Working Paper 2009:14
Department of Economics

The effect of information on voting behavior

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Working paper 2009:14
September 2009
ISSN 1653-6975

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September 22, 2009

This paper investigates how information affect voting behavior. There exist a large literature suggesting that uninformed voters can use informational shortcuts or cues to vote as if they were informed. This paper tests this hypothesis using unique Swedish individual survey data on the preferences of both politicians and voters. I find that uninformed voters are significantly worse than informed voters at voting for their most preferred politicians. This suggests that uninformed voters can not make up for their lack of information using shortcuts. Furthermore, the errors uninformed voters make do not cancel out in large elections. Estimates suggest that the ruling majorities would have switched in almost 5% of Swedish municipalities had all voters been fully informed. The effects are estimated with both parametric and nonparamteric estimation techniques.

Keywords: Voting behavior, Citizen candidates, Information, Cues

*I am grateful for comments and suggestions made by Eva Mörk, Adrian Adermon, Matz Dahlberg, Mikael Elinder, Che-Yuan Liang, Heléne L. Nilsson, Jeffrey Racine and Ulrika Vikman as well as seminar participants at Uppsala university and participants at the 2009 Midwestern Political Science Association Conference, 2009 International Institute of Public Finance and 2009 IEB Summer School in Public Economics.

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1 Introduction

A fundamental difference between voting decisions and other economic decisions is that while the economic outcome for each individual depends on the economic decisions the individual makes, each voter has a negligible impact on the actual voting outcome. This lead Downs (1957) to the conclusion that for the rational self-interested voter there is no reason to acquire information about electoral issues as long as information is costly. However, some individuals may become informed as a by-product of private economic decisions (see Aidt 2000). In this paper I will study whether informed voters to a higher degree vote for their most preferred politicians compared with uninformed voters and if the information heterogeneity in the electorate has an aggregate impact on the electoral result. To do this I will utilize a unique individual survey data on the preferences of both politicians and voters in Swedish municipalities which makes it possible to directly investigate this issue.

To what extent is it informative to study the preferences of the politicians? In the classical median voter model (see Hotelling 1929 and Downs 1957) candidates are office-motivated and converge to the median voter's preferred position in order to win the election. Even if they are policy-motivated they are still forced to locate at the median under certainty. If, on the other hand, there is uncertainty then Wittman (1977) shows that policy divergence is possible and that the preferences of the politicians actually matter. The underlying assumption of these models is that it is possible for candidates to commit to policy *ex ante*, before the election. If the candidates in fact can not commit, there is, as Alesina (1988) showed, no other credible policy position than for the candidates to propose their most preferred position. This is the fundamental characteristic of the citizen candidate model (see Osborne and Slivinski 1996 and Besley and Coate 1997).

Recently there has been some empirical evidence supporting the claim the politicians' preferences actually do matter for policy outcome. Levitt (1996) investigate congress voting using senator-specific effects while Lee, Moretti, and Butler (2004) applies a regression-discontinuity method to dis-

entangle voter preferences from party effects. Both these studies find that U.S. congressmen is not bound by the voters' preferences. Utilizing a natural experiment in India Chattopadhyay and Duflo (2004) also find support that politicians matter. Relevant to this study Pettersson-Lidbom (2008) and Tyrefors (2007) find that parties in Swedish municipalities matter for policy using the regression-discontinuity method and Ågren (2005) find that politicians' preferences matter more than voter preferences for municipal tax policy.

Given that politicians' preferences have an impact on policy outcome the natural question is to ask to what extent the preferences of the voters and politicians correspond. Ågren, Dahlberg, and Mörk (2007)[1] find that politicians want significantly more spent on local public services such as schools, child care and social care than voters do. This raises the issue why voters elect politicians that have preferences different from their own. In this paper I will investigate whether the fact that voters are heterogeneously informed can be one explanation to this.

Information heterogeneity in the electorate may affect policy in at least two ways. First, if only informed voters observe the policy positions of the politicians then politicians have an incentive to target the groups with a high degree of informed voters since only they can reward of punish the politicians with their vote. This point is made theoretically by Baron (1994) and Grossman and Helpman (1996) and both Besley and Burgess (2002) and Strömberg (2004) find empirical support for this hypothesis.

Second, policy may be biased towards informed voters if they are more likely to vote for their most preferred candidate. It is not clear, however, that this is the case. A large literature has focused on the uninformed voters' ability to use cues to vote as if they were informed. These cues may be the party or ideology label as well as demographic characteristics of the candidates as a proxy for their actual policies (see for instance Popkin, Gorman, Phillips, and Smith 1976, Conover and Feldman 1989, Lupia 1994 and McDermott 1997). Furthermore, Shapiro and Page (1988) argue that while voters may be uninformed on the individual level, when aggregated prefer-

[1]They use the same data as Ågren (2005) which is also the same data I use.

ences are actually stable and reflect the available information. The reason is simply that each voter's error cancel out in a large electorate. Bartels (1996) on the other hand find that voters make systematic mistakes and while the mistakes may be smaller on the aggregate level they are not negligible.

In this paper I test if (i) more informed voters to a higher degree vote for their most preferred politicians compared with less informed voters and (ii) if this also translates into a bias on the aggregate level. Different from previous studies is that I not only have individual-level data on the preferences of the voters but also on the preferences of the politicians which provide a unique opportunity to investigate the effect of information heterogeneity in the electorate. The results support both hypothesis, the most informed voters are on average around 15% more likely to vote for their most preferred politicians compared with the least informed voters and on the aggregate level I find that the left-wing bloc receives around 1% to 2% more votes than they would have if all voters were fully informed.

2 Theoretical framework

In order to structure the empirical analysis I will use a very simple model of partisan politics. There are two parties (blocs), R and L, assumed to have exogenous preferences, i.e. they can be thought of as citizen candidates that cannot credible commit to anything other but their own preferred policy. They have preferences over the size of the government budget with bliss points g_R and g_L respectively. Voter i derive indirect utility $W_i(g_p)$[2] of party p:s policy.

There is also a individual-specific parameter, θ_i, which is simply everything that matter for the individuals voting decision apart from preference for government spending. Following the terminology used in Persson and Tabellini (2000) this will be called the individuals ideological bias for party

[2]I will not model explicitly why individuals have different preferences for government spending but rather take it as given, hence the index i in the utility function. However, it can easily be thought of as standing for the fact that voters have different income and hence want different level of government spending.

R over party L. The parameter can take on positive or negative values. Voter i belonging to the informed group votes for party L[3] if

$$W_i(g_L) > W_i(g_R) + \theta_i \tag{1}$$

The uninformed voters on the contrary do not observe the parties' preferences but have some prior idea about their positions[4] which means they will vote for party L if

$$E(W_i(g_L)) > E(W_i(g_R)) + \theta_i. \tag{2}$$

I will assume the voters' utility functions have the form $W_i(g_p^*) = -f(|g_p^* - g_i^*|)$ where $f(\cdot)$ is a monotonically increasing function which means preferences are single-peaked. Without loss of generality I will denote the uninformed voters' perceived utility of party p:s policy as $W_i(g_p^*) = -f(|g_p^* - g_i^*|) + \mu_{ip}$ where μ_{ip} is a i.i.d symmetric error with expectation zero saying that uninformed voters are right on average. With these assumptions the probability voter i votes for L is

$$\Pr(i \text{ votes for } L) = \Pr(f(|g_R - g_i^*|) - f(|g_L - g_i^*|) > \theta_i - \mu_{iL} + \mu_{iR}) \tag{3}$$

Let the cumulative distribution function of θ_i be denoted F_I (that is, for the informed voters) and the cumulative distribution function of $\theta_i + \mu_{iL} - \mu_{iR}$ be denoted F_U (for the uninformed voters). The probability that the voter votes for L is then $F_k(|g_R - g_i^*| - |g_L - g_i^*|)$ for $k \in (I, U)$. Let $x_i \equiv |g_R - g_i^*| - |g_L - g_i^*|$ it follows that:

[3]In order to keep it as simple as possible I ignore the case when $W_i(g_L) = W_i(g_R) + \theta_i$ since θ_i is assumed to be continuous. Without changing any conclusions we could say the voter votes for either party with probability 0.5 in that case.

[4]Specifically we may naturally assume they expect the left-wing bloc wants higher government spending than the right-wing bloc.

$$\begin{aligned}
&\text{If } x_i < 0\text{: } F_I(x_i) - F_U(x_i) \leq 0 \\
&\text{If } x_i = 0\text{: } F_I(x_i) - F_U(x_i) = 0 \\
&\text{If } x_i > 0\text{: } F_I(x_i) - F_U(x_i) \geq 0
\end{aligned} \tag{4}$$

What this says is that as long as voter i is closer to party R than party L ($x_i < 0$) she is less likely to vote for party L if she is informed compared to if she is uninformed. On the other hand, if she is closer to party L than party R ($x_i > 0$) she is more likely to vote for party L if she is informed compared to if she is uninformed.

This means that the probability the voter votes for the party closest to her in preference for government spending is larger for informed voters than uninformed voters. The intuition for this is quite clear. The element of uncertainty among uninformed voters means they are less likely to vote for the party closest to them compared with the informed voters. This is illustrated in figure 1. Without any further functional assumption on μ_{iL}, μ_{iR} and θ_i we can not say what form $F_I(x_i)$ and $F_U(x_i)$ should take other than that (4) must hold. This is seen in the figure as the curves cross where $x_i = 0$.

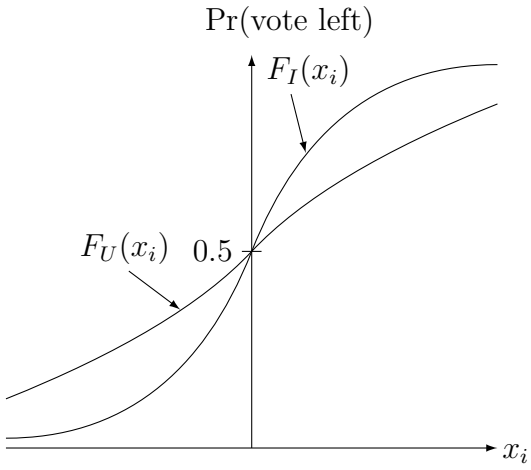

Figure 1: Probability of voting for the left-wing parties

3 Institutional setting and data

In order to test the hypothesis presented above we need to know what policies that are important to the voters when they decide who to vote for. The obvious candidate is the size of the government budget, i.e. the classical left-right dimension. The Swedish municipalities are well suited for this testing because of their economic importance. During the period studied in this paper Swedish municipalities stood for about 20% of total GDP and employed about 18% of the Swedish workforce. Their responsibilities range from providing schools, child care and social care to housing and infrastructure. Furthermore, in the Swedish constitution it is stated that the municipalities are autonomous.

The municipalities collect revenue from primarily three sources, income taxation, grants from the national government, and different user fees. The amount of grants received, which stand for about one fourth of the local budget, are determined exogenously at the national level and is not likely to be a determinant when voters decide who to vote for.[5] The most important factor in the local budget is the proportional income tax, which is also the most important tax on any level in Sweden. It stands for about half the local budget (which means almost ten percent of national GDP) and are determined by the municipal council. The rest of the revenues comes from different user fees (around 17%) and loans.

I therefore argue that the municipal tax rate is the most straightforward way of affecting the size of the municipal budget which means I will test the hypothesis that the informed voters vote for the politicians that have tax preferences closest to their own to a higher degree than uninformed voters.

[5]Dahlberg and Johansson (2002) and Johansson (2003) find evidence suggesting the central government use grants strategically and Jordahl (2002) find some support for the hypothesis that voters actually reward the central government with their vote if they get a large amount of grants. However, this is only for the central government who actually redistributes the grants. Their is less reason to believe voters hold the local government responsible since they are not the ones who decide on the grant allocation.

3.1 The survey

As mentioned above I will use survey data on the preferences of both politicians and voters to test the hypothesis presented above. The survey[6] covers two elections, the 1979 election and the 1991 election. Most of the voters were interviewed just prior to the elections and the rest just after. The politicians were interviewed just after and up to six months after the 1979 election and two years after the 1991 election. The fact that the politicians were interviewed two years after the voters in the 1991 election poses a problem which will be discussed below.

The municipalities that participated in the survey were drawn using stratified selection. The municipalities in the 1979 survey were divided into 25 strata based on demographic, economic and political characteristics of the municipalities.[7] One municipality was drawn out of each stratum, hence the survey covers 25 municipalities. A total number of 2100 individuals were selected out of which 1593 interviews could be conducted which means the response rate is about 76%[8].

20 of the municipalities in the 1979 survey were also in the 1991 survey. Apart from those 8 new municipalities were added.[9] The total number of individuals selected was 7550. Of these 2596 responded which means the response rate is about 34%. The reason the response rate dropped compared to the 1979 survey is likely because this survey was conducted via mail.

Even though Sweden has a multiparty system it has been tradition to treat it as a two-party system with one right-wing bloc (consisting of the center party, the liberals and the conservatives) and one left-wing bloc (consisting of the communists and the social democrats). In order to test the hypothesis presented above I will only study the voters who actually voted

[6]The survey data is handled and distributed by the *Swedish Social Science Data Service* (SSD). Neither SSD, nor the principal investigators bear responsibility for the analysis in this paper.

[7]The three biggest municipalities, Stockholm, Göteborg and Malmö were excluded from the population.

[8]This number is for those respondents who both had an opinion about the tax rate and also answered all information questions.

[9]One of the municipalities added was Göteborg which was excluded from the population in the 1979 survey.

and who reported voting for either of the five parties listed above.[10] This means the final sample size is 3245.

All members of the municipal councils in the selected municipalities were selected to answer the survey. Out of these 70% (827/1179) replied in the 1979 survey and 78% (1011/1292) replied in the 1993 survey.

3.2 Who is informed?

The variable of interest is if the voter is informed about the tax preferences of the politicians in each bloc. However, we do not observe this. What we do observe are several noisy proxy variables. We could of course use each proxy variable in a regression model but there are two problems associated with this. First, interpretation with a lot of different variables becomes harder. Second, several variables that are highly correlated with each other will lead to a multicollinearity problem causing large standard errors.

What I will do instead is to use factor analysis to combine the information proxies to a smaller set of variables, called common factors, which I will use in the regressions. The general factor analysis model with P proxy variables can be written in the following way:

$$x_p = \boldsymbol{\phi}'_{\mathbf{p}}\mathbf{F} + \epsilon_p \qquad p \in (1, ..., P), \tag{5}$$

where x_p is proxy variable p. $\mathbf{F}$ is a vector of the common factors with dimension $M \times 1$ where M is smaller than P (we want to describe a large set of variables with a smaller set of variables). $\boldsymbol{\phi}_{\mathbf{p}}$ is a parameter vector, usually called factor loadings or pattern loadings, which describe how much of the variation in x_p is due to the common factors and ϵ_p the independent variation not explained by the common factors.

We do not know neither the common factors nor the factor loadings so they both have to be estimated. We can clearly see that (5) has an infinite number of solutions. In order to find a single solution we use the fact that the higher correlated x_p is with the rest of the proxy variables the higher cor-

[10] In 1979 these five parties held 95% of the seats in the municipalities under study whereas the corresponding number for 1991 is 89%

related that variable is with the latent "information" variable and the higher weight (i.e. factor loading) that variable should have when determining the common factors. There are several ways to do this and I use the regression method which minimizes the mean squared error.

The question is how many common factors that should be used, that is, the size of M. In theory M can range from 1 to P but because our goal is to describe $\mathbf{x}$ with a smaller set of variables, M should be substantially smaller than P. In practice one can look at how many of the factors that actually contributes substantially to the variation in $\mathbf{x}$. There are also a number of formal criterions, for instance the eigenvalue-greater-than-one rule (see Sharma 1995).

I will use six different variables as proxy variables for information. Three of them measure information directly, namely if the respondent knows the name of a member of the municipal council, if the respondent knows of at least one issue that a party has brought forth in the electoral campaign and if the respondent feels she has enough information about the upcoming election. Apart from those I will use three proxy variables that are likely to be correlated with the level of information. The first is if the respondent reads the part in the local newspaper that deals with the local government. The local newspaper is likely to be the primary source of information concerning the local government[11] which would make this a good proxy. The second variable is if the respondent is interested in politics. If the respondent is interested she is also likely to obtain information about the municipal election. The third is if the respondent often talks about issues that concern the municipality.

3.3 Tax rate demand

Both the politicians and the voters were asked to respond to the following statement:

[11] In the 1979 survey 30% of the respondents stated that the newspaper was the primary source of information about municipal issues and 65% stated it was one of the three most important sources of information. No similar question was asked in the 1991 survey.

It is more urgent to lower municipal taxes than to increase municipal services.

There were four different answers the respondents could give. They could "agree", "agree on the whole", "disagree on the whole" and "disagree". However, there is no reason *a priori* to believe that it is natural to divide peoples tax preferences into four groups. More theoretically appealing would be to say that the individuals have tax preferences in a continuous interval. If respondent i living in municipality j in time t wanted taxes to be cut she would state "agree" if the preferred tax rate, t^*_{ijt}, was lower than $t_{jt} - \delta_1$ where t_{jt} is the actual tax rate in municipality j in time t and δ_1 is an arbitrary cut-off value. The individual would "agree on the whole" if $t_{jt} - \delta_1 \leq t^*_{ijt} < t_{jt}$, "disagree on the whole" if $t_{jt} \leq t^*_{ijt} < t_{jt} + \delta_2$ and "disagree" if $t_{jt} + \delta_2 \leq t^*_{ijt}$. I will assume $\delta_1 = \delta_2 = \delta$.[12] This is shown in Figure 1 where A would "agree on the whole" and B would "disagree".

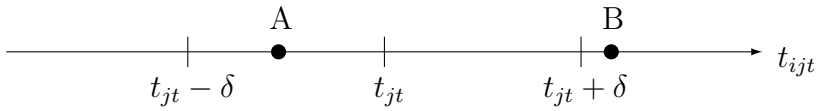

Figure 2

According to theory we want a single measure of each blocs' preferences in each municipality. From a theoretical standpoint the most appealing would be to use the median tax preference of the politicians in each bloc. However, as mentioned above, we do not observe the latent tax preference variable we are interested in. What I will do is to assume that given that the respondent answered, for instance, "agree on the whole" then t^*_{ijt} is equally likely to be at any point between $t_{jt} - \delta$ and t_{jt}. That is equivalent to viewing t^*_{ijt} as uniformly distributed on the interval $[t_{jt} - \delta, t_{jt}]$. We can then get an unbiased estimate of t^*_{mjt}, the median tax preference, in the following way: Suppose the observed median is in the interval $[a, b]$ and there are N individuals with tax

[12] This similar to the assumption Bergstrom, Rubinfeld, and Shapiro (1982) make. Additionally I will assume data is cardinal so that the lower bound of tax preference is $t_{jt} - 2\delta$ and the upper bound is $t_{jt} + 2\delta$.

preference in that interval and the median has the $\tilde{N}th$ lowest tax preference of those. The estimate would then be

$$\hat{t}_{mjt} = a + \frac{\tilde{N} - 0.5}{N} = E(t^*_{mjt}) \tag{6}$$

which follows from the uniform distribution assumption.

4 Descriptive statistics

Table 1 shows the result from the factor analysis. I have only retained one common factor. The other factors contributes almost nothing to the variation in the proxies and, for instance, the criterion that the eigenvalue of the factor matrix should be greater than one can easily be rejected for all factors but the first one. The uniqueness column shows how much of the variation that is not explained by the common factor. As can be seen all information proxies have positive regression scores as expected which means they are all positively associated with information.

Table 1: Factor analysis result

	Factor loading	Uniqueness	Regression score
Know issue	0.3918	0.8360	0.1456
Know politician name	0.4381	0.7974	0.1691
Read local newspaper	0.5747	0.6684	0.2477
Interested in politics	0.6206	0.6105	0.2890
Subjectively informed	0.4036	0.8369	0.1480
Talk about municipality	0.5970	0.6427	0.2661

The question is if the proxies are correlated enough so that factor analysis is suitable. If the variables are not correlated enough we have a very weak identification of the latent information variable. There is a formal criterion to test for this, the so called Kaiser-Meyer-Olkin (KMO) measure (see Kaiser and Rice 1974). It is suggested that this measure, that lies between 0 and

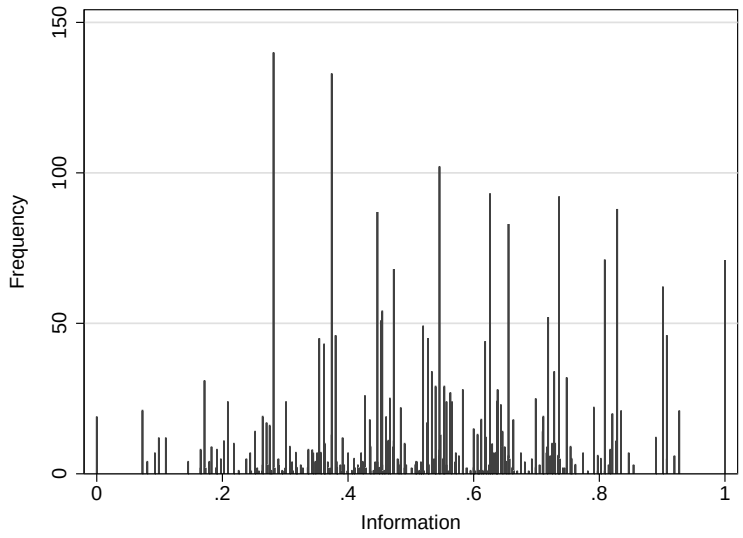

Figure 3: Frequency plot over the information variable

1, should be 0.8 or greater even though a measure of 0.6 or greater can be accepted (Sharma 1995). In this case the KMO-measure is 0.79 which suggests the data is acceptable for factor analysis.

Figure 3 shows a frequency plot over the first common factor which I will refer to as "information". Since this variable is an artificial construct the scale is without interpretation. In order to make it easier to interpret the variable I normalize it so that the minimum value is 0 and the maximum value is 1. The reason the information spikes at certain values is because each value of information corresponds to one combination of answers on the information questions and some combinations of answers are much more likely than others.

If information leads to more political power it is important to know which voters that have a high level of information. Aidt (2000) argues that some voters are more likely to acquire political information as a by-product from other economic decisions. He hypothesises that individuals with high income should have higher level of information because they make more investment related decisions in which information of the political reality may be important, high educated people should have more information since acquiring

information is less costly for them and women should have more information because they make more day-to-day consumption decisions. In their comprehensive study of political knowledge in the U.S. Delli Carpini and Keeter (1996) find that education is strongly positively correlated with information, that income is also positively correlated but not as strong and, contrary to Aidt's hypothesis, that women are less likely to be informed. To test how these findings correspond to the data used in this study I have regressed the information variable on a number of different background characteristics to see how they correlate. The results are shown in table 2.

As can be seen education is strongly positively correlated with information as expected but there is little evidence that income is positively correlated. Women have lower level of information but, as can be seen when analyzing the results for each of the two years separately, this effect decreased substantially between the studies. Furthermore it seems that those working in the municipal sector are substantially more likely to have information about the politics in the municipality which is natural. Finally there seems to be an increasing effect of age even though the marginal effect is decreasing. Taken together these results are similar to the findings in Delli Carpini and Keeter (1996) which also indicates that that the information variable used is a good proxy for actual information.

5 Econometric specification and results

The theoretical idea presented in section 2 is that informed voters are better at voting for the bloc closest in preference to themselves. If we define the party (bloc) closest in tax preference to individual i as party A_{ijt} this can be tested by estimating the following equation:

$$\Pr(i \text{ votes for } A_{ijt}) = \beta_0 + \beta_1 I_{ijt} + \beta_2 |x_{ijt}| + \boldsymbol{\gamma}' \mathbf{D_{jt}} + \boldsymbol{\rho}' \mathbf{C_{ijt}} + \varepsilon_{ijt}. \quad (7)$$

The theoretical prediction is that $\beta_1 > 0$, i.e. the more informed the voter is the more likely she is to vote for the party who's tax preference

Table 2: Regression on information

	(1) Both years	(2) 1979	(3) 1991
Age	0.00858***	0.00812***	0.00852***
	(0.00144)	(0.00248)	(0.00175)
Age^2	-0.0000637***	-0.0000656**	-0.0000554***
	(0.0000152)	(0.0000244)	(0.0000199)
Female	-0.0499***	-0.0919***	-0.0203***
	(0.00711)	(0.0119)	(0.00618)
Medium education level	0.0597***	0.0609***	0.0566***
	(0.00981)	(0.0148)	(0.0126)
High education level	0.117***	0.125***	0.110***
	(0.00909)	(0.0146)	(0.0129)
2nd income quartile	0.0120	0.00936	0.00761
	(0.0107)	(0.0177)	(0.0143)
3rd income quartile	0.0108	0.00385	0.0158
	(0.0118)	(0.0161)	(0.0145)
4th income quartile	0.0162	0.0138	0.0288
	(0.0133)	(0.0194)	(0.0171)
Married	0.0302***	0.0298**	0.0233**
	(0.00762)	(0.0122)	(0.00965)
Children under 16	0.00739	0.0180	0.00572
	(0.0106)	(0.0208)	(0.0108)
Working home	-0.0385**	-0.0268	-0.0330
	(0.0163)	(0.0236)	(0.0211)
Student	0.0154	0.0258	0.0128
	(0.0163)	(0.0233)	(0.0242)
Retired	-0.00386	-0.0214	-0.00200
	(0.0146)	(0.0253)	(0.0181)
Not working	-0.0311**	-0.0114	-0.0381*
	(0.0128)	(0.0211)	(0.0186)
Working in state sector	0.0207*	0.0140	0.0215*
	(0.0114)	(0.0184)	(0.0123)
Working in municipal sector	0.0616***	0.0684***	0.0571***
	(0.00805)	(0.0122)	(0.0102)
Working in county sector	0.0281**	0.0135	0.0322**
	(0.0105)	(0.0217)	(0.0140)
Civil servant	0.0343***	0.0371*	0.0332***
	(0.00838)	(0.0184)	(0.00974)
Employer	0.0341**	0.0278*	0.0446**
	(0.0130)	(0.0142)	(0.0214)
Never worked	-0.0139	0.00171	0.00953
	(0.0107)	(0.0132)	(0.0189)
Municipality × time fixed effects	Yes	Yes	Yes
N	4233	1659	2574
adj. R^2	0.148	0.157	0.150

*, ** and *** denote significance on the 10, 5 and 1 precent level repectively.
Standard errors, clustered on the municipal level, are shown in parentheses.

most corresponds to her own. As mentioned above x_{ijt} is the voter's distance to the right-wing parties minus the distance to the left-wing parties. That means $|x_{ijt}|$ is the distance to the bloc farthest away in tax preference minus the distance to the bloc closest in tax preference. The expectation is that $\beta_2 > 0$, the closer the voter is to one of the blocs compared to the other the more likely she is to vote for her most preferred bloc (when it comes to taxes). $\mathbf{D_{jt}}$ is a vector of municipaliy $\times$ time dummies[13] to control for the fact that the ideological bias and, hence, the probability of voting according to tax preference may differ between the different municipalities. I will also include control variables, $\mathbf{C_{ijt}}$, for age, sex, education and marital status.

As mentioned above voters and politicians are not observed at the same time for the 1991 election. This poses a problem if something happened between the time the voters' preferences are observed (in 1991) and the time the politicians' preferences are observed (in 1993). Specifically, we may be worried that the tax rate demand is a function of economic conditions in the municipalities. The time between 1991 and 1993 was one of the most economically turbulent in Sweden the last century which means accounting for the economic situation is important. However, we can not just simply add economic indicators to the right hand side of (7) since the preferences of both the median politician and the voter is on the left hand side for each observation.

I will instead use a generated regressor approach. Let $\mathbf{Z_{jt}}$ be a vector of macroeconomic variables. Under the assumption that voters and politicians react in the same way with respect to the macroeconomic condition I can estimate preferences in two steps. First I estimate the relationship between observed tax rate demand, $\tilde{t}_{ijt}$ (on voters and politicians simultaneously) and macroeconomic variables using OLS:

$$\tilde{t}_{ijt} = \alpha + \boldsymbol{\lambda}'\mathbf{Z_{jt}} + u_{ijt}. \tag{8}$$

I then use the predicted residuals, $\hat{u}_{ijt}$, instead of the observed tax preference.

[13]The interaction with time simply means that municipalities that took part in both the 1979 survey and the 1991 survey have a different dummy variable for each of the two years.

If voters and politicians react similarly to macroeconomic conditions then this would yield consistent estimates of their tax preferences. I will use variables for unemployment, tax base, grants, net migration, proportion of immigrants, proportion of young and elderly, as well as municipal taxes, debts and expenses to take the macroeconomic situation in the municipalities into account.

Table 3 shows the result from the estimation of (7), both using stated preferences and estimated preferences. As can be seen in column 1 information is strongly positively correlated with voting according to tax preference and significant on any conventional significance level. Adding the relative distance does not affect the point estimate and the coefficient (β_2 in equation (7)) is positive as expected. Adding municipal fixed effects do not seem to affect the result in any significant way either. When the other control variables are added the point estimate drop somewhat. This is likely due to the fact that information is strongly correlated with education level (see result in table 2) and that education also seem to have an impact on the probability of voting according to preference. However the effect of information is still significant. Since information is scaled between 0 and 1 the point estimate show the difference between the least informed voters and the most informed voters which is somewhere between 13 to 18 percentage points. A standard deviation increase in information increases the probability of voting according to tax preference with around 2.8 to 3.7 percentage points. When the relationship has been estimated using the two-stage estimation procedure outlined above the results are virtually identical.

As mentioned above information is an endogenous variable meaning we can not credible conclude the effects estimated above are causal effects. One concern is that I do not estimate an information effect but rather that the ideological bias differs between the groups. Suppose for instance that the null hypothesis is true; there exist no information effect but that uninformed voters are biased on average towards the left-wing parties and that the informed voters are not biased towards any party on average. Figure 4 shows an example of this. For voters with right-wing tax preferences ($x_i < 0$) we would estimate a positive information effect since informed voters on average

Table 3: LPM regressions on probability of voting for party closest in tax preference

	Stated preferences				Estimated preferences			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Information	0.171***	0.175***	0.161***	0.134***	0.174***	0.179***	0.162***	0.142***
	(0.0363)	(0.0319)	(0.0336)	(0.0355)	(0.0351)	(0.0331)	(0.0354)	(0.0394)
Relative distance		0.124***	0.136***	0.137***		0.119***	0.135***	0.136***
		(0.0237)	(0.0221)	(0.0231)		(0.0207)	(0.0216)	(0.0216)
Age				0.00146				0.00134
				(0.00264)				(0.00252)
Age^2				-0.131×10^{-4}				-0.117×10^{-4}
				(-0.281×10^{-4})				(-0.275×10^{-4})
Female				-0.00839				-0.0264
				(0.0204)				(0.0192)
Medium education level				0.0419**				0.0213
				(0.0207)				(0.0193)
Higher education level				0.0793***				0.0302
				(0.0258)				(0.0208)
Married				-0.0106				-0.00372
				(0.0190)				(0.0178)
Constant	0.540***	0.399***	0.393***	0.344***	0.543***	0.406***	0.398***	0.372***
	(0.0213)	(0.0398)	(0.0328)	(0.0643)	(0.0193)	(0.0348)	(0.0324)	(0.0680)
Municipality × time fixed effects	No	No	Yes	Yes	No	No	Yes	Yes
adj. R^2	0.006	0.033	0.048	0.050	0.006	0.028	0.046	0.045
N	3231	3231	3231	3207	3245	3245	3245	3221

Dependent variable is probability of voting for party closest in tax preference. *, ** and *** denote significance on the 10, 5 and 1 precent level respectively. Standard errors, clustered on the municipal level, are shown in parenthesis. Columns (1) to (4) show the results from estimations using the observed preferences while columns (5) to (8) show the results from estimations using two-stage estimated preferences as outlined in equation (8).

are more likely to vote for the right-wing parties. For voters with left-wing tax preferences on the other hand we would estimate a negative information effect since the uninformed voters are more likely to vote for the left-wing parties on average. The areas in the figure show the size of the over- and underestimation of the information effect. Since the overestimation area in this example is the largest we would identify a spurious positive information effect overall when in fact the differently informed voters just have different ideological biases.

Fortunately this can be tested in the estimations by interacting the information variable with a variable indicating if the voter have tax preference for the left-wing parties. If such an interaction is different from zero it would indicate that informed and uninformed voters have different ideological biases which means that enodogeneity is a serious problem.

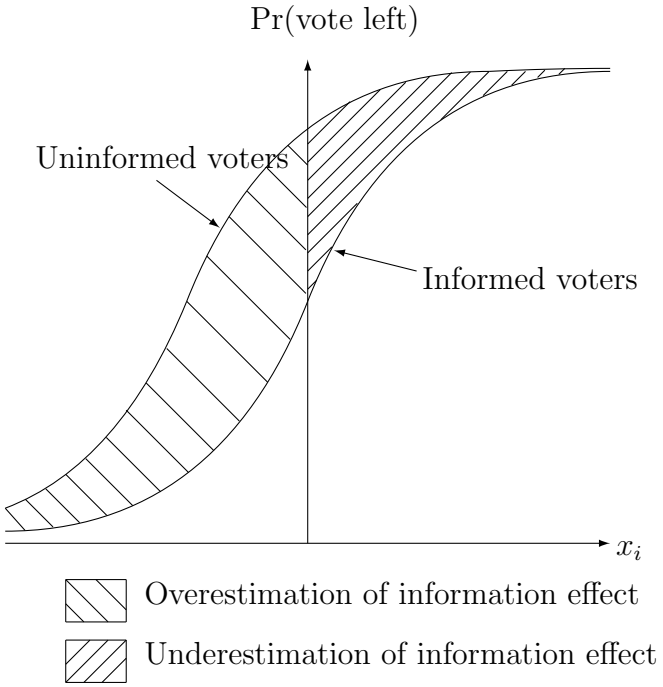

Figure 4

Table 4 shows the result when information has been interacted with a dummy variable indicating if the voter have left-wing tax preference. As can be seen the interaction is not significiantly different from zero in any of the

estimations suggesting that more informed voters are not differently ideologically biased compared with lesser informed voters. Furthermore the dummy variable indicating left-wing tax preference is not significantly different from zero in any specification which suggest that the electorate at large is not ideologically biased towards either of the blocs. That means if a voter has an equal distance in tax preference to the two blocs she is equally likely to vote for either of them.

So far I have assumed that the effect of information is the same regardless of the relative distance to the two blocs. That means that if a voter goes from slightly preferring the right-wing bloc to slightly preferring the left-wing bloc the probability she votes for the left-wing bloc increases discontinuously. However, that is not what the theoretical framework suggest. In fact, in general the information effect depends on the relative distance, something that can be seen in figure 1.[14] To capture this in the estimation I will estimate the following equation:

$$\Pr(i \text{ votes for } A_{ijt}) = \beta_0 + \beta_1 I_{ijt} + \beta_2 |x_{ijt}| + \beta_3 (I_{ijt} \times |x_{ijt}|) + \boldsymbol{\gamma}' \mathbf{D_{jt}} + \boldsymbol{\delta}' \mathbf{C_{ijt}} + \varepsilon_{ijt} \tag{9}$$

The expectation is now that $\beta_3 > 0$. That means that the increase in the probability of voting according to tax preference for informed voter is larger the closer the voter is to one bloc compared with the other. The intuition for this is that when the voter is on almost equal distance from the two blocs the utility difference for the different tax policies is negligible for the voter and the ideological bias is almost all that matters for the voter, hence the information effect is small. However, when the relative distance increases the tax dimension becomes relatively more important and the information effect increases. At some point even the least informed voters may know they are much closer to one of the blocs compared to the other and the information effect will actually decrease. To control for that I will also use a 2nd order

[14] From the theoretical framework the size of the information effect depends on the distributions of θ_i, μ_{iL}, and μ_{iR} and that will cause the information effect to depend on the relative distance.

Table 4: LPM regressions on probability of voting for party closest in tax preference

	Stated preferences				Estimated preferences			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Information	0.153***	0.163***	0.146***	0.118**	0.196***	0.203***	0.186***	0.169***
	(0.0541)	(0.0502)	(0.0504)	(0.0529)	(0.0519)	(0.0500)	(0.0513)	(0.0531)
Left preference	-0.0260	-0.00380	-0.00857	-0.00382	-0.0414	-0.0148	-0.0392	-0.0337
	(0.0690)	(0.0684)	(0.0785)	(0.0679)	(0.0661)	(0.0656)	(0.0664)	(0.0674)
Left preference × information	0.0436	0.0220	0.0305	0.0274	-0.0142	-0.0298	-0.0214	-0.0217
	(0.0817)	(0.0786)	(0.0785)	(0.0780)	(0.0801)	(0.0779)	(0.0788)	(0.0797)
Relative distance		0.124***	0.137***	0.138***		0.116***	0.125***	0.127***
		(0.0222)	(0.0199)	(0.0209)		(0.0183)	(0.0184)	(0.0186)
Age				0.00147				0.00125
				(0.00264)				(0.00253)
Age^2				-0.129×10^{-4}				-0.123×10^{-4}
				(-0.282×10^{-4})				(-0.275×10^{-4})
Female				-0.00982				-0.0212
				(0.0187)				(0.0169)
Medium education level				0.0424**				0.0183
				(0.0214)				(0.0201)
Higher education level				0.0801***				0.0252
				(0.0262)				(0.0201)
Married				-0.0103				-0.00380
				(0.0191)				(0.0179)
Constant	0.550***	0.402***	0.396***	0.345***	0.558***	0.414***	0.423***	0.397***
	(0.0338)	(0.0392)	(0.0319)	(0.0709)	(0.0346)	(0.0398)	(0.0404)	(0.0840)
Municipality × time fixed effects	No	No	Yes	Yes	No	No	Yes	Yes
adj. R^2	0.006	0.033	0.047	0.050	0.008	0.029	0.048	0.047
N	3231	3231	3231	3207	3245	3245	3245	3221

Dependent variable is probability of voting for party closest in tax preference. *, ** and *** denote significance on the 10, 5 and 1 precent level respectively. Standard errors, clustered on the municipal level, are shown in parenthesis. Columns (1) to (4) show the results from estimations using the observed preferences while columns (5) to (8) show the results from estimations using two-stage estimated preferences as outlined in equation (8).

polynomial of the interaction effect.

As can be seen in table 5 the interaction effect is significant in almost all specifications whereas just the information variable in itself is not significant in any specification. This suggests that the magnitude of the effect depends on the relative distance to the two blocs. The quadratic term of the interaction is negative but not significant. Since there is an interaction term in the estimations the magnitue of the information effect depends on the relative distance. For instance, taking the estimate from column 1 in table 5, when the relative distance is held at its median, 1.15, a standard deviation increase in information increases the probability of voting according to tax preference with 3.6%. When the relative distance is held at its minimum the corresponding number is -0.1% and at its maximum 7.6%.

5.1 Nonparametric estimation

There are some reason to be sceptical at the results presented above. First, it is a probability model estimated with OLS which is problematic when probabilities approach 0 and 1. But more importantly it relies heavily on the specific functional assumption made in (9). As discussed above we may in fact think that there is some nonlinearity in the interaction effect.

To account for this I will also estimate the model nonparametrically, that is, not assuming any functional form of the underlying datagenerating process. Specifically, I will use the local linear Kernel estimator with data-driven bandwidth selection. The drawback with this approach is that I can not use a lot of covariates as controls since this causes the estimator to converge slowly towards the true value, the so called *curse of dimensionality*. The model I will estimate is simply:

$$\Pr(i \text{ votes for } L) = f(I_{ijt}, |x_{ijt}|, \mathbf{D_{jt}}) + \varepsilon_{ijt} \tag{10}$$

By use of a smooth Kernel function (this was originally proposed by Aitchison and Aitken (1976)) we can allow for the municipal-specific effect to vary with the other covariates. Furthermore, use of categorical variables in a Kernel regression framework does not lead to a slower rate of converge

Table 5: LPM regressions on probability of voting for party closest in tax preference

	Stated preferences				Estimated preferences			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Information	-0.00848	-0.0211	-0.0362	-0.0663	-0.0773	-0.0912	-0.114	-0.154
	(0.0282)	(0.0833)	(0.0846)	(0.0950)	(0.0870)	(0.0874)	(0.0888)	(0.101)
Relative distance	0.0356	0.0492	0.0552	0.0352	-0.00424	0.0130	0.0123	-0.0111
	(0.0372)	(0.0378)	(0.0380)	(0.0477)	(0.0397)	(0.0406)	(0.0409)	(0.0497)
Relative distance × information	0.160**	0.158**	0.148**	0.225*	0.224***	0.221***	0.224***	0.316**
	(0.0633)	(0.0634)	(0.0638)	(0.128)	(0.0676)	(0.0676)	(0.0681)	(0.130)
(Relative distance × information)^2				-0.0309				-0.0356
				(0.0445)				(0.0428)
Age			0.00150	0.00146			0.00136	0.00132
			(0.00332)	(0.00332)			(0.00331)	(0.00331)
Age^2			-0.134×10^{-4}	-0.129×10^{-4}			-0.114×10^{-4}	-0.109×10^{-4}
			(0.342×10^{-4})	(-0.342×10^{-4})			(-0.340×10^{-4})	(0.340×10^{-4})
Female			-0.00890	-0.00857			-0.0276	-0.0273
			(0.0169)	(0.0169)			(0.0168)	(0.0168)
Medium education level			0.0426*	0.0419*			0.0226	0.0219
			(0.0223)	(0.0224)			(0.0222)	(0.0223)
Higher education level			0.0784***	0.0781***			0.0289	0.0286
			(0.0234)	(0.0234)			(0.0233)	(0.0233)
Married			-0.0110	-0.0112			-0.00491	-0.00524
			(0.0199)	(0.0199)			(0.0198)	(0.0198)
Constant	0.500***	0.493***	0.437***	0.447***	0.548***	0.538***	0.513***	0.526***
	(0.0486)	(0.0494)	(0.0853)	(0.0865)	(0.0512)	(0.0524)	(0.0871)	(0.0883)
Municipality × time fixed effects	No	Yes	Yes	Yes	No	Yes	Yes	Yes
adj. R^2	0.034	0.049	0.052	0.051	0.030	0.049	0.048	0.048
N	3231	3231	3207	3207	3245	3245	3221	3221

Dependent variable is probability of voting for party closest in tax preference. *, ** and *** denote significance on the 10, 5 and 1 precent level respectively. Standard errors, clustered on the municipal level, are shown in parenthesis. Columns (1) to (4) show the results from estimations using the observed preferences while columns (5) to (8) show the results from estimations using two-stage estimated preferences as outlined in equation (8).

of the estimator as is the case for continuous variables.

When estimating regressions using a smooth Kernel function bandwidth selection is very important. I will use the Akaike information criterion cross-validation method proposed by Hurvich, Simonoff, and Tsai (1998). Li and Racine (2004) has shown that in small samples this method of selecting bandwidth tends to perform better than least-squares cross-validation and in large sample the difference between the methods is negligible.[15]

Figure 5 shows the result from the local linear estimation.[16] As can be seen the information effect is small or even negative when the relative distance is small.[17] However as the relative distance increases the information effect increases sharply until the relative distance is about 1. After that the effect seems to be constant and the difference between the least informed voters and the most informed voters is around 20% to 30% which correspond to an information effect of 4% to 6% of a standard deviation increase in information.[18] For comparison, figure 6 shows the result from the parametric estimation corresponding to column 1 in table 5. The basic result is similar but it seems the information effect is larger when estimating nonparametrically when the relative distance is small (around 1).

5.2 Aggregate effect

Even though information may have a large effect on the individuals voting decision it is not clear that it matters on the aggregate level. For instance, if informed and uninformed voters have the same preferences on average it will not matter for the electoral outcome that informed voters are better at voting according to tax preference. Wittman (1989) argues that even if there exist a preference difference as long as it is not too large the outcome

[15] I have tested using both least-squares cross-validation and maximum likelihood cross-validation and the difference from the AIC method is indeed small.

[16] The estimated effect differs for each municipality so in order to present the effect in a single graph I have taken the mean effect weighted with the number of respondents in each municipality.

[17] However, one should note that Kernel estimation is not very precise in the boundaries.

[18] Figure 8 in the appendix shows the result when preferences have been estimated with the two-stage procedure outlined above. As can be seen the result is virtually identical.

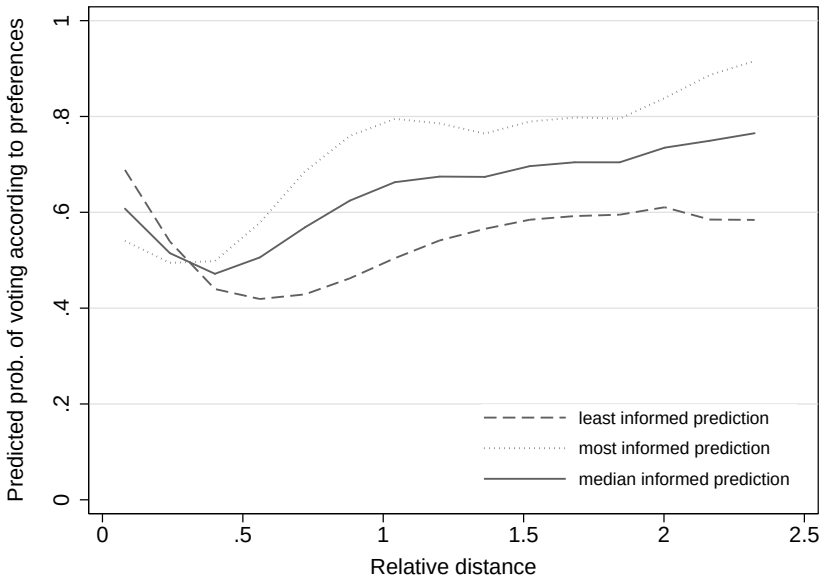

Figure 5: Predicted probability of voting according to tax preference, local linear regression using a bandwidth selected by AIC cross-validation, stated preferences

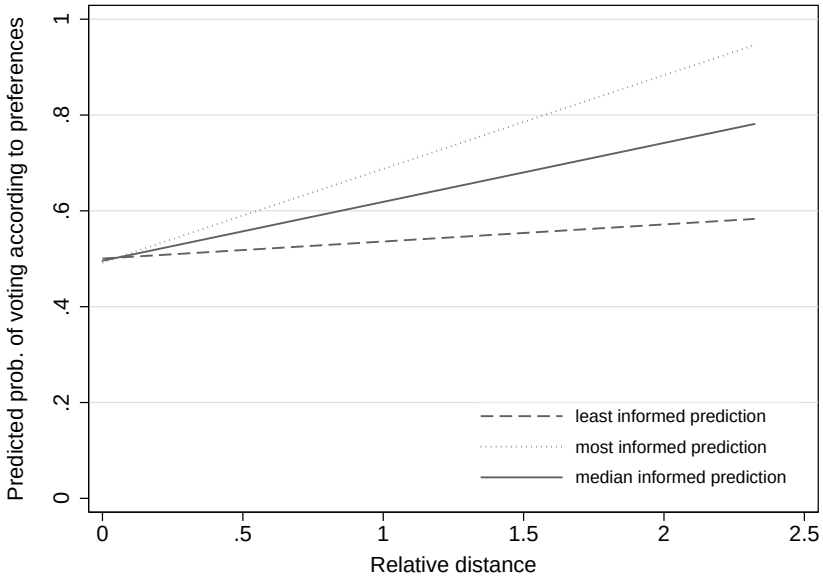

Figure 6: Predicted probability of voting according to tax preference, LPM

would still not be biased. On the other hand, if informed and uninformed voters have very different preferences the composition of politicians will be biased towards informed voters since they are better at voting according to their tax preferences. For the data I have it turns out that informed voters want significantly higher taxes than uninformed voters. This is illustrated in figure 7 where individuals are aggregated over each information level. The relationship is statistically significant on any significance level (t-value of 7.39).

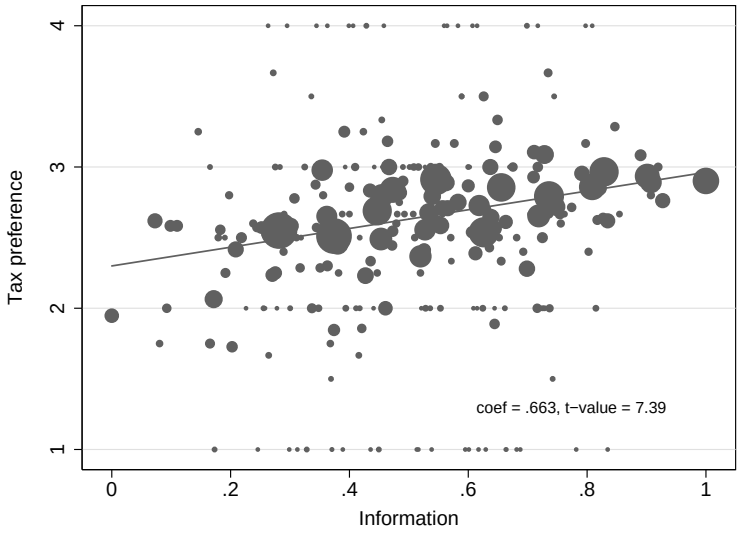

Figure 7: Scatterplot over tax preference and information

Since informed voters are better at voting according to tax preference and also want higher taxes compared to uninformed voters we might suspect the election result would have been different had all voters been equally informed. Given the estimation results above we can calculate what the election result would have been had all voters had the same amount of information. This will be done for the parametric model outlined in equation (9) and estimated in table 5. Aggregating the predicted probability for each individual of voting for the left-wing parties gives the predicted vote share for the left bloc.[19] I can

[19]The predicted probability of voting for the left-wing bloc is simply the predicted probability of voting according to tax preference when the voter has left-wing tax preference

then compare this to the predicted left-wing vote share had all voters been fully informed. This is done by changing the information effects ($I_{ijt} \times x_{ijt}$ and $(I_{ijt} \times x_{ijt})^2$) and then aggregate these predicted probabilities.

This gives a measure of what effect information has on the aggregate level. For instance, in the sample the actual vote share for the left-wing parties is 48.5% while the the predicted left-wing vote share calculated from the estimation in column 1 of table 5 is 48.2%. However if all voters were informed[20] (i.e. setting the interaction terms to be equal to $1 \times x_{ijt}$ for all voters while leaving the other variables unchanged) the predicted vote share would be 46.3% a difference of 1.9 percentage points. On the other hand if all voters were uninformed (i.e. setting the interaction terms to be equal to $0 \times x_{ijt}$ for all voters) the predicted vote share for the left-wing parties would increase to 49.4%. Table 6 summarizes the predicted probabilities and the differences from the actual predicted probabilities for all the regressions shown in table 5. As can be seen, the estimations suggest that if all voters were informed the vote share for the left-wing parties would decrease with 1 to 2 percentage points. Out of the 2851 municipal elections that has been held in Sweden between 1976 and 2006 in 135 of these the left-wing bloc has had between 50% and 51.5% suggesting that, with an information effect of 1.5%, had all voters been fully informed the majority would have switched in 4.7% of the municipalities. These results suggests that the fact that information is not distributed homogeneously in the electorate does have an aggregate impact on the voting outcome, the errors voters make do not cancel out when aggregated.

6 Summary

A large literature has focused on the fact that even though uninformed voters know little about politics they are still able to vote for their most preferred

and 1 minus the predicted probability of voting according to tax preference when the voter has right-wing tax preference.

[20]Note that while changing the interaction effect I leave the main effect of information unchanged.

Table 6: Predicted vote share for the left-wing bloc given different information levels

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Predicted prob.	0.482	0.481	0.481	0.481	0.502	0.500	0.499	0.498
All uninformed	0.494	0.493	0.492	0.496	0.498	0.497	0.495	0.494
Difference	0.012	0.012	0.011	0.015	-0.004	-0.003	-0.004	-0.004
All informed	0.463	0.462	0.464	0.461	0.492	0.490	0.489	0.486
Difference	-0.019	-0.019	-0.017	-0.020	-0.010	-0.010	-0.010	-0.012

politicians by using different informational shortcuts or cues to vote as if they were informed. This idea is tested in this paper utilizing a unique data set with preferences for the municipal tax rate for both politicians and voters which makes it possible to directly investigate the effect of information. Specifically I am able to test if voters with a high level of information vote for politicians with preferences closer to themselves compared with voters with a low level of information.

The results suggest that informed voters are significantly better at voting for their most preferred politicians. On average, a standard deviation increase in information increases the probability of voting for the most preferred bloc (with respect to tax preference) with around 3%. However I also showed that the effect depends on the relative distance to the two blocs; when a voter is at almost equal distance from the two blocs the effect of information is negligible. As the relative distance increases the effect also increases. At most, a standard deviation increase in information increases the probability of voting according to preference with around 6% to 7%. This suggests that uninformed voters are not able to use informational shortcuts to vote as if they were informed.

These effects are at the micro level. Perhaps more interesting would be to know if information heterogeneity among the electorate also have an aggregate effect on electorate outcome. If the information level is uncorrelated with policy preferences it does not matter that some voters are informed and others are not. However, in this case, information is strongly related

to tax preferences, more informed voters also want higher taxes. Using the parameter estimates from the micro regression I am able to calculate what the election result would have been had all voters been informed. The results suggests that the left-wing bloc would have gotten 1% to 2% fewer votes in that case which would translate into losing almost an additional 5 percentage points of the municipal elections. The size of the estimated effects are slightly larger on the micro level and slightly smaller on the macro level than what Bartels (1996) find. One big difference is that while Bartels do not observe neither the voters' preferences or the politicians' preferences I am able to directly relate the effect of information to the preferences of the agents.

There is some reason not to take these results too literally. First, acquiring information is a costly activity which means that endogeneity is a big problem. I use a crude way of testing for endogeneity and while the results do not suggest endogeneity is present it is not enough to rule out the potential problem. Furthermore when calculating the aggregate impact I assume that information does not have a direct causal effect on tax preference. If information in fact does have a causal effect then the result might be different.

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A Appendix

Table 7: Descriptive statistics, micro data

	count	mean	sd	min	max
Information	2849	0.546	0.208	0	1
Know issue	2849	0.257	0.437	0	1
Know politician name	2849	0.690	0.462	0	1
Read local newspaper	2849	2.791	0.874	1	4
Interested in politics	2849	2.611	0.752	1	4
Subjectively informed	2849	0.408	0.492	0	1
Talk about municipality	2849	2.236	0.617	1	3
Voted according to stated pref.	2849	0.637	0.481	0	1
Voted according to estimated pref.	2849	0.640	0.480	0	1
Voted for a left-wing party	2849	0.493	0.500	0	1
Relative distance (stated pref.)	2849	1.116	0.641	0.0167	2.323
Relative distance (estimated pref.)	2849	1.125	0.593	0.0167	2.323
Rel. distance to right (stated pref.)	2849	-0.188	1.273	-2.323	2.323
Rel. distance to right (estimated pref.)	2849	-0.0321	1.272	-2.323	2.323
Age	2849	45.29	15.91	18	80
Age^2	2849	2304.1	1524.9	324	6400
Female	2849	0.463	0.499	0	1
Low education level	2849	0.373	0.484	0	1
Medium education level	2849	0.312	0.463	0	1
High education level	2849	0.314	0.464	0	1
1st income quartile	2849	0.194	0.396	0	1
2nd income quartile	2849	0.246	0.431	0	1
3rd income quartile	2849	0.269	0.443	0	1
4th income quartile	2849	0.290	0.454	0	1
Married	2849	0.698	0.459	0	1
Children under 16	2849	0.389	0.488	0	1
Working	2849	0.703	0.457	0	1
Working home	2849	0.0534	0.225	0	1
Student	2849	0.0340	0.181	0	1
Retired	2849	0.169	0.375	0	1
Not working	2849	0.0407	0.198	0	1
Working in private sector	2849	0.494	0.500	0	1
Working in state sector	2849	0.129	0.335	0	1
Working in municipal sector	2849	0.155	0.362	0	1
Working in county sector	2849	0.0748	0.263	0	1
Worker	2849	0.423	0.494	0	1
Civil servant	2849	0.430	0.495	0	1
Employer	2849	0.0983	0.298	0	1
Never worked	2849	0.0488	0.215	0	1
Expenses	81	11383.4	2225.7	7366	20269.1
Debts	81	5445.4	2383.8	17	13286.0
Population	81	40913.1	70607.1	3488	435562
Net migration	81	0.00323	0.00801	-0.0146	0.0352
Proportion foreign citizens	81	0.0437	0.0296	0.00611	0.145
Prop. age 0-15	81	0.211	0.0217	0.166	0.302
Prop. age 16-64	81	0.619	0.0332	0.544	0.700
Prop. age 65-	81	0.169	0.0417	0.0447	0.262
Tax rate	81	16.32	1.069	13.75	18.20
Unemployment	81	4.536	3.098	0.600	12.09
Tax base	81	30743.7	4293.8	21391	43218.4

Table 8: Descriptive statistics, macro data

	count	mean	sd	min	max
Expenses	81	11383.4	2225.7	7366	20269.1
Debts	81	5445.4	2383.8	17	13286.0
Population	81	40913.1	70607.1	3488	435562
Net migration	81	0.00323	0.00801	-0.0146	0.0352
Proportion foreign citizens	81	0.0437	0.0296	0.00611	0.145
Prop. age 0-15	81	0.211	0.0217	0.166	0.302
Prop. age 16-64	81	0.619	0.0332	0.544	0.700
Prop. age 65-	81	0.169	0.0417	0.0447	0.262
Tax rate	81	16.32	1.069	13.75	18.20
Unemployment	81	4.536	3.098	0.600	12.09
Tax base	81	30743.7	4293.8	21391	43218.4

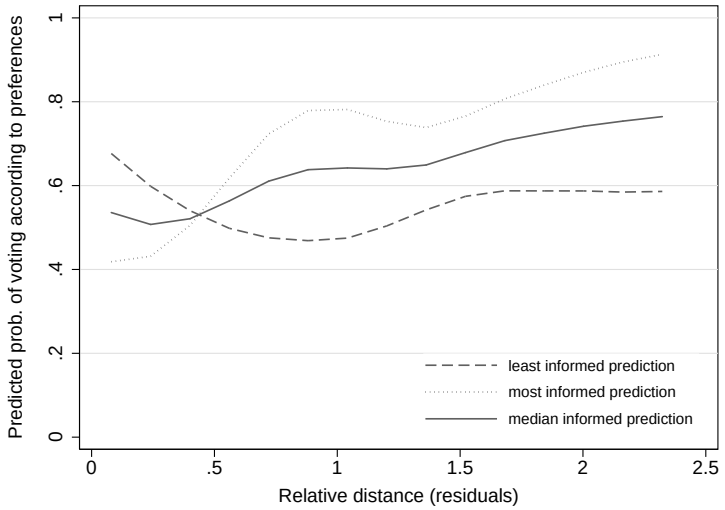

Figure 8: Predicted probability of voting according to preference, local linear regression using a bandwidth selected by AIC cross-validation, estimated preferences

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