examine quorum rules in referendums from the point of view of accurate representation, i.e., whether outcomes under different rules are consistent with the whole electorate revealing their true preferences through voting. Although their main concern was not to show how the existence of quorum rules changes the incentives to vote, one corollary of their formal analysis is that participation quorums do create conditions under which supporters of the status quo may have incentives to abstain, thus contributing to low turnout. The general argument about the relationship between quorum rules and actual turnout has been formalized in a second study by Herrera and Mattozzi (2009), who use a group turnout

model. In that framework, they show that political parties' and interest groups' behavior is influenced by quorum rules: in their presence, the incentives to mobilize voters are distorted, allowing groups that are in favor of preserving the status quo to use a "quorum-busting strategy". As a result, the mere existence of a quorum requirement may suppress turnout. In equilibrium, it is even possible to have a voting paradox: the quorum is not reached precisely because of its existence or, in other words, turnout exceeds the quorum only if this requirement does not exist. However, Herrera and Mattozzi reach another result that did not follow from Côté-Real and Pereira's analysis, namely that, from the point of view of the effects on turnout, "approval quorums" and "participation quorums" are basically equivalent. None of these works, however, proceed to an empirical test of the formal models they develop.

In this study we shed light on the discussion of the institutional design of referendums, both theoretically and empirically. We use a prototypical rational-choice, decision-theoretic voting model to highlight how the existence of quorum requirements changes the incentives some individuals face when deciding whether to vote or not. We argue that participation quorums do indeed produce what can only be described as perverse and paradoxical effects: introduced in order to prevent distortions that result from low turnout, they end up contributing to a decrease in turnout and introduce distortions in referendum outcomes. However, in our model, approval quorums have no similar effects. We then proceed to test empirically the main predictions of the model as they relate to the impact of quorums on turnout, using a dataset with information on about one hundred referendums that have been conducted in the countries that are now members of the European Union from 1970 until today.

Besides analyzing the specific consequences of quorum rules on turnout, we also see this article as providing two additional contributions to the literature. First, we address a curious disjuncture in the literatures on referendums and electoral turnout. Although large bodies of work have been produced both on how direct democracy affects policy-making (for a review of this literature, see, e.g., Lupia and Matsusaka 2004) and on the political, institutional and socio-economic causes of turnout (see e.g., Franklin 2002, 2004; Blais 2006; Geys 2006), these literatures have seldom met. In other words, we know very little

not only about how variations in the institutional design of referendums affect turnout, but also about whether the prevalent propositions about the causes of turnout also apply to referendums (for exceptions, see Matsusaka 1993; Coate and Conlin 2004). Thus, we aim at testing the robustness of several well-known propositions about the causes of turnout, typically formulated and tested while resorting to general elections data. Second, we will argue that, contrary to what is done in most of the empirical literature on turnout, Berkson's minimum logit chi-square estimator, not typical ordinary least squares estimation, is the best form to empirically study turnout models with aggregate data.

2. A prototypal rational choice voting model

Our objective is not to provide a general model to explain turnout: for that purpose, a simple rational-choice model, like the one we consider next, would be insufficient, and some interesting alternatives, like behavioral models of turnout (see Bendor et al. 2003) or pivotal-voter models (see Coate et al. 2008), seem more promising.² We aim simply at illustrating how the existence of a quorum rule may change the incentives to vote. We abstract from every other aspect that may influence voting decisions and derive a prototypal rational-choice, decision theoretic model of voting. Like in pivotal-voter models, citizens are motivated to vote by the chance that they might swing the election. Unlike a pivotal model, our rational choice model abstracts from the link going from strategies to beliefs about actions. In that sense, our model is a "partial equilibrium" model. Still, it captures several interesting features of approval and participation quorums.

We start by assuming no frictions. We follow Feddersen and Pesendorfer (1999) and assume that voting is costless. According to this frictionless model, a defender of the referendum proposal will vote "Yes", an opponent will vote "No", and only those who are indifferent will abstain.³ Then we add frictions (quorum rules), and analyze how they change the incentives to vote.

2.1. No quorum requirements

Consider an individual who has to decide how to vote in a particular referendum. The individual must decide whether to vote or to abstain, and, if he decides to vote, in which way to vote. Assume that if the referendum passes the derived utility is U_p and if the proposal is defeated, the utility is given by U_d . The expected utility of not voting is given by:

$$EU_{nv} = p_{nv}U_p + (1 - p_{nv})U_d, \quad (1)$$

Where p_{nv} is the subjective probability that the proposal will receive the majority of votes, given that the individual does not vote. The expected utility of voting is given by:

$$EU_v = p_vU_p + (1 - p_v)U_d, \quad (2)$$

where p_v is the subjective probability that the proposal will be supported by the majority of voters, given that the individual does vote. Note that if $U_p > U_d$ (or $U_p < U_d$) the expected utility of voting is maximized if the elector votes in favor of (or against) the proposal, so that p_v (or $1 - p_v$) is maximized.

The individual will vote if and only if $EU_v > EU_{nv}$. Simple algebra shows that this condition is equivalent to

$$(p_v - p_{nv})(U_p - U_d) > 0. \quad (3)$$

If the individual is for the proposal, then $(U_p - U_d) > 0$ and $(p_v - p_{nv}) > 0$. On the other hand, if the elector is against we have $(p_v - p_{nv}) < 0$ and $(U_p - U_d) < 0$, which implies that condition (3) is met.

