An Empirical Study of the Determinants of Green Party Voting

January 7, 2014

Abstract

I empirically study the determinants of individuals' green voting behavior. For this I make use of three datasets from Germany, a panel dataset and two cross-sectional datasets. The empirically strongest determinants are the voters' attitude or distance to nuclear sites, the level of schooling and net income. I show that those voters with deviant attitudes or alternative world views are more likely to vote green, a result of the fact that the green party has always had the position of a protest party. I find little role for demographic variables like sex, marital status or the number of children. This is in contrast to the stated preference literature. Age plays a role for explaining voting behavior only insofar as it proxies for health.

JEL classification: D72, Q50.

Keywords: green voting, environmental attitude, nuclear power, econometric study.

[1]I am grateful for comments by two anonymous referees, Luisito Bertinelli, Marc Joets, Agustin Perez-Barahona, Eric Strobl, Benteng Zou as well as the participants at the Sustainable Development Seminar of Ecole Polytechnique Paris and those at the economics seminar of the University of Luxembourg.
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1 Introduction

It is being more and more recognized that by not integrating both environmental constraints and concerns into our every-day decisions we essentially miss important feedbacks that may bear strong adverse impacts upon others or even ourselves (Stern, 2007).[1] Apart from starting to accept the physical constraints where a finite planet can hardly accommodate infinite economic growth, we also understood that preferences affect how we want to shape the future that we and our children are going to live in. Decisions reflecting those preferences are then taken at two levels, the private one and the public one. While there have been many studies that try to elicit the willingness-to-pay at the private level (for overview see Torgler and Garcia-Valiñas, 2007), the private preferences and actions may - for a variety of reasons (see Sagoff, 1981; Söderbaum, 1999; Nyborg, 2000; Faber, Petersen and Schiller, 2002) - differ substantially from public preferences and actions. Consequently, the way preferences transcend into voting behavior is not always clear and cannot necessarily be extrapolated from results based on e.g. willingness-to-pay studies. Since all environmental laws, regulations and local or nation-wide policies first have to pass through the political decision process, it is useful to know how this process is influenced by the voters' preferences. Thus, the objective of this article is to study the determinants of green voting.

Most studies dealing with choices at the public level have looked at referendums (among others, Deacon and Shapiro, 1975; Coates and Munger, 1995; Kahn and Matsusaka, 1997; Wu and Cutter, 2011; Thalmann, 2004; Wu and Cutter, 2011), with fewer studies actually trying to understand how environmental attitudes and beliefs shape party voting in general. Exceptions, among possibly others, are the studies by Comin and Rode (2013) and Kahn (2007), the latter study showing that the share of Green Party registered voters can explain the voting outcome on green propositions. My work here is most closely related to that by Comin and Rode (2013), who also look at the determinants of green voting in Germany. The main difference to Comin and Rode (2013) is that they investigate how the diffusion of photovoltaic affects green votes, while I study the role of nuclear power plants, environmental quality, socio-

[1] For example, a study by the US Environmental Protection Agency (2011) estimates the direct costs from the 1990 Clean Air Act Amendments and its associated programs to be roughly 65 billion USD in 2020, whereas the direct benefits are expected to be 20 trillion USD.

demographic characteristics, and furthermore check the robustness and further determinants with two cross-sectional datasets at the individual level.

My hypothesis is that environmental concerns are able to predict the share of votes going to the green party. For this study I rely on three datasets. The first dataset uses geographical data from Germany on the voting outcome from the parliamentary elections at the county level for the period 1998 to 2009. This balanced panel dataset consists of four elections and 402 counties. I use two proxies for environmental quality, one being the share of a county's untilled area, the other being a hazard index based on the proximity to atomic power pants. I also control for income and education. The second dataset is a cross-sectional dataset from the Eurobarometer study ZA3861 covering 2,835 respondents that was obtained around the 2002 election. This dataset includes a question on the attitude towards nuclear energy, which allows to compare results to those from the panel dataset. Furthermore, it has information on the respondents' place of living and additional controls which also allow to deal with some fixed effects. The third dataset utilizes the 2005-2008 wave of the World Value Survey, with responses from 1,343 individuals in Germany. The proxy for environmental quality is the subjective environmental belief of respondents. With this third dataset I can control further for individual-specific effects, but do not have the advantages of a panel structure. Thus, while I cannot take into account potential endogeneities or control for fixed effects, I have more detailed information on individual-specific drivers of decisions. For example, I can also study the claim that the Green party is mainly used as a protest voting parting, or whether religious denomination or the number of children play important roles.

The main results to take away are that ecological concern has a direct impact on green voting, where the econometric models of the panel dataset can explain up to 70% of the variance in green voting, while the models of the cross-sectional datasets can explain up to 20% of the variance.[2] The strongest environmental predictors of green voting are the nuclear hazard index, the attitude towards nuclear energy, and global environmental quality. In addition, in line with the literature we find income and education as being significant

[2]Additionally, there has recently been some work analyzing the effects of extreme events on prevention expenditure (Schumacher and Strobl, 2011) or welfare (Barro, 2009). Here I use the hazard index that I construct in order to study whether anticipated extreme events influence green voting through beliefs or ecological preferences and thereby whether these anticipations have an effect on the political agenda.

determinants of green voting. In contrast to the stated preference literature, we find that the only personal characteristic that may explain green voting is age, and we suggest this is due to its indirect impact through health. Thus, differences in sex, marital status, religion or the number of children, previously thought to play important roles for the willingness to act green, do not seem to impact green voting behavior. This may mean that green voting behavior, being a revealed choice and not a stated preference, is not subject to some of the known biases of stated preferences (Whitehead, Haab and Huang, 2011). Another explanation could be that voters act as citizens at the ballots (Sagoff, 1981) and the demographic variables that help to differentiate stated preferences for consumer decisions no longer play a role for citizen decisions.

The article is structured as follows. Section 2 shows how the study relates to the existing literature. In section 3.1 I study the panel dataset, while in section 3.2 I focus on the more detailed cross-sectional datasets. I discuss the difference between the two datasets, the advantages and disadvantages of both, as well as the different questions that I can address. Finally, section 4 concludes with some general lessons and further questions. Readers that require a further background on green parties and the voting process in Germany are referred to the Appendix of Schumacher (2013a).

2 Literature overview

One can group the literature on this topic in roughly four groups, the contingent valuation studies, the referendum studies, the policy implementation studies and the election studies. The list of studies is certainly not complete and should only be viewed as a guide of the work that has been done on this topic up to now, in order to understand in how far the current article extends the literature.

Contingent valuation studies

Contingent valuation studies rely on stated preferences and are generally based on cross-sectional survey data (Hanemann, 1994; Whitehead et al., 2011). The focus of this literature is on studying as to how preferences affect the willingness to pay for environmental protection

or the willingness to accept a reduction in environmental quality. A large overview of the literature is given in Turaga et al. (2010), as well as Torgler and Garcia-Valiñas (2007). This literature has identified a set of socio-demographic variables that are able to explain differences in valuations. Among others, the main determinants include age and sex (e.g. Whitehead, 1991; Carlsson and Johansson-Stenman, 2000; Howell and Laska, 1992; Nord, Luloff and Bridger, 1998), marital status (e.g. Dupont, 2004), education (e.g. Blomquist and Whitehead, 1998; Engel and Pötschke, 1998; Danielson, Hoban, Van Houtven and Whitehead, 1995), wealth (e.g. Stevens, More and Glass, 1994; Popp, 2001; Israel and Levinson, 2004), geographic locality (e.g. Veisten, Hoen, Navrud and Strand, 2004; Bulte, Gerking, List and De Zeeuw, 2005), political interests (Torgler and Garcia-Valiñas, 2007; Dupont and Bateman, 2012), feelings of atomism as well as beliefs about technological solutions aiding sustainability and the severity of environmental impacts (Schumacher, 2013b).

While most of the studies cited in these overviews rely on cross-sectional data, the current work can control further for fixed effects due to the panel dataset and one of the cross-sectional datasets. Controlling for fixed effects is important because, if there is a third, time-constant variable that is not controlled for in a cross-sectional study, then this may bias the coefficients. In the analysis below one can see that those fixed effects turn out to be highly statistically significant. Furthermore, the panel dataset allows to control for endogeneities, which have up to now seen little emphasis in the literature.[3]

The stated preference approach has been criticized, time and again, for various reasons, including hypothetical bias (intention may not lead to action), strategic responses, overstatement of the willingness-to-pay due to e.g. social norms and framing problems (Hanemann, 1994; Carson, Flores and Meade, 2001; McFadden, 1994). Thus, when available or possible, priority should be given to the use of revealed preference studies. One way to obtain information on revealed preferences is to look at voting behavior. This has the advantage of being a more neutral measure, in the sense that it is not subject to overstatement or potential planned behavior that may never realize.

[3]Imagine you regress the pollution level on the willingness to pay for a cleaner environment. Then a higher pollution level may increase that willingness, which then reduces pollution. Clearly, the pollution level is thus endogenous to the willingness to pay.

At the same time, voting outcomes may measure not a consumer's preference on the market but a citizen's preference, which do not necessarily need to be the same as individuals may choose differently when faced with a market choice or a policy choice (Sagoff, 1981). For example, Crosby et al. (1981) observe in their study on the voting behavior on the 1971 Michigan Container Law that

> "[a]t the time of the election, returnable containers accounted for less than 15 percent of consumer purchases of beer in Michigan and less than 25 percent of purchases of soft drinks (Rideout and Reyes, 1976)... In the 1976 general election the voters of that state approved by a substantial margin (64 percent to 36 percent) a proposal to require refundable cash deposits for soft drink and beer containers."

One reason for this disparity may be that, by voting green, individuals believe that the free-rider problem may be circumvented and thus their atomistic feeling will not prevent ecological concern to transcend into actual behavior.[4]

Another reason may be that choices taken in the market place differ from those taken in the public domain because individuals decide differently depending on whether they are acting as a consumer or as a citizen (see e.g. Sagoff, 1981; Söderbaum, 1999; Nyborg, 2000; Faber et al., 2002). For example, someone may vote for tighter laws on drunk driving, but despite this may drive drunk from time to time. Moral reasons may, therefore, weigh more heavily when one's choices may impact the direction that a society takes, than those choices that tend to affect only oneself. Public and private choices could also differ in the sense that one does not buy a certain product but at the same time votes against banning it because one does not want to constrain one's future choices (Hamilton, Sunding and Zilberman, 2003; Brooks and Lusk, 2012). Conclusively, the same individual may decide differently, depending on whether the choices are in the private or public domain.[5]

Thus, on the one hand, voting behavior may be more tightly linked to environmental concern than measures of environmental attitudes elicited through the stated preference ap-

[4] In a previous study (Schumacher, 2013b) I have already shown that feelings of atomism have a negative impact on the willingness to undertake prevention expenditure.

[5] This is a thriving literature, which contains evidence in favor of differences between consumer and citizen preferences (Blamey, Common and Quiggin, 1995; Ovaskainen and Kniivilä, 2005; Spaargaren and Oosterveer, 2010), and evidence rejecting differences (Howley, Hynes and O'Donoghue, 2010; Rolfe and Bennett, 1996).

proach simply because voting is a revealed preference and thus avoids the potential biases of the stated preferences. Or, put differently, while someone may state to have a high willingness to act green, this willingness may not transcend into actual behavior. Hence, voting might be a better indicator of the willingness to act green since by voting green one hopes to influence governmental regulation and policies that then force everyone to act green. On the other hand, voting results may simply measure something completely different from stated preferences since they give information on the citizens' preferences and not necessarily consumers' preferences. Thus, studying voting behavior gives us some information on potential differences between citizens and consumer preferences, and on whether revealed preferences differ much to the stated preferences. If the results between voting outcomes and the stated preference literature are sufficiently similar, then both methods mutually support each other. If they are different, then this would warrant further investigation.

Referendum studies

In general, referendum studies use voting outcomes, i.e. revealed preferences, in order to study attitudes to or demand for public goods.[6] Among the earliest studies are Deacon and Shapiro (1975) and Fischel (1979). The authors investigate what determines the support of referendums on environmental goods. Environmental quality, educational attainment, occupation, political orientation, and income were significant determinants of the support for the referendums. Similar results have been found in Thalmann (2004), Nelson, Uwasu and Polasky (2007), and Halbheer et al. (2006). Another earlier article is Crosby et al. (1981), studying the voting behavior on the 1971 Michigan Container Law. The authors conclude that green voting is linked to ecological concern only indirectly via behavioral intention. Kahn and Matsusaka (1997) study the determinants of voting on referendums using data at the county level in California. The main result is that income may be non-linearly related to the support of the environmental policy. This relationship may arise since medium-income respondents may be more environmentally-concerned than poor respondents, while even richer respondents may be able to shelter themselves from environmental problems. A similar observation is found in

[6] In addition, there are also referendum-type studies that rely on the stated preference approach, see e.g. Howley et al. (2010).

Kahn (2002), who observes greater pollution exposure in lower income neighborhoods.[7] Wu and Cutter (2011) emphasize the importance of spatial dependence and aggregation issues.

Policy implementation studies

The next type of studies investigates the determinants for policy implementation. In general, the results conclude that a senator's ideology is the main determinant for voting green (Kalt and Zupan, 1984; Nelson, 2002). Obviously, it is useful to know what then determines a senator's ideology. This should, to a large extent, be the voters. In this respect, Kahn (2007) shows, based on census-track data for California, that the share of Green Party registered voters can explain the voting outcome on three green propositions. In addition, he finds that representatives from greener constituencies are more likely to support environmental legislation than representatives from other constituencies. What his work is missing though is a clear identification of what are the determinants of green voting.

Another point that has been partly addressed is the question of local versus global environmental problems. Local environmental problems do not necessarily need a legislative change or nation-wide policy or campaign, but can be addressed within the community itself. In contrast, those voters who believe that global or regional environmental problems are important should vote for a green party because they would feel that there is a larger need for a political agenda that transcends the local region. If that is the case, then this would show that voters believe that environmental problems also require a political platform in order to be addressed or solved. The article by Andrew Chupp (2011) looks into this and finds that constituent interest, measured by damages or benefits from pollution, affects the stringency of environmental policies across US states. Jacobsen (2013) used a panel dataset of the votes of US Senators to show that the unemployment rate in a senator's state reduces the support for environmentally-favorable policies. Furthermore, Ashworth et al. (2006) find, among others, that municipalities are more likely to introduce green policies if their peers have already done so.

Thus, in addition to the willingness-to-pay studies that look at socio-demographic variables and personal opinion, these studies emphasize also variables with a macroeconomic flavor, like

[7] This would be an example for the Tiebout sorting (see below), which requires to deal with endogenous sorting of the population.

constituent interest, or unemployment.

Election studies

The election studies are much fewer in number, and this article belongs to this last group of studies. Somewhat different aspects than the ones raised above are studied in Guber (2003). The author looks at determinants of green party voting and discusses topics like issue salience, perception of candidate differences, and partisan loyalty in the US. One observation from this study is that the environment, at least in the US, is not placed sufficiently highly on the political agenda of candidates such that it would drive voters' choices. Consequently, it would be useful to look more closely at a country with a stronger history of green voting, where the green party itself entered the government. A country that meets this condition is Germany.

The one study that is the closest to this one is Comin and Rode (2013). They investigate how the diffusion of photovoltaic affects green votes in Germany. In comparison, I study the role of nuclear power plants, environmental quality, and socio-demographic variables, and furthermore check the robustness and further determinants with two cross-sectional datasets at the individual level. Additionally, I control for education attainment and net income, while Comin and Rode (2013) only control for income.

3 The empirical analysis

In this section I present the empirical analysis. One obvious problem lies in identifying what exactly constitutes green voting. The difficulty here is that, in general, political parties present themselves as having a multitude of objectives, and voters eventually choose parties based on bundles of promises. It is, however, also well-known that this bundling of objectives intends to attract as many voters from as diverse backgrounds as possible, while the actual decisions of the political party that comes into power mainly reflect its narrow, main party orientation. In this respect, one can say the socialists tend to take more decisions with the lower and middle class in mind, the conservatives are more oriented towards the demands of the industry, and the liberals towards a reduction of the welfare state. The only party that has a clear environmental focus as its top priority is the green party. The assumption here is, then, that voting for the

green party in one's country reveals one's green preferences.

3.1 The panel dataset

The panel dataset consists of the voting outcomes from the parliamentary elections at the county level for the federal elections between 1998 and 2009. This gives a balanced panel dataset consisting of four elections and 402 counties, totaling 1,617 available observations for our estimations. The elections were held in 1998, 2002, 2005 and 2009. We obtained the share of the voters' second votes for the Lower House. With the second vote a voter chooses the party that he or she wishes to enter into the Lower House, and thus potentially into government.[8]

We use two proxies for environmental quality, one being the share of a county's untilled area, the other being a hazard index based on proximity to atomic power plants. Furthermore, we use two controls, namely the share of those without a lower secondary education to the number of potential voters (dubbed noschulpc),[9] as well as the per capita after-tax income (dubbed ypc), both at the county level.

The hazard index is constructed as follows. I obtained the GPS coordinates of each atomic power plant and final atomic disposal site in Germany and in close proximity to Germany.[10] I then constructed a hazard index based on the Haversine distance[11] according to the formula

$$\text{Hazard}_{it} = \sum_{j} \frac{1}{d_{ij_t}},$$

where the hazard index H_{it} of each county i at time t is an aggregate of the inverse functions of the distance d_{ij_t} of county i's center to each nuclear site j_t. It is time varying because

[8] In contrast, a voter's first votes are more personal and may be less based on party orientation. With the first vote, a voter chooses his favorite candidate that may directly enter the Lower House.

[9] The age structure should be very similar across counties, so per capita or per voter should give equivalent results.

[10] The empirical results had only marginal quantitative changes when I calculated the hazard index based on German atomic power plants only.

[11] The Haversine distance is calculated as $d = 2r\text{arcsin}\left(\sqrt{\sin^2\left(\frac{\theta_2-\theta_1}{2}\right) + \cos(\theta_1)\cos(\theta_2)\sin^2\left(\frac{\lambda_2-\lambda_1}{2}\right)}\right)$, where d is the distance, r is the radius of the earth, θ_1 and θ_2 the latitudes of point 1 and 2, λ_1 and λ_2 the longitude of point 1 and 2.

of the changing number of nuclear sites.[12] Thus, the closer a county is to a nuclear site the higher will be its hazard index. Individual hazards are calculated as an inverse function of the distance in order to emphasize that someone living very close to a nuclear power plant will view it as a large hazard, with no potential to react in case of a large-scale accident, while someone further away will be much less or little concerned by it. Another concern captured by the hazard index is that of potentially continuous exposure to increased radiation.[13] An example for the hazard index in 2009 is given in Figure 1.[14] We see that most nuclear power plants or hazardous waste sites are in western Germany. As a result, the hazard index in these counties takes on higher values, indicated by the darker surfaces. We forward the following hypotheses.

Hypothesis 1 *A higher hazard index induces more green voting.*

The basic hypothesis is that voters face a continuous fear of large-scale accidents at nuclear sites. Hence, voters that are living closer to nuclear sites have a stronger overall fear of nuclear accidents and the hypothesis is that they are consequently more likely to vote for the green party.

Hypothesis 2 *Less natural area induces more green voting.*

With respect to the other environmental variable, namely the share of untilled area within a voter's county, the hypothesis is that the larger this share the less likely are voters going to vote for the green party. This comes from any economic model where a lower environmental quality induces a higher willingness-to-pay for the environment. The share of the untilled area should be a good proxy for how much of a county is kept in a natural state; the extent of urban sprawl; the amount of industrial activity located in a county. This variable is calculated as the

[12] Two power plants were closed during that period, one in 2003 and one in 2005. The variability in the fixed effects estimations for the hazard index comes from those two closures.

[13] There has been a long-standing debate on whether an increased number of leukemia cases occurs in closer proximity to nuclear sites or not. While scientific proof of this is still not final, there is still the fear of a potential positive relationship. For example, Ansolabehere and Konisky (2009) find that a majority of Americans oppose the existence of nuclear power plants in their area.

[14] A suggestion for another hazard index would be to use the accidents reports accumulated during a period of time for each nuclear power plant. Those plants with more accidents would be viewed as having a higher hazard. Though this may be possible, few information on accidents at nuclear power plants get leaked to the public, and it does not seem to be common practice to obtain the individual accident reports. Furthermore, a weighting according to the distance would still be necessary.

sum of (agricultural area + forest area + water area+ Other area) divided by the total area of the county. Other area includes protected areas, training area, dunes, etc.). Thus, this is a measure of a county's untilled area, or natural area, since a low value for this variable implies that that county has many urban areas, industrial sites, transport areas (e.g. streets). Thus, a county that is full of untilled areas is also one where environmental quality should be higher than in a county where the share of untilled area is small, e.g. with many industrial sites. Thus, the variable untilled area should be a rough measure of the amount of environmental quality in a county.

Consequently, one would also expect more votes going to the party that is most likely to increase environmental quality in that county. We discuss and treat potential endogeneities in the next section.

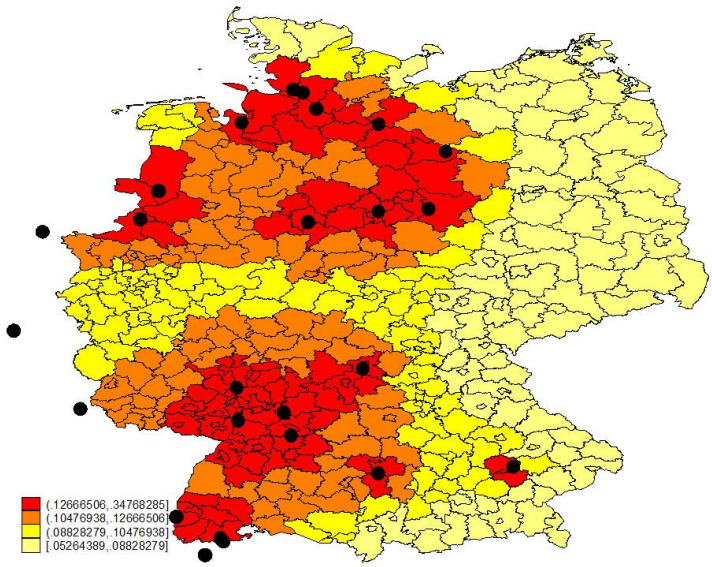

Figure 1: Hazard index 2009

The other variables are the share of those without a lower secondary education to the number of potential voters, as well as the per capita after-tax income (available income) of the households.

Hypothesis 3 *A higher income leads to more green voting.*

This hypothesis is related to the ability to undertake prevention expenditure, or the ability to free resources for environmental taxes. Obviously, the higher the net income of voters the

more money they are likely to have that they may be willing to spend on the environment. This channel has already been shown to hold in cross-sectional willigness-to-pay studies by e.g. Stevens et al. (1994), Popp (2001), or Isael and Levinson (2004).

Hypothesis 4 *A better educational level induces more green voting.*

The higher educational level should be associated with a better knowledge of the linkages between the economic world and the environment, or a better understanding of one's own impact on nature. Previous cross-sectional studies based on stated preferences that found linkages between the educational level and the willingness-to-pay for the environment are e.g. Blomquist and Whitehead (1998), Danielson et al. (1995), and Engel and Pötschke (1998).

Table 1: Summary statistics: Panel data

Variable	**Mean**	**Std. Dev.**	**N**
$\log(\text{greenpc}_{it})$	1.642	0.462	1,617
Hazard_{it}	0.181	0.061	1,617
noschulpc_{it}	0.129	0.051	1,617
ypc_{it}	16879.568	2639.97	1,617
nature_{it}	0.796	0.152	1,617

Summary statistics are available in Table 1 for the full dataset used in the models of Table 2.

Table 2: Panel data - baseline model

VARIABLES	(1) OLS	(2) FE	(3) XTSCC	(4) XTSCC FE	(5) OLS	(6) FE	(7) XTSCC	(8) XTSCC FE
Hazard	1.683***	4.184***	1.683***	4.184**	1.566***	1.371*	1.566***	1.371**
	(0.246)	(1.300)	(0.101)	(1.718)	(0.253)	(0.712)	(0.102)	(0.667)
noschulpc	-1.357***	-0.691***	-1.357***	-0.691**	-1.517***	-0.311***	-1.517***	-0.311
	(0.303)	(0.106)	(0.138)	(0.297)	(0.316)	(0.115)	(0.161)	(0.214)
ypc	8.18e-05***	7.50e-05***	8.18e-05***	7.50e-05***	8.59e-05***	-3.01e-06	8.59e-05***	-3.01e-06
	(8.09e-06)	(6.07e-06)	(2.13e-06)	(1.55e-06)	(1.03e-05)	(5.89e-06)	(2.45e-06)	(7.26e-06)
nature	-0.901***	-2.225***	-0.901***	-2.225***	-0.911***	-0.268	-0.911***	-0.268
	(0.112)	(0.596)	(0.0257)	(0.359)	(0.113)	(0.456)	(0.0273)	(0.198)
Constant	0.849***	1.478**	0.849***	1.478***	0.845***	1.881***	0.800***	1.881***
	(0.222)	(0.580)	(0.0599)	(0.516)	(0.231)	(0.394)	(0.0553)	(0.345)
Observations	1,617	1,617	1,617	1,617	1,617	1,617	1,617	1,617
R^2	0.540	0.592	0.540		0.549	0.695	0.549	
Time dummies	no	no	no	no	yes	yes	yes	yes
Stand. Err.	rob. & clus.	rob. & clus.	Drisc/Kraay	Drisc/Kraay	rob. & clus.	rob. & clus.	Drisc/Kraay	Drisc/Kraay
Number of groups		412	412	412		412	412	412

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

We begin by a straight-forward estimation of the basic model via ordinary-least squares (OLS), model (1), and a fixed effects estimator, model (2). Both models use the Huber-White correction for the standard errors in order to correct for possible heteroscedasticity, and furthermore standard errors are clustered at the county level. Thus, the results should be heteroscedasticity-robust and cluster-robust. The baseline OLS model (1) explains 54% of the variance in the green voting outcome across counties. Allowing for fixed effects in model (2) increases the R-squared only little, to 59.2%.[15] Thus, the Hazard index, the schooling level, income per capita and the share of untilled area are able to explain somewhat more than half the variance in green voting and are all highly statistically significantly different from zero. A unit increase in the Hazard index increases the percent of green votes by 1.68 in the OLS estimator and by 4.184 in the fixed effects estimator. This is the result that was to be anticipated: the closer voters live to nuclear sites the more likely are they going to vote for the green party. The larger the share of voters with lower educational levels the fewer votes go to the green party (OLS coeff -1.356; FE coeff -0.691). Consequently, higher levels of schooling improve the attitude towards green values. The fixed effect estimator is the preferred model, since the results indicate that the correlation between the fixed effects and the explanatory variables is quite high (corr(u_i, Xb)=-0.58), which would render the OLS estimator inconsistent.

The models (5) and (6) include time dummies, which have little impact on the OLS estimator but render income per capita and the share of untilled area statistically insignificant in the fixed effect estimator. Nation-wide annual shocks thus seem to play a significant role only for the fixed effects estimator, which is now able to explain 69.5% of the overall variance of green voting. One likely reason for the difference in the OLS and the FE estimator in the case of time dummies is that the FE estimator only uses within data. It is, for example, well-known that income per capita or schooling levels improved steadily during the past years, and these trends could have been captured by the time dummies. As a consequence, it could be worthwhile to investigate whether autoregressive processes (for example in ypc or noschulpc) played a role for our results. For this we rely on the estimator by Hoechle (2007) that uses the

[15] However, the fixed effects are statistically highly significant.

Driscoll and Kraay standard errors (Driscoll and Kraay, 1998). They are able to correct for arbitrary kinds of autocorrelation and heteroscedasticity. Results without time dummies are shown in model (3) and (4), with time dummies in models (7) and (8). While models (3) and (4) have no significant differences to their OLS and FE counterparts, and neither has model (7), the fixed effects estimator with Driscoll and Kraay standard errors in model (8) also loses significance for the schooling variable. Thus, the only variable that can consistently explain green voting behavior is the Hazard index.[16]

3.1.1 Dealing with endogeneity

The estimators that we used in the previous section are standard estimators that are able to correct for some problems like heteroscedasticity, clustering or autocorrelation. However, problems of endogeneity are possible and should not be neglected. For example, as an environmentalist I might have an aversion to nuclear power plants and thus not move close to one. Consequently, there should be another variable, like the endogenous choice where to live, that affects both the explanatory variables and my choice of voting green. Or, in the words of Tiebout, "[t]he consumer-voter may be viewed as picking that community which best satisfies his preference pattern for public goods." (Tiebout, 1956, p. 418) The previous estimators did not take this kind of endogeneity into account. Therefore, under Tiebout sorting of individuals or households, we expect our variables to be pre-determined. This implies that, among the possibility that e.g. the coefficient on the Hazard index in the OLS or FE estimators actually understates the impact from hazard to green voting, and thus the true aversion to nuclear sites, that our estimations are not consistent. In this case a first-difference estimator would help in resolving this kind of endogeneity, since the first-difference estimator allows for weak exogeneity (Engle et al. (1983)).

Another source of endogeneity is that, for those counties in which the green party is governing, it is likely that there is an impact on the Hazard index via nuclear sites that the green party prevents from being built. This kind of endogeneity would also violate the strict exogeneity assumption of the FE estimator, since the error at time, ϵ_{it}, would impact the

[16] Since most nuclear power sites are in the western part of Germany, I re-ran the estimations on the western Germany sub-sample only. The results continued to hold.

Table 3: Panel data - accounting for endogeneity

VARIABLES	(9) FD	(10) FD	(11) AB	(12) AB
D.Hazard	9.064***	2.775***		
	(1.645)	(0.926)		
D.noschulpc	-0.565***	-0.209*		
	(0.111)	(0.108)		
D.ypc	8.93e-05***	-7.34e-06		
	(5.36e-06)	(5.47e-06)		
D.nature	-2.918***	-0.405		
	(0.668)	(0.454)		
Hazard			11.97***	13.22***
			(2.629)	(3.261)
noschulpc			-1.429***	-1.354*
			(0.431)	(0.728)
ypc			0.000357***	0.000338**
			(7.14e-05)	(0.000164)
nature			-9.051***	-7.716
			(2.969)	(8.547)
Observations	1,205	1,205	1,205	1,205
R^2	0.503	0.641		
Time dummies	no	yes	yes	yes
Stand. Err.	robust	robust	robust	robust
Number of groups			402	402
Number of instruments			12	8
Sargan p-val.			0.031	0.854
Hansen p-val.			0.285	0.881
AR(1) p-val.			0.506	0.389
AR(2) p-val.			0.121	0.0923

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

explanatory variable H_{it+1}.

Finally, recent research on endogenous preferences has been able to show that there are dynamic interactions between green preferences and the environment. Articles that study this aspect are, for example, Nyborg et al. (2006), Buenstorf and Cordes (2008), Schumacher (2009). The main idea that these articles have in common is that social norms or other incentives lead to changes in the proportions of people that have green preferences and those that are less environmentally-concerned. Thus, there may be other drivers that determine both ecological concern and green voting at the same time.

Consequently, I supplement the previous results with two estimators that are specifically designed to deal with endogeneity. One is the first difference (FD) estimator, which allows the explanatory variables to be weakly exogenous.[17] In contrast, if even weak exogeneity is not satisfied, then the explanatory variables are endogenous and must be treated as such. I make use of the particular structure of this dataset, namely the short 'T' but large 'N' structure, which allows to take instrumental variables from inside the dataset itself, namely the lagged values of the explanatory variables. The estimator is called Arellano-Bond (AB), see Roodman (2009).[18] The results for both estimators are presented in Table 3. There are several criteria for the Arellano-Bond estