Determinants of Electoral Behavior: A Study Using Individual-Level Data

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Abstract

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Previous research on the impact of reforms to the Portuguese electoral system has assessed mechanical effects assuming that the behavior of individuals would remain the same. We improve on this state of affairs by using a rich dataset to study the impact of district magnitude on three relevant decisions made by individuals: the decision to vote or abstain, the decision to vote sincerely or not and the party choice decision. Then, we use our models to predict the effects of four alternative scenarios: uniform-size circles, a reduction of Members of Parliament to 180, a national circle and single-member circles. Besides making contributions to the understanding of how several individual and contextual-level variables shape the voting behavior of the Portuguese, we make four additional contributions in this study. Firstly, we show that the relationship between district magnitude and the probability of abstention is negative and shows diminishing returns. Secondly, we show that the impact of district magnitude on the probability of voting strategically is strikingly similar to its impact on the probability of abstaining. Thirdly, we show that district magnitude plays an important role in shaping the choice of party by individuals. Finally, by using the models estimated we quantify the impact of different types of redistricting on abstention, sincere voting and party choice.

Contents

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1 Introduction

Even though in 40 years of democracy there has not been any significant change in the Portuguese electoral system (with the exception of the reduction of the number of the Members of Parliament from 250 to 230), the electoral reform has been a recurring theme in the Portuguese political agenda and several alternatives have been debated, including a further decrease in the number of Members of Parliament (henceforth MPs) and a transition to a new system that would comprise single-member circles or small multi-member circles with a national circle.

The knowledge of the effects of these alternative scenarios is essential so that they can be assessed strictly. However, research on this topic has focused on the mechanical effects of reforms such as the conversion of votes into seats, assuming that the electoral behavior of electors would remain unchanged if electoral rules changed (e.g. Presidência do Conselho de Ministros (1997) and Freire et al. (2008)). This study is innovative in that it studies what would possibly be the adjustment of the electors' strategies to the change in electoral rules and not the mechanical effects already addressed by these contributions.

Our approach is to first model three relevant decisions made by individuals: the decision to vote or abstain, the decision to vote sincerely or strategically and the party choice decision. With this analysis, we identify the impact of the number of seats assigned to each district (defined by Rae (1971) as district magnitude) on these decisions. Then, we use our results to predict the effects of four alternative scenarios: a scenario where all circles have the same magnitude, a reduction to 180 MPs, a national circle and single-member circles.

Our approach is innovative and the gains from using it are twofold.

First, our analysis does not draw on a cross-national sample, but uses elections taking place in the same country to avoid possible heterogeneity problems from cross-national pooling. Indeed, the design of any electoral reform, albeit supported by comparative studies, should essentially focus on the analysis of the respective countries because the effects of changes in electoral systems depend on the characteristics of the country concerned, such as basic and social cleavages, cultural factors and the national political context (see Hix et al. (2013)). Moreover, cross national studies typically summarize the distribution of district magnitude within the country using only one single value such as the mean which can be very problematic when district magnitude varies a lot within the country (see Monroe and Rose (2002)).

Portugal fits the ideal conditions for this single country analysis since it has a large variation of district magnitude (currently from 2 seats in the electoral circle of Portalegre to

47 seats in Lisbon). Indeed, Monroe and Rose (2002) examined a sample of sixteen countries using districted proportional representation systems and concluded that Portugal is the country with the largest degree of variation in district magnitude. This variation combined with a high nationalization of the party system creates the ideal conditions for this analysis.

Second, our study uses individual-level data, which is the most appropriate type of data when we are interested in studying the behavior of individuals, avoiding ecological fallacies associated to the use of aggregate data (see Robinson (2009)).

Overall, we contribute to the study of an object of high complexity - the reform of an electoral system - and we believe our conclusions will enrich the quality of this debate that has recently gained a fresh prominence with the issuance of a manifesto by a list of thirty "independent figures" with political ties (see Bourbon (2014)). Moreover, the analysis of our controls examines different factors that influence the electoral behavior of the Portuguese, reasserting previous knowledge but also contradicting some conclusions from other studies and illuminating important new aspects.

The rest of this study proceeds as follows. The second section presents a brief overview of the Portuguese electoral system and of the 2002 and 2005 elections. The third section describes the proposals that have been made for an electoral reform. The fourth section describes the dataset. The fifth section explores the decision to vote or abstain, the sixth section explores the decision to vote sincerely or not and section 7 explores the party choice decision. Section 8 concludes.

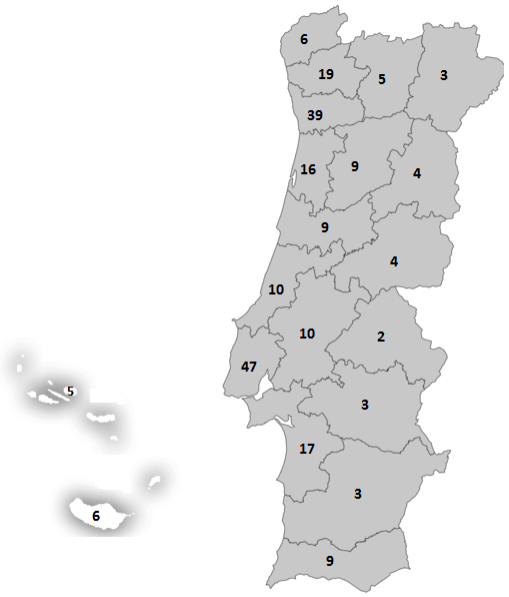
2 Brief Overview of the Portuguese Electoral System and of the 2002 and 2005 Elections

Given that our study uses Portuguese data for the 2002 and 2005 elections, it is informative at this point to summarize some of the relevant characteristics of the Portuguese electoral system and of these elections that are important to the understanding of our study's methodology and results.

Since the original drafting of the 1976 Constitution, Portugal has used a proportional representation system. Electors vote in the electoral circle where they are registered. Candidates must be presented in party lists and electors vote in one and only one of the lists presented by the political parties, with no possibility for preferential votes to be expressed (closed lists). Votes are then converted into seats in each electoral circle using the D'Hondt formula and there are no electoral thresholds. Candidates are elected according to the votes received by their party and according to the order in which their name appears in the party list.

There are two two-member districts for Portuguese citizens living abroad and the remaining 226 legislators are elected in twenty electoral circles with a magnitude that currently ranges from 2 in the district of Portalegre to 47 in Lisbon (see Figure 2.1). In 2002, district magnitude ranged from 3 in Portalegre to 48 in Lisbon; in 2005, it ranged from 2 in Portalegre to 48 in Lisbon.

Figure 2.1: District Magnitude in Portugal



Source: Official Gazette 1st Series A - Number 71-11/04/2011

The two major parties are the center-left Socialist Party (PS) and the center-right Social Democratic Party (PPD-PSD). There are also three minor parties that hold seats: a communist-green alliance (CDU), a conservative party (CDS-PP) and a relatively new left party, the "Left Block" (BE).

Given that our dataset covers the elections of 2002 and 2005, we also present a brief summary of these elections.

The 2002 election took place after the resignation of the former Socialist Prime-Minister António Guterres, following a defeat of PS in the local elections. A right-wing coalition between PSD and CDS-PP came to power with the PSD leader Durão Barroso as Prime Minister.

The 2005 election was won by PS, which obtained its first absolute majority in Parliament, and took place after the decision of President Jorge Sampaio of dissolving the Parliament due to to the political instability caused by the government led by Pedro Santana Lopes (PSD) in coalition with the CDS-PP. Pedro Santana Lopes had become Prime-Minister after Durão Barroso left the country in order to become President of the European Commission.

The national level results of these two elections are presented in Table 2.1.

Table 2.1: 2002 and 2005 Elections: National Level Results

	2002	2005
BE	2.7%	6.4%
CDS-PP	8.8%	7.3%
CDU	6.9%	7.5%
PPD-PSD	40.2%	28.8%
PS	37.8%	45.0%
Other	1.6%	2.1%
Blank	1.0%	1.8%
Null	1.0%	1.1%
Abstention	*38.5%*	*35.7%*

Source: Official Gazette 1st Series A - Number 77-2/04/2002 and Number 47-8/03/2005

3 Proposals for an Electoral Reform

As in other countries, the electoral reform has been a recurring theme in the Portuguese political agenda.

The first wave of proposals occurred in the second half of the 1980s and regarded a change to a system of majority representation that would privilege governability at the expense of proportionality. These proposals emerged as Portugal had five legislative elections between December 1979 and July 1987, which is around an election every 18 months. However, these proposals were no longer discussed after the emergence of absolute majorities of one party between 1987 and 1995 and between 2005 and 2009.

More recently, the discussion shifted to two main points (see Freire et al. (2008)).

First, the divergence of positions concerning the optimal number of MPs has been a controversial aspect. The original text of the Portuguese Constitution has set up a number of MPs that could vary between 240 and 250, and the ceiling was chosen due to concerns about proportionality. In 1989, concerns with the governability of the system created by political instability led to a constitutional revision that reduced the number of MPs to a minimum of 230 and a maximum of 235. This time the minimum was chosen. In 1997, the constitutional revision reduced the number of MPs to a minimum of 180 and a maximum of 230, and the ceiling was chosen. This sequence of events led to the ever-recurring question of whether Portugal has an excessive number of MPs or not.

In 2007, PSD proposed a decrease in the number of MPs to 181 for reasons related to the dignity and efficacy of parliamentary work (Guedes et al. (2007)). However, this proposal was rejected by BE, CDS-PP, PCP and PS. These parties have argued that, from a comparative perspective with other EU countries, Portugal does not have a high number of MPs and a reduction could have negative consequences on the proportionality of the system since it would decrease average district magnitude (see Freire et al. (2008)). Recently, the PS leader said that he will propose reducing the number of MPs to 180 by September 15 (JN (2014)).

Second, the debate has focused on the transition to a system that favors a greater proximity between the elected and the electorate, ensuring a greater accountability of MPs and increasing the levels of electoral participation. Two main proposals have been made in this area.

One solution, advocated by PS and PSD, is a transition to a new system that would comprise single-member circles with a national circle (Rodrigues et al. (2002) and Guedes et al. (2007)). Single-member circles would permit a better knowledge of the elected by the electorate and the implied distortions in proportionality would be compensated by a

national circle.

This proposal has been subject to criticism, in particular due to the disadvantages associated to single-member constituencies (see VV.AA. (1998a)). First, single-member districts can lead to a logic of localism and clientelism in the political competition: the political discussion would give much more prominence to local problems and MPs would give more emphasis to the satisfaction of the interests of the constituents of the circle by which they were elected than to the interests of the country. Second, there is the risk that this system would lead to a bipolarization since in these circles only a party can win and therefore the chances of victory would, in general, be focused on the two major parties (e.g. VV.AA. (1998b) and VV.AA. (1998c)). As pointed out by Teixeira (2009) one could expect the introduction of single-member circles "to increase further the effects of the so-called strategic voting" since the electors would be "forced" to vote in one of the two major parties.

Given these shortcomings of single-member circles, Freire et al. (2008) have proposed a system that combines a national circle with multi-member circles of low or medium magnitude (3-10 seats). This proposal was object of a considerable debate since it was known and, in December 2008, PS organized a Parliamentary Conference in the National Assembly with the participation of the authors and various experts that has not led to any reform.

Thus, in 40 years of democracy, there has not been any considerable change in the Portuguese electoral system with the exception of the reduction of the number of MPs from 250 to 230. Inter-party divisions have contributed to the failure of reforms but there is also a "fear of the unknown" (Katz (2005)) since any reform is associated with a high level of uncertainty regarding its effects. The knowledge of the effects of these alternative scenarios is essential so that they can be assessed strictly and this fear is reduced. This study intends to contribute to the enrichment of this debate by studying what would possibly be the adjustment of the electors' strategies to the change in electoral rules.

Before delving into the empirical analysis, next section gives an overview of the data used to conduct it.

4 Data

We have built a database that consists of a merger of three different datasets.

Firstly, as individual level data we use survey data from the election study for 2002 and 2005 coordinated by ICS-UL (Social Sciences Institute of the University of Lisbon). The data is based on a random probability sample of eligible voters and includes electoral behavior of 2801 individuals in these years as well as several other variables such as sociodemographic measures. Secondly, the data on district magnitude was obtained in the Official Gazette. Finally, data on the rain was obtained in the Portuguese Weather Institute (IPMA).

Our dataset does not cover four electoral districts: Madeira and Azores (which are not in mainland Portugal), Europe (the district for the Portuguese citizens living abroad in Europe) and Outside Europe (the district for the Portuguese citizens living abroad but not in Europe) because individual-level data is not available.

Almost all variables in the raw data have missing values. On average, the missing percentage is equal to 6.8%, which is a relatively small number, for example comparing with the percentages reported by Lee and Kang (2009), which lie between 10% and 20%. We have removed all observations with any missing value. Respondents who do not know the answers or refused to answer are coded as missing.

In each part of this study, we will present appropriate descriptive statistics according to the particular decision that we will be analyzing. We present, however, descriptive statistics for three demographic variables that are used throughout our analysis (gender, age and region) and compare them with the Census 2001 information (Figures 4.1, 4.2 and 4.3). We also break down our dataset by district magnitude (Table 4.1).

Figure 4.1: Gender: Comparison of Census 2001 Information with Sample Proportions

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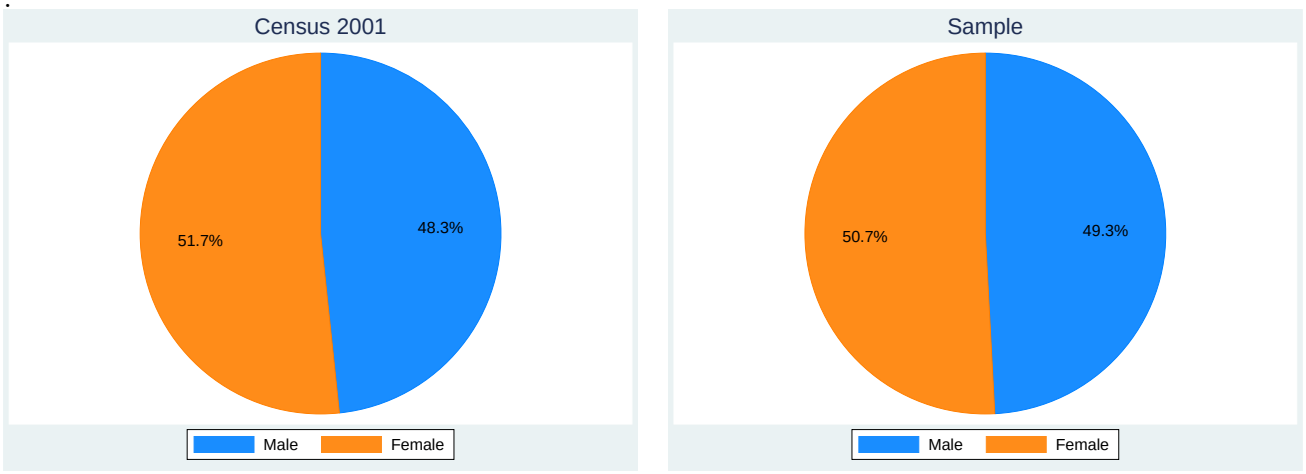

Source of Census 2001 Data: Statistics Portugal - Data for the Mainland.

Figure 4.2: Age: Comparison of Census 2001 Information with Sample Proportions

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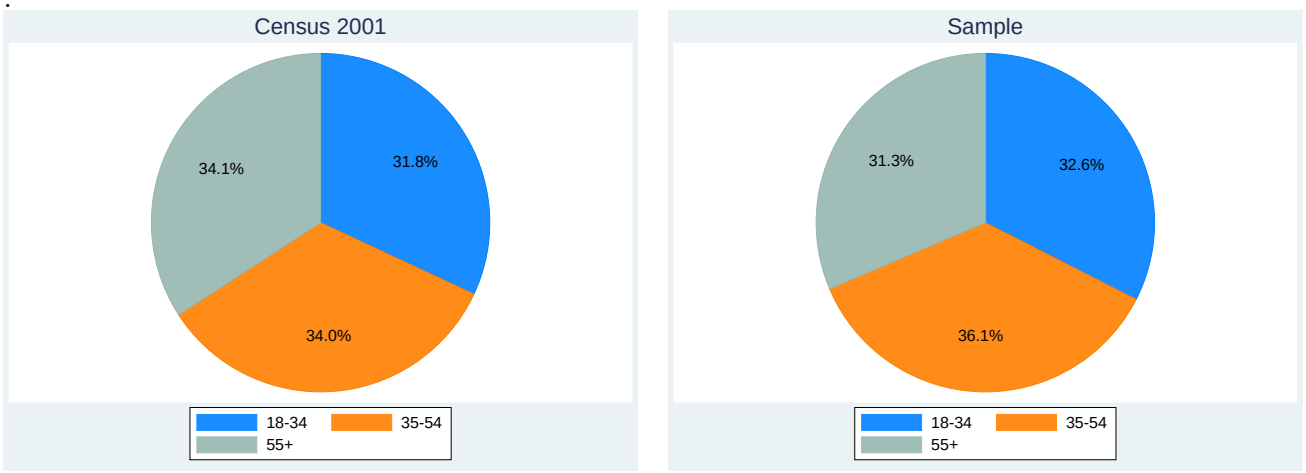

Source of Census 2001 Data: Statistics Portugal - Data for the Mainland.

Figure 4.3: Regions: Comparison of Census 2001 Information with Sample Proportions

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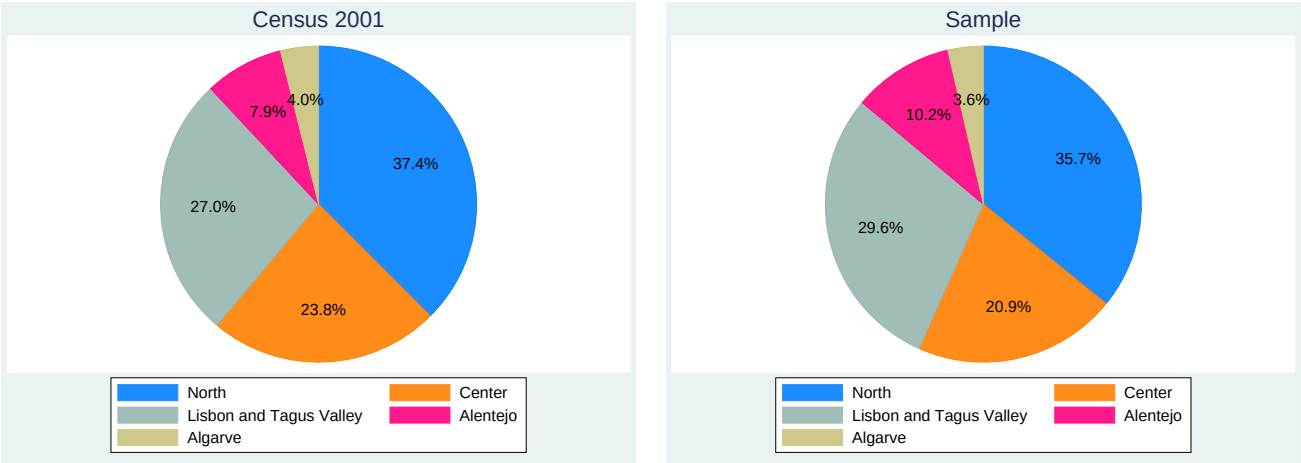


Source of Census 2001 Data: Statistics Portugal - Data for the Mainland.

Table 4.1: District Magnitude Frequencies in the Sample

	District Magnitude														
	2	3	4	5	6	8	9	10	15	17	18	38	48	Missing	Total
Total	3	87	81	125	93	95	87	333	199	227	328	424	553	166	2801

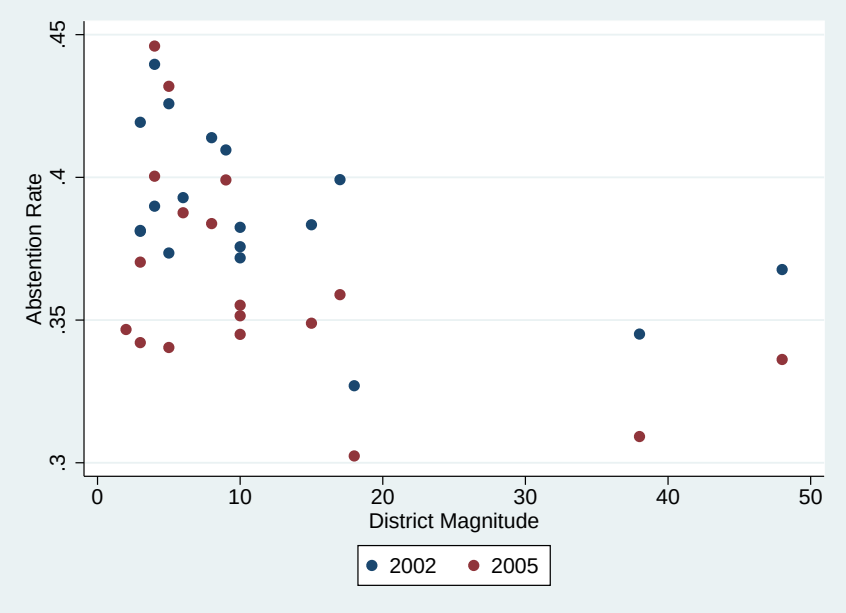
5 Vote/Abstain Decision

5.1 Introduction

The reforms to the electoral system that have been proposed imply a change in the dimension of electoral circles. This section aims to understand the consequences on electoral participation that might result from this resizing.

Our plan to achieve this goal is as follows. First, we aim to understand the way in which district magnitude affects (or not) turnout. A first glance at aggregate data for 2002 and 2005 indicates a negative relationship between these variables (see Figure 5.1), but we are not controlling for other variables that might be influencing this relationship. For a proper test, we model the individual decision of voting or abstaining including district magnitude as an explanatory variable to determine its relevance for this decision. Second, we make predictions for different electoral scenarios to show the importance of this effect in a possible resizing of electoral circles.

Figure 5.1: Abstention Rate by District Magnitude (Aggregate Data for the Mainland)



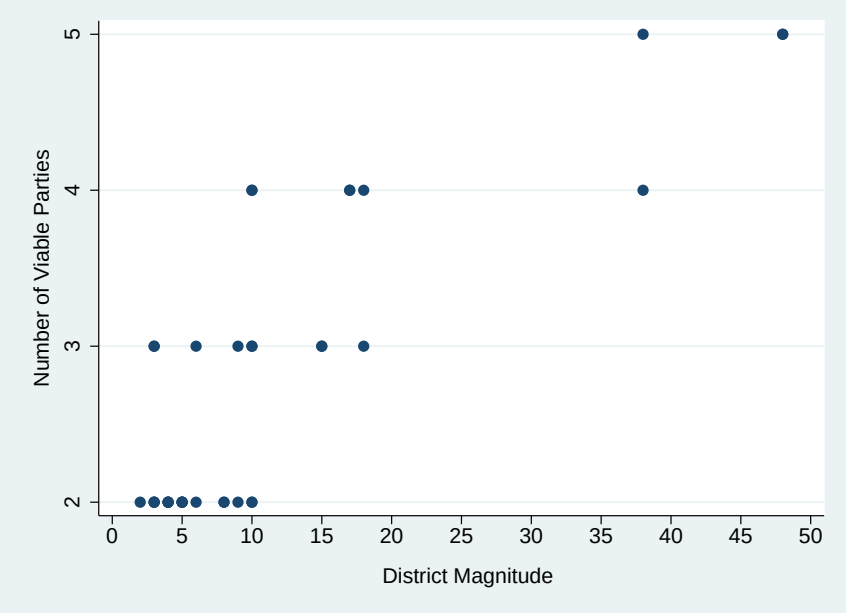
Source: Official Gazette 1st Series A - Number 77-2/04/2002 and Number 47-8/03/2005

5.2 Literature Review

For decades, the idea that higher district magnitude encourages voter participation has been an established rule in the study of electoral behavior (e.g., Powell Jr (1986) and

Jackman (1987)). The argument is that large districts have more parties with electoral chances of winning at least one seat and this provides the voter with an expanded choice set, increasing the probability that one of the parties is a good match for him or her and thereby decreasing the likelihood that none of the options is satisfactory (e.g. Cox (1997) and Blais (2006)). For this reason, almost all research finds higher district magnitude to be a key determinant encouraging voter turnout. Indeed, for Portugal, as Figure 5.2 shows, there is a positive relationship between district magnitude and the number of viable parties[1]. This provides voters with more viable choices in larger districts, potentially decreasing abstention.

Figure 5.2: Number of Viable Parties and District Magnitude (2002 and 2005)



Source: Official Gazette 1st Series A - Number 247-22/10/1999 and Number 77-2/04/2002

However, in recent years, this positive relationship between turnout and district magnitude has been challenged. Brockington (2004) finds that when the number of viable parties is higher, the creation of coalition governments and the increased complexity of the decision making environment may depress turnout. Taagepera et al. (2013) showed that there are two opposite forces - greater likelihood of finding a party close to one's preferred position and increased complexity of choice - that push in opposite directions as district magnitude increases. Cunow (2013) finds that voters may find themselves overwhelmed by choice and unable or unwilling to make choices when presented with many options.

[1]We define a viable party as a party that gained at least one seat in that district in the previous election.

Moreover, recent studies conclude that a large part of the empirical research can be challenged on methodological grounds (e.g. Monroe and Rose (2002) and Blais and Aarts (2006)). These studies point out that most of the research uses the country as the unit of analysis, combines presidential and legislative elections, does not control for the type of electoral system and summarizes the distribution of district magnitude within the country using one single value such as the mean or the median, which may be problematic when district magnitude varies largely within the country. Powell Jr (1986), Jackman (1987), Jackman and Miller (1995) and Pérez-Liñán (2001) use a variable called "nationally competitive election districts" that combines electoral formula and district magnitude: "countries with national elections by proportional representation or a national pool for some legislative districts or a simple national presidential vote are assigned a score of four; those with proportional representation in large districts receive a score of three; countries with proportional representation and three to five members per district are scored two; and countries with single-member or winner take-all districts receive the lowest score of one" (Jackman (1987)). This implies that for example Portugal, where district magnitude ranges currently from 2 to 47, would be considered either a two or a three in this classification, not fully reflecting its electoral system. Blais and Aarts (2006) also consider that, for example, Spain receives "a dubious score of 3".

Furthermore, in a proper test of the influence of district magnitude on abstention it is necessary to control for individual-level characteristics to avoid ecological fallacies (see Robinson (2009)). Thereby, in this study we will analyze the impact of district magnitude at the individual-level, taking advantage of the fact that we are able to examine the behavior of electors of the same country who ought to have similar characteristics (assuming those characteristics are based on the variables we control for) in different districts with different magnitudes. And Portugal is a particularly well-suited case given that district magnitude varies considerably over a meaningful range of values.

To our knowledge, there are very few empirical studies on the impact of district magnitude on turnout that use individual-level data. One exception is the study of Jacobs and Spierings (2010) that includes 32 districts of Dominican Republic and concludes that district magnitude has a highly significant and negative effect on voter turnout. The authors argue that this negative effect is caused by the stronger influence of clientelism in smaller districts (politicians grant economic benefits such as the provision of pork-barrel benefits in exchange for the vote or support of an individual).

For Portugal, to our knowledge there are several articles that use individual-level data to study the impact of several variables on abstention (Magalhães (2001), Freire and Magalhães (2002b), Viegas and Faria (2002) and Freire et al. (2007)) but they do not test

the impact of district magnitude and use methodological and modeling choices that differ from the ones in our analysis.

In sum, the impact of district magnitude on electoral turnout is not as well established in research as it was some years ago and to our knowledge it has not yet been assessed for Portugal. Because of the above-mentioned contradictory effects, it is not clear whether we should expect the impact of district magnitude on turnout to be positive, negative, or nonexistent. We use our rich database with individual-level data to make a contribution to this debate and use our results to make predictions for alternative electoral scenarios.

5.3 Method

Our dependent variable is a binary variable that indicates whether the respondent has abstained or not, which was constructed based on the answers given to the questions about whether the individuals voted or not in the 2002 and 2005 elections.

What we want to study is the individual decision to abstain or not. (5.1) summarizes the individual decision process:

$$Abstention = \begin{cases} 1 & if\ Absention^* > 0 \\ 0 & otherwise \end{cases} \tag{5.1}$$

The zero threshold is a normalization and it has no consequence since our vector of regressors will include an intercept. $Abstention^*$ is unobservable and we assume that it is linear so that it satisfies the following model:

$$Abstention^* = x'\beta + \upsilon \tag{5.2}$$

where x includes the independent variables, β is a vector of regression coefficients and υ is the error-term. For this reduced form, the probability that the individual abstains is given by:

$$Pr(Abstention = 1) = Pr(x'\beta + \upsilon > 0) = Pr(\upsilon > -x'\beta) \tag{5.3}$$

Assuming that υ follows a logistic distribution, (5.3) becomes:

$$Pr(Abstention = 1) = \Lambda(x'\beta) \tag{5.4}$$

where $\Lambda(.)$ is the logistic cdf with:

$$\Lambda(z) = \frac{e^z}{1 + e^z} \tag{5.5}$$

The model is estimated by maximum likelihood (logit), with inference based on cluster-robust standard errors, clustered by individual.

As independent variables, we use both individual-level variables and context-level variables. Individual-level variables are divided into four categories: individual characteristics, institutional involvement, political variables and position towards issues. As context-level variables, we use district magnitude, data on the rain in the district capital, a time dummy, a measure of urbanization and regional dummies. Table A.1, in the appendix, includes a detailed description and descriptive statistics of all variables. We follow the approach of Jacobs and Spierings (2010) and include as a regressor at the individual level the difference between aggregate turnout figures and the reported turnout in each district to counter for over-reporting at district level.

Next section presents descriptive statistics.

5.4 Descriptive Statistics

For both years, the proportion of abstainers in the sample is substantially lower than in the official results (see Table 5.1), in line with what is common in election surveys (Selb and Munzert (2013)).

Table 5.1: Abstention Rates: Comparison of National Results in the Mainland with Sample

	National Results	Sample
2002	37.4%	21.3%
2005	34.6%	18.7%

Source of National Results: Official Gazette 1st Series A - Number 77-2/04/2002 and Number 47-8/03/2005

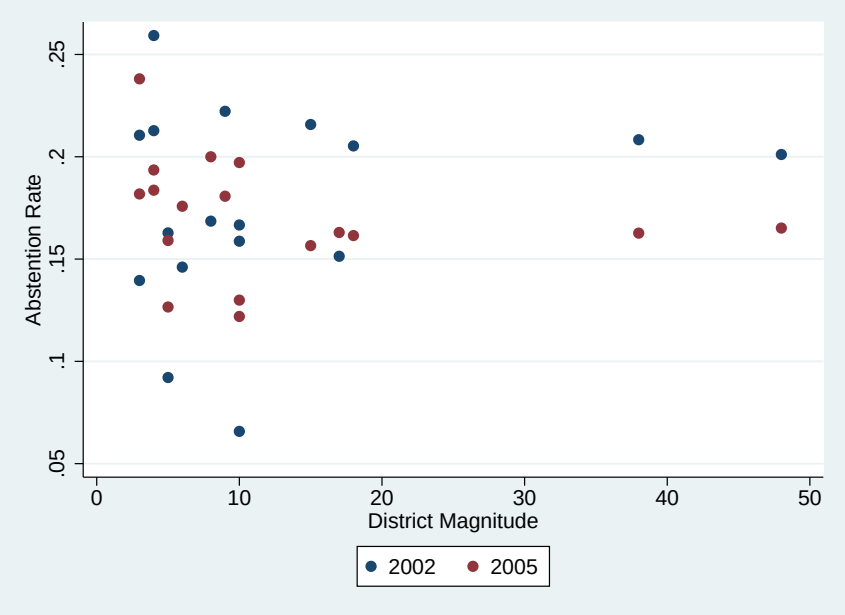
Table 5.2 breaks down abstention rates by individual's closest party. In 2002, the largest abstention rate is the one for individuals reporting feeling close to BE. For 2005, the largest rate is the one for individuals reporting not feeling close to any party.

Table 5.2: Abstention Rates by Closest Party

	BE	CDS-PP	CDU	PPD-PSD	PS	Other	None
2002	28.0%	17.9%	12.7%	13.0%	14.0%	9.8%	26.6%
2005	19.8%	8.6%	8.3%	15.6%	9.7%	12.7%	24.1%

Figure 5.3 breaks down abstention rates by district magnitude in 2002 and 2005.

Figure 5.3: Abstention Rates by District Magnitude in Sample



Note: This graphic uses sample proportions. National results are presented in Figure 5.1. The observations for Portalegre are not included in this graphic because the abstention rate in both years is equal to 66.67%, which requires a large extension of the y-axis, reducing the clearness of the results for the other districts.

Next section determines the best specification for the functional form of district magnitude.

5.5 District Magnitude Functional Form

The common specification of district magnitude in the literature is a logarithmic one. This specification of functional form allows for some nonlinearity in the marginal effect of district magnitude on abstention, meaning, for example, that we should expect a lower impact when district magnitude changes from 25 to 26 when compared to the impact of changing it from 5 to 6.

However, given the recent theories that recognize that there are opposite forces affecting turnout as we increase district magnitude, we start with a more general specification that allows the relationship between abstention and district magnitude to show a reversal by including both the logarithm of district magnitude and its inverse (Model 1). Then, we test two other specifications: including only the inverse of district magnitude (Model 2) and the commonly used logarithmic specification (Model 3). This allows us not to impose a functional form *a priori* but rather to choose the one that best fits the data.

Instead of the logarithm of district magnitude, we use the logarithm of district magnitude plus one because we will use our model to make predictions for districts of dimension one, as this possibility incorporates one of the electoral reforms proposed for the Portuguese system (Rodrigues et al. (2002) and Guedes et al. (2007)). The impact of this methodological choice is analyzed in the Sensitivity Analysis section.

The estimates for district magnitude obtained with the estimation of these three models[2] are presented in Table 5.3.

Table 5.3: Logit Estimates- Models 1-3

	Model 1		Model 2		Model 3	
lnM	0.176	(0.457)	—	—	-0.332*	(0.195)
1/lnM	3.116	(2.529)	2.240**	(1.072)	—	—

N=1728. * p<0.1; ** p<0.05; *** p<0.01.
Cluster-robust standard errors are in parentheses. Control variables are omitted.

To choose between Models 1-3, we compute three measures that weight both the fit and the parsimony of the model: the Akaike's information criterion (AIC), proposed in Akaike (1998), the Schwarz's Bayesian information criterion (BIC), proposed in Schwarz et al. (1978) and McFadden adjusted pseudo-r^2 (McFadden (1974)).

The AIC is given by:

$$AIC = -2ln\mathscr{L} + 2q \tag{5.6}$$

where q is the number of parameters and $ln\mathscr{L}$ is the maximized log-likelihood.

The BIC is given by:

$$BIC = -2ln\mathscr{L} + ln(n)q \tag{5.7}$$

[2]STATA 12.0 is used to implement these models as well as all the statistical analysis throughout this thesis.

where n is the number of observations.

McFadden adjusted pseudo-r^2 is given by:

$$r^2_{adj} = 1 - \frac{ln\mathscr{L}_{full} - q}{ln\mathscr{L}_{intercept}} \tag{5.8}$$

where $ln\mathscr{L}_{full}$ is the maximized log-likelihood of the full model and $ln\mathscr{L}_{intercept}$ is the one of the intercept-only model.

Results for these three measures are presented in Table 5.4.

Table 5.4: AIC, BIC and McFadden Adjusted Pseudo-r^2 - Models 1-3

	Model 1	Model 2	Model 3
AIC	1349.92	1348.12	1350.05
BIC	1584.47	1577.22	1579.15
McFadden Adjusted Pseudo-r^2	0.064	0.066	0.064

Model 2 presents the lowest AIC and BIC and the highest McFadden adjusted pseudo-r^2 and therefore we choose it to pursue our analysis. Next section presents the estimates obtained for the whole model.

5.6 Results

The results from the estimation of Model 2 are presented in Table 5.5.

Table 5.5: Abstention Logit Estimates

Individual -Level Variables		
Individual Characteristics		
Age	-0.082**	(0.035)
Age2	0.001**	(0.000)
Male	0.069	(0.193)
Income (Ref=0€-300 €)		
301€-750€	-0.795	(0.537)
751€-1500€	-1.007*	(0.555)
1501€-2500€	-0.835	(0.581)
>2500€	-1.356**	(0.625)
Education (Ref=None or primary)		
Basic	0.528*	(0.302)
Secondary	0.479*	(0.289)
High or postgraduate	-0.046	(0.359)
Married	0.155	(0.236)
Nº minors in the house	-0.102	(0.120)
Catholic	-0.193	(0.312)
Unemployed	-0.202	(0.334)
Public worker	-0.601**	(0.279)

Institutional Involvement		
Church attendance (Ref=Never)		
Once a year	-0.602*	(0.313)
2-11x a year	-0.257	(0.280)
1x or more a month	-0.686**	(0.314)
Once a week or more	-0.803**	(0.336)
Trade union member	-0.523*	(0.302)
Political Variables		
Close to a party (Ref=PS)		
BE	0.718	(0.440)
CDS-PP	0.631	(0.489)
CDU	0.055	(0.482)
PPD-PSD	0.363	(0.343)
Other	-1.641	(1.102)
None	0.842***	(0.257)
Informed about politics	-0.694**	(0.317)
Position towards issues		
Wealth inequality	0.073***	(0.028)
Taxes	0.034	(0.035)
Government decision making	0.017	(0.029)
Context-Level Variables		
1/lnM	2.240**	(1.072)
Rain	-0.013	(0.022)
2005	-0.379	(0.254)
Urbanization (Ref=Rural area or village)		
Small or middle-size town	-0.189	(0.265)
Suburbs of large town or city	0.044	(0.314)
Large town or city	0.396	(0.299)
Regional Dummies (Ref=North)		
Center	-0.510	(0.314)
Lisbon and Tagus Valley	-0.219	(0.272)
Alentejo	-0.741*	(0.396)
Algarve	-0.086	(0.603)
Correction	-5.905***	(1.656)
Intercept	1.772	(1.285)

N=1728. * p<0.1; ** p<0.05; *** p<0.01. Cluster-robust standard errors are in parentheses.

Before we proceed to the interpretation of coefficients, next section assesses more deeply the model fit and diagnoses potential problems.

5.7 Model Diagnosis

Firstly, the log-likelihood chi-square test for global significance indicates that the model as a whole is statistically significant with $p < 0.0001$.

Secondly, we compare predicted outcomes with actual outcomes to assess the fit of the model. Using the estimated model, we predict whether an individual abstains or not setting the following:

$$\hat{Abstention} = \begin{cases} 1 & if\ \Lambda(x'\hat{\beta}) > 0.5 \\ 0 & if\ \Lambda(x'\hat{\beta}) \leq 0.5 \end{cases} \tag{5.9}$$

The percentage correctly classified is equal to 85.59%. Note, however, that as most of the sample has $Abstention = 0$ (80.04%), then it is likely that $\Lambda(\hat{x'\beta}) \leq 0.5$ and hence $\hat{Abstention}$ =0 for most of the observations. Indeed, the model predicts that $Abstention = 0$ for 98.67% of the observations. This makes the specificity (the fraction of observed $Abstention = 0$ cases that are correctly classified) very high (99.39%) and the sensitivity (the fraction of observed $Abstention = 1$ cases that are correctly classified) very low (5.51%).

Hence, more generally, a range of cutoff values may be considered. Figure 5.4 plots the sensitivity and specificity values by probability cutoff (c). The point that maximizes their sum is $c = 0.140$, which leads to a percentage correctly specified equal to 65.10%.

Figure 5.4: Sensitivity and Specificity by Probability Cutoff

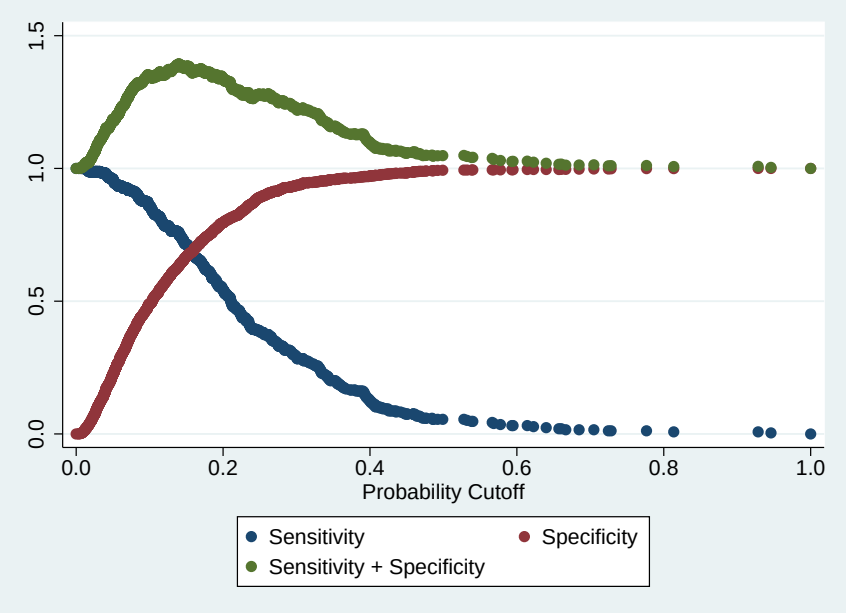
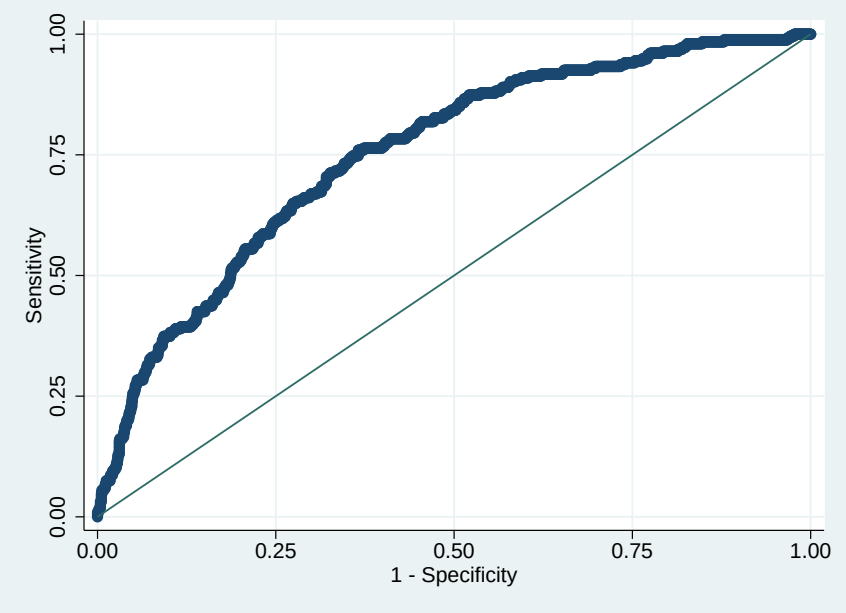


Figure 5.5 plots the receiver operating characteristics curve, which plots sensitivity versus one minus specificity as the probability cutoff varies. A model with no predictive power would be a 45^o line. The greater the predictive power the more bowed the curve. The area below the curve is used as a measure of predictive power that ranges from 0.5 (no predictive power) to 1 (perfect model). For our model, the area is equal to 0.7515.

Figure 5.5: Receiver Operating Characteristics Curve



Thirdly, we conduct the Lagrange multiplier test of generalized logit (Stukel (1988)) to test for model misspecification. We consider as an alternative to the logit model the generalized h-family logit model

$$\Lambda_\alpha(x'\beta) = \frac{e^{h_\alpha(x'\beta)}}{1 + e^{h_\alpha(x'\beta)}} \tag{5.10}$$

where $h_\alpha(x'\beta)$ is a strictly increasing nonlinear function of $x'\beta$ indexed by the shape parameters α_1 and α_2 that control, respectively, the heaviness of the tails and the symmetry of the function $\Lambda_\alpha(.)$. To test for departure from the logit in the direction of an asymmetric h-family, we add the regressor $(x'\hat{\beta})^2$ and use a Lagrange multiplier test to test whether this regressor significantly improves the fit of the model. The null hypothesis of correct model specification is not rejected because the test for the added regressor yields a $\chi^2(1)$ statistic of 0.0 with $p = 0.4622$.

Fourthly, we perform the Hosmer and Lemeshow's goodness-of-fit test (Hosmer and Lemesbow (1980)). We compare the average predicted probabilities $n^{-1}\sum \Lambda(x'\hat{\beta})$ with the sample frequency $\bar{y}$ within groups based on the quantiles of the ordered predicted probabilities. Let $\bar{\hat{p}}_g$ and $\bar{y}_g$ denominate, respectively, the average predicted probability and sample frequency in group g. The test statistic is given by:

$$\sum_{g=1}^{G} \frac{(\bar{\hat{p}}_g - \bar{y}_g)^2}{\bar{y}_g(1 - \bar{y}_g)} \tag{5.11}$$

Under the null of correct specification, the statistic is distributed as χ^2_{g-2}. Even though the choice of the number of groups is arbitrary, a common practice is to have 10 groups[3]. We follow this practice and obtain $p = 0.3220$. Therefore, we do not reject the null of correct model specification.

Finally, we test for collinearity problems. The model takes six iterations to converge which is a signal that there is not a high degree of multicollinearity. Then, we compute two interrelated collinearity diagnosis measures: the variance inflation factor and the tolerance, given by:

$$VIF = \frac{1}{tolerance} \tag{5.12}$$

$$tolerance = 1 - r_j^2 \tag{5.13}$$

where r_j^2 is the coefficient of determination of a regression of regressor j in all the other regressors. Results are presented in the first two columns of Table A.2, in the appendix. Only for age and its squared is the VIF larger than rule-of-thumb's[4] 10 value and is the tolerance less than 0.1. This is not problematic, as we can solve it by centering squared age. Therefore, if we use $(age - mean\ age)^2$ instead of age^2, VIF and tolerance become lower than the critical thresholds, as presented in the third and fourth columns of Table A.2, in the appendix, and the coefficients and the standard errors of the other variables (except the constant) remain the same.

Overall, results validate the adequacy of our model. In the next section, we interpret the coefficients obtained.

5.8 Interpretation of Results

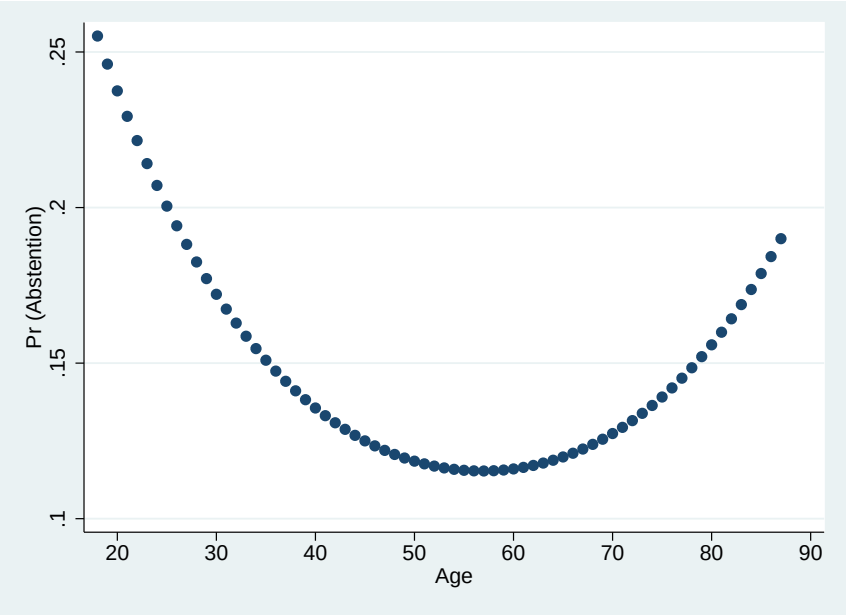
Even though our main focus is on the impact of district magnitude, we start with a brief overview of the results obtained for the rest of the model to assess whether the model is performing as expected in most of its variables and to give a picture of the typical reasoning behind the decision to vote or abstain. Then, we interpret the results for district magnitude.

[3]See Archer et al. (2007).
[4]See Neter et al. (1996).

5.8.1 Controls

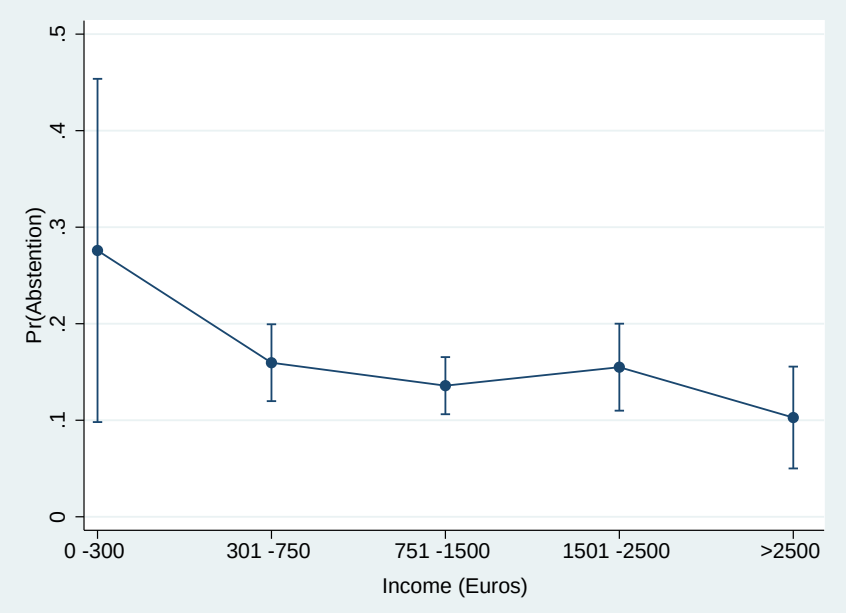
Regarding the impact of age, results show a curvilinear relationship between age and abstention, with a negative significant effect of age on abstention and a positive significant effect of age squared, in line with international studies (see Smets and Van Ham (2013)). Hence, as Figure 5.6 shows, abstention is predicted to decrease with age at a decreasing rate and to have a reversal when age is around 60. Freire and Magalhães (2002b), Viegas and Faria (2002) and Freire et al. (2007) also found a negative relationship between age and abstention for Portugal, but the possibility of a curvilinear relationship was not tested.

Figure 5.6: Mean Predicted Pr(Abstention) and Age



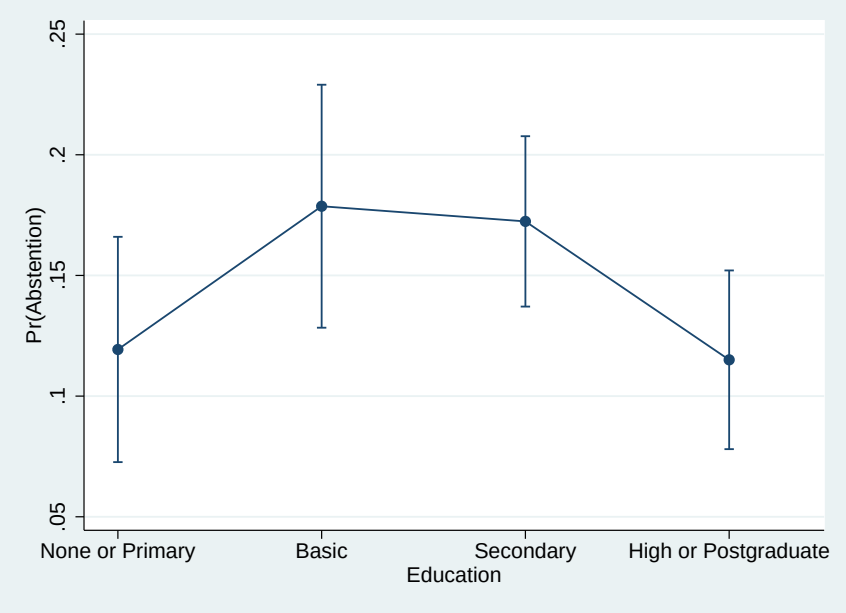
Individuals with income between 751€ and 1500€ and more than 2500€ are less likely to abstain than those with income between 0€ and 300€. Figure 5.7 shows the average predictions for each income class. This negative relationship between income and abstention is in line with international studies (see Smets and Van Ham (2013)). For Portugal, Magalhães (2001) concluded that, for 1999, this variable is not significant, but this variable was treated as continuous, not exploring non-linear effects.

Figure 5.7: Predictive Margins for Income with 95% Confidence Level



Regarding the educational attainment variables, results show that the probability of abstaining is higher for individuals with basic or secondary education when compared with individuals with no education or primary education. For individuals with high or post-graduate education, the difference is not statistically significant for a significance level lower than 10%. Figure 5.8 shows the average predictions for each education class. These results go against our expectation that the more educated people are the less they abstain. One possible explanation for this result is that people with more education perceive better that their vote has a very little influence over the election outcome. This result explains why turnout levels have not raised in advanced western democracies despite the rise of educational attainment levels (Burden (2009)).

Figure 5.8: Predictive Margins for Education with 95% Confidence Level

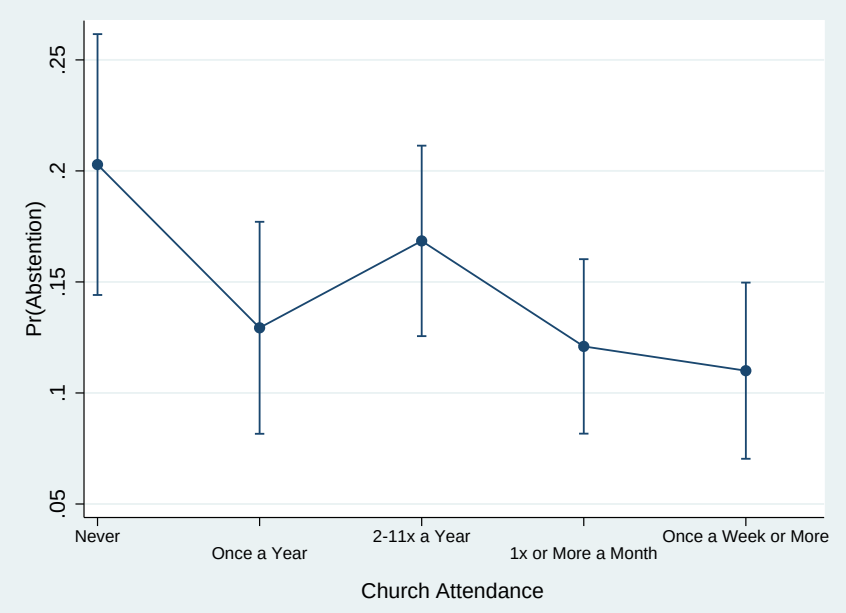


For Portugal, Magalhães (2001), Viegas and Faria (2002) and Freire et al. (2007) found that educational attainment is not significant to explain abstention and Freire and Magalhães (2002b) found a negative relationship. However, this variable is treated as continuous, not looking into non-linear effects.

Public workers are potentially more affected by the decisions taken by the government. So, as expected, we estimate that they are less likely to abstain: we estimate that the probability of abstaining is 0.059 points lower. This is directionally in line with the results of Corey and Garand (2002) for the US. For Portugal, this variable was not included in the above-mentioned studies.

Attendance of church has, in general, a negative statistically significant impact on the probability of abstaining (Figure 5.9 shows the average predictions for each category). This result was to be expected since attendance of religious services builds civic skills that are thought to promote civil commitment and stimulate political participation (Gerber et al. (2008)). This result is in line with international studies (see Smets and Van Ham (2013)) and with the conclusions of Viegas and Faria (2002) for Portugal. In the latter study this variable is treated as continuous, not exploring for non-linear effects.

Figure 5.9: Predictive Margins for Church Attendance with 95% Confidence Level



Also, our findings indicate that belonging to a trade union has explanatory power. We estimate the probability of abstention to be lower for trade union members in 0.052 points. This was expected since unions emphasize values that are thought to mobilize citizens (Radcliff and Davis (2000)) and this conclusion is in line with the results for Portugal obtained by Freire and Magalhães (2002b), Viegas and Faria (2002) and Freire et al. (2007). Most international studies do not find a statistically significant effect for this variable (see Smets and Van Ham (2013)).

Of the political variables, individuals that report not being close to any party are more likely to abstain than those that report being close to PS. Previous studies, both national (Magalhães (2001), Freire and Magalhães (2002a), Viegas and Faria (2002) and Freire et al. (2007)) and international (see Smets and Van Ham (2013)), have already found a positive impact of not being close to any party on abstention. Being more informed decreases the probability of abstention, in accordance with international studies (see Smets and Van Ham (2013)).

Of the position towards issues variables, results show that the more individuals believe that there should be more incentives for individual initiative, instead of a more equal distribution of wealth, the more they abstain. This result is in line with our expectations, since the less people attribute an important role to the government, the more they abstain (in line with other studies, e.g. Brockington (2009)). This variable was not included in previous national studies.

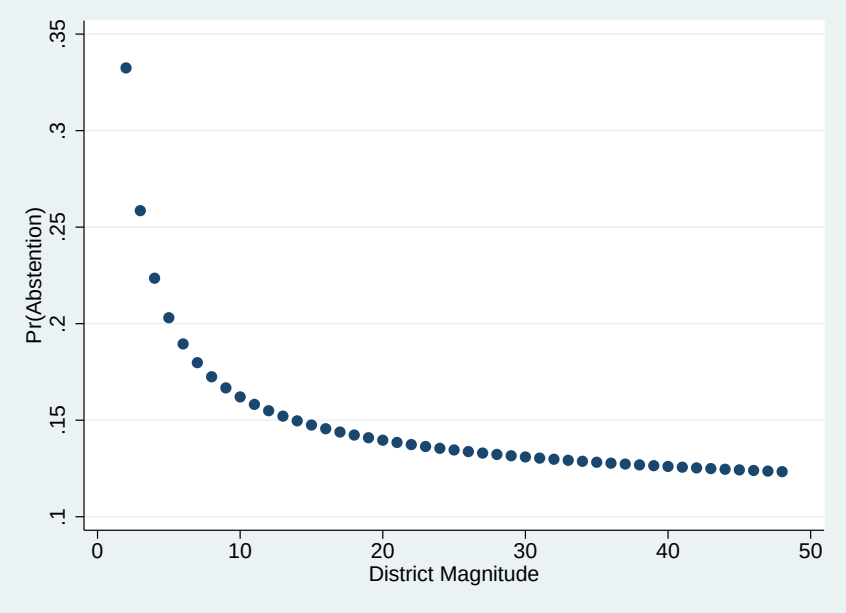
Finally, individuals that live in Alentejo are less likely to abstain than those that live in

the North. To our knowledge, regional dummies were not included in previous studies for Portugal.

5.8.2 District Magnitude

Figure 5.10 illustrates the effect of district magnitude on abstention, with predicted values derived from the estimation of Model 2 and with all the regressors except the inverse of district magnitude at the mean.

Figure 5.10: Mean Predicted Pr(Abstention) and District Magnitude



The plot shows a diminishing returns (asymptotic) effect. Indeed, there is a steep decline in the probability of abstention as district magnitude increases followed by a flattening out of this relationship.

This shape indicates that the vast bulk of improvements in electoral participation can be realized with quite modest district magnitudes, meaning that districts of moderate size can allow for relatively low abstention rates while bearing relatively fewer of the costs associated to very large districts (for example in terms of the so-discussed distance between the elected and the electors).

5.9 Predictions

In order to estimate the effects of potential electoral reforms on turnout, we compare abstention outcomes under five different scenarios.

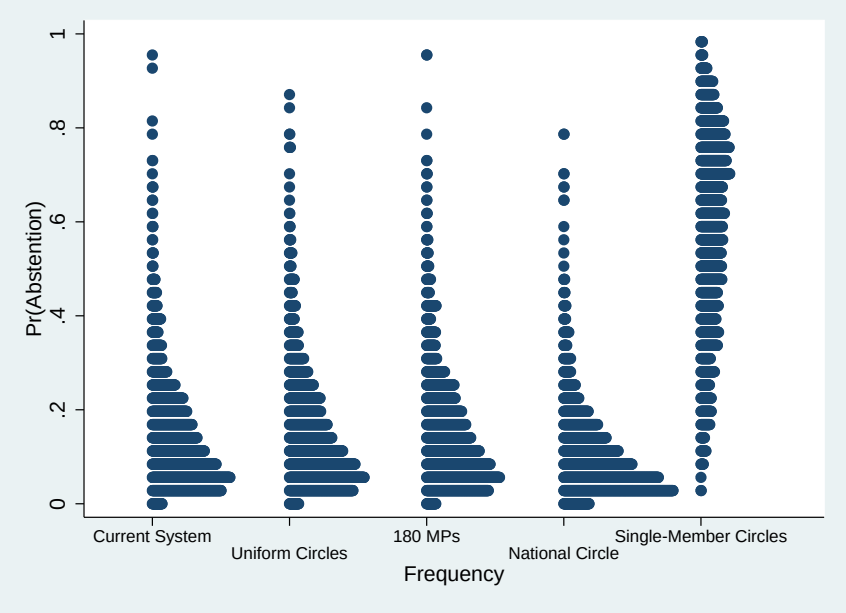
Our reference is the current system. Then, we make predictions for four hypothetical scenarios. First, we consider a system where all circles have the same magnitude, equal to the mean magnitude (uniform circles), a theoretical scenario that enables us to assess the impact of the nonuniformity of district magnitude. Second, given the proposals to decrease the MPs to 180, we compute the hypothetical MPs in each circle under this scenario using the D'Hondt formula (the new distribution of district magnitude is detailed in Figure A.1, in the appendix) and we predict the impact on the mean probability of abstention. Third, given the proposals that comprise a national circle and single-member circles, we also consider these scenarios. Caution should be taken in the interpretation of these last two scenarios since we are making out-of-sample predictions of substantial changes to the current electoral system.

The mean predicted probability of abstention in the five scenarios is given in Table 5.6. The distributions of the predicted probability of abstention are plotted in Figure 5.11, which groups individuals together vertically (as in a histogram) according to their predicted probability of abstention.

Table 5.6: Mean Predicted Pr(Abstention) Under the Alternative Scenarios

Scenario	Mean Predicted Pr(Abstention)
Current System	14.8%
Uniform Circles	15.5%
180 MPs	15.7%
National Circle	10.8%
Single-Member Circles	57.1%

Figure 5.11: Distribution of the Predicted Pr(Abstention) Under the Alternative Scenarios



Firstly, results show that the mean probability of abstention is higher under the uniform circles system than under the current system. This means that the current heterogeneity in the dimension of electoral circles (that results from different amounts of electors across districts) leads to a lower mean probability of abstention than the one that would hold in a theoretical system where all districts have the same magnitude.

Secondly, the 180 MPs scenario also leads to a higher mean predicted probability of abstention than the current system. This was to be expected given the negative relationship that we have found between the probability of abstention and district magnitude. Indeed, with a decrease on the number of MPs there is a decrease of the average district magnitude which has a negative impact on abstention.

Thirdly, under the national circle scenario, the mean predicted probability of abstention decreases substantially, which again was to be expected given the negative relationship we have found between abstention and district magnitude.

Finally, under a scenario with single-member circles, the mean predicted probability of abstention increases dramatically. As expected, these circles "stimulate" abstention (VV.AA. (1998d)). However, the result is too extreme most likely due to the small number of observations available for very small districts.[5]

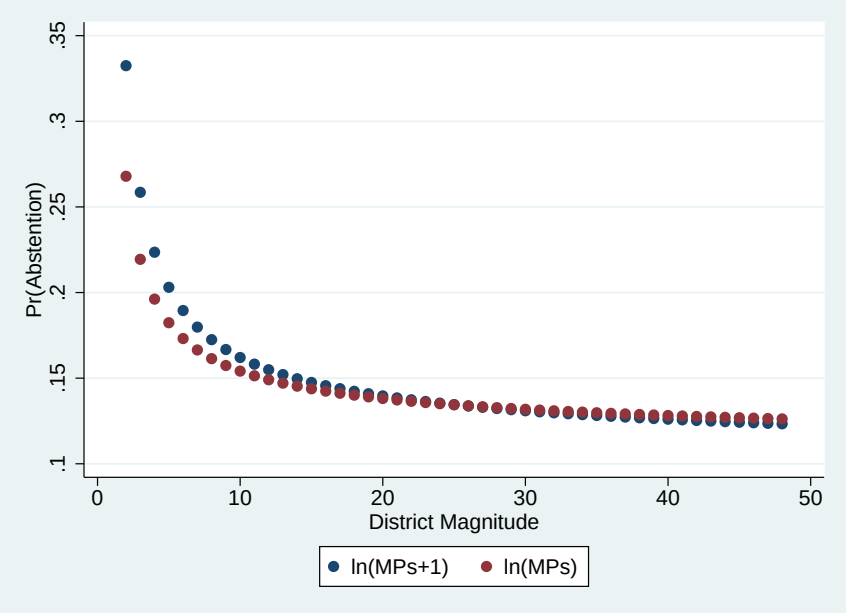
[5]For Portalegre, with district magnitude equal to 2 in 2002 and equal to 3 in 2005, we only have 3 individuals and a sample abstention rate of 66.66%. Note, however, that these observations are not influencing the negative relationship previously found between abstention and district magnitude as the coefficient of the inverse of district magnitude remains significant and positive when we exclude them from the estimation of the model (see the Sensitivity Analysis section).

Hence, results indicate that a system with uniform circles, a reduction of the MPs to 180 and single-member circles would have a negative impact on turnout. A national circle, on the other hand, would have a positive impact.

5.10 Sensitivity Analysis

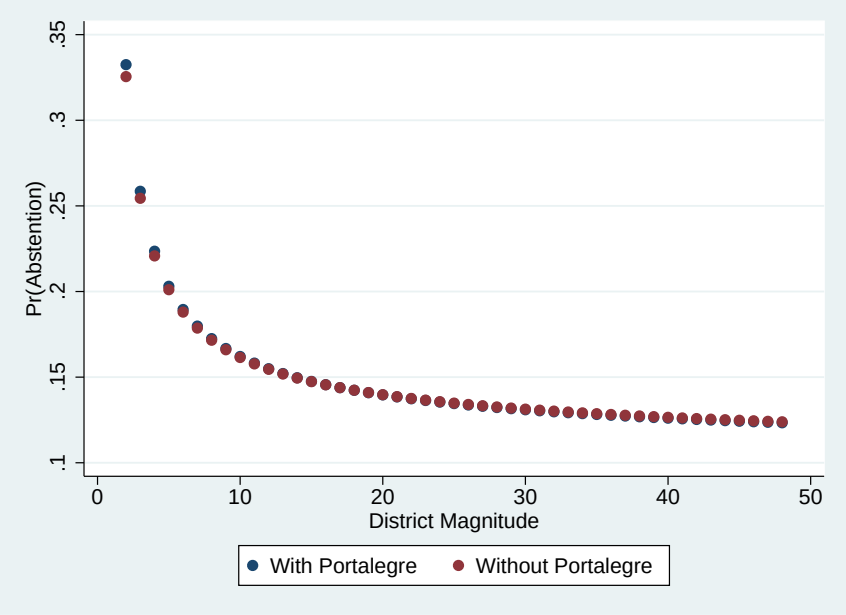
In our estimated model, we use the inverse of district magnitude plus one instead of the inverse of district magnitude because of our intention of using the model to make predictions for districts of dimension one. We show that this choice has no substantial implications for our conclusions. Indeed, when we estimate the model using the inverse of district magnitude, the coefficients of the control variables are similar (see Table A.3, in the appendix) as well as the impact of district magnitude, even though, for small districts, the difference between the mean predicted probability of abstention between the two models is larger (see Figure 5.12).

Figure 5.12: Mean Predicted Pr(Abstention) and District Magnitude: Using ln(MPs+1) and ln(MPs)



Secondly, given the small number of observations available in our dataset for Portalegre, we estimate our model excluding this district. The coefficients of the control variables are similar (see Table A.4, in the appendix) and for district magnitude the mean predicted probability of abstention is slightly smaller for very small districts (see Figure 5.13).

Figure 5.13: Mean Predicted Pr(Abstention) and District Magnitude: With and Without Portalegre



Finally, we estimate the model assuming that υ in (5.2) is standard normal distributed (probit). Then (5.4) is replaced by:

$$Pr(Abstention = 1) = \Phi(x'\beta) \tag{5.14}$$

where $\Phi(.)$ is the cdf of the standard normal.

The models yield quite different estimates for the regression coefficients since different formulas are used for the probabilities. To make them comparable, we compute the marginal effects at the mean as these are scaled similarly across models.

The marginal effects, with respect to a change in the continuous regressor x_j, evaluated at $x = \bar{x}$, for the logit and the probit model, are given by (5.15) and (5.16), respectively:

$$\frac{\partial Pr(Abstention = 1)}{\partial x_j} = \Lambda(\bar{x}'\hat{\beta}) \left\{1 - \Lambda(\bar{x}'\hat{\beta})\right\} \hat{\beta}_j \tag{5.15}$$

$$\frac{\partial Pr(Abstention = 1)}{\partial x_j} = \Phi(\bar{x}'\hat{\beta})\hat{\beta}_j \tag{5.16}$$

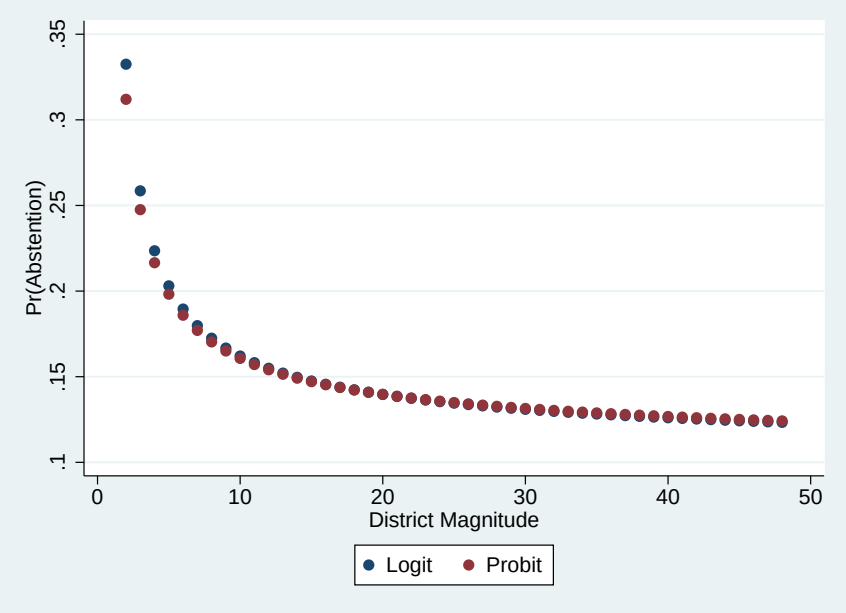
For the dummy variables, the marginal effect is the the discrete change in the predicted probability of $Abstention = 1$, as the dummy variable changes from 0 to 1.

Results are presented in Table A.5, in the appendix. As often is the case[6], there is little

[6]See Cameron and Trivedi (2009): page 472.

difference between these models. In particular for district magnitude, the mean predicted probability of abstention is very similar across models (see Figure 5.14), even though it is slightly lower for very small districts when the probit model is used. Since the models have the same number of parameters, the natural metric to compare them is the fitted log-likelihood. The probit model has a log likelihood of -631.90 which is 0.16 lower than the -632.06 for the logit, favoring the probit model but suggesting little additional gain to using one model rather than the other.

Figure 5.14: Mean Predicted Pr(Abstention) and District Magnitude: Using Logit and Probit



5.11 Conclusions

We have proposed a model that explains the individual decision of voting or abstaining. Most of the control variables perform as was theoretically expected, confirming previous knowledge and illuminating new aspects of the electoral behavior of the Portuguese.

In terms of the impact of district magnitude, we have found that a larger district magnitude encourages electoral participation and quantified this relationship. We have concluded that there is a steep decrease in the probability of abstaining as district magnitude increases followed by a flattening out of this relationship. This means that districts of moderate size can allow for relatively low abstention rates while bearing relatively fewer of the costs associated to very large districts (for example in terms of the so-discussed distance between the elected and the electors).

We have also tested a specification that allows for a reversal point but the fit of the model is lower, indicating that there is not a point where the increased complexity of the decision making environment outweighs the incentives created by a higher probability of finding a party close to one's position.

Then, we have made predictions for four alternative electoral scenarios to shed light on the consequences on abstention of potential electoral reforms that imply a resizing of electoral circles. We have shown that the heterogeneity in terms of district magnitude leads to a lower mean probability of abstention than the one that would hold in a theoretical system where all districts have the same magnitude. For the reduction to 180 MPs, we have estimated an increase in the mean probability of abstention and we have quantified it.

Next, even though we are aware that our method is not the most accurate to make predictions for national and single-member circles, since the smaller district in our sample has 2 seats and the largest has 48, we have made out-of-sample predictions that give us a rough measure of the potential consequences of these scenarios on abstention. Results indicate that a national circle would decrease the mean probability of abstention and single-member circles would increase it dramatically. For the latter we have obtained an extreme result that we believe can be justified by the small number of observations available in our dataset for very small districts. Ideally, one would need a larger sample or a survey that oversamples individuals in these districts.

All in all, our findings have one substantial implication: district magnitude influences the probability of abstaining and therefore this change in the behavior of electors should not be disregarded in electoral engineering debates.

6 Vote Sincerely/Strategically Decision

6.1 Introduction

Literature on voting behavior has shown that voters may find it rational to vote for a party other than the most preferred one in order to avoid wasting their vote in a party with no viable chances of being elected to parliament. Such voters are traditionally called "strategic voters".

Given that district magnitude is a critical determinant of the number of viable parties (Taagepera and Shugart (1989)), we expect it to influence the decision to vote sincerely or strategically. The idea is as follows: in small districts, voters that have as favorite party a party that is not viable may defect from it and instead vote for a viable party with prospects of gaining a seat. In contrast, in large districts with more viable parties, most voters may simply vote for their preferred party. A key implication is that, as the proposed electoral reforms imply a resizing of electoral districts, they can potentially have an impact on whether people vote for their favorite party or not.

In order to study the strategic electoral behavior of the Portuguese and its implications, we proceed in a similar way as for the vote/abstain decision. First, we aim to understand whether district magnitude affects (or not) the decision to vote sincerely or strategically. Then we illustrate the implications of this relationship for the proposed electoral reforms.

6.2 Literature Review

Duverger's Law (Duverger et al. (1954)) highlights the importance of strategic voting under first-past-the-post (FPTP) systems, such as those in the US and in the UK, where there is only one winner per district: the candidate with the most votes. His argument is that voters do not simply take into account their preferences but also the expectation about the outcome of the election, for instance whether their most preferred candidate is actually a viable alternative in their electoral district. This, as Duverger argues, depresses the chances of "third" parties.

Duverger thought that strategic voting would not emerge under Proportional Representation (PR) systems, such as the Portuguese one, since these systems distribute the available seats in proportion to each party's votes. Following the same reasoning, Bowler and Lanoue (1992) mention that "under proportional representation, voters can help "their" party by voting for it under any circumstances; thus, voting sincerely is a dominant strategy".

Contrarily to these views, Leys (1959) and Sartori (1968) argue that strategic voting is significant under PR systems, but only in districts with a magnitude lower than five. The argument is that in districts larger than five the percentages that separate winners from losers are smaller and therefore the informational requirements needed to become confident that a particular party is out of the running in the upcoming election become too high. As a result, in PR systems with large district magnitudes strategic voting should not be an empirically relevant phenomenon. This hypothesis was validated later by Cox (1994) and Cox and Shugart (1996) that analyze Japanese and Japanese and Colombian aggregate data, respectively.

However, recent research has challenged these conclusions. Forsythe et al. (1993), Gschwend (2007) and Lago (2008) conclude that strategic votes can also be cast in large districts because voters only need to know if the party they prefer has some chance of winning at least one seat in their district and for that they only need to look back to the previous election, which is not harder for voters in large districts.

Given the diversity in findings, it is not clear whether we should expect district magnitude to impact the decision to vote sincerely or strategically in PR systems and whether there is a cutoff point. To our knowledge this impact has not yet been assessed for Portugal, with the exception of Gschwend (2007) that, using aggregate data, concludes that parties that did not gain any seat in the previous election are likely to have a lower percentage of votes in the next election and shows that this effect is weaker in larger districts.

As Portugal has quite a wide range of district magnitude, at this point it is relevant to take advantage of that and assess the impact of district magnitude within the country using our rich individual-level data, avoiding problems from cross-national pooling and from the use of aggregate data. Moreover, to our knowledge there is not any study for Portugal that examines individual-level factors that might influence the probability of voting sincerely or not. Hence, the analysis of our control variables is an important contribution to the understanding of other factors, besides district magnitude, that might influence this decision.

The detailed methodology used in our analysis is explained in the next section.

6.3 Method

Our dependent variable is a binary variable that indicates whether the voter has voted sincerely or not. To construct this variable, we compare the answer given by the respondent to the question about whether she usually thinks of herself as close to any particular party (and if yes, which party) with the party the respondent declares having voted for.

Hence, we will consider that a voter is sincere if she votes for the the party that she reports feeling close to[7]; otherwise, the voter is considered strategic. This terminology is not uniform across studies. For example, Felsenthal and Brichta (1985) emphasize the process and not the outcome: a strategic voter is one that takes into consideration how others are likely to vote and strategic voters are those that are not interested in other voters' preferences and probable decisions. Blais and Nadeau (1996), Blais et al. (2001) and Blais et al. (2005) define a strategic voter as one that does not vote for the preferred alternative and is motivated by the intention to affect the outcome of the election.

What we want to study is the individual decision to be a sincere or a strategic voter. (6.1) summarizes the individual decision process:

$$Sincere = \begin{cases} 1 & if\ Sincere^* > 0 \\ 0 & otherwise \end{cases} \tag{6.1}$$

$Sincere^*$ is unobservable and we assume that it is linear so that it satisfies the following model:

$$Sincere^* = x'\beta + \upsilon \tag{6.2}$$

where x includes the independent variables, β is a vector of regression parameters and υ is the error-term. The probability that the individual votes sincerely is given by:

$$Pr(Sincere = 1) = Pr(x'\beta + \upsilon > 0) = Pr(\upsilon > -x'\beta) \tag{6.3}$$

Assuming that υ follows a logistic distribution, :

$$Pr(Sincere = 1) = \Lambda(x'\beta) \tag{6.4}$$

where $\Lambda(.)$ is the logistic cdf with:

$$\Lambda(z) = \frac{e^z}{1 + e^z} \tag{6.5}$$

The model is estimated by maximum likelihood (logit), with inference based on cluster-robust standard errors, clustered by individual.

As controls, we use both individual-level variables and context-level variables. Table A.6, in the appendix, includes a detailed description and descriptive statistics of all variables.

[7]When the individual reports feeling close to more than one party, we use the party that she feels closest to among those parties.

Next section presents descriptive statistics.

6.4 Descriptive Statistics

We present our dependent variable broken down by three factors: year, closest party and district magnitude.

The proportion of sincere voters is equal to 85.9% in 2002 and 87.6% in 2005. Breaking down by closest party (Table 6.1) the proportion of sincere voters is relatively high for individuals that feel close to one of the two major parties, which is expected since these individuals have less incentives to use strategic voting options (Felsenthal and Brichta (1985) and Duch and Palmer (2002)). Surprisingly, in 2005 the proportion of sincere voters for individuals that feel close to CDS-PP is higher than the one for individuals that feel close to PPD-PSD. The proportion of sincere voters for individuals that feel close to one of the residual parties is very low, which is expected given that these parties are not viable in any district (see Table 6.2).

Table 6.1: Proportion of Sincere Voters by Closest Party

	BE	CDS-PP	CDU	PPD-PSD	PS	Other
2002	63.1%	80.4%	81.8%	98.7%	93.7%	0%
2005	77.3%	93.4%	84.6%	90.4%	96.5%	4.8%

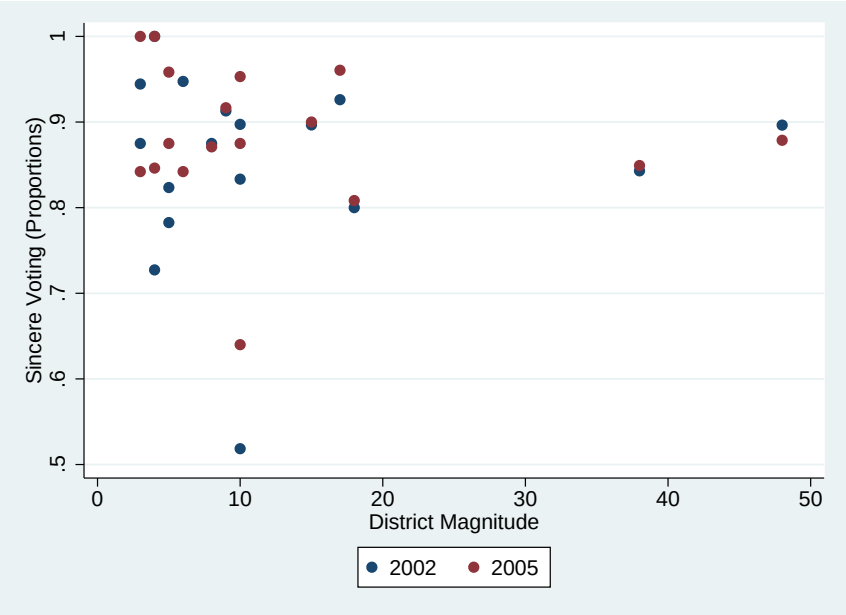
Table 6.2: Number of Districts (in the Mainland) in Which Parties are Viable

	BE	CDS-PP	CDU	PPD-PSD	PS	Other
2002	1	9	7	17	18	0
2005	2	8	6	17	18	0

Source: Official Gazette 1st Series A - Number 247-22/10/1999 and Number 77-2/04/2002

Breaking down by district magnitude, there is not a clear relationship between sincere voting and district magnitude (see Figure 6.1). However, several factors might be contaminating this two-way analysis. Therefore, we will make a proper test, controlling for several variables, to determine whether district magnitude influences the probability of voting sincerely or not.

Figure 6.1: Sincere Voting by District Magnitude in Sample



Next section determines the best specification for the functional form of district magnitude.

6.5 District Magnitude Functional Form

As for the vote/abstain decision, we estimate three different models to determine the best functional form for district magnitude.

We start with a more general specification that allows the relationship between sincere voting and district magnitude to show a reversal by including both the logarithm of district magnitude and its inverse (Model 1). Model 2 includes only the inverse of district magnitude, allowing for a steep increase in sincere voting as district magnitude increases while district magnitude is below a given level (potentially 5) and a flat curve afterward. Finally, we estimate the common specification in the literature: a logarithmic one (Model 3). Again, we use the logarithm of district magnitude plus one because we will use our model to make predictions for districts of dimension one.

The estimates for district magnitude obtained with the estimation of these three models are presented in Table 6.3.

Table 6.3: Logit Estimates - Models 1-3

	Model 1		Model 2		Model 3	
lnM	-0.674	(0.844)	—	—	0.566*	(0.328)
1/lnM	-7.871*	(4.731)	-4.243**	(1.792)	—	—

N=719. * p<0.1; ** p<0.05; *** p<0.01.
Cluster-robust standard errors are in parentheses. Control variables are omitted.

The computation of the Akaike's information criterion (AIC), Schwarz's Bayesian information criterion (BIC) and McFadden's adjusted pseudo-r^2 (see Table 6.4) indicates that Model 2 is the most appropriate model. Therefore we choose it to pursue our analysis.

Table 6.4: AIC, BIC and McFadden Adjusted Pseudo-r^2 - Models 1-3

	Model 1	Model 2	Model 3
AIC	424.48	423.15	425.15
BIC	607.60	601.69	603.69
McFadden's Adjusted Pseudo-r^2	0.244	0.246	0.243

Next section presents the logit estimates and standard errors obtained with the estimation of Model 2.

6.6 Results

The results obtained with the estimation of Model 2 are presented in Table 6.5.

Table 6.5: Sincere Voting Logit Estimates

Individual -Level Variables		
Individual Characteristics		
Age	-0.079	(0.084)
Age2	0.001	(0.001)
Male	0.017	(0.371)
Income (Ref=0€-300 €)		
301€-750€	0.883	(0.929)
751€-1500€	0.734	(0.965)
1501€-2500€	0.159	(0.972)
>2500€	0.181	(0.948)
Education (Ref=None or primary)		
Basic	-0.750	(0.548)
Secondary	-1.043*	(0.559)
High or postgraduate	-1.172*	(0.626)
Married	0.057	(0.458)
Nº minors in the house	0.128	(0.246)
Catholic	-1.286*	(0.742)
Unemployed	0.194	(0.631)
Public worker	0.822*	(0.476)
Institutional Involvement		
Church attendance (Ref=Never)		
Once a year	-1.053*	(0.620)
2-11x a year	-0.289	(0.624)
1x or more a month	-0.578	(0.641)
Once a week or more	-0.576	(0.664)
Trade union member	0.555	(0.484)
Political Variables		
Close to a party (Ref=PS)		
BE	-2.145***	(0.515)
CDS-PP	-0.046	(0.599)
CDU	-1.955***	(0.516)
PPD-PSD	-0.085	(0.462)
Other	-5.848***	(0.923)
Informed about politics	1.540***	(0.536)
Position towards issues		
Wealth inequality	-0.071	(0.054)
Taxes	0.066	(0.067)
Government decision making	-0.187***	(0.053)
Context-Level Variables		
1/lnM	-4.243**	(1.792)
2005	0.559**	(0.277)
Urbanization (Ref=Rural area or village)		
Small or middle-size town	-0.946*	(0.483)
Suburbs of large town or city	-2.160***	(0.588)
Large town or city	-1.357***	(0.486)
Regional Dummies (Ref=North)		
Center	1.176**	(0.515)
Lisbon and Tagus Valley	1.006**	(0.466)
Alentejo	1.361**	(0.542)
Algarve	-0.363	(0.800)
Intercept	7.540***	(2.301)

N=719. * p<0.1; ** p<0.05; *** p<0.01. Cluster-robust standard errors are in parentheses.

Before moving to the interpretation of these coefficients, next section assesses more deeply the model fit and diagnoses potential problems.

6.7 Model Diagnosis

Firstly, the log-likelihood chi-square test for global significance indicates that the model as a whole is statistically significant with $p < 0.0001$.

Secondly, we compare predicted outcomes with actual outcomes. When we use as cutoff value $c = 0.5$, the percentage correctly classified is equal to 92.35%. However, as most of the sample has $Sincere = 1$ (86.80%), it is likely that $\Lambda(x'\hat{\beta}) > 0.5$ and hence $\widehat{Sincere}$ =1 for most of the observations. Indeed, the model predicts that $Sincere = 1$ for 93.32% of the observations. This makes the specificity (the fraction of observed $Sincere = 0$ cases that are correctly classified) relatively low (46.32%) and the sensitivity (the fraction of observed $Sincere = 1$ cases that are correctly classified) very high (99.36%). Hence, more generally, a range of cutoff values may be considered. Figure 6.2 plots the sensitivity and specificity values by probability cutoff. The point that maximizes their sum is $c = 0.814$, which leads to a percentage correctly specified equal to 86.93%.

Figure 6.2: Sensitivity and Specificity by Probability Cutoff

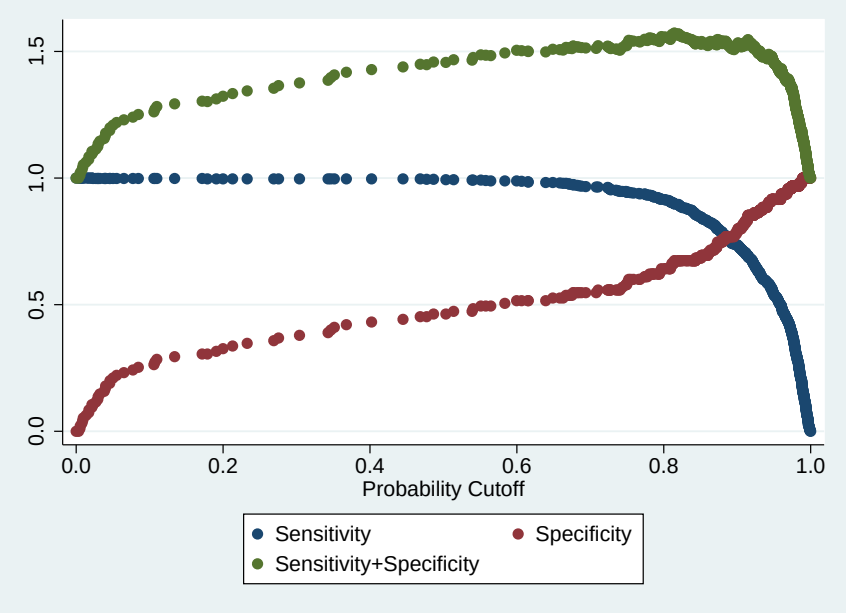
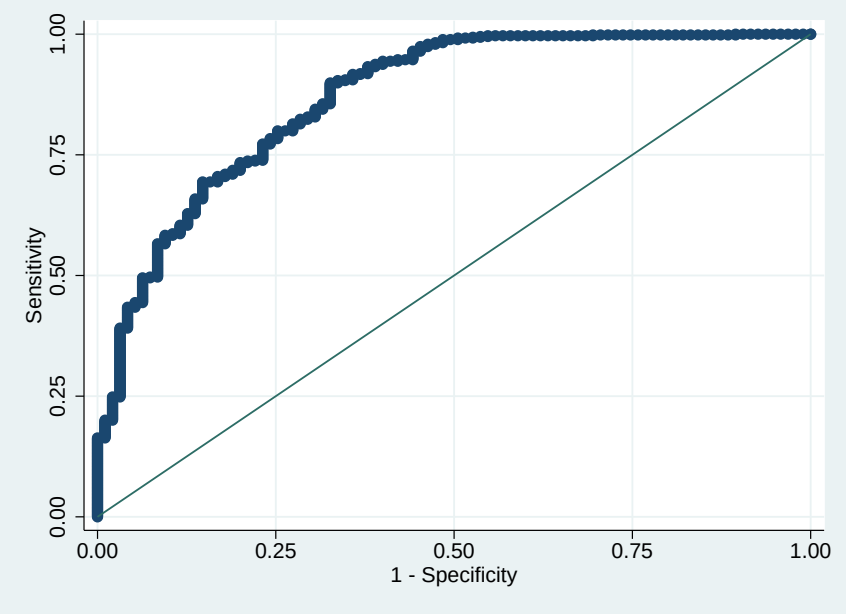


Figure 6.3 plots the receiver operating characteristics curve. For our model, the area below it is equal to 0.8687.

Figure 6.3: Receiver Operating Characteristics Curve



Thirdly, we conduct the Stukel Lagrange multiplier test of generalized logit. The null hypothesis of correct model specification is not rejected because the test yields a $\chi^2(1)$ statistic of 0.66 with $p = 0.4162$.

Fourthly, we perform the Hosmer and Lemeshow's goodness-of-fit test. We use 10 groups and obtain $p = 0.8466$. Therefore, we do not reject the null of correct specification.

Finally, we test for collinearity problems. The model takes seven iterations to converge which is a signal that there is not a high degree of multicollinearity. Coefficients for tolerance and VIF are presented in the first two columns of Table A.7, in the appendix. Only for age and its squared is the VIF larger than rule-of-thumb's 10 value and is the tolerance less than 0.1. This is not problematic, as we can solve it by centering squared age, as presented in the third and fourth columns of Table A.7, in the appendix.

Overall, results support the adequacy of our model. In the next section, we interpret the coefficients obtained.

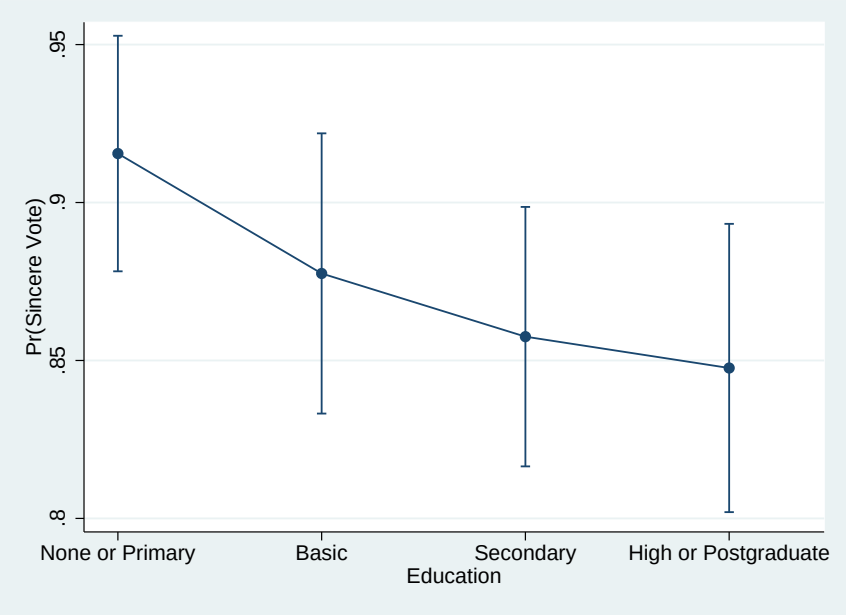
6.8 Interpretation of Results

We start with a brief overview of the results obtained for the controls to assess whether the model is performing as expected and to give a picture of the typical reasoning behind the decision to vote sincerely or not. Then, we interpret the results obtained for district magnitude.

6.8.1 Controls

Individuals with secondary or high or postgraduate education are less likely to vote sincerely than those with none or primary education. Figure 6.4 shows the average predictions for each education class. These results are directionally in line with numerous studies that have argued that those with more education are more likely to vote strategically (e.g. Felsenthal and Brichta (1985), Duch and Palmer (2002) and Merolla and Stephenson (2007)) since strategic voting requires some knowledge and analytical skills to understand the mechanics of the voting system and how votes may be wasted.

Figure 6.4: Predictive Margins for Education with 95% Confidence Level



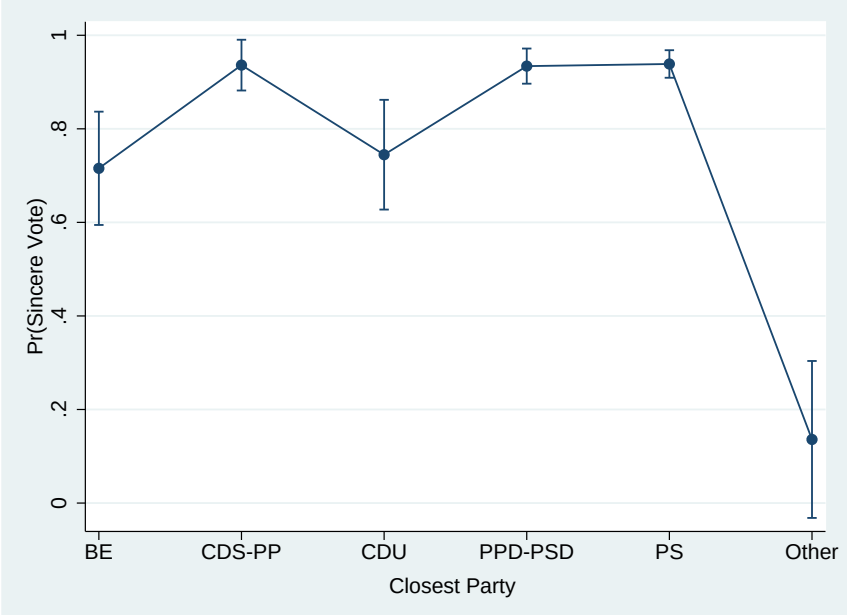
Catholic individuals are less likely to vote sincerely: we estimate that the probability of voting sincerely is 0.074 points lower (directionally in line with Merolla and Stephenson (2007)). Public workers are more likely to vote sincerely (0.048 points).

Of the institutional involvement variables, we estimate that individuals that attend religious services once a year are less likely to vote sincerely (0.064 points) than those that never attend.

Of the political variables, individuals that report feeling close to BE, CDU and the residual parties are less likely to vote sincerely when compared to individuals that report being close to PS. Figure 6.5 shows the average predictions for each party. As expected, individuals that feel close to one of the two major parties have higher mean predicted probabilities of voting sincerely since these individuals have less incentives to use strategic voting options (in line with Felsenthal and Brichta (1985) and Duch and Palmer (2002)). This

probability is lower for individuals that feel close to BE and CDU, the two parties that, after the residual parties, have the smallest number of districts in which they are viable (see Table 6.2). Surprisingly, for CDS-PP this probability is similar to the one of the two major parties. For the residual parties, as expected, the mean predicted probability of sincere voting is very low since they are not viable in any district.

Figure 6.5: Predictive Margins for Closest Party with 95% Confidence Level



More informed individuals are more likely to vote sincerely (the probability is 0.089 points higher). This result may seem counter-intuitive since one would expect more informed individuals to be more apt to identify situations in which their vote would be wasted (Duch and Palmer (2002) and Lawrence (2003)). However, these individuals are also likely to be more sensitive to the costs or benefits of voting and more likely to understand that their vote has no impact over the election outcome.

Of the position towards issues variable, results show that the more individuals believe that there should be an increase of citizen participation in government decision making, the more they vote sincerely.

Of the context-level controls, we estimate that the probability of voting sincerely is higher in 2005 (0.032 points). Individuals that live in a rural area or village are more likely to vote sincerely (directionally in line with Spenkuch (2013)) . Individuals that live in the Center, Lisbon and Tagus Valley or Alentejo are more likely to vote sincerely than those that live in the North. Figures 6.6 and 6.7 show the average predictions by degree of urbanization and region, respectively.

Figure 6.6: Predictive Margins for Urbanization with 95% Confidence Level

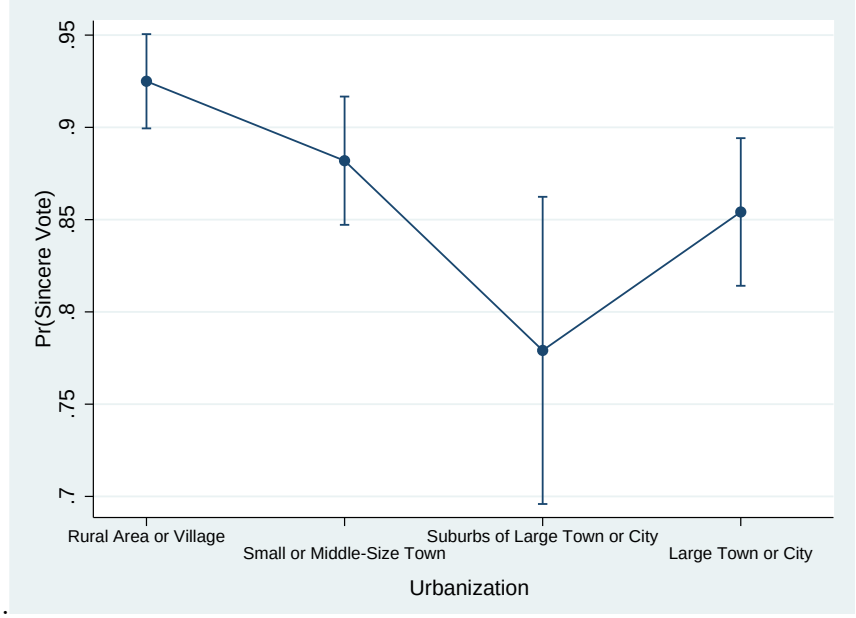
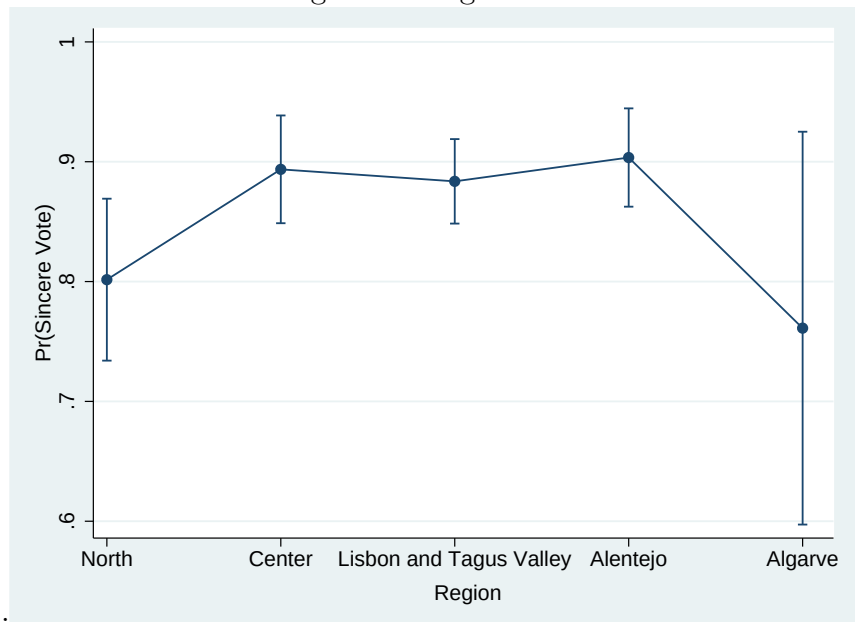


Figure 6.7: Predictive Margins for Regions with 95% Confidence Level

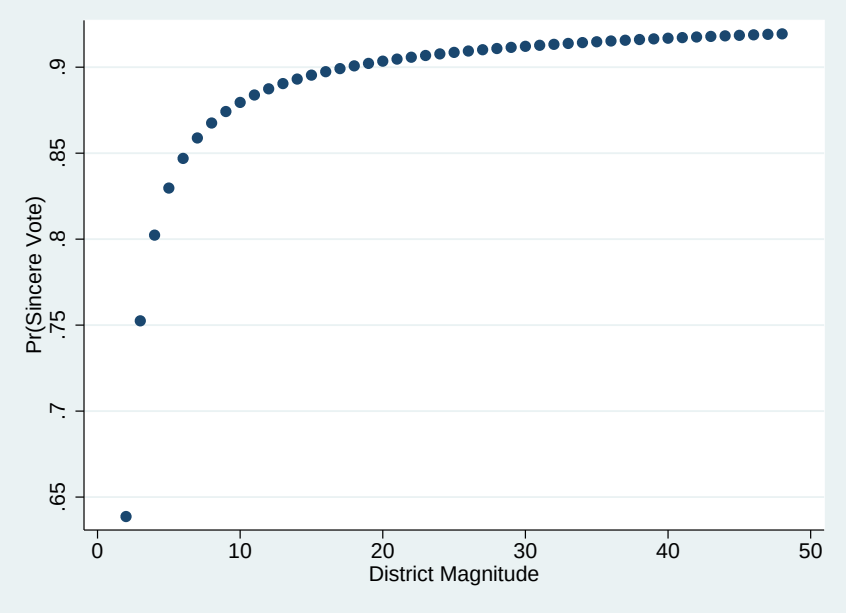


6.8.2 District Magnitude

Figure 6.8 illustrates the impact of district magnitude on the probability of voting sincerely, with predicted values derived from the estimation of Model 2 with all regressors except the inverse of district magnitude at the mean.

There is a steep increase in the probability of voting sincerely as district magnitude increases followed by a flattening out of this relationship. Contrarily to previous research, our results do not indicate that strategic voting vanishes when district magnitude is larger than five. For example when district magnitude is equal to ten we estimate that the mean probability of voting strategically is still equal to 12.05%. Note, however, that as aforementioned, the definition of strategic voting differs across studies.

Figure 6.8: Mean Predicted Pr(Sincere Vote) and District Magnitude



6.9 Predictions

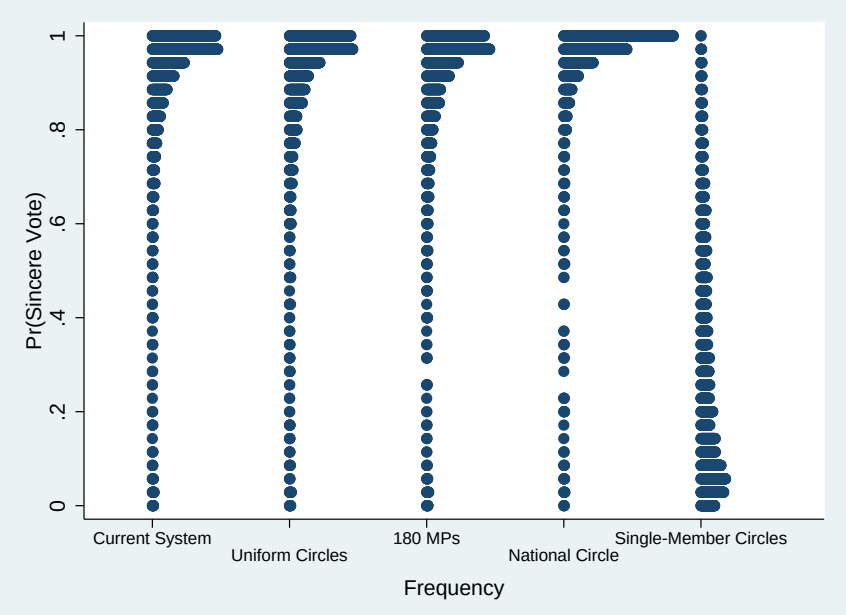
In order to estimate the effects of potential reforms to the electoral system on sincere voting, we compare the mean predicted probability of sincere voting under the same scenarios as in the vote/abstain decision.

The mean predicted probability of voting sincerely in the five scenarios is given in Table 6.6. The distributions of the predicted probability of voting sincerely are plotted in Figure 6.9. Again, it is important to reinforce that caution should be taken in the interpretation of the last two scenarios since we are making out-of-sample predictions of substantial changes to the current electoral system.

Table 6.6: Mean Predicted Pr(Sincere Vote) Under the Alternative Scenarios

Scenario	Mean Predicted Pr(Sincere Vote)
Current System	0.896
Uniform Circles	0.887
180 MPs	0.887
National Circle	0.933
Single-Member Circles	0.275

Figure 6.9: Distribution of the Predicted Pr(Sincere Vote) Under the Alternative Scenarios



Firstly, results show that the mean probability of sincere voting is lower under the uniform circles system. Under this theoretical system, we no longer have both very large districts with higher probabilities of sincere voting and very small ones with lower probabilities. The first effect dominates and the mean probability decreases.

Secondly, the 180 MPs scenario also leads to a lower mean probability of sincere voting (similar to the one of the uniform circles scenario). This was to be expected given the positive relationship that we have found between the probability of sincere voting and district magnitude: as circles become smaller, the mean probability of sincere voting decreases.

Thirdly, under the national circle scenario, the mean probability of sincere voting increases, which again was to be expected given the positive relationship between sincere voting and district magnitude. This result goes in line with our expectations and with

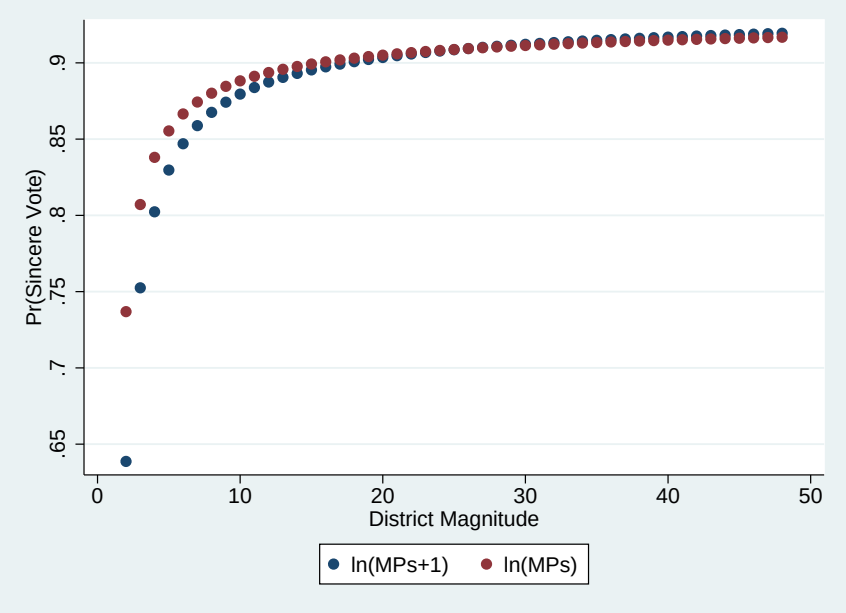
those of Rodrigues et al. (2002) that refer the possibility of circumventing strategic voting as one of the reasons for the creation of a national circle.

Finally, under a scenario with single-member circles, the mean probability of sincere voting dramatically decreases. As expected, this scenario stimulates tactical voting (VV.AA. (1998b) and VV.AA. (1998c)) but the magnitude of the effect is too extreme. As for the vote/abstain decision, we believe that it can be explained by the small number of observations available for very small districts[8].

6.10 Sensitivity Analysis

We start by revisiting our model using the inverse of the logarithm of district magnitude instead of the inverse of the logarithm of district magnitude plus one. Results show that this has no substantial implications for our conclusions. Indeed, the coefficients of the control variables are similar (see Table A.8, in the appendix) as well as the impact of district magnitude (see Figure 6.10), even though, for small districts, the difference between the mean predicted probability of sincere voting between the two models is larger.

Figure 6.10: Mean Predicted Pr(Sincere Vote) and District Magnitude: Using ln(MPs+1) and ln(MPs)



[8]In this case, the estimation is not even including the 3 individuals that belong to Portalegre because some of the required information for the estimation of the model is not available and therefore these observations are deleted (listwise deletion).

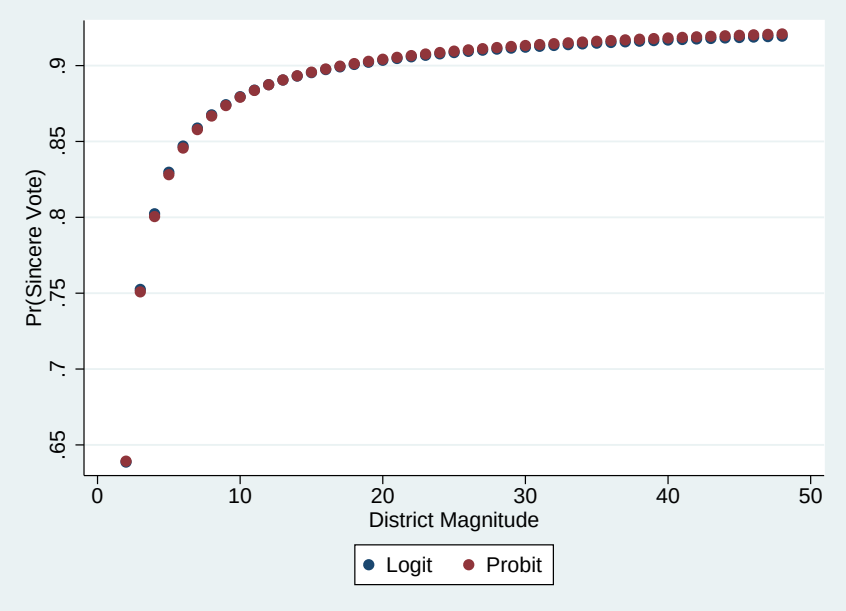
Secondly, we estimate the model assuming that υ in (6.2) is standard normal distributed (probit). Then (6.4) is replaced by:

$$Pr(Sincere = 1) = \Phi(x'\beta) \tag{6.6}$$

where $\Phi(.)$ is the cdf of the standard normal.

To make the estimates comparable to our previously estimated model, we compute the marginal effects at the mean. Results are presented in Table A.9, in the appendix, and show little difference between the models. In particular for district magnitude, the mean predicted probability of sincere voting is very similar across models (see Figure 6.11).

Figure 6.11: Mean Predicted Pr(Sincere Vote) and District Magnitude: Using Logit and Probit

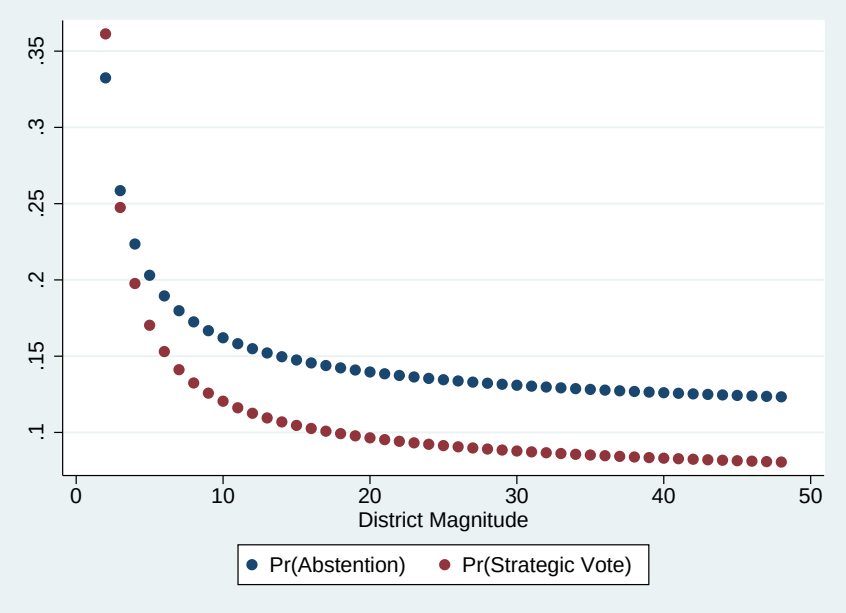


Finally, we test whether the probit model is better than the logit. The logit model has a log likelihood of -172.58 which is 1.21 higher than the -173.79 for the probit, which favors the logit model but suggests little additional gain to using one model rather than the other.

6.11 Discussion and Policy Recommendations

The impact of district magnitude on the vote sincerely/strategically decision is very similar to the impact on the vote/abstain decision, as distilled more clearly in Figure 6.12.

Figure 6.12: Mean Predicted Pr(Abstention)/Pr(Strategic Vote) and District Magnitude



This result has a key implication: it is possible to have a relatively low level of abstention and strategic voting while bearing relatively fewer of the costs associated to very large districts, for example in terms of the so-discussed distance between the elected and the electors.

Note, however, that strategic voting is not necessarily an undesirable property of an electoral system, given that, for example, it can have a positive effect on governmental stability. Notwithstanding, if policy makers want to minimize it and increase the degree to which the vote is anchored in the preferences of individuals, then results indicate that it is possible to achieve a relatively low level of strategic voting with circles with a quite moderate magnitude - such as the ones of Santarém and Leiria -, avoiding the problems of lack of proximity and accountability associated to circles of very large magnitudes such the ones of Lisbon and Porto.

Hence, even though we recognize that there is no such thing as an ideal district magnitude, our results indicate that for these two variables the trade-off is not linear. This result adds to the result of Rae (1971), which states that the increase in proportionality with the increase in district magnitude is curvilinear and beyond a district magnitude equal to 20 it tends to zero, suggesting that one does not need very large districts to capture most of the proportionality gains. Also, Carey and Hix (2011) find a curvilinear relationship between district magnitude and favorable outcomes (proportionality, accountability and short ideological distance between voters and the government), with sharp increases in the probability of these outcomes when district magnitude is below five.

6.12 Conclusions

We have proposed a model that explains the individual decision of voting sincerely or not. Several measures of model fit and diagnosis validate its adequacy.

The analysis of our control variables is, to our knowledge, the first contribution for Portugal to the understanding of individual-level factors that might explain the decision to vote sincerely or strategically. We have shown that individual characteristics (education, religion and whether the individual is a public worker), institutional involvement (attendance of religious services), political variables (closest party and being informed about politics), position towards issues variables (position of the respondent towards government decision making) and context-level variables (year, degree of urbanization and region) have an impact on this decision.

In terms of the impact of district magnitude, we have concluded that there is a sharp increase in the level of sincere voting as district magnitude increases followed by a flattening out of this relationship. This result, together with the results obtained in this study for the vote/abstain decision and with the results of previous studies that have shown curvilinear relationships between district magnitude and proportionality, accountability and short ideological distance between voters and the government, suggests that the trade-off between different facets of alternative electoral systems is not linear.

Contrarily to previous research, we have not concluded that strategic voting disappears when district magnitude is larger than five. However, one needs to take into account that the definition of strategic voting differs across studies.

Then, we have made predictions for the same alternative electoral scenarios as in the vote/abstain decision in order to shed light on the consequences of potential electoral reforms that imply a resizing of electoral circles on sincere voting. We have shown that the heterogeneity in terms of district magnitude leads to a higher mean probability of sincere voting than in a theoretical system where all districts have the same magnitude. Also, we have shown that the so discussed reduction of MPs to 180 decreases the mean probability of sincere voting and quantified it.

Our out-of-sample predictions of a national circle and single-member circles give us a rough measure of the potential consequences of these scenarios on sincere voting. Results indicate that a national circle would increase sincere voting and single-member circles would decrease it dramatically. As for the vote/abstain decision, the result for single-member circles is extreme, which we believe that can be explained by the small number of observations available in our dataset for very small districts.

Altogether, this section contributes to the understanding of the typical reasoning behind

the decision of voting sincerely or not and shows that, besides several other factors, district magnitude is a significant variable. This indicates that redistricting exercises have an impact on sincere voting and therefore this effect should not be disregarded in the debate about potential electoral reforms.

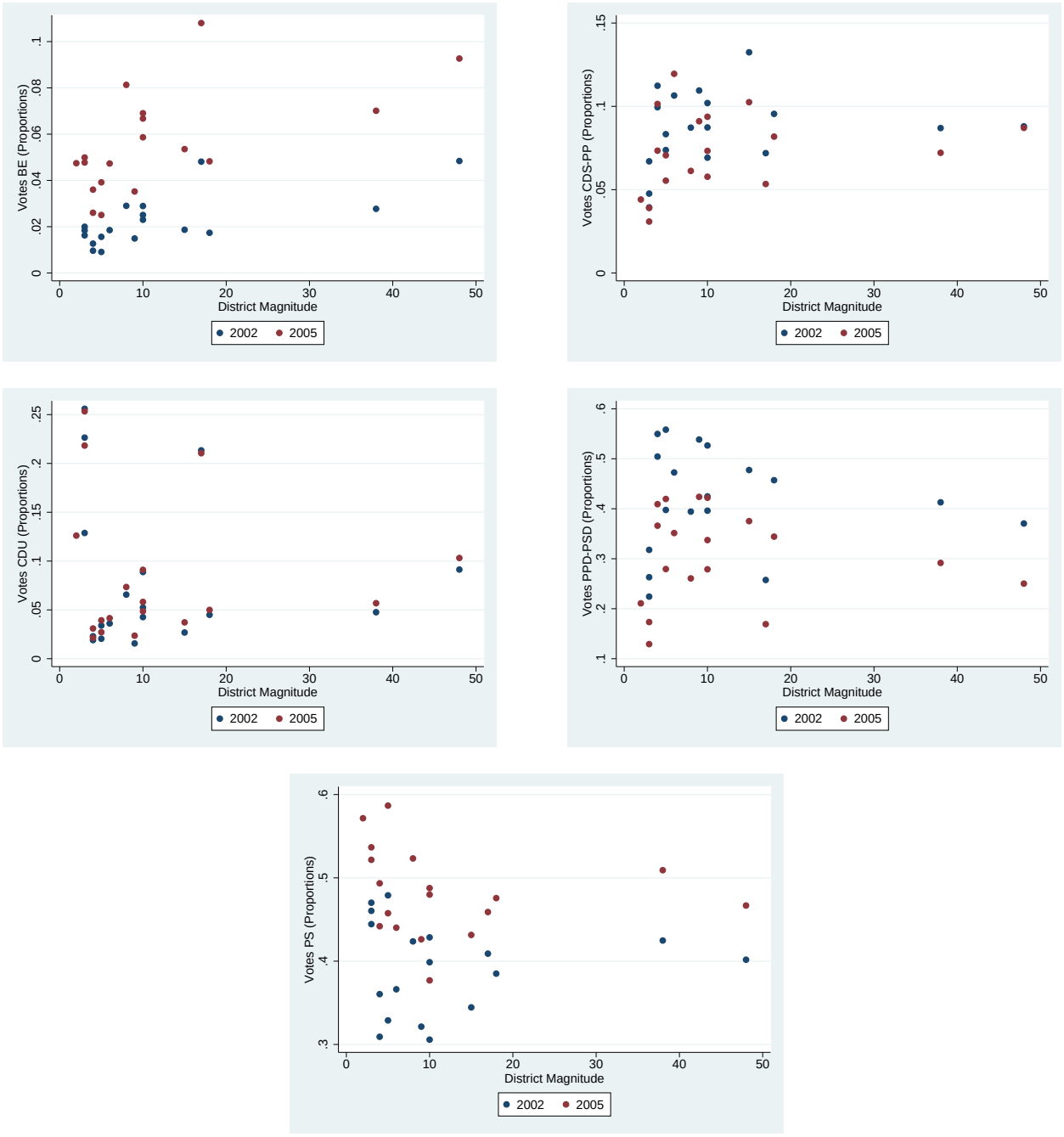
7 Party Choice Decision

7.1 Introduction

The analysis conducted in the previous section showed a positive relationship between district magnitude and sincere voting. The purpose of this section is to measure the implied consequences on parties votes.

Our plan to achieve this goal is as follows. First, we aim to understand whether district magnitude has an impact on the choice of electors among parties. Figure 7.1 gives us a first idea about how district magnitude and parties vote shares are interrelated by presenting the vote shares of each of the five main parties, in the mainland, in the 2002 and 2005 elections (as a percentage of the sum of votes of these main parties in the mainland). This two-way graphics show a positive relationship between BE's vote share and district magnitude. For the other parties, there is not a clear relationship between the variables. Note, however, that this bivariate relationships only gives us a first hint of how these variables are interrelated since we are not controlling for other variables that might be influencing this relationship. Hence, in our analysis, we use our rich dataset to develop a model of vote choice that includes district magnitude as an explanatory variable and controls for several variables that might contaminate these relationships. Second, we illustrate the implications for the reforms that have been proposed to the electoral system.

Figure 7.1: Vote Proportions by District Magnitude (Aggregate Data for the Mainland)



Source: Official Gazette 1st Series A - Number 77-2/04/2002 and Number 47-8/03/2005

7.2 Literature Review

Choice is a fundamental topic in political science, but models that incorporate more than two alternatives began to appear only in the 1990s. Born (1990) introduced the nested logit multinomial model, Whitten and Palmer (1996) the multinomial logit model and Alvarez and Nagler (1998) the multinomial probit model.

Previous research uses these models to explain vote choice but typically does not include district magnitude as an independent variable. One exception is Monroe and Rose (2002), a study that, using district-level vote results, develops a model of vote shares for Portugal using the logarithm of population density, the logarithm of district magnitude and a dummy variable for the region Alentejo as covariates. Portugal is chosen due to its large degree of variation in district magnitude and to the absence of regional parties; indeed, the authors refer that an ideal analysis would require "a pure DPR system with many districts, with an identical list of competing parties in each district, and relevant covariate data at the district level". However, we identify two fragile points in this analysis: the use of aggregate data and the inclusion of a small number of controls given the sample size (n=20). In our study, we overcome these points with the use of individual-level data and by including more covariates (which is possible given our larger sample size and their availability in our rich dataset).

With respect to other determinants of the electoral behavior of the Portuguese, Freire (2002), Jalali (2002), Lobo (2002), Freire (2005), Lobo (Lobo), Jalali (2007) and Lobo (2007) outlined fundamental traits about the way the Portuguese vote. These studies do not include district magnitude as explanatory variable and use methodological and modeling choices that differ from the ones in our analysis.

Hence, our study fulfills a need as it uses individual-level data to assess the impact of district magnitude on the parties votes and models the consequences of potential electoral reforms that imply changes in the dimension of electoral circles. We also complement the literature on other determinants of vote choice of the Portuguese.

Next section explains the method used in our analysis.

7.3 Method

Our dependent variable is a categorical variable which consists of the party that individuals report having voted for in the 2002 and 2005 elections. We exclude the residual group that includes votes for parties that have never gained a seat, because these parties do not compete in all districts, their electoral support is tiny (resulting in a small number

of observations (n=33), which would make the results of our estimates unstable) and we do not know for which party had the voters who reported voting for this group (that includes very heterogeneous parties in terms of ideology and left-right location) voted for. Therefore, our analysis focuses in the choice between the five main parties that have been competing in all districts. With this methodological choice, rather than investigating complete voter choice, we investigate choice from among the five main parties.

We use an additive random utility framework to model the vote choice decision. For individual i, the utility of the j^{th} party is specified to be given by:

$$U_{ij} = V_{ij} + \varepsilon_{ij} \quad j = 1, 2, ..., 5 \tag{7.1}$$

where V_{ij} denotes the deterministic component of utility and ε_{ij} denotes the random component of utility. The deterministic component is specified as:

$$V_{ij} = x_i \beta_j \tag{7.2}$$

where x_i is a vector of case-specific regressors of the i^{th} individual and β_j contains the regression coefficients.

Suppressing the individual subscript i for notational simplicity, the chosen party is the one that yields the highest utility so that:

$$Pr(y = j) = Pr(U_j \geq U_k \ , \ all\, k \neq j) = Pr(U_k - U_j \leq 0 \ , \ all\, k \neq j) \tag{7.3}$$

Using (7.1), (7.3) becomes:

$$Pr(y = j) = Pr(\varepsilon_k - \varepsilon_j \leq V_j - V_k \ , \ all\, k \neq j) \tag{7.4}$$

If we assume that the errors ε_j are iid and follow a type 1 extreme value distribution with density given by

$$f(\varepsilon_j) = e^{-\varepsilon_j} exp(-e^{-\varepsilon_j}) \quad j = 1, 2, ..., 5 \tag{7.5}$$

, then it can be shown[9] that (7.4) yields

$$Pr(y = j) = \frac{e^{V_j}}{e^{V_1} + e^{V_2} + ... + e^{V_5}} = \frac{e^{V_j}}{\sum_{l=1}^{5} e^{V_l}} \quad j = 1, 2, ..., 5 \tag{7.6}$$

[9]See Cameron and Trivedi (2009): page 486

(7.6) gives the probability of choosing party j and is estimated by maximum likelihood (multinomial logit).

To ensure identification, β_j is set to zero for one of the categories: the base category. We choose PS as the base category since it has the largest support in our dataset. Inference is based on cluster-robust standard errors, clustered by individual.

We use individual characteristics, institutional involvement variables and context-level variables as independent variables. Table A.10, in the appendix, includes a detailed description and descriptive statistics of all variables. Contrarily to the previous sections, we do not include political variables and position towards issues variables to avoid endogeneity problems that are very likely to result from the inclusion of these variables.

Next section presents descriptive statistics.

7.4 Descriptive Statistics

This section makes a brief analysis of our dependent variable.

First, we compare the voting percentages in our dataset with the national results in the mainland (see Figures 7.2 and 7.3). In both years, the percentage of votes of BE, CDU and PS is larger in the sample than in the national results. The opposite holds for CDS-PP and PPD-PSD.

Figure 7.2: Votes by Party: Comparison of National Results in the Mainland with Sample Proportions - 2002

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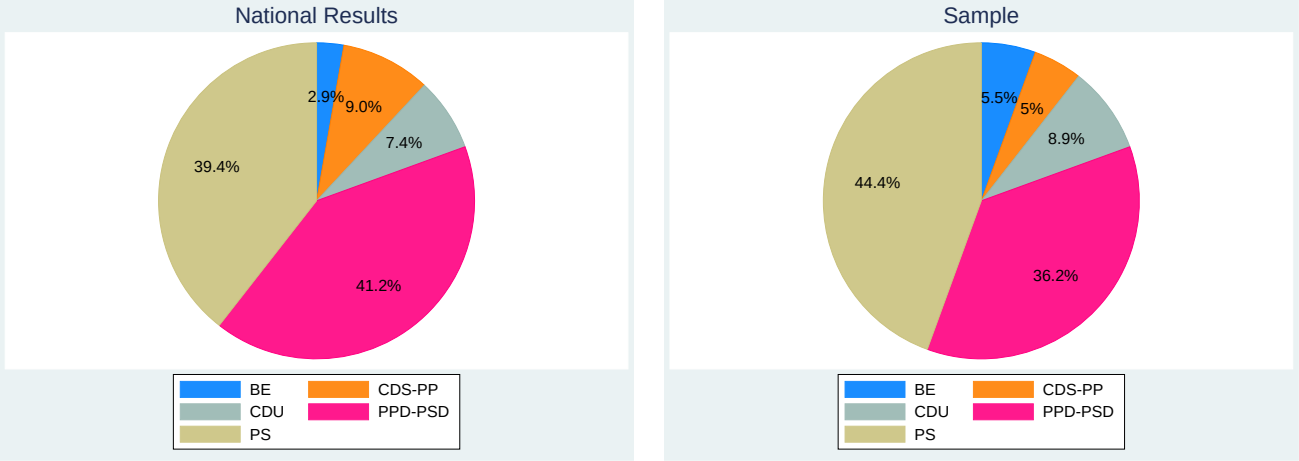

Source of National Results: Official Gazette 1st Series A - Number 77-2/04/2002

Figure 7.3: Votes by Party: Comparison of National Results in the Mainland with Sample Proportions - 2005

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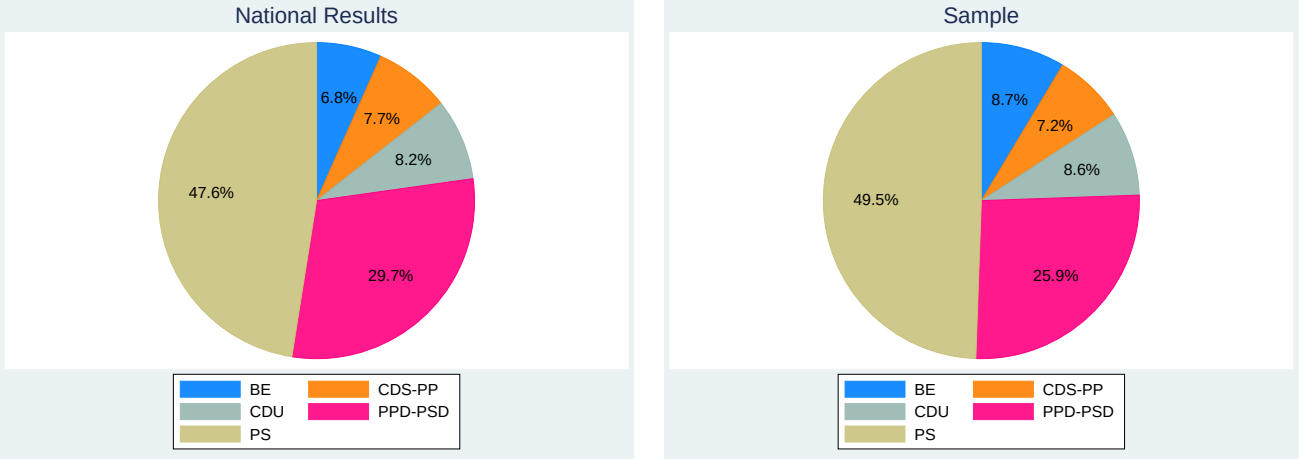
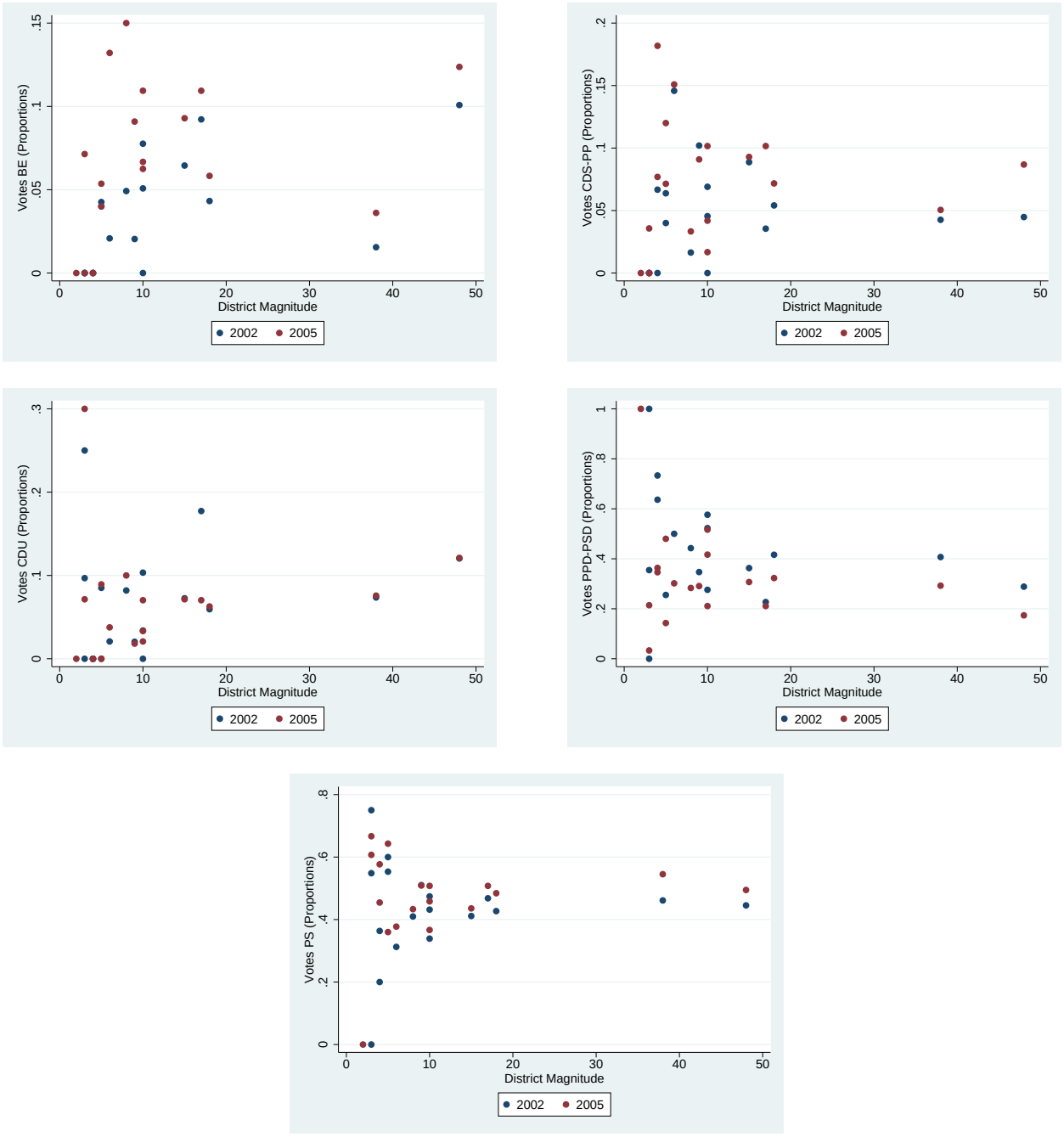


Source of National Results: Official Gazette 1st Series A - Number 47-8/03/2005

Figure 7.4 presents vote proportions (in the sample) by district magnitude.

Figure 7.4: Vote Proportions by District Magnitude in Sample



Note: These graphics use sample proportions. National results are presented in Figure 7.1.

Next section determines the best specification for the functional form of district magnitude to use in our analysis.

7.5 District Magnitude Functional Form

As for the previous sections, we estimate three different models to assess the impact of district magnitude on the vote choice. We start with Model 1 that includes both the logarithm of district magnitude and its inverse. Model 2 only includes the inverse of district magnitude and Model 3 only includes the logarithm of district magnitude. Once again we use the logarithm of district magnitude plus one because we will use our model to make predictions for districts of dimension one.

The estimates for district magnitude obtained with the estimation of these three models are presented in Table 7.1.

Table 7.1: Multinomial Logit Estimates- Models 1-3

	BE		CDS-PP		CDU		PPD-PSD	
Model 1								
lnM	-0.962	(0.717)	-0.779	(0.668)	-0.288	(0.604)	-0.309	(0.409)
1/lnM	-10.147**	(4.869)	-5.519	(3.748)	-1.025	(3.689)	-2.280	(2.398)
Model 2								
1/lnM	-4.297**	(1.771)	-1.267	(1.702)	0.503	(1.566)	-0.623	(0.973)
Model 3								
lnM	0.429	(0.273)	0.063	(0.298)	-0.124	(0.259)	0.049	(0.166)

N=1647. * p<0.1; ** p<0.05; *** p<0.01.
Cluster-robust standard errors are in parentheses. Control variables are omitted.

The computation of the Akaike's information criterion, Schwarz's Bayesian information criterion and McFadden's adjusted pseudo-r^2 (see Table 7.2) indicates that Model 2 is the most appropriate model. Therefore we choose it to pursue our analysis.

Table 7.2: AIC, BIC and McFadden Adjusted Pseudo-r^2 - Models 1-3

	Model 1	Model 2	Model 3
AIC	3982.604	3978.797	3983.541
BIC	4653.036	4627.602	4632.346
McFadden Adjusted Pseudo-r^2	0.075	0.076	0.075

Next section presents the estimates obtained for the whole model.

7.6 Results

We present the multinomial logit estimates of Model 2 in Table 7.3.

Table 7.3: Vote Decision Multinomial Logit Estimates

	BE		CDS-PP		CDU		PPD-PSD	
Individual -Level Variables								
Individual Characteristics								
Age	0.141	(0.108)	-0.105*	(0.061)	-0.061	(0.048)	-0.064*	(0.033)
Age2	-0.002	(0.001)	0.001	(0.001)	0.001	(0.001)	0.001**	(0.000)
Male	-0.240	(0.269)	0.459	(0.295)	0.100	(0.246)	0.341**	(0.170)
Income (Ref=0€-300 €)								
301€-750€	-0.707	(0.743)	1.510	(1.026)	2.043*	(1.162)	0.036	(0.388)
751€-1500€	-1.101	(0.786)	1.493	(1.027)	2.237*	(1.180)	-0.113	(0.412)
1501€-2500€	-0.747	(0.859)	2.084**	(1.034)	1.914	(1.219)	-0.396	(0.454)
>2500€	-0.853	(0.895)	2.830***	(1.062)	2.246*	(1.273)	0.235	(0.474)
Education (Ref=None or primary)								
Basic	0.934	(0.702)	0.113	(0.454)	-0.278	(0.431)	0.354	(0.253)
Secondary	1.280**	(0.650)	0.026	(0.406)	-0.278	(0.434)	1.000***	(0.262)
High or postgraduate	1.646**	(0.681)	0.348	(0.484)	-0.658	(0.482)	1.029***	(0.311)
Married	-0.135	(0.298)	-0.253	(0.380)	-0.391	(0.268)	0.215	(0.204)
Nº minors in the house	0.180	(0.205)	0.467**	(0.184)	-0.109	(0.180)	0.133	(0.103)
Catholic	-1.548***	(0.345)	-0.022	(0.535)	-0.597	(0.397)	0.914**	(0.430)
Unemployed	-0.565	(0.479)	-0.361	(0.673)	-0.212	(0.437)	-0.731**	(0.355)
Public worker	-0.124	(0.306)	0.004	(0.386)	0.058	(0.297)	-0.439**	(0.205)
Institutional Involvement								
Church attendance (Ref=Never)								
Once a year	-0.320	(0.374)	-0.065	(0.498)	-0.930**	(0.396)	-0.412	(0.324)
2-11x a year	-0.234	(0.375)	0.121	(0.489)	-1.380***	(0.398)	-0.047	(0.290)
1x or more a month	-1.519***	(0.487)	-0.302	(0.491)	-1.125***	(0.404)	-0.355	(0.298)
Once a week or more	-1.606***	(0.528)	0.982*	(0.505)	-1.190***	(0.458)	0.424	(0.290)
Trade union member	-0.066	(0.331)	-0.466	(0.421)	0.630**	(0.312)	-0.319	(0.228)
Context-Level Variables								
1/lnM	-4.297**	(1.771)	-1.267	(1.702)	0.503	(1.566)	-0.623	(0.973)
2005	0.353**	(0.148)	0.328**	(0.144)	-0.052	(0.111)	-0.526***	(0.072)
Urbanization (Ref=Rural area or village)								
Small or middle-size town	0.617	(0.470)	0.060	(0.459)	0.952**	(0.414)	0.370*	(0.224)
Suburbs of large town or city	0.302	(0.490)	0.464	(0.511)	0.935*	(0.484)	-0.031	(0.279)
Large town or city	0.826*	(0.453)	0.537	(0.460)	0.971**	(0.462)	0.141	(0.255)
Regional Dummies (Ref=North)								
Center	0.675	(0.506)	0.248	(0.461)	0.222	(0.416)	0.190	(0.238)
Lisbon and Tagus Valley	0.015	(0.389)	0.190	(0.469)	0.169	(0.375)	-0.461*	(0.245)
Alentejo	0.191	(0.520)	0.659	(0.596)	-0.010	(0.458)	-0.236	(0.303)
Algarve	0.619	(0.817)	0.506	(1.123)	0.263	(0.800)	0.700	(0.448)
Intercept	-1.624	(2.269)	-2.227	(1.993)	-1.451	(1.709)	-0.441	(1.053)

N=1647 * p<0.1; ** p<0.05; *** p<0.01. Cluster-robust standard errors are in parentheses.

Next section assesses the model fit and diagnoses potential problems.

7.7 Model Diagnosis

Firstly, the log-likelihood chi-square test for global significance indicates that the model as a whole is statistically significant with $p < 0.001$.

The percentage correctly classified, if the predicted choice corresponds to the maximum predicted probability, is equal to 49.54%.

When we conduct the Stukel Lagrange multiplier test, the null hypothesis of correct model specification is not rejected because the test of zero coefficient for the added regressor yields a $\chi^2(4)$ statistic of 3.49 with $p = 0.4801$. For the Hosmer and Lemeshow's goodness-of-fit test, using 10 groups, we obtain $p = 0.180$ and therefore we do not reject the null of correct model specification.

Finally, we test for collinearity problems. The model takes six iterations to converge which is a signal that there is not a high degree of multicollinearity. Coefficients for tolerance and VIF are presented in the first two columns of Table A.11, in the appendix. Only for age and its squared is the VIF larger than rule-of-thumb's 10 value and is the tolerance less than 0.1. With the appropriate centering, VIF and tolerance become lower than the critical thresholds, as presented in the third and fourth columns of Table A.11, in the appendix.

Overall, results validate the adequacy of our model. In the next section, we interpret the results obtained.

7.8 Interpretation of Results

Results in Table 7.3 give us the impact of our regressors relative to the base category (PS). To illustrate their impact more intuitively and taking into account that the sign of the coefficients does not necessarily give the sign of the impact of these variables on that party[10], Table 7.4 presents the marginal effects at the mean. For the multinomial logit model, the marginal effects can be shown to be[11]:

$$\frac{\partial Pr(y_i = j)}{\partial x_i} = \frac{\partial p_{ij}}{\partial x_i} = p_{ij}(\beta_j - \bar{\beta}_i) \tag{7.7}$$

where $\bar{\beta}_i = \sum_{l=1}^{5} p_{il}\beta_l$ is a probability weighted average of β_l. For the dummy variables, the marginal effect is the the discrete change in the predicted probability of voting for that party as the dummy variable changes from 0 to 1. For each regressor there are five

[10] See Cameron and Trivedi (2009): page 502.
[11] See Cameron and Trivedi (2009): page 525.

marginal effects corresponding to the five probabilities of voting for each party, and these sum to zero because probabilities sum to one.

Table 7.4: Vote Decision Marginal Effects

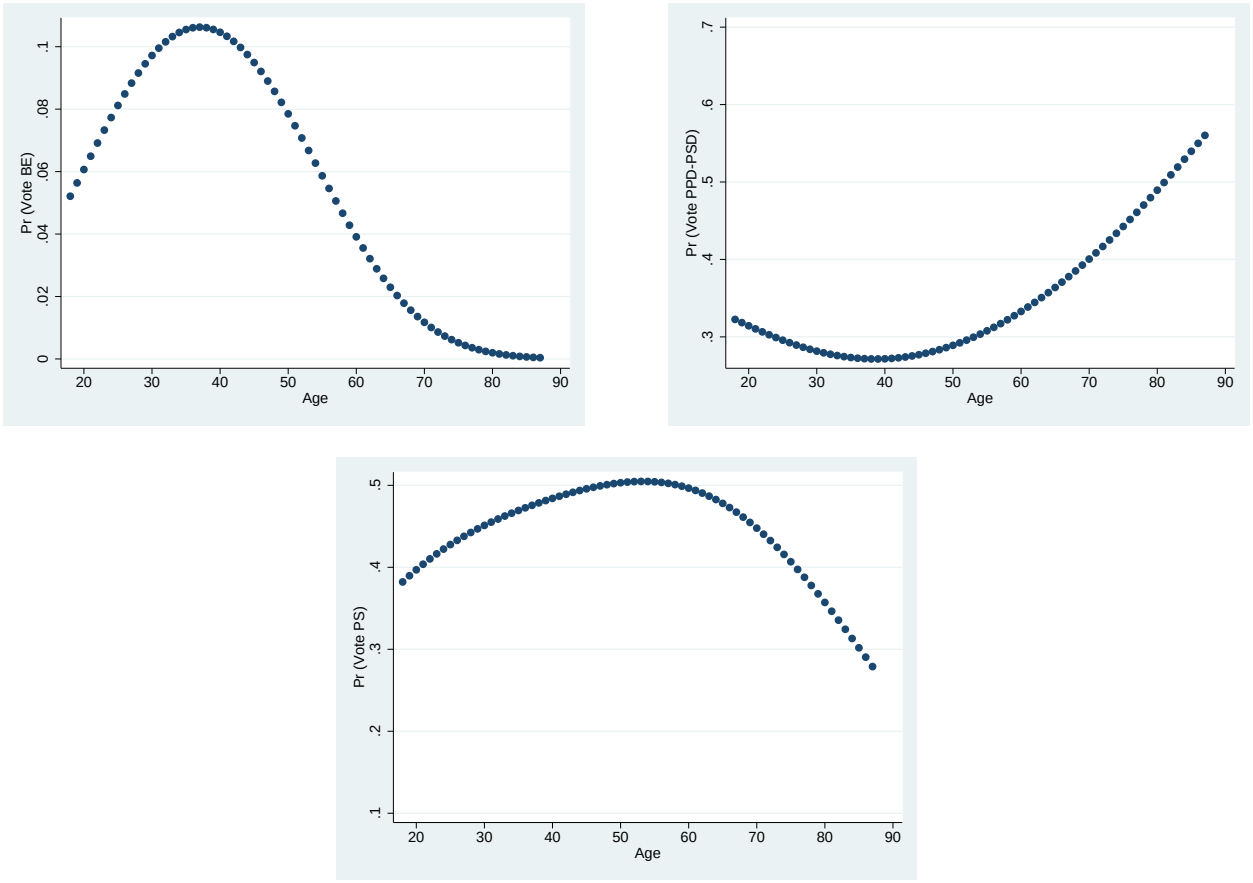
	BE	CDS-PP	CDU	PPD-PSD	PS
Individual -Level Variables					
Individual Characteristics					
Age	0.005*	-0.004	-0.003	-0.012*	0.013*
Age2	-0.000**	0.000	0.000	0.000**	-0.000*
Male	-0.012	0.018	-0.002	0.065**	-0.068*
Income (Ref=0€-300 €)					
301€-750€	-0.043	0.033**	0.065***	-0.014	-0.042
751€-1500€	-0.054	0.034**	0.086***	-0.048	-0.019
1501€-2500€	-0.041	0.075***	0.063***	-0.108	0.011
>2500€	-0.053	0.125***	0.067**	-0.010	-0.129
Education (Ref=None or primary)					
Basic	0.026	-0.000	-0.031	0.070	-0.066
Secondary	0.031	-0.016	-0.047	0.206***	-0.174***
High or postgraduate	0.043**	0.001	-0.076**	0.212***	-0.179***
Married	-0.005	-0.015	-0.031*	0.060	-0.009
Nº minors in the house	0.004	0.022**	-0.013	0.021	-0.034
Catholic	-0.056***	-0.011	-0.060**	0.224***	-0.097
Unemployed	-0.009	-0.004	0.005	-0.139**	0.148**
Public worker	0.000	0.007	0.015	-0.093**	0.071
Institutional Involvement					
Church attendance (Ref=Never)					
Once a year	-0.005	0.008	-0.086*	-0.042	0.125*
2-11x a year	-0.004	0.013	-0.123***	0.034	0.080
1x or more a month	-0.045**	-0.000	-0.098**	-0.015	0.158***
Once a week or more	-0.051***	0.060**	-0.123***	0.130**	-0.016
Trade union member	0.000	-0.021	0.054**	-0.074	0.041
Context-Level Variables					
1/lnM	-0.128**	-0.049	0.066	-0.080	0.191
2005	0.016**	0.025***	0.007	-0.120***	0.072***
Urbanization (Ref=Rural area or village)					
Small or middle-size town	0.012	-0.006	0.045**	0.056	-0.106**
Suburbs of large town or city	0.005	0.022	0.053*	-0.032	-0.048
Large town or city	0.021	0.022	0.050**	-0.005	-0.088
Regional Dummies (Ref=North)					
Center	0.018	0.007	0.009	0.024	-0.059
Lisbon and Tagus Valley	0.004	0.017	0.022	-0.105**	0.062
Alentejo	0.007	0.037	0.002	-0.063	0.016
Algarve	0.011	0.012	-0.001	0.128	-0.150

N=1647 * p<0.1; ** p<0.05; *** p<0.01. Cluster-robust standard errors are used.

7.8.1 Controls

For BE, PPD-PSD and PS, there is a curvilinear relationship between age and the probability of voting for these parties (Figure 7.5 shows the mean predicted probabilities as age varies).

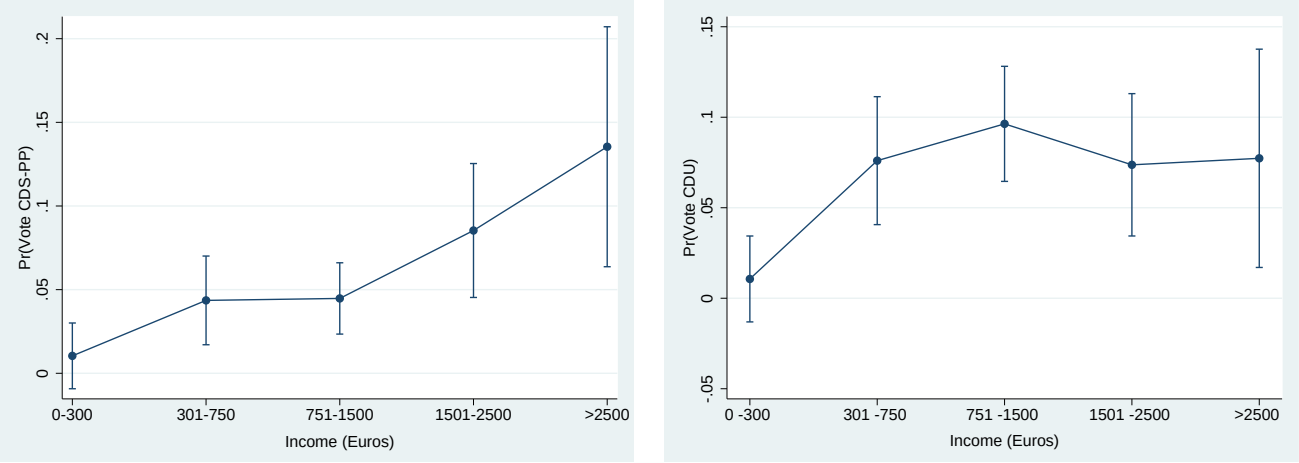
Figure 7.5: Mean Predicted Pr(Vote BE)/Pr(Vote PPD-PSD)/Pr(Vote PS) and Age



Male individuals are more likely to vote for PPD-PSD (0.065 points) and less likely to vote for PS (0.068 points).

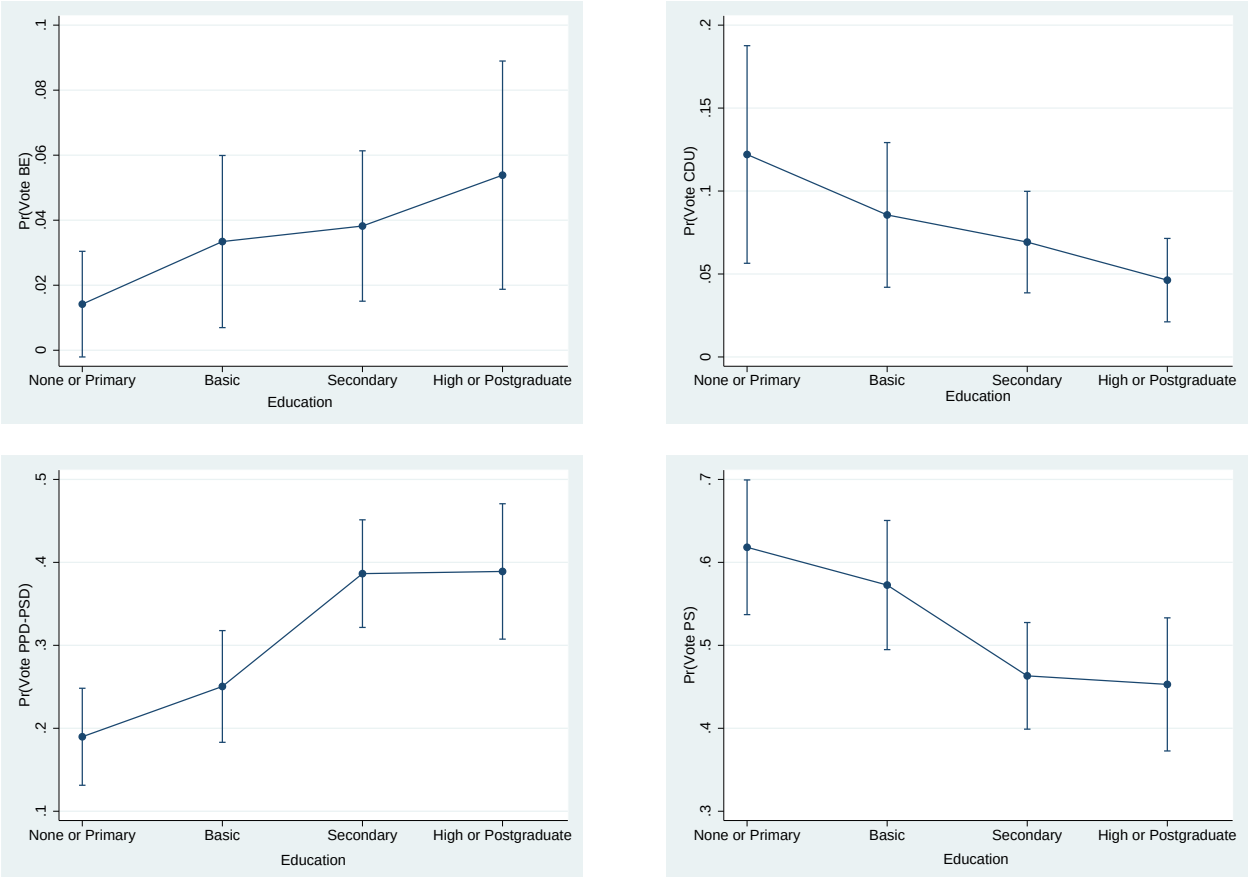
Regarding income, we estimate that it has a statistically significant impact on the probability of voting for CDS-PP and CDU (see predictive margins in Figure 7.6).

Figure 7.6: Predictive Margins for Income with 95% Confidence Level



Education has a statistically significant impact on the probability of voting for BE, CDU, PPD-PSD and PS, even though the difference for the base category (none or primary education) is not significant for all the categories of this variable. Predictive margins are presented in Figure 7.7.

Figure 7.7: Predictive Margins for Education with 95% Confidence Level

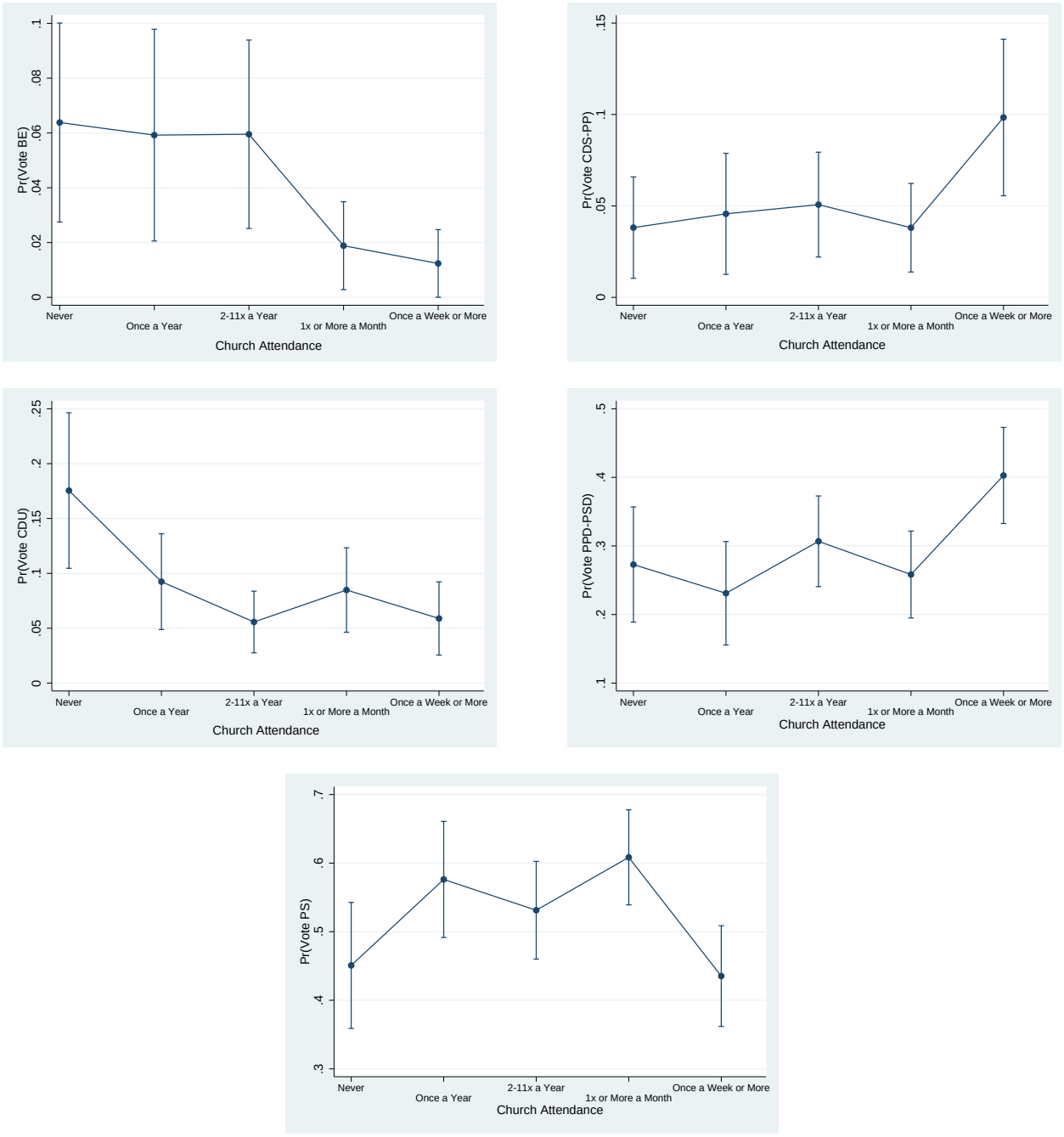


Married individuals are less likely to vote for CDU (0.031 points). The higher the number of minors living in the house, the higher the probability of voting for CDS-PP (0.022 points for each additional minor).

Being catholic increases the probability of voting for PPD-PSD (0.224 points) and decreases the probability of voting for BE (0.056 points) and CDU (0.060 points). Unemployed individuals are less likely to vote for PPD-PSD (0.139 points) and more likely to vote for PS (0.148 points). Public workers are less likely to vote for PPD-PSD (0.093 points).

Church attendance has an impact on the probability of voting for all the parties, even though the difference for the base category (never attends church) is not statistically significant for all the categories of this variable, except for CDU. Figure 7.8 presents the predictive margins for each party.

Figure 7.8: Predictive Margins for Church Attendance with 95% Confidence Level



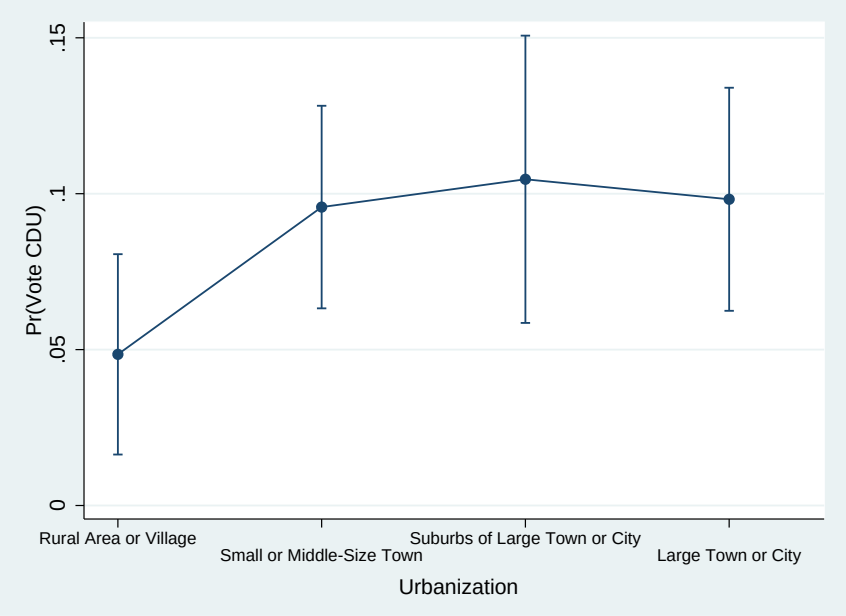
Trade union membership increases the probability of voting for CDU (0.054 points).

For 2005, the probability of voting for BE, CDS-PP and PS is higher (0.016, 0.025 and 0.072 points, respectively) and the probability of voting for PPD-PSD is lower (0.120 points).

The degree of urbanization has an impact on the probability of voting for CDU (see Figure

7.9) and for PS (the probability is lower in small or middle-size towns than in rural areas or villages in 0.106 points).

Figure 7.9: Predictive Margins for Urbanization with 95% Confidence Level



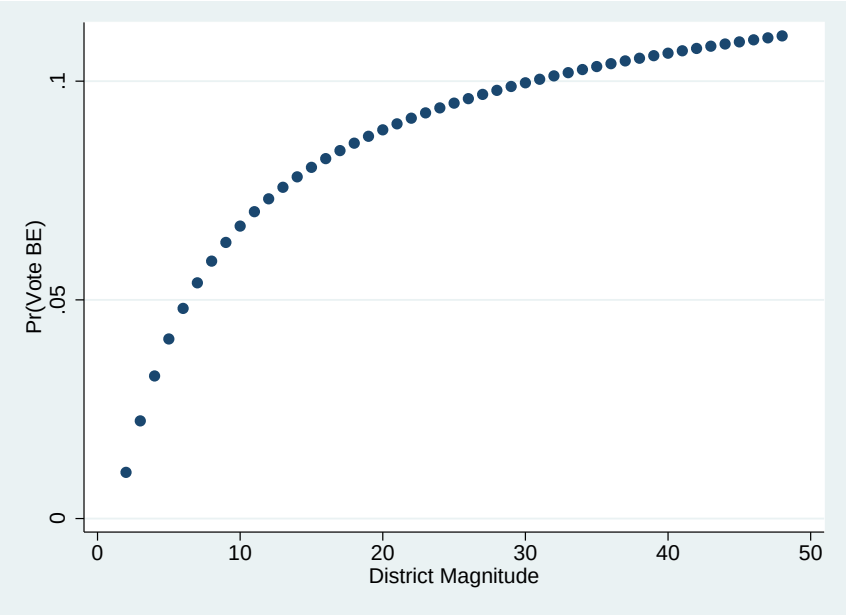
In terms of regional effects, individuals that live in the Lisbon and Tagus Valley region are less likely to vote for PPD-PSD (0.105 points) than those that live in the North.

Given the vast methodological differences that we have introduced, our results for the control variables are not comparable with previous studies for Portugal.

7.8.2 District Magnitude

District magnitude only has a statistically significant impact on the probability of voting for BE. Figure 7.10 illustrates the effect of district magnitude on the probability of voting for this party, with predicted values derived from the estimation of Model 2 with all the regressors except the inverse of district magnitude at the mean. The probability of voting for BE increases as district magnitude increases, with diminishing returns.

Figure 7.10: Mean Predicted Pr(Vote BE) and District Magnitude



District magnitude is not statistically significant for the other parties, which is surprising. We were expecting the marginal effect of district magnitude on large parties to be positive, indicating that the probability of voting for them is larger in smaller districts, and negative for small parties, indicating that the probability of voting for them is larger in larger districts. Even though the marginal effects for CDS-PP and PS are signed according to our expectations, they are not statistically significant; the direction for the marginal effects of CDU and PPD-PSD is not the one we would expect and they are not statistically significant.

7.9 Predictions

In order to estimate the effects of a potential reform to the electoral system on parties votes, we compare the mean predicted probability of voting for each party under the same alternative scenarios as in the previous sections of this study (Table 7.5). The results for the national and single-member circles should be interpreted with caution since we are dealing with out-of-sample predictions.

Table 7.5: Mean Predicted Probability of Voting for Each Party Under the Alternative Scenarios

	BE	CDS-PP	CDU	PPD-PSD	PS
Current System	8.2%	6.1%	8.9%	30.5%	46.3%
Uniform Circles System	7.3%	6.0%	9.2%	30.6%	46.8%
180 MPs	7.5%	6.0%	9.2%	30.4%	47.0%
National Circle	13.6%	6.7%	7.2%	30.8%	41.6%
Single-Member Circles	0.1%	2.2%	18.6%	21.0%	58.0%

To illustrate the effects more intuitively, Table 7.6 presents the mean predicted probability of voting for each party in 2005, with results weighted to replicate national level results in the mainland.

Table 7.6: Mean Predicted Probability of Voting for Each Party Under the Alternative Scenarios - 2005 (Weighted)

	BE	CDS-PP	CDU	PPD-PSD	PS
Current System	6.8%	7.7%	8.2%	29.7%	47.6%
Uniform Circles System	6.1%	7.6%	8.5%	29.7%	48.1%
180 MPs	6.3%	7.6%	8.4%	29.5%	48.2%
National Circle	11.4%	8.5%	6.7%	30.2%	43.2%
Single-Member Circles	0.1%	2.8%	17.3%	20.3%	59.5%

Firstly, under the uniform circles system, the mean predicted probability of voting for CDU and PS increases, for BE and CDS-PP decreases and for PPD-PSD remains similar. Secondly, under a system with 180 MPs, the mean predicted probability of voting for BE, CDS-PP and PPD-PSD decreases and for CDU and PS it increases. BE presents the largest decrease in this probability (0.5 p.p.) and PS is the party with the largest increase (0.6 p.p.).

Thirdly, under a national circle, the mean predicted probability of voting for BE, CDS-PP and PPD-PSD increases, whereas for CDU and PS it decreases. The increase of this probability for BE is substantial (4.6 p.p.) and is explained by the positive relationship that we have found between the probability of voting for this party and district magnitude.

Finally, for single-member circles, we estimate a substantial decrease of the mean probability of voting for BE, CDS-PP and PPD-PSD (6.7 p.p., 4.9 p.p. and 9.4 p.p., respectively) and a considerable increase for CDU and PS (9.1 p.p. and 11.9 p.p., respectively). Contrarily to what was expected (for example by Teixeira (2009), VV.AA. (1998b) and VV.AA. (1998c)), we estimate that this scenario would not "force" the electors to vote

in one of the two major parties, which would reinforce the negative effects for the small parties from a decrease in the proportionality of the system and lead to a bipolarization of the system. Indeed, contrarily to this view, we estimate not only a substantial decrease of the mean probability of voting for PPD-PSD but also a considerable increase of the mean probability of voting for CDU. For BE, CDS-PP and PS the results are directionally in line with these expectations.

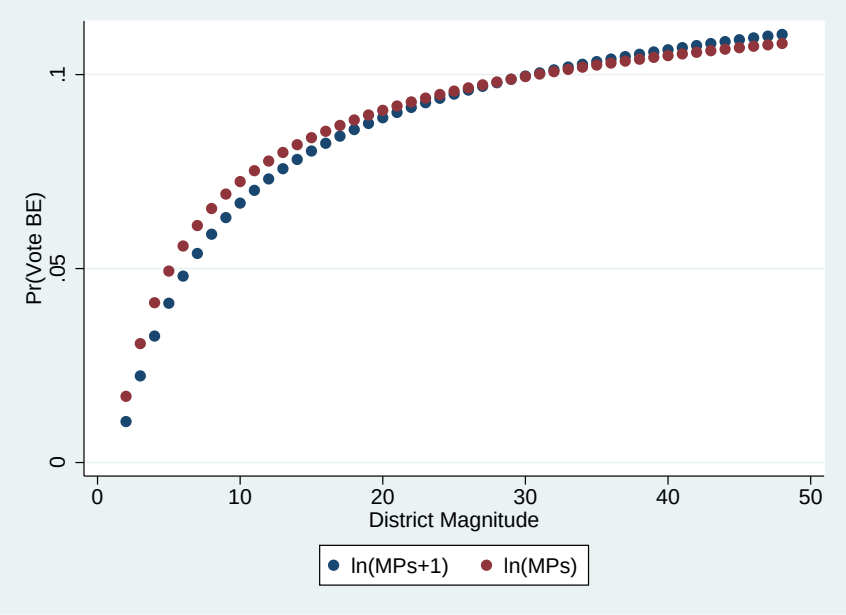
Overall, whereas the results for BE, CDS-PP and PS, for the last three scenarios, are directionally in line with our expectations, the same is not true for CDU and PPD-PSD. The explanation lies in the fact that the sign of the marginal effects for these two parties is not the one that we were expecting. This can be a consequence of the limitations of our dataset (with a small number of observations for very small districts) and, therefore, this is an important point for further studies to scrutinize (potentially using improved datasets).

Within these limitations, these results shed light on a number of important points regarding redistricting exercises. In particular, they suggest that reforms to the electoral system would have consequences on the way individuals vote, adding to the consequences on the conversion of votes into seats that have been simulated in previous research (Presidência do Conselho de Ministros (1997) and Freire et al. (2008)). For example, these results indicate that a reduction to 180 MPs would hurt BE and CDS-PP through a decrease of the mean probability of voting for these parties, besides the so-discussed effect through the decrease of the proportionality of the system (e.g. Antunes (2010)).

7.10 Sensitivity Analysis

We start by revisiting our model using the inverse of the logarithm of district magnitude instead of the inverse of the logarithm of district magnitude plus one. The coefficients of the control variables are similar (see Table A.12, in the appendix). Regarding district magnitude, when we use our operationalization the mean predicted probability of voting for BE is smaller in small districts and larger in large districts (see Figure 7.11).

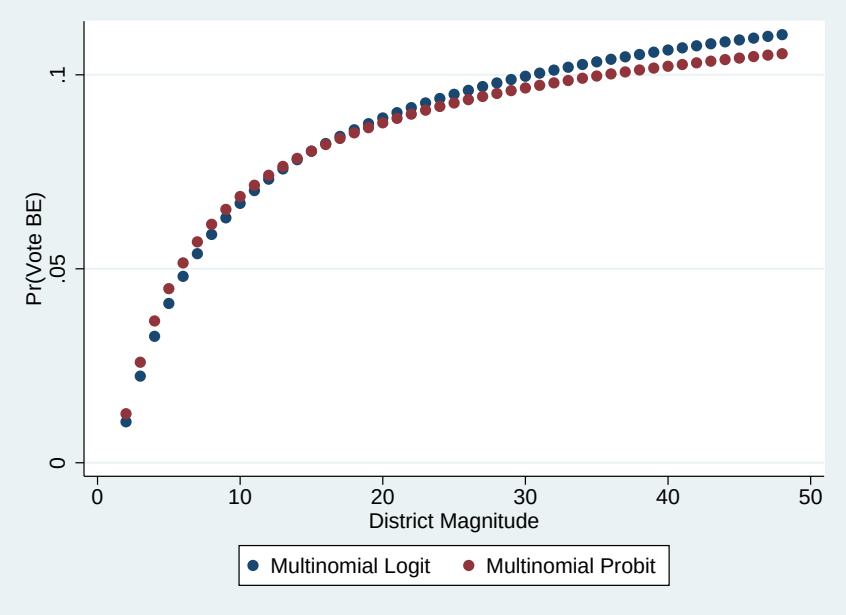
Figure 7.11: Mean Predicted Pr(Vote BE) and District Magnitude: Using ln(MPs+1) and ln(MPs)



Then, we estimate the model assuming that $\varepsilon_{i1}, ..., \varepsilon_{i5}$ are independent, standard normal, random variables (multinomial probit model[12]). To make the estimates comparable to our previously estimated model, we compute the marginal effects at the mean. Results are presented in Table A.13, in the appendix, and show little difference between the models. For district magnitude, when the multinomial probit is used the mean predicted probability of voting for BE in small districts is higher and in large districts is lower (see Figure 7.12).

[12]Command mprobit using STATA 12.0

Figure 7.12: Mean Predicted Pr(Vote BE) and District Magnitude: Using Multinomial Logit and Multinomial Probit



We test whether the multinomial probit model is better than the multinomial logit. The multinomial logit has a log likelihood of -1869.40 which is 2.59 higher than the -1871.99 for the multinomial probit, favoring the multinomial logit model.

Finally, a shortcoming of our analysis is that the multinomial logit imposes the independence of irrelevant alternatives property. In a party choice model, this property implies that the ratio of the probability of choosing one party to the probability of choosing a second party is unchanged for individual voters if a third party enters the race. A multinomial probit model that estimates the variance-covariance parameters of the latent variable errors[13] does not impose this property and therefore can clarify what might happen were new parties to move in or current parties to drop out. However, when we use this estimation method our model does not converge. This problem is in line with previous studies: Lee and Kang (2009) state that "MNP hardly converges well" and that studies that use it have "critical errors that non-identified parameters are estimated". Moreover, Dow and Endersby (2004) conclude that for most studies of vote choice "the IIA property is neither relevant nor particularly restrictive" and Kropko (2007) adds that the multinomial logit model "nearly always provides more accurate results (...) even when the IIA assumption is severely violated".

[13]Command asmprobit using STATA 12.0

7.11 Conclusions

In this section we have presented a model of vote choice that outlines fundamental traits about the way the Portuguese vote.

Regarding our controls, many variables are statistically significant and their analysis uncovers factors that drive the decision of the Portuguese in choosing among the five main parties.

Regarding district magnitude, our findings show that it has as a positive and significant impact on the probability of voting for BE, with diminishing returns. Contrarily to our expectations, for the other parties district magnitude is not statistically significant.

As for the other sections, we have made predictions for four alternative electoral scenarios. For a scenario with uniform circles, results show that the mean predicted probability of voting for CDU and PS increases, for BE and CDS-PP decreases and for PPD-PSD it remains similar. For a reduction to 180 MPs, results show a decrease in the mean probability of voting for BE, CDS-PP and PPD-PSD, and an increase for CDU and PS.

Our predictions for a national circle and single-member circles need to be interpreted with caution given that they are out-of-sample predictions. They give us, however, a rough idea of what would be the impact of these scenarios. For the national circle, the mean predicted probability of voting for BE, CDS-PP and PPD-PSD increases, whereas for CDU and PS it decreases. For single-member circles, we estimate a huge decrease of the mean probability of voting for BE, CDS-PP and PPD-PSD and a substantial increase of this probability for CDU and for PS.

For the last three scenarios, the results for BE, CDS-PP and PS are directionally in line with our expectations, but the same is not true for CDU and PPD-PSD. The explanation lies in the fact that the sign for the marginal effects for these two parties is not the one that we were expecting.

Overall, we have shed additional light on the vote decision of the Portuguese and we have shown the impact of district magnitude on this decision. Within the limitations of our dataset, we demonstrate the importance of district magnitude on the way people vote, reinforcing the importance of scrutinizing its impact and of giving it more attention in further electoral reform debates. Also important is to study the impact of district magnitude on the probability of voting for the Portuguese residual parties (which would require a larger dataset and a disaggregation of this group into its several parties).

8 Conclusions and Discussion

We have made five contributions in this study.

Firstly, the analysis of our control variables corroborates previous knowledge about the electoral behavioral of the Portuguese but also contradicts other and sheds light on important new aspects. In particular, to our knowledge our study is the first contribution to the understanding of the impact of individual-level determinants on the decision to vote sincerely or strategically.

Secondly, we show that district magnitude has a statistically significant impact on the probability of abstaining: we estimate that there is a steep decrease in this probability as district magnitude increases followed by a flattening out of this relationship.

Thirdly, we show that district magnitude also has a negative impact on the probability of voting strategically, with diminishing returns. Moreover, results indicate that the impact of district magnitude on the probability of voting strategically is very similar to its impact on the probability of abstention. Therefore, it is possible to have relatively low levels of abstention and strategic voting while bearing relatively fewer of the costs associated to very large districts, for example in terms of the so-discussed distance between the elected and the electors.

Fourthly, we show that district magnitude plays an important role in shaping the choice of party by individuals as it has a statistically significant positive impact on the probability of voting for the "Left Block" party (BE).

Finally, the predictions for the uniform-size circles, reduction of Members of Parliament to 180, national circle and single-member circles scenarios quantified the impact of these redistricting exercises on the mean probability of abstaining, voting sincerely and voting for each of the five main parties.

Notwithstanding, we identify five main limitations in our analysis.

Firstly, our dataset includes a small number of observations for very small districts and we believe that this is influencing some points of our analysis as mentioned throughout this study.

Secondly, ideally one would have a larger variation of district magnitude between 2002 and 2005, to have variation between years besides variation within districts. Indeed, even though district magnitude changes in two districts between these years, these districts are Portalegre, with a small number of observations, and Madeira, which is not included in our dataset.

Thirdly, we use data for 2002 and 2005 and the behavior of individuals might have changed

meanwhile, posing some limitations on the applicability of our results to a future electoral reform.

Fourthly, our predictions for the national and single-member circles are out-of-sample predictions, which requires caution in their interpretation, as mentioned throughout our analysis.

Finally, as we are using survey data, besides the limitations associated to non-response, the answers might be intentionally or accidentally false. Sigelman (1982) argues that "no major differences emerge when identical discriminant models of voting are fitted using respondent-reported and officially validated voting data" and Katosh and Traugott (1981) refers that "there are no major changes in the fundamental nature of basic relationships". However, ideally one would have validated data.

Within these limitations, we believe that we have taken a big step by using individual-level instead of aggregate data, by overcoming other shortcomings that we have identified in previous research and by presenting an innovative approach that provides an idea of the quantitative importance of non-mechanical effects that can result from redistricting exercises. Therefore, this study should remind researchers and electoral system's designers that redistricting exercises imply more than changes in the conversion of votes into seats and that these effects that result from the adjustment of electors' strategies should be given more attention in further electoral reform debates.

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Appendices

Table A.1: Vote/Abstain Decision: Variables Used in the Models

Name	Description	Categories/Range
Dependent Variable		
Abstention	Whether the respondent voted or not.	(1) did not vote: 19.96% (0) voted: 80.04%
Individual-Level Variables		
INDIVIDUAL CHARACTERISTICS		
Age	Age of the respondent measured in years.	min: 18 max: 89 mean: 45.08
Age2	Age squared.	min: 324 max: 7921 mean: 2321.36
Male	Gender of the respondent.	(1) male: 49,29% (0) female: 50.71%
Income	A set of dummies indicating the income of the respondent.	Reference= 0€-300 €: 8.60% (301€-750€): 33.21% (751€-1500€): 34.45% (1501€-2500€): 15.65% (>2500€): 8.10%
Education	A set of dummies indicating the educational attainment of the respondent.	Reference = No education or primary incomplete or completed (0-4 years): 28.42% (Basic) basic incomplete or completed (5-9 years): 20.53% (Secondary) secondary incomplete or completed (10-12 years): 28.82% (High or postgraduate) higher incomplete or completed or postgraduate incomplete or completed: 22.24%
Married	Marital status of the respondent.	(1) married or living together as married: 62.68% (0) widowed, divorced or separated, married but separated or single: 37.32%
Nº minors in the house	Number of minors that live in the house.	min: 0 max: 7 mean: 0.575
Catholic	Religion of the respondent.	(1) catholic: 88.38% (0) other or none: 11.62%
Unemployed	Whether the respondent is unemployed or not.	(1) yes: 8.84% (0) no: 91.16%
Public worker	Whether the respondent (or the main contributor in the household if the respondent is a student) works for the public sector (central and local public administration/autonomous public entities/public enterprises).	(1) works for the public sector: 19.96% (0) works for the private sector, on a mixed firm, for a non-profit organization or is self-employed: 80.04%
INSTITUTIONAL INVOLVEMENT		
Church attendance	How often the respondent goes to church/attends religious services.	Reference = Never: 16.87% (Once a year): 13.50% (2-11x a year): 20.99% (1x or more a month): 22.81% (Once a week or more): 25.83%

Table A.1: Vote/Abstain Decision: Variables Used in the Models

Name	Description	Categories/Range
Trade union member	Whether the respondent is a trade union member or not.	(1) trade union member: 11.72% (0) not a trade union member: 88.28%
POLITICAL VARIABLES		
Close to a party	Whether the respondent feels close to a party (and which party) or not	Reference=PS: 17.50% (BE): 4.00% (CDS-PP): 2.67% (CDU): 4.56% (PPD-PSD): 10.64% (Other): 2.04% (None): 58.58%
Informed about politics	Dummy variable indicating whether the individual answered correctly to the question: "Do you remember which was the most voted party in the last election?"	(1) yes: 92.61% (0) no: 7.39%
POSITION TOWARDS ISSUES		
Wealth inequality	Thermometer measure of the position of the respondent towards wealth inequality.	1- there should be a more equal distribution of wealth 10- there should be more incentives for individual initiative min: 1 max: 10 mean: 4.51
Taxes	Thermometer measure of the position of the respondent towards taxes.	1- we should improve government services and social assistance even if it means increasing taxes 10- we should reduce taxes, even if it means reducing government services and social assistance min: 1 max: 10 mean: 3.94
Government decision making	Thermometer measure of the position of the respondent towards government decision making.	1- increase citizen participation in government decision making 10- government should make decisions quickly based on the knowledge of experts min: 1 max: 10 mean: 4.79
Context-level Variables		
1/lnM	Inverse of the logarithm of one plus the number of seats in a district.	min: 0.26 max: 0.91 mean: 0.37
Rain	Rainfall in the district capital (mm).	min: 0 max: 24.67 mean: 3.95
2005	Dummy for the year 2005.	(1) 2005: 50% (0) 2002: 50%
Urbanization	A set of dummies indicating the level of urbanization.	Reference=Rural area or village: 21.42% (Small or middle-size town): 33.57% (Suburbs of large town or city): 17.20% (Large town or city): 27.81%
Regional Dummies	A set of dummies indicating the region where the respondent lives. When districts belong to more than one region, we include them in the region of the district capital.	Reference=North: 35.67% (Center): 20.91% (Lisbon and Tagus Valley): 29.60% (Alentejo): 10.21% (Algarve): 3.61%
Correction	Difference between aggregate turnout figures and the reported turnout in each district.	min: -0.32 max: 0.35 mean: 0.18

Table A.2: Vote/Abstain Decision: Collinearity Diagnosis

	Before age correction		After age correction	
	VIF	Tolerance	VIF	Tolerance
Individual -Level Variables				
Individual Characteristics				
Age	41.26	0.02	1.90	0.53
Age2	40.44	0.02	1.30	0.77
Male	1.17	0.86	1.17	0.86
Income (Ref=0€-300 €)				
301€-750€	6.90	0.15	6.90	0.15
751€-1500€	8.84	0.11	8.84	0.11
1501€-2500€	7.04	0.14	7.04	0.14
>2500€	4.87	0.21	4.87	0.21
Education (Ref=None or primary)				
Basic	1.84	0.54	1.84	0.54
Secondary	2.81	0.36	2.81	0.36
High or postgraduate	3.44	0.29	3.44	0.29
Married	1.50	0.67	1.50	0.67
Nº minors in the house	1.41	0.71	1.41	0.71
Catholic	1.38	0.73	1.38	0.73
Unemployed	1.11	0.90	1.11	0.90
Public worker	1.28	0.78	1.28	0.78
Institutional Involvement				
Church attendance (Ref=Never)				
Once a year	1.80	0.56	1.80	0.56
2-11x a year	2.11	0.47	2.11	0.47
1x or more a month	2.20	0.45	2.20	0.45
Once a week or more	2.28	0.44	2.28	0.44
Trade union member	1.21	0.83	1.21	0.83
Political Variables				
Close to a party (Ref=PS)				
BE	1.36	0.73	1.36	0.73
CDS-PP	1.26	0.80	1.26	0.80
CDU	1.24	0.81	1.24	0.81
PPD-PSD	1.54	0.65	1.54	0.65
Other	1.15	0.87	1.15	0.87
None	1.83	0.55	1.83	0.55
Informed about politics	1.07	0.93	1.07	0.93
Position towards issues				
Wealth inequality	1.12	0.89	1.12	0.89
Taxes	1.10	0.91	1.10	0.91
Government decision making	1.11	0.90	1.11	0.90
Context-Level Variables				
1/lnM	2.32	0.43	2.32	0.43
Rain	5.70	0.18	5.70	0.18
2005	5.05	0.20	5.05	0.20
Urbanization (Ref=Rural area or village)				
Small or middle-size town	2.12	0.47	2.12	0.47
Suburbs of large town or city	2.02	0.49	2.02	0.49
Large town or city	2.49	0.40	2.49	0.40
Regional Dummies (Ref=North)				
Center	1.83	0.55	1.83	0.55

Lisbon and Tagus Valley	2.53	0.40	2.53	0.40
Alentejo	2.18	0.46	2.18	0.46
Algarve	1.30	0.77	1.30	0.77
Correction	1.46	0.68	1.46	0.68

Table A.3: Vote/Abstain Decision: Estimation of Model 2 Using ln(MPs)

Individual -Level Variables		
Individual Characteristics		
Age	-0.081**	(0.035)
Age2	0.001**	(0.000)
Male	0.070	(0.193)
Income (Ref=0€-300 €)		
301€-750€	-0.789	(0.537)
751€-1500€	-1.003*	(0.555)
1501€-2500€	-0.832	(0.581)
>2500€	-1.351**	(0.626)
Education (Ref=None or primary)		
Basic	0.528*	(0.301)
Secondary	0.479*	(0.289)
High or postgraduate	-0.050	(0.359)
Married	0.157	(0.236)
Nº minors in the house	-0.101	(0.120)
Catholic	-0.193	(0.312)
Unemployed	-0.212	(0.334)
Public worker	-0.598**	(0.278)
Institutional Involvement		
Church attendance (Ref=Never)		
Once a year	-0.599*	(0.313)
2-11x a year	-0.251	(0.281)
1x or more a month	-0.688**	(0.314)
Once a week or more	-0.798**	(0.336)
Trade union member	-0.518*	(0.302)
Political Variables		
Close to a party (Ref=PS)		
BE	0.726*	(0.441)
CDS-PP	0.636	(0.489)
CDU	0.057	(0.483)
PPD-PSD	0.371	(0.343)
Other	-1.636	(1.102)
None	0.844***	(0.257)
Informed about politics	-0.697**	(0.318)
Position towards issues		
Wealth inequality	0.074***	(0.028)
Taxes	0.033	(0.035)
Government decision making	0.017	(0.029)
Context-Level Variables		
1/lnM	1.632**	(0.760)
Rain	-0.012	(0.022)
2005	-0.366	(0.254)
Urbanization (Ref=Rural area or village)		
Small or middle-size town	-0.191	(0.265)
Suburbs of large town or city	0.032	(0.313)
Large town or city	0.384	(0.298)
Regional Dummies (Ref=North)		
Center	-0.475	(0.307)
Lisbon and Tagus Valley	-0.238	(0.270)
Alentejo	-0.745*	(0.398)
Algarve	-0.049	(0.602)
Correction	-5.636***	(1.662)

Intercept	1.894	(1.265)

N=1728. * p<0.1; ** p<0.05; *** p<0.01. Cluster-robust standard errors are in parentheses.

Table A.4: Vote/Abstain Decision: Estimation of Model 2 Without Portalegre

Individual -Level Variables		
Individual Characteristics		
Age	-0.081**	(0.035)
Age2	0.001**	(0.000)
Male	0.067	(0.193)
Income (Ref=0€-300 €)		
301€-750€	-0.7958	(0.535)
751€-1500€	-1.012*	(0.553)
1501€-2500€	-0.836	(0.579)
>2500€	-1.356**	(0.624)
Education (Ref=None or primary)		
Basic	0.528*	(0.301)
Secondary	0.478*	(0.289)
High or postgraduate	-0.049	(0.360)
Married	0.155	(0.236)
Nº minors in the house	-0.100	(0.120)
Catholic	-0.195	(0.312)
Unemployed	-0.201	(0.334)
Public worker	-0.600**	(0.279)
Institutional Involvement		
Church attendance (Ref=Never)		
Once a year	-0.601*	(0.313)
2-11x a year	-0.262	(0.282)
1x or more a month	-0.686**	(0.314)
Once a week or more	-0.806**	(0.336)
Trade union member	-0.522*	(0.302)
Political Variables		
Close to a party (Ref=PS)		
BE	0.717	(0.439)
CDS-PP	0.629	(0.489)
CDU	0.053	(0.482)
PPD-PSD	0.363	(0.343)
Other	-1.643	(1.101)
None	0.839***	(0.257)
Informed about politics	-0.694**	(0.317)
Position towards issues		
Wealth inequality	0.073**	(0.028)
Taxes	0.034	(0.035)
Government decision making	0.017	(0.029)
Context-Level Variables		
1/lnM	2.171**	(1.104)
Rain	-0.012	(0.022)
2005	-0.363	(0.258)
Urbanization (Ref=Rural area or village)		
Small or middle-size town	-0.192	(0.264)
Suburbs of large town or city	0.041	(0.314)
Large town or city	0.391	(0.299)
Regional Dummies (Ref=North)		
Center	-0.506	(0.313)
Lisbon and Tagus Valley	-0.231	(0.274)
Alentejo	-0.739*	(0.395)
Algarve	-0.088	(0.604)
Correction	-5.641***	(1.868)

Intercept	1.752	(1.286)

N=1728. * p<0.1; ** p<0.05; *** p<0.01. Cluster-robust standard errors are in parentheses.

Table A.5: Vote/Abstain Decision: Marginal Effects

	Logit	Probit
Individual -Level Variables		
Individual Characteristics		
Age	-0.008**	-0.009**
Age2	0.000**	0.000**
Male	0.007	0.004
Income (Ref=0€-300 €)		
301€-750€	-0.115	-0.120
751€-1500€	-0.136	-0.143
1501€-2500€	-0.119	-0.122
>2500€	-0.165*	-0.173*
Education (Ref=None or primary)		
Basic	0.052*	0.057*
Secondary	0.047*	0.048
High or postgraduate	-0.005	-0.006
Married	0.015	0.012
Nº minors in the house	-0.010	-0.009
Catholic	-0.019	-0.027
Unemployed	-0.020	-0.025
Public worker	-0.059**	-0.063**
Institutional Involvement		
Church attendance (Ref=Never)		
Once a year	-0.068*	-0.073*
2-11x a year	-0.033	-0.034
1x or more a month	-0.075**	-0.079**
Once a week or more	-0.085**	-0.091**
Trade union member	-0.052*	-0.053*
Political Variables		
Close to a party (Ref=PS)		
BE	0.071	0.078*
CDS-PP	0.062	0.059
CDU	0.005	0.004
PPD-PSD	0.036	0.042
Other	-0.162	-0.139
None	0.083***	0.089***
Informed about politics	-0.069**	-0.076**
Position towards issues		
Wealth inequality	0.007**	0.008***
Taxes	0.003	0.003
Government decision making	0.002	0.001
Context-Level Variables		
1/lnM	0.222**	0.226**
Rain	-0.001	-0.002
2005	-0.037	-0.047*
Urbanization (Ref=Rural area or village)		
Small or middle-size town	-0.019	-0.021
Suburbs of large town or city	0.004	0.001
Large town or city	0.039	0.040
Regional Dummies (Ref=North)		
Center	-0.050	-0.052
Lisbon and Tagus Valley	-0.022	-0.020
Alentejo	-0.073*	-0.075*
Algarve	-0.009	-0.004

Correction	-0.584***	-0.660***

N=1728. * p<0.1; ** p<0.05; *** p<0.01. Cluster-robust standard errors are used.

Table A.6: Vote Sincerely/Strategically Decision: Variables Used in the Models

Name	Description	Categories/Range
Dependent Variable		
Sincere	Whether the respondent voted sincerely or not.	(1) yes: 86.80% (0) no: 13.82%
Individual-Level Variables		
INDIVIDUAL CHARACTERISTICS		
Age	Age of the respondent measured in years.	min: 18 max: 89 mean: 45.08
Age2	Age squared.	min: 324 max: 7921 mean: 2321.36
Male	Gender of the respondent.	(1) male: 49,29% (0) female: 50.71%
Income	A set of dummies indicating the income of the respondent.	Reference= 0€-300 €: 8.60% (301€-750€): 33.21% (751€-1500€): 34.45% (1501€-2500€): 15.65% (>2500€): 8.10%
Education	A set of dummies indicating the educational attainment of the respondent.	Reference = No education or primary incomplete or completed (0-4 years): 28.42% (Basic) basic incomplete or completed (5-9 years): 20.53% (Secondary) secondary incomplete or completed (10-12 years): 28.82% (High or postgraduate) higher incomplete or completed or postgraduate incomplete or completed: 22.24%
Married	Marital status of the respondent.	(1) married or living together as married: 62.68% (0) widowed, divorced or separated, married but separated or single: 37.32%
Nº minors in the house	Number of minors that live in the house.	min: 0 max: 7 mean: 0.575
Catholic	Religion of the respondent.	(1) catholic: 88.38% (0) other or none: 11.62%
Unemployed	Whether the respondent is unemployed or not.	(1) yes: 8.84% (0) no: 91.16%
Public worker	Whether the respondent (or the main contributor in the household if the respondent is a student) works for the public sector (central and local public administration/autonomous public entities/public enterprises).	(1) works for the public sector: 19.96% (0) works for the private sector, on a mixed firm, for a non-profit organization or is self-employed: 80.04%
INSTITUTIONAL INVOLVEMENT		
Church attendance	How often the respondent goes to church/attends religious services.	Reference = Never: 16.87% (Once a year): 13.50% (2-11x a year): 20.99% (1x or more a month): 22.81% (Once a week or more): 25.83%
Trade union member	Whether the respondent is a trade union member or not.	(1) trade union member: 11.72% (0) not a trade union member: 88.28%
POLITICAL VARIABLES		

Table A.6: Vote Sincerely/Strategically Decision: Variables Used in the Models

Name	Description	Categories/Range
Close to a party	Whether the respondent feels close to a party (and which party) or not	Reference=PS: 42.26% (BE): 9.67% (CDS-PP): 6.45% (CDU): 11.01% (PPD-PSD): 25.69% (Other): 4.92%
Informed about politics	Dummy variable indicating whether the individual answered correctly to the question: "Do you remember which was the most voted party in the last election?"	(1) yes: 92.61% (0) no: 7.39%
POSITION TOWARDS ISSUES		
Wealth inequality	Thermometer measure of the position of the respondent towards wealth inequality.	1- there should be a more equal distribution of wealth 10- there should be more incentives for individual initiative min: 1 max: 10 mean: 4.51
Taxes	Thermometer measure of the position of the respondent towards taxes.	1- we should improve government services and social assistance even if it means increasing taxes 10- we should reduce taxes, even if it means reducing government services and social assistance min: 1 max: 10 mean: 3.94
Government decision making	Thermometer measure of the position of the respondent towards government decision making.	1- increase citizen participation in government decision making 10- government should make decisions quickly based on the knowledge of experts min: 1 max: 10 mean: 4.79
Context-level variables		
1/lnM	Inverse of the logarithm of one plus the number of seats in a district.	min: 0.26 max: 0.91 mean: 0.37
2005	Dummy for the year 2005.	(1) 2005: 50% (0) 2002: 50%
Urbanization	A set of dummies indicating the level of urbanization.	Reference=Rural area or village: 21.42% (Small or middle-size town): 33.57% (Suburbs of large town or city): 17.20% (Large town or city): 27.81%
Regional Dummies	A set of dummies indicating the region where the respondent lives. When districts belong to more than one region, we include them in the region of the district capital.	Reference=North: 35.67% (Center): 20.91% (Lisbon and Tagus Valley): 29.60% (Alentejo): 10.21% (Algarve): 3.61%

Table A.7: Vote Sincerely/Strategically Decision: Collinearity Diagnosis

	Before age correction		After age correction	
	VIF	Tolerance	VIF	Tolerance
Individual -Level Variables				
Individual Characteristics				
Age	41.03	0.02	1.89	0.53
Age2	40.26	0.02	1.30	0.77
Male	1.17	0.86	1.17	0.86
Income (Ref=0€-300 €)				
301€-750€	6.89	0.15	6.89	0.15
751€-1500€	8.83	0.11	8.83	0.11
1501€-2500€	7.03	0.14	7.03	0.14
>2500€	4.87	0.21	4.87	0.21
Education (Ref=None or primary)				
Basic	1.83	0.55	1.83	0.55
Secondary	2.81	0.37	2.81	0.37
High or postgraduate	3.43	0.29	3.43	0.29
Married	1.49	0.67	1.49	0.67
Nº minors in the house	1.41	0.71	1.41	0.71
Catholic	1.38	0.73	1.38	0.73
Unemployed	1.10	0.91	1.10	0.91
Public worker	1.28	0.78	1.28	0.78
Institutional Involvement				
Church attendance (Ref=Never)				
Once a year	1.79	0.56	1.79	0.56
2-11x a year	2.08	0.48	2.08	0.48
1x or more a month	2.17	0.46	2.17	0.46
Once a week or more	2.27	0.44	2.27	0.44
Trade union member	1.21	0.83	1.21	0.83
Political Variables				
Close to a party (Ref=PS)				
BE	1.15	0.87	1.15	0.87
CDS-PP	1.12	0.89	1.12	0.89
CDU	1.07	0.93	1.07	0.93
PPD-PSD	1.13	0.89	1.13	0.89
Other	1.07	0.93	1.07	0.93
Informed about politics	1.07	0.93	1.07	0.93
Position towards issues				
Wealth inequality	1.12	0.90	1.12	0.90
Taxes	1.10	0.91	1.10	0.91
Government decision making	1.10	0.91	1.10	0.91
Context-Level Variables				
1/lnM	2.07	0.48	2.07	0.48
2005	1.00	1.00	1.00	1.00
Urbanization (Ref=Rural area or village)				
Small or middle-size town	2.12	0.47	2.12	0.47
Suburbs of large town or city	2.01	0.50	2.01	0.50
Large town or city	2.48	0.40	2.48	0.40
Regional Dummies (Ref=North)				
Center	1.66	0.60	1.66	0.60
Lisbon and Tagus Valley	2.24	0.45	2.24	0.45
Alentejo	1.98	0.520	1.98	0.520
Algarve	1.19	0.84	1.19	0.84

Table A.8: Vote Sincerely/Strategically Decision: Estimation of Model 2 Using ln(MPs)

Individual -Level Variables		
Individual Characteristics		
Age	-0.078	(0.084)
Age2	0.001	(0.001)
Male	0.031	(0.371)
Income (Ref=0€-300 €)		
301€-750€	0.864	(0.930)
751€-1500€	0.720	(0.966)
1501€-2500€	0.137	(0.973)
>2500€	0.165	(0.950)
Education (Ref=None or primary)		
Basic	-0.723	(0.546)
Secondary	-1.032*	(0.555)
High or postgraduate	-1.149*	(0.622)
Married	0.046	(0.459)
Nº minors in the house	0.126	(0.244)
Catholic	-1.314*	(0.753)
Unemployed	0.219	(0.622)
Public worker	0.815*	(0.479)
Institutional Involvement		
Church attendance (Ref=Never)		
Once a year	-1.045*	(0.620)
2-11x a year	-0.306	(0.622)
1x or more a month	-0.556	(0.640)
Once a week or more	-0.560	(0.666)
Trade union member	0.536	(0.485)
Political Variables		
Close to a party (Ref=PS)		
BE	-2.165***	(0.516)
CDS-PP	-0.069	(0.600)
CDU	-1.948***	(0.516)
PPD-PSD	-0.101	(0.461)
Other	-5.875***	(0.926)
Informed about politics	1.556***	(0.537)
Position towards issues		
Wealth inequality	-0.072	(0.054)
Taxes	0.065	(0.067)
Government decision making	-0.187***	(0.053)
Context-Level Variables		
1/lnM	-3.116**	(1.285)
2005	0.557**	(0.276)
Urbanization (Ref=Rural area or village)		
Small or middle-size town	-0.953**	(0.484)
Suburbs of large town or city	-2.141***	(0.589)
Large town or city	-1.334***	(0.485)
Regional Dummies (Ref=North)		
Center	1.115**	(0.510)
Lisbon and Tagus Valley	1.035**	(0.461)
Alentejo	1.337**	(0.540)
Algarve	-0.453	(0.791)
Intercept	7.181***	(2.230)

N=719. * p<0.1; ** p<0.05; *** p<0.01. Cluster-robust standard errors are in parentheses.

Table A.9: Vote Sincerely/Strategically Decision: Marginal Effects

	Logit	Probit
Individual -Level Variables		
Individual Characteristics		
Age	-0.005	-0.005
Age2	0.000	0.000
Male	0.001	0.004
Income (Ref=0€-300 €)		
301€-750€	0.056	0.056
751€-1500€	0.049	0.049
1501€-2500€	0.013	0.006
>2500€	0.015	0.007
Education (Ref=None or primary)		
Basic	-0.043	-0.046
Secondary	-0.060*	-0.071*
High or postgraduate	-0.068*	-0.082*
Married	0.003	0.004
Nº minors in the house	0.007	0.011
Catholic	-0.074*	-0.074*
Unemployed	0.011	0.017
Public worker	0.048*	0.057*
Institutional Involvement		
Church attendance (Ref=Never)		
Once a year	-0.064*	-0.072*
2-11x a year	-0.012	-0.006
1x or more a month	-0.028	-0.027
Once a week or more	-0.028	-0.027
Trade union member	0.032	0.035
Political Variables		
Close to a party (Ref=PS)		
BE	-0.124***	-0.148***
CDS-PP	-0.003	-0.003
CDU	-0.113***	-0.126***
PPD-PSD	-0.005	-0.010
Other	-0.338***	-0.424***
Informed about politics	0.089***	0.104**
Position towards issues		
Wealth inequality	-0.004	-0.005
Taxes	0.004	0.004
Government decision making	-0.011***	-0.012***
Context-Level Variables		
1/lnM	-0.245**	-0.303**
2005	0.032**	0.038**
Urbanization (Ref=Rural area or village)		
Small or middle-size town	-0.055*	-0.070**
Suburbs of large town or city	-0.125***	-0.152***
Large town or city	-0.078***	-0.094***
Regional Dummies (Ref=North)		
Center	0.068**	0.088**
Lisbon and Tagus Valley	0.058**	0.069**
Alentejo	0.079**	0.103***
Algarve	-0.021	-0.020

N=719. * p<0.1; ** p<0.05; *** p<0.01. Cluster-robust standard errors are used.

Table A.10: Party Choice Decision: Variables Used in the Models

Name	Description	Categories/Range
Dependent Variable		
Vote Choice	Reported vote choice.	Reference=PS: 47.05% (BE): 7.16% (CDS-PP): 6.19% (CDU): 8.74% (PPD-PSD): 30.86%
Individual-Level Variables		
INDIVIDUAL CHARACTERISTICS		
Age	Age of the respondent measured in years.	min:18 max: 89 mean: 45.08
Age2	Age squared.	min: 324 max: 7921 mean: 2321.36
Male	Gender of the respondent.	(1) male: 49,29% (0) female: 50.71%
Income	A set of dummies indicating the income of the respondent.	Reference= 0€-300 €: 8.60% (301€-750€): 33.21% (751€-1500€): 34.45% (1501€-2500€): 15.65% (>2500€): 8.10%
Education	A set of dummies indicating the educational attainment of the respondent.	Reference = No education or primary incomplete or completed (0-4 years): 28.42% (Basic) basic incomplete or completed (5-9 years): 20.53% (Secondary) secondary incomplete or completed (10-12 years): 28.82% (High or postgraduate) higher incomplete or completed or postgraduate incomplete or completed: 22.24%
Married	Marital status of the respondent.	(1) married or living together as married: 62.68% (0) widowed, divorced or separated, married but separated or single: 37.32%
Nº minors in the house	Number of minors that live in the house.	min: 0 max: 7 mean: 0.575
Catholic	Religion of the respondent.	(1) catholic: 88.38% (0) other or none: 11.62%
Unemployed	Whether the respondent is unemployed or not.	(1) yes: 8.84% (0) no: 91.16%
Public worker	Whether the respondent (or the main contributor in the household if the respondent is a student) works for the public sector (central and local public administration/autonomous public entities/public enterprises).	(1) works for the public sector: 19.96% (0) works for the private sector, on a mixed firm, for a non-profit organization or is self-employed: 80.04%
INSTITUTIONAL INVOLVEMENT		
Church attendance	How often the respondent goes to church/attends religious services.	Reference = Never: 16.87% (Once a year): 13.50% (2-11x a year): 20.99% (1x or more a month): 22.81% (Once a week or more): 25.83%

Table A.10: Party Choice Decision: Variables Used in the Models

Name	Description	Categories/Range
Trade union member	Whether the respondent is a trade union member or not.	(1) trade union member: 11.72% (0) not a trade union member: 88.28%
Context-level variables		
1/lnM	Inverse of the logarithm of one plus the number of seats in a district.	min: 0.26 max: 0.91 mean: 0.37
2005	Dummy for the year 2005.	(1) 2005: 50% (0) 2002: 50%
Urbanization	A set of dummies indicating the level of urbanization.	Reference=Rural area or village: 21.42% (Small or middle-size town): 33.57% (Suburbs of large town or city): 17.20% (Large town or city): 27.81%
Regional Dummies	A set of dummies indicating the region where the respondent lives. When districts belong to more than one region, we include them in the region of the district capital.	Reference=North: 35.67% (Center): 20.91% (Lisbon and Tagus Valley): 29.60% (Alentejo): 10.21% (Algarve): 3.61%

Table A.11: Party Choice Decision: Collinearity Diagnosis

	Before age correction		After age correction	
	VIF	Tolerance	VIF	Tolerance
Individual -Level Variables				
Individual Characteristics				
Age	39.55	0.03	1.96	0.51
Age2	39.13	0.03	1.34	0.75
Male	1.12	0.89	1.12	0.89
Income (Ref=0€-300 €)				
301€-750€	5.28	0.19	5.28	0.19
751€-1500€	6.11	0.16	6.11	0.16
1501€-2500€	4.80	0.21	4.80	0.21
>2500€	3.32	0.30	3.32	0.30
Education (Ref=None or primary)				
Basic	1.72	0.58	1.72	0.58
Secondary	2.46	0.41	2.46	0.41
High or postgraduate	2.94	0.34	2.94	0.34
Married	1.42	0.70	1.42	0.70
Nº minors in the house	1.34	0.75	1.34	0.75
Catholic	1.29	0.77	1.29	0.77
Unemployed	1.07	0.93	1.07	0.93
Public worker	1.23	0.81	1.23	0.81
Institutional Involvement				
Church attendance (Ref=Never)				
Once a year	1.79	0.56	1.79	0.56
2-11x a year	2.16	0.46	2.16	0.46
1x or more a month	2.23	0.45	2.23	0.45
Once a week or more	2.34	0.43	2.34	0.43
Trade union member	1.14	0.88	1.14	0.88
Context-Level Variables				
1/lnM	1.95	0.51	1.95	0.51
2005	1.00	1.00	1.00	1.00
Urbanization (Ref=Rural area or village)				
Small or middle-size town	1.92	0.52	1.92	0.52
Suburbs of large town or city	1.87	0.53	1.87	0.53
Large town or city	2.26	0.44	2.26	0.44
Regional Dummies (Ref=North)				
Center	1.57	0.64	1.57	0.64
Lisbon and Tagus Valley	2.09	0.48	2.09	0.48
Alentejo	1.82	0.55	1.82	0.55
Algarve	1.15	0.87	1.15	0.87

Table A.12: Party Choice Decision: Estimation of Model 2 Using ln(MPs)

	BE		CDS-PP		CDU		PPD-PSD	
Individual -Level Variables								
Individual Characteristics								
Age	0.141	(0.108)	-0.105*	(0.061)	-0.062	(0.048)	-0.064*	(0.033)
Age2	-0.002	(0.001)	0.001	(0.001)	0.001	(0.001)	0.001**	(0.000)
Male	-0.242	(0.269)	0.458	(0.295)	0.101	(0.247)	0.341**	(0.170)
Income (Ref=0€-300 €)								
301€-750€	-0.708	(0.742)	1.490	(1.024)	2.044*	(1.161)	0.031	(0.388)
751€-1500€	-1.107	(0.785)	1.472	(1.025)	2.240*	(1.180)	-0.119	(0.412)
1501€-2500€	-0.746	(0.858)	2.065**	(1.032)	1.914	(1.219)	-0.401	(0.454)
>2500€	-0.853	(0.894)	2.806***	(1.060)	2.247*	(1.273)	0.229	(0.474)
Education (Ref=None or primary)								
Basic	0.927	(0.703)	0.110	(0.454)	-0.279	(0.431)	0.353	(0.253)
Secondary	1.271*	(0.651)	0.022	(0.405)	-0.278	(0.434)	1.000***	(0.262)
High or postgraduate	1.642**	(0.681)	0.346	(0.483)	-0.657	(0.482)	1.029***	(0.311)
Married	-0.136	(0.298)	-0.250	(0.379)	-0.392	(0.268)	0.214	(0.204)
Nº minors in the house	0.177	(0.205)	0.468**	(0.184)	-0.108	(0.179)	0.133	(0.103)
Catholic	-1.550***	(0.345)	-0.026	(0.536)	-0.595	(0.397)	0.913**	(0.430)
Unemployed	-0.558	(0.481)	-0.352	(0.674)	-0.212	(0.437)	-0.728**	(0.355)
Public worker	-0.132	(0.306)	0.007	(0.385)	0.062	(0.297)	-0.439**	(0.205)
Institutional Involvement								
Church attendance (Ref=Never)								
Once a year	-0.327	(0.374)	-0.066	(0.499)	-0.930**	(0.396)	-0.414	(0.324)
2-11x a year	-0.245	(0.376)	0.117	(0.491)	-1.377***	(0.399)	-0.050	(0.290)
1x or more a month	-1.520***	(0.487)	-0.304	(0.491)	-1.125***	(0.404)	-0.356	(0.298)
Once a week or more	-1.612***	(0.527)	0.974*	(0.507)	-1.187***	(0.458)	0.422	(0.290)
Trade union member	-0.072	(0.332)	-0.470	(0.421)	0.631**	(0.311)	-0.319	(0.228)
Context-Level Variables								
1/lnM	-3.473**	(1.385)	-1.242	(1.222)	0.411	(1.133)	-0.515	(0.720)
2005	0.352**	(0.148)	0.327**	(0.144)	-0.051	(0.111)	-0.527***	(0.072)
Urbanization (Ref=Rural area or village)								
Small or middle-size town	0.605	(0.468)	0.041	(0.460)	0.959**	(0.416)	0.366	(0.225)
Suburbs of large town or city	0.306	(0.488)	0.444	(0.510)	0.942*	(0.485)	-0.033	(0.278)
Large town or city	0.830*	(0.452)	0.526	(0.460)	0.974**	(0.463)	0.141	(0.255)
Regional Dummies (Ref=North)								
Center	0.640	(0.494)	0.258	(0.454)	0.222	(0.405)	0.186	(0.233)
Lisbon and Tagus Valley	0.019	(0.389)	0.178	(0.468)	0.222	(0.405)	-0.461*	(0.243)
Alentejo	0.177	(0.500)	0.697	(0.583)	-0.021	(0.456)	-0.229	(0.300)
Algarve	0.558	(0.804)	0.512	(1.119)	0.268	(0.796)	0.691	(0.444)
Intercept	-1.830	(2.242)	-2.159	(1.913)	-1.440	(1.666)	-0.456	(1.023)

N=1647 * p<0.1; ** p<0.05; *** p<0.01. Cluster-robust standard errors are in parentheses.

Table A.13: Party Choice Decision: Marginal Effects Using Multinomial Probit

	BE	CDS-PP	CDU	PPD-PSD	PS
Individual -Level Variables					
Individual Characteristics					
Age	0.006**	-0.005	-0.002	-0.121*	0.014*
Age2	-0.000**	0.000	0.000	0.000**	-0.000*
Male	-0.013	0.020	-0.004	0.062*	-0.066*
Income (Ref=0€-300 €)					
301€-750€	-0.065	0.042***	0.069***	-0.008	-0.039
751€-1500€	-0.076	0.040***	0.087***	-0.039	-0.012
1501€-2500€	-0.057	0.082***	0.066**	-0.111	0.019
>2500€	-0.079	0.130***	0.070**	-0.010	-0.111
Education (Ref=None or primary)					
Basic	0.023	-0.007	-0.031	0.078	-0.063
Secondary	0.032	-0.023	-0.051	0.207***	-0.165***
High or postgraduate	0.048**	-0.004	-0.085**	0.212***	-0.171***
Married	-0.005	-0.012	-0.036*	0.058	-0.005
Nº minors in the house	0.006	0.024**	-0.014	0.019	-0.035
Catholic	-0.075***	-0.015	-0.069**	0.209***	-0.050
Unemployed	-0.016	-0.004	0.001	-0.127*	0.147**
Public worker	-0.002	0.013	0.019	-0.099**	0.069
Institutional Involvement					
Church attendance (Ref=Never)					
Once a year	-0.002	0.011	-0.089**	-0.037	0.118**
2-11x a year	-0.008	0.014	-0.128***	0.039	0.083
1x or more a month	-0.054***	0.001	-0.099**	-0.005	0.157***
Once a week or more	-0.060***	0.059**	-0.129***	0.136**	-0.006
Trade union member	0.002	-0.024	0.058**	-0.066	0.031
Context-Level Variables					
1/lnM	-0.144**	-0.057	0.068	-0.057	0.191
2005	0.023**	0.027***	0.007	-0.124***	0.067***
Urbanization (Ref=Rural area or village)					
Small or middle-size town	0.016	-0.009	0.049**	0.056	-0.112**
Suburbs of large town or city	0.007	0.022	0.061**	-0.030	-0.060
Large town or city	0.029*	0.021	0.054**	-0.008	-0.095
Regional Dummies (Ref=North)					
Center	0.014	0.010	0.008	0.024	-0.056
Lisbon and Tagus Valley	0.001	0.017	0.022	-0.010**	0.060
Alentejo	-0.000	0.044	0.002	-0.059	0.013
Algarve	0.003	0.013	-0.006	0.130	-0.139

N=1647 * p<0.1; ** p<0.05; *** p<0.01. Cluster-robust standard errors are used.

Figure A.1: Distribution of District Magnitude Under the 180 MPs Scenario - 2002 and 2005

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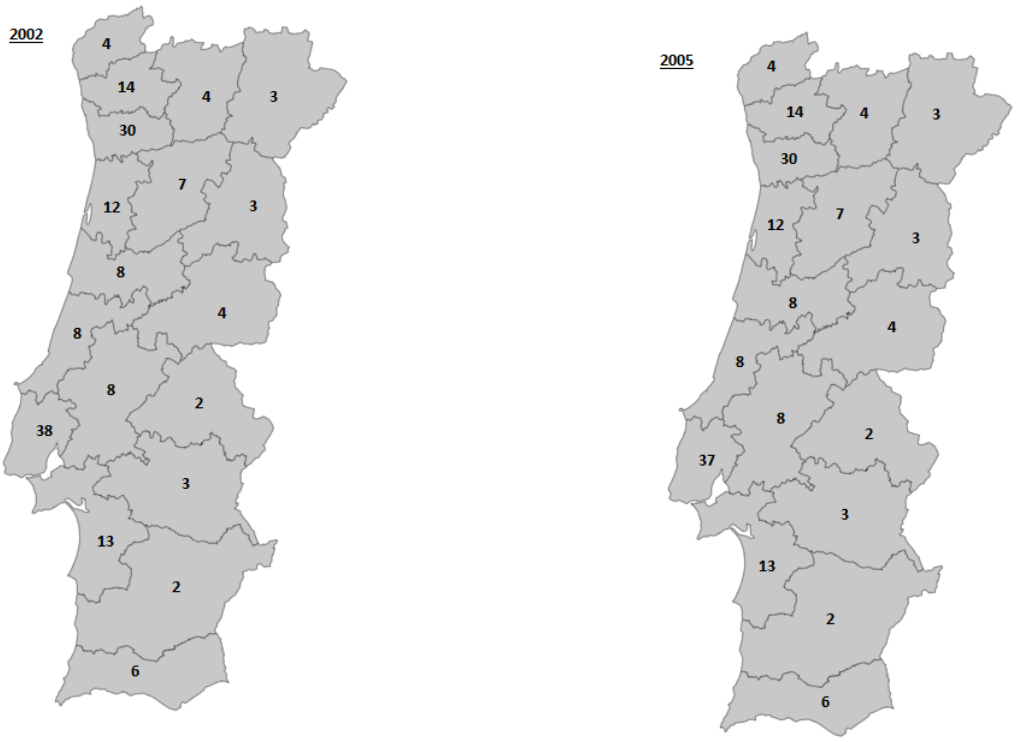

Note: We have used the number of electors published in STAPE (www.eleicoes.mj.pt) instead of the number published in the Official Gazette because if we use the data from the Official Gazette and apply the D'Hondt formula the distribution of district magnitude differs from the one published in the Official Gazette. The difference between results from these two sources has been acknowledged before by Freire et al. (2008).