Therefore, according to this simplified model those who favor the proposal will vote "Yes", those who are against it will vote "No", and only those who are indifferent will abstain ($U_p - U_d = 0$).

2.2. Quorum requirements

Let's now assume that there exists a quorum requirement. In the case of approval quorum, this means that for a proposal to pass, i.e., to change the status quo, not only will the majority of the voters have to vote "Yes" but also that majority needs to represent a certain percentage of the total electorate. In the case of the participation quorum, a change in status quo requires both a "Yes" majority and that a certain percentage of electors vote at all.

Let q_{nv} be the conditional probability that the quorum will be met, given that "Yes" receives the majority of votes and that the individual does not vote. q_v represents the analogous probability, given that the individual votes. (p_v and p_{nv} have the same interpretation as before).

The probability that a proposal will pass is given by the probability that both the majority of the voters choose "Yes" and that the quorum is met. Therefore, the expected utility of voting, and of not voting, is given by:

$$EU_v = p_v q_v U_p + (1 - p_v q_v) U_d, \quad (4)$$

$$EU_{nv} = p_{nv} q_{nv} U_p + (1 - p_{nv} q_{nv}) U_d. \quad (5)$$

As before, simple algebra shows that the individual will vote if and only if

$$(p_v q_v - p_{nv} q_{nv})(U_p - U_d) > 0. \quad (6)$$

2.2.1. Approval quorum

As before, if a person favors the proposal, it is easy to check that voting "Yes" strictly dominates the option of voting "No". Hence if the elector chooses to cast a vote, both the probability that the proposal will receive the majority of votes and the probability that the quorum is met will increase. Therefore we have $(p_v q_v - p_{nv} q_{nv}) > 0$ and $(U_p - U_d) > 0$, and condition (6) is fulfilled.

On the other hand, if the person is against the proposal, voting “No” strictly dominates the option of voting “Yes”. Therefore, voting will have no effect on the approval quorum but it will decrease the probability that the proposal will receive the majority of votes. Hence we have $(p_v q_v - p_{nv} q_{nv}) < 0$ and $(U_p - U_d) < 0$, and condition (6) is fulfilled.

The implication is that, in this setup, the existence of an approval quorum does not affect the incentives to vote. Therefore, the prediction of the prototypal model is that whoever favors or opposes the proposal will vote. Only those who are indifferent will not participate.⁴

2.2.2. Participation quorum

Again, we look at condition (6). The reasoning for a person who supports the proposal is the same as with the approval quorum. If the person votes, both probabilities will increase and, therefore, the elector will choose to vote.

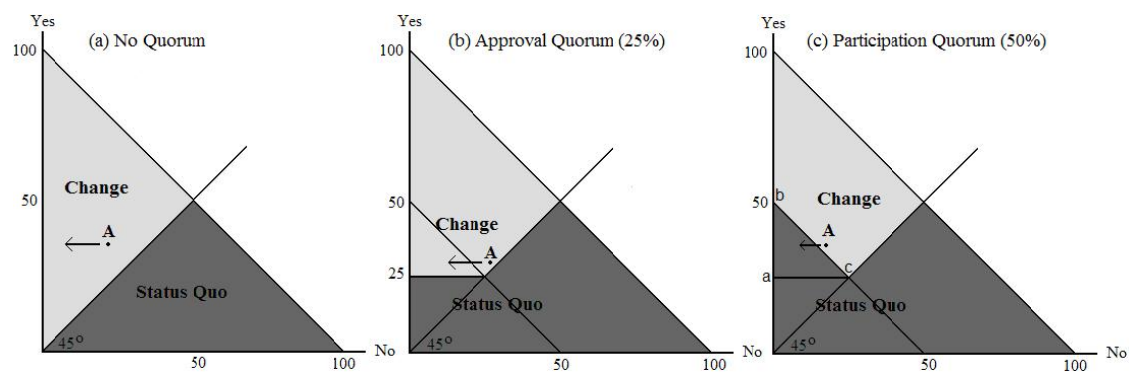
But if a person opposes the proposal the incentives are mixed up. For an opponent of the proposal, $(U_p - U_d) < 0$. So an opponent will vote if and only if $(p_v q_v - p_{nv} q_{nv}) < 0$. If the person votes “No”, the probability that the proposal is supported by a majority of votes decreases, but the probability that the quorum is met increases.⁵ Therefore, even for a person who opposes the proposal and would otherwise vote “No”, it is possible to have $(p_v q_v - p_{nv} q_{nv}) > 0$,⁶ in which case the rational choice is to abstain. Basically, if an opponent of the proposal believes that there is a solid majority in favor of the proposal but there is a good chance that the participation quorum is not met, then the best chance to defeat the proposal is not to vote at all.

In this way, the existence of quorum requirements may open, for supporters of the status quo, an additional course of action besides voting “No”: to swing the election by not voting and forcing the quorum not to be met. In certain situations, then, abstention can be turned into the functional equivalent of a “No” vote.

2.3. Graphical analysis

The ideas formalized previously can be illustrated with a simple picture. In Figure 1, let the vertical axis represent the percentage of the population that favors the proposal submitted to referendum. On the horizontal axis, we have the percentage of people that oppose the proposal. If there are no quorum requirements (left picture), there is a change in the status quo if the outcome of the referendum places the results above the 45-degree line (meaning that the majority of the voters vote “Yes”). Note that if an opponent believes that the outcome will be near point A, he/she will have nothing to gain from abstaining. It would just move point A to the left, making “Change” more likely.

Figure 1 The inefficiency triangle



In the picture in the middle, we describe a situation where there is an approval quorum of 25%. Therefore, a change the status quo requires the results to be above the 45-degree line and above the 25%-Yes line. In this case, the ‘Status Quo’ region increases, but there is no change in the incentives. An opponent has nothing to gain from abstaining, as abstention will always make ‘Change’ more likely. Therefore, this type of rule makes the change of the status quo harder, which may be politically justifiable, and does not give incentives to voters to mask their preferences.

Finally, on the right, we describe a situation where there is a participation quorum of 50%. The “Status Quo” region is now reduced to the area above the 50% participation rate and above the 45-degree line. If an opponent of the proposal believes that the final results will be in the neighborhood of A, then his/her best bet is not to vote against the proposal, but simply not to show up at the polls. By doing this, the elector is helping the

final result to be somewhat to the left of A, moving the final outcome to the “Status Quo” region.

Therefore the participation quorum has one perverse effect and one ironic potential outcome. The perverse effect is that, in some situations it gives incentives to people to mask their true preferences and to abstain, acting as if they were indifferent. The ironic potential outcome is known in the literature as the “No-Show paradox”: it is possible that the quorum is not reached precisely because of its existence or, in other words, turnout exceeds the quorum only if this requirement does not exist. Looking at the picture on the right of Figure 1, we can see where the distortion in the incentives lays in this case.

3. Data and hypotheses

The model presented in the previous section suggests that participation quorums should be related to lower turnout and that approval quorums should not produce the same effects. In order to test these and a series of other theoretical hypotheses, we collected data on all national referendums that have taken place in the current member states of the European Union from 1970 to (mid-) 2007. A total of 109 national referendums were, therefore, initially considered. (The database is available online — C2D 2007).⁷

Table 1 shows all present European Union member countries where either participation or approval quorums have been imposed for national referendums (in the remaining member-states, no quorums exist). In each case, the figures refer to shares of the electorate whose participation or approval is required for the referendum to be deemed valid. In the specific case of “non-rejection” quorums, they refer to a percentage of electorate voting “No” that, if surpassed, renders a change in the status quo invalid. As we can see, a large number of countries have such provisions for several types of referendums, and Lithuania even has imposed both participation and approval quorums.

Table 1 Quorum rules for national referendums in the European Union countries

| Country | Participation quorum | Approval (or non-rejection) quorum |
|-------------|---|--|
| Bulgaria | 50% | - |
| Denmark | - | 40% approval (constitutional amendments) Less than 30% rejection (other cases) |
| Hungary | 50% (only until July 1997) | 25% approval (since July 1997) |
| Ireland | - | Less than 33.3% rejection (legislative extraordinary referendum) |
| Italy | 50% (abrogative legislative referendum) | - |
| Latvia | 50% (except constitutional amendments) | 50% approval (constitutional amendment) |
| Lithuania | 75% (for sovereignty issues) 50% (other cases) | 50% approval (sovereignty issues) 30% approval (mandatory referendum) |
| Malta | 50% (for abrogative legislative referendum) | - |
| Netherlands | 30% | - |
| Poland | 50% | - |
| Portugal | 50% | - |
| Romania | 50% (constitutional amendments) | - |
| Slovenia | 50% (constitutional amendments) | - |
| Slovakia | 50% | - |

Source: Venice Commission (2005); for Romania, Slovenia and Slovakia, C2D (2007)

3.1. Main Hypotheses

The main goal of this article is to assess the impact of quorum rules on referendum turnout. For that, on the basis of the information listed in Table 1, we created two dummy variables to represent the two possible quorum rules in force for each referendum: (1) a participation quorum dummy, which takes the value one if there is a participation quorum requirement and zero otherwise; and (2), an approval (or non-rejection) quorum dummy, which takes the value one if there is such a requirement and zero otherwise. Given our discussion in the previous section, we can state the following hypothesis:

H1.: Participation quorum effect. Referendums held under a participation quorum requirement should have lower turnout than those where such requirement is absent.

We can even make a more precise statement about the effects of a participation quorum. According to our model (see Figure 1.c), supporters of the status quo have an incentive to abstain only when they believe that the majority of the voters will vote for a change. To

test this possibility, we build a dummy variable that takes value 1 when the “Yes” option received the majority of the votes and zero otherwise.⁸ Similarly, we also created a “No” dummy. Then we estimate the interaction between these variables and the participation quorum variable. Ideally, of course, an ex-ante measure of the probability of a ‘Yes’ majority, such as the one provided by voting intention polls, for example, would have been preferable. However, such an indicator is impossible to find for so many different referendums in so many different countries, some of them taking place more than 30 years ago. Having said that, there is relatively solid evidence that most electors are able to make accurate predictions about who’s going to win or lose an election (Lewis-Beck and Skalaban 1989; Lewis-Beck and Tien 1999). Assuming accurate predictions, then, our analysis implies the following two additional hypotheses besides the main negative effect of participation quorums:

H1.a: Participation quorum effect under a “Yes” majority: Referendums held under a participation quorum requirement should have lower turnout than those where such requirement is absent if the “Yes” option receives the majority of the votes.

H1.b: Participation quorum effect under a “No” majority: The participation quorum requirement should have no impact on turnout when “No” is in the majority.

What to expect concerning the consequences of approval quorums? According to our analysis, the existence of an approval quorum should have no effect on turnout. However, Herrera and Mattozzi (2009) argue that the effects of “approval quorums” and “participation quorums” are equivalent, i.e, both negative. We take a cautious approach and just hypothesize that the impact of approval quorums should not be positive, although our model does suggest that no impact at all should ensue.

H2.: Approval quorum effect: Referendums held under an approval quorum requirement should not have a higher turnout than those where such requirement is absent.

3.2. Other Hypotheses

Any effects of voting quorums on turnout need to be estimated while controlling for a number of other factors known to affect turnout. Given, to our knowledge, the complete absence of cross-national studies about the determinants of turnout in referendums, these results are of substantive interest on their own. By controlling for other variables, we are also testing if several stylized facts about turnout in general elections outlined by the literature also apply to the case of national referendums.

First, like what happens in general elections, we expect the relationship between *compulsory voting* and turnout in referendums to be positive (Jackman 1987), especially considering that we are dealing exclusively with established democracies in our sample (Norris 2002).⁹ Second, we also expect that turnout should be higher when referendums are *concurrent* with other elections (LeDuc 2003).¹⁰ Third, to test for the effects of voter fatigue (Franklin 2002, 2004; Rallings et al. 2003), we measure the time (in years or fractions thereof) elapsed since the last national election that has taken place before each referendum (*Years since last election*).¹¹ This should have a positive effect on turnout. A fourth potentially relevant variable concerns the *margin of victory* in the referendum, which we measure as the absolute difference in percentage points between the “Yes” and “No” options in each referendum. We expect it to have a negative effect on turnout, as more competitive referendums should increase both the expected utility of voting and the efforts at voter mobilization (Jackman 1987; Cox and Munger 1989).¹² Although this way of measuring election closeness is rather common in this literature (used in about 70% of the empirical studies — Geys 2006), we are aware that, ideally, one should consider an *ex ante* measure of closeness (such as that provided by electoral polls). In any case, to be sure that our inferences are not severely affected by this variable, we re-estimated each model excluding this variable.

Electorate size is inversely related to the probability of casting the decisive vote (Chamberlain and Rothchild 1981) and should, therefore, have a negative effect on turnout (Blais and Dobrzynska 1998; Levine and Palfrey 2007; Coate et al. 2008).¹³ We also include in the model two additional variables. First, we use a measure of the *literacy*

rate.¹⁴ The idea is that at least some cognitive skills and competences are required to participate in politics and, therefore, countries whose populations enjoy higher levels of literacy should have higher turnout (Blais 2006). However, one opposing argument would be that voting, contrary to other participatory activities, is not very skill demanding (Verba et al. 1995) and that, furthermore, we will be dealing here with a relatively homogeneous set of countries from this point of view. Finally, although previous studies are not encouraging about the inclusion of this type of control (Radcliff 1992; Kostadinova 2003; Fornos et al. 2004), we include a *business cycle* variable.¹⁵

Ideally, one would also like to include year and country specific effects. However, with ninety-nine observations, it is unrealistic to include several dummy variables to capture year effects or a dummy variable for each country, with the obvious over-fitting consequences (furthermore, for some countries we only have one observation). Instead, we include in the model the *year of the referendum* and the level of *turnout in preceding first-order election*. If, in a particular country, turnout is expected to be higher for some idiosyncratic reason not captured by the other control variables, this should be revealed by a high turnout in previous elections, and thus can capture country-specific effects.¹⁶ With the inclusion of this variable, we also take into account the “habit-forming” nature of voting (Gerber et al. 2003).

4. Estimation and modeling choices

Our dependent variable, turnout, is defined as the ratio of the number of people that voted to the number registered to vote. In most of the literature dealing with aggregate levels of turnout, it is common to estimate this type of voting function using Ordinary Least Squares (OLS). The typical equation (see, e.g., Radcliff 1992; Blais and Dobrzynska 1996; Shachar and Nalebuff 1999; Washington 2006; or Gentzkow 2006) to be estimated is given by:

$$\bar{P} = X\alpha + e,$$

where the X is matrix that represents the independent variables described in the previous section, α a vector of the associated coefficients and \bar{P} is the turnout rate.

There is, of course, a first drawback with this specification: while the turnout variable must be between zero and one, this range is not respected for extreme values of the independent variables when a simple OLS regression is used. However, a simple logistic transformation will solve this drawback: $0 < \bar{P} < 1 \Rightarrow -\infty < \log(\bar{P}/(1-\bar{P})) < +\infty$. Therefore, we can directly estimate the equation

$$\log\left(\frac{\bar{P}}{1-\bar{P}}\right) = X\beta + \varepsilon.$$

The estimated coefficients are slightly more difficult to interpret because they do not directly give us the marginal impact of the independent variables on turnout. But it is a matter of simple algebra to derive such marginal effects:

$$\frac{\partial \bar{P}}{\partial X} = \beta(1-\bar{P})\bar{P}$$

There is, nonetheless, a second drawback involved in using simple OLS. When applied to observations of elections in particular countries, OLS consists on an unweighted analysis of aggregate data, which gives the exact same weight to every observation. However, a turnout of 70% in, say, France, means that more than 26 million people chose to vote, while the same turnout for, say, Portugal, means that less than 7 million were persuaded to vote. Therefore, the same turnout rate gives us information about more people in France than in Portugal. More rigorously, if we use the sample mean as an estimator of the population mean, then the variance of the estimator decreases with the number of electors. A turnout rate for a large country is an estimator of the population mean with a lower variance than the turnout rate for a small country, and efficient estimation requires that more weight be given to observations with lower variance. OLS, however, makes no distinction between referendums that occurred in a country with 9 million voters or in a country with 40 million voters. This implies that simple OLS is not efficient, although, of course, consistency is not a problem.

We can tackle this weakness by looking at the data from a different perspective, one that takes into account the fact that what is being tested is a rational choice model where

turnout is treated as an individual decision. From this perspective, each individual faces a binary choice: to vote or to abstain. Turnout in a given referendum can be seen as the aggregated information about the decisions of several individuals. Hence, it can be interpreted as an estimator of the expected value of a binary decision. Given this interpretation, the observed turnout rate is just a sample mean, an estimator of the population mean. More specifically, turnout in referendum c (\bar{P}_c) is the proportion of voters that chose to vote. Assume that an individual facing referendum c votes with a probability given by $P_c = F(X\beta)$, where F is some distribution function. Assuming that F is strictly increasing, we can solve with respect to $X\beta$: $F^{-1}(P_c) = X\beta$. For mathematical convenience, we use the logistic distribution function, so we have $P_c = \exp(X\beta)/(1 + \exp(X\beta))$.¹⁷ Rearranging, we get:

$$\log\left(\frac{P_c}{1-P_c}\right) = X\beta. \quad (7)$$

We do not observe P_c , but \bar{P}_c is a consistent estimator. Therefore, we can directly estimate

$$\log\left(\frac{\bar{P}_c}{1-\bar{P}_c}\right) = X\beta + \varepsilon_c. \quad (8)$$

The error term, $\varepsilon_c = \log(\bar{P}_c/(1-\bar{P}_c)) - \log(P_c/(1-P_c))$, is heteroscedastic and its variance,

$$\sigma_c^2 = \frac{1}{N_c(P_c)(1-P_c)}, \quad (9)$$

decreases with the electorate size (N_c). Weighed Least Squares based on (8) and (9) produces the minimum chi-squared estimates of β .

Since the weights are functions of the unknown parameters, we use a two-step procedure. First, we estimate (8) by ordinary least squares. Based on the first step, we estimate the weights and re-estimate equation (8) by weighted least squares.¹⁸ This estimator, also

known as the Berkson's minimum logit chi-square estimator, is fully efficient and asymptotically equivalent to a maximum likelihood estimator.

5. Estimation results

Table 2 reports the estimation results for two models testing the effects of quorum rules on turnout using Berkson's chi-square binary choice model. Model 1 tests Hypotheses 1 and 2, concerning the direct impact of participation and approval quorum rules on turnout, while Model 2 tests a more specific prediction of our prototypical rational-choice model: that under a participation quorum, the supporters of the "No" option would have an incentive to abstain only when a victory for "Yes" is to be expected (H1.a and H1.b).

The models account for a respectable amount of variance (about 65%) and the control variables with statistically significant coefficients have the expected signs and are well in line with previous results in the literature. Thus, compulsory voting has a very strong positive impact in the turnout rates in referendums, close to 30 percentage points. The extent to which the election was competitive (captured here by the margin of victory) displays the expected sign: the larger the margin of victory, the lower the turnout. If the margin of one of the choices in the referendum over the other increases by ten percentage points, then turnout is expected to be nearly two percentage points lower. Voter fatigue also seems to produce lower levels of turnout, with the coefficient for the years since last election displaying the expected positive sign. In countries with higher levels of literacy, people participate more in referendums. And finally, the coefficient associated with referendum year is negative, suggesting a decline in turnout in referendums in Europe of about six percentage points per decade since the early 1970s.

There are also several control variables that lack statistical significance. The position of the economy in the business cycle seems irrelevant, confirming most previous studies that have included this type of variable. The parameter for size of the electorate is not statistically significant, although it has the expected sign (negative). Perhaps the most surprising of these non-significant estimates is the irrelevance of concurrent elections, even if it is true that it has the expected sign. We should recall, however, three things. First, only in twelve of the ninety-nine observations does this variable have a value

different from zero. Thus, the lack of variation may explain its statistical insignificance. Second, five out of twelve of these referendums were held concurrently not with first-order elections (presidential elections in France or legislative elections elsewhere) but with “second-order” elections, i.e., European Parliament or presidential elections in semi-presidential systems, which are themselves not particularly mobilizing, as the literature suggests (Flickinger and Studlar 1992).¹⁹ Finally, the finding of a positive impact of concurrent elections is clearly not among the most robust in the literature (Geys 2006: 652).

Table 2 Predicting voter turnout in referendums (logit chi-square estimation)

| | Model 1 | | | Model 2 | | |
|---|---|-----------|------------------|---|-----------|------------------|
| | Coeffs | Std Error | Marginal effects | Coeffs | Std Error | Marginal effects |
| Participation quorum | -0.365*** | 0.123 | -0.090 | | | |
| (Participation quorum)x x(No dummy) | | | | -0.167 | 0.173 | |
| (Participation quorum)x x(Yes dummy) | | | | -0.465*** | 0.137 | -0.114 |
| Approval quorum | 0.225 | 0.291 | | 0.253 | 0.289 | |
| Compulsory voting | 1.212*** | 0.183 | 0.297 | 1.195*** | 0.181 | 0.293 |
| Concurrent elections | 0.212 | 0.274 | | 0.199 | 0.272 | |
| Literacy | 0.203*** | 0.069 | 0.050 | 0.208*** | 0.068 | 0.051 |
| Years since last election | 0.207*** | 0.065 | 0.051 | 0.209*** | 0.064 | 0.051 |
| Margin of victory | -0.009*** | 0.002 | -0.002 | -0.007*** | 0.002 | -0.002 |
| Electorate size | 0.007 | 0.079 | | 0.018 | 0.078 | |
| Business cycle | 0.014 | 0.020 | | 0.008 | 0.020 | |
| Previous turnout | 0.821 | 0.738 | | 0.861 | 0.732 | |
| Referendum year | -0.026*** | 0.007 | -0.006 | -0.023*** | 0.007 | -0.006 |
| Constant | 49.803 | 14.082 | | 43.589 | 14.474 | |
| R ² | | 0.643 | | | 0.654 | |
| Adj. R ² | | 0.598 | | | 0.605 | |
| White Heteroskedasticity Test | F – Stat: 1.303 (p-value 0.224) χ – Stat: 76.64 (p-value 0.303) | | | F – Stat: 1.379 (p-value 0.212) χ – Stat: 83.47 (p-value 0.315) | | |

*p<.10; **p<.05; ***p<.01

Since the results are broadly in line with the literature, and noting that tests for heteroscedasticity show no evidence of this pathology, we can move to test the effects of quorum rules. The estimated effects for the participation quorum in Model 1 confirm the predictions of our model: as stated in Hypothesis 1, participation quorums have a negative impact on turnout. More interestingly, as we can see with the results for Model 2, this negative impact is associated to victories of the “Yes” option. When the “No” option receives the majority of the votes, the impact of the participation quorum is statistically insignificant. This result lends support to the implications of our prototypal rational-choice model: only when a victory for the “Yes” is expected do supporters of the status quo have an incentive to abstain in order to render the referendum invalid (Hypotheses H1.a and H1.b). The estimated effects for the approval quorum, statistically not significant, are also in line with the predictions of the model, according to which approval quorums should have no impact.

5.1. Some Robustness Checks

Angrist and Pischke (2009: 92) agree that if “the goal is to get back to the microdata regression, it makes sense to weight by group size”, as we did. However, they also acknowledge that analysts “accustomed to working with published averages (...) and ignoring the underlying microdata, might disagree, or perhaps take the point in principle but remain disinclined to buck tradition in their discipline, which favors the unweighted analysis of aggregate variables” (ibid.). Thus, as a robustness check, we follow tradition in the empirical study of aggregate turnout levels, estimating equation (8) by OLS. As we see in Table 3, OLS results are broadly similar to the ones obtained by the logit chi-square estimation, suggesting robust empirical support for hypotheses 1, 1.a and 1.b. One aspect, however, deserves to be mentioned: unlike what occurred with the results obtained under the logit chi-square estimation, the positive coefficient for approval quorum approaches statistical significance at conventional levels in model 2 (p-value of 0.103). What makes this result particularly intriguing is the fact that it is unanticipated from a theoretical point of view, both in our decision-theoretical rational-choice model (which predicted no effects whatsoever of approval quorums) and in Herrera and

Mattozzi's group turnout model (which actually predicted a *negative* effect of approval quorums on turnout).

Table 3 Predicting voter turnout in referendums (OLS estimation)

| | Model 1 | | | Model 2 | | |
|---|---|-----------|------------------|--|-----------|------------------|
| | Coeffs | Std Error | Marginal effects | Coeffs | Std Error | Marginal effects |
| Participation quorum | -0.276* | 0.161 | -0.068 | | | |
| (Participation quorum)x x(No dummy) | | | | -0.037 | 0.253 | |
| (Participation quorum)x x(Yes dummy) | | | | -0.393** | 0.188 | -0.096 |
| Approval quorum | 0.376 | 0.243 | | 0.408 | 0.198 | |
| Compulsory voting | 1.246*** | 0.215 | 0.305 | 1.210*** | 0.278 | 0.297 |
| Concurrent elections | 0.017 | 0.161 | | 0.022 | 0.216 | |
| Literacy | 0.194*** | 0.067 | 0.048 | 0.204*** | 0.062 | 0.050 |
| Years since last election | 0.159** | 0.076 | 0.039 | 0.149* | 0.075 | 0.037 |
| Margin of victory | -0.008*** | 0.003 | -0.002 | -0.007** | 0.003 | -0.002 |
| Electorate size | -0.069 | 0.063 | | -0.067 | 0.058 | |
| Business cycle | -0.002 | 0.014 | | -0.003 | 0.013 | |
| Previous turnout | 2.164** | 0.974 | 0.530 | 2.235*** | 0.804 | 0.548 |
| Referendum year | -0.014* | 0.009 | -0.003 | -0.012 | 0.008 | |
| Constant | 25.106 | 16.954 | | 21.593 | 16.641 | |
| R ² | | 0.550 | | | 0.558 | |
| Adj. R ² | | 0.493 | | | 0.596 | |
| White Heroskedasticity Test | F – Stat: 2.144 (p-value 0.015) χ – Stat: 84.91 (p-value 0.137) | | | F – Stat: 1.68 (p-value 0.094) χ – Stat: 85.91 (p-value 0.252) | | |

*p<.10; **p<.05; ***p<.01 White Heteroscedasticity-Consistent Standard Errors

So, why does the estimated coefficient for the “approval quorum” almost become significant at 10% when we move from the binary choice model to OLS? This occurs because, in our dataset, approval quorums exist only in three countries: Denmark, Hungary and Lithuania (in this latter case coupled with a participation quorum). These three countries are rather small and, therefore, receive a low weight in the logit chi-square estimation. In particular, in the eight referendums held in Denmark average turnout was

very high (81%), while the whole sample average is just 57%. As it happens, if a dummy for Danish referendums is included in the OLS estimation, then the coefficient for the approval quorum becomes clearly non-significant (p-value above 0.35), while the coefficient associated with Denmark becomes positive and significant at the 5% level. Therefore, one can conclude the OLS results for the approval quorum rely completely on the case of Denmark, which is downplayed by the logit chi-square estimator.

We performed another robustness check. Given the potential endogeneity problems involved with using *margin of victory*, we re-estimated the models excluding that variable. If we exclude the variable margin of victory, the estimated coefficients and their significance do not change in a relevant way, although the R^2 and the adjusted R^2 drop, as we would expect from dropping a significant variable. The only relevant changes are with the coefficients associated with the participation quorum in Model 1 and with the participation quorum under a “Yes” majority in Model 2, which actually become larger. This result is precisely to be expected according to our model. The model predicts that in the presence of a participation quorum (and, in particular, when the “Yes” option wins) the “No” supporters have an incentive to desert the ballot box and, therefore, the margin of victory of “Yes” increases. By excluding the variable *margin of victory*, its effect is partially captured by the participation quorum variables.

6. Conclusion

Direct democracy is becoming increasingly common in Western democracies (Setälä 1999; LeDuc 2003), public support for referendums is high and arguably rising (Bowler et al. 2007), and there is some theoretical and empirical work showing that direct democracy outcomes are Pareto efficient most of the time (Noam 1980). The institutional design of referendums is, therefore, an issue that is likely to receive more attention from of policy-makers and citizens alike. The existence of quorum rules is one crucial aspect of that design, common to many democracies where referendums and initiatives are constitutionally allowed. Such rules are typically seen as a way of preventing active minorities from imposing their will or even as a way of fostering resistance to change.

However, although these are certainly acceptable goals from a normative point of view, there are good reasons to reject participation quorums as a way to achieve them. Under referendum systems that include only an approval quorum or no quorum at all, voting for one of the options can only increase that option's chance of victory, never decrease it. Yet, the latter is not necessarily the case under rules that impose a participation quorum. Under such rules, if the option for change is more likely to obtain the majority, an individual who supports the status quo and votes for its preservation may actually be contributing to a victory for change, by helping turnout reach the quorum level. Hence, under circumstances of a likely majority for change, a participation quorum induces eligible voters who support the status quo to abstain rather than vote for their preferred option.

Consequently, the participation quorum system displays a bias towards lower turnout. A correct estimation should show that participation quorum systems have, on average, lower turnout than other referendum systems. Our empirical analysis suggests this is precisely the case. Using data on all national referendums held in the European Union countries since 1970, we found that the existence of a participation quorum does have negative effects on turnout, confirming our basic hypothesis. Additionally, we found that such effects take place primarily when the "Yes" option is expected to win.²⁰ The estimated effects not only are statistically significant but also politically relevant. According to our results, the mere existence of a participation quorum may lead to a decrease in the participation rate of 11 percentage points. Of the 99 referendums in our dataset, 40 took place under participation quorum requirements; about half of those had turnout levels below 50%. In several of those cases, the absence of a participation quorum could very well have had contributed to turnout rates exceeding that threshold.

A second set of relevant findings from this paper concerns the other determinants of turnout in referendums. Compulsory voting has a huge positive effect, quite larger than that commonly found for general elections, even among established democracies (Norris 2002). One possible reason for that is the fact that the baseline of turnout in referendums is, in general, below that found in general elections (Blais 2000), causing compulsory voting to produce larger effects. Interestingly, literacy has a positive effect on turnout in

referendums, something that should not necessarily be anticipated, given the modest effect of education on turnout in general elections found in comparative studies using individual-level data (Franklin 2002). However, these results also suggest the possibility that, unlike what occurs in general elections – fought along party lines, where party identification, ideology and incumbency serve as readily available cues for voters – participation in referendums can be quite more demanding in terms of the skills and resources required from voters. It is also comforting to find that several of the other major propositions advanced in the literature about the causes of turnout in other types of elections also seem to hold in the case of the cross-national study of referendums: more competitive referendums and held under conditions less promoting of voter fatigue tend to be characterized by higher levels of turnout. Finally, although this result is less robust across estimation strategies and model specification, the results suggest the possibility of a decline in levels of referendum turnout since the early 1970s, in line with similar findings for first order elections in established democracies (Franklin 2002).

Finally, we also discussed the best econometric methodology to deal with the analysis of aggregate turnout levels. While many hypotheses about turnout are built upon modeling individual decisions, individual observations are often unavailable. But if their aggregated counts are indeed available, as in turnout rates, OLS is not necessarily the best estimation strategy. We argued that Berkson's minimum logit chi-square estimator (based on a binary choice model) is preferable over the more traditional OLS, both for statistical reasons (giving more weight to aggregated counts that represent more individuals) and for theoretical reasons (to match the theoretical model's basic individual-level assumptions with the econometric modeling). As it happens, broadly speaking, both estimations produce similar results, as one would expect from two consistent estimators. The only difference in the results concerns approval quorums. While OLS does not close the door to a theoretically unanticipated positive effect of approval quorums on turnout, this result seems to be due solely to the high participation rates in Danish referendums and is not robust to the estimation choice: the logit chi-square estimation shows no statistically significant effects of approval quorums on turnout, as implied by our model.

Endnotes

¹ John L. Allen Jr., “Cardinal Ruini’s Victory: Low Voter Turnout for In Vitro Referendum is Ascribed to Church’s Political Muscle in Italy,” *National Catholic Reporter*, July 1st 2005.

² See Blais (2000); Dhillon and Peralta (2002); and Fedderson (2004) for discussions of the strengths and weaknesses of the rational-choice approach.

³ Fedderson and Pesendofer (1996) show that, even when voting is costless, electors less informed about the state variable prefer to abstain. In our setup, that fraction of voters can be interpreted as deriving the same utility independent of whether the proposal is defeated or not.

⁴ A similar case could be made for a “non-rejection” quorum, where passing the proposal requires that the percentage of the electorate voting against it is below a certain threshold. Since the implications are basically the same, we do not present them here.

⁵ Again, note that voting “Yes” is even worse, since both probabilities would increase.

⁶ To see this, just consider an extreme case. Assume that there are 10 people eligible to vote, with 5 of them in favor of the proposal, 1 against, and 4 indifferent. Assume that there is a participation quorum that requires the participation of 6 people. Finally, suppose that the person who is against is quite sure (for sake of simplicity, assume that the elector is almost sure) that the 5 supporters will vote yes, and that the 4 indifferent will abstain. In this extreme case, we have $(p_v q_v - p_{nv} q_{nv}) = (1 * 1 - 1 * 0) = 1 > 0$.

⁷ We excluded from the analysis all referendums where political and institutional conditions may have prevented citizens from freely expressing their preferences. For that purpose, we consulted both the Freedom House indexes (Freedom House 2007) and the Polity IV project’s dataset (Marshall et al. 2006), excluding all referendums taking place in countries not rated as ‘free electoral democracies’ or with a value below 8 in Polity’s “Democ” score at the time of the referendum. We also excluded referendums where voters had three or more alternatives. Overall, only ten cases were excluded from the initial selection, leaving us with a total of 99 referendums.

⁸ In coding the “Yes” dummy, in cases where a referendum was held on multiple issues, we coded the variable as 1 only when the “Yes” option prevailed in all issues.

⁹ In our set of cases, only eleven referendums were held under compulsory voting. These include the Greek November 1974 referendum on the form of government (monarchy or republic), all referendums held in Italy until 1993 (the year when compulsory voting was abolished) and the 2005 referendum in Luxembourg on the European Constitution. We created a dummy variable that takes value 1 in those cases and 0 in all the others.

¹⁰ Twelve referendums in our dataset were held concurrently with other elections, including legislative, presidential (in semi-presidential systems) and European Parliament elections. We created a dummy variable that takes value 1 in those cases and 0 in all the others.

¹¹ We take into account all types of national elections, including legislative, presidential (in semi-presidential systems), and European Parliament elections, as well as, of course, other referendums. In the case of two-round presidential or legislative elections, we count time since the second round.

¹² In the cases where referendums were held simultaneously on multiple issues, we selected the smallest absolute value of the difference between the “Yes” and “No” votes.

¹³ Given the huge variation in population size, we use the logarithmic transformation of the population size, measured as the number of registered voters at the time of elections. Source: International IDEA (2007).

¹⁴ We use the average years of schooling in the population aged 25 and over. The data come from the Barro and Lee (2001) dataset and we use the years closest to the referendum date. Data for Luxembourg were not available, so, as in Voitchovsky (2005), the education data of the Netherlands are used for Luxembourg instead.

¹⁵ Measured as the difference between GDP growth rate of the year of the referendum and the average growth rate of the two previous years. Source: IMF World Economic Outlook and Eurostat.

¹⁶ By “first-order” (Reif and Schmitt 1980), we mean the elections upon which the formation of the executive is dependent. In our sample, this means presidential elections in France and legislative elections in the remaining cases. Source: International IDEA (2007).

¹⁷ The choice of the distribution function is quite arbitrary. Another natural choice would be the Normal distribution, but since it does not have a closed form we would have to rely on Taylor approximations.

¹⁸ Simply using $\bar{\sigma}_c^2 = 1/(N_c(\bar{P}_c)(1 - \bar{P}_c))$ is not efficient. Fitted probabilities should be based on a consistent set of parameter values; see Greene (2008).

¹⁹ We also re-estimated the models with a different measurement of concurrent elections, coding the variable with value 1 only for those referendums held concurrently with first order elections. However, this made the number of referendums held concurrently with national first order elections drop to only seven cases and, understandably, the results remained basically the same.

²⁰ Strictly speaking, we can only say that we find such effects when the “Yes” option receives the majority of the votes. So we are implicitly assuming that electors are able to produce accurate forecasts election winners, as suggested by extant research (Lewis-Beck and Skalaban 1989; Lewis-Beck and Tien 1999).

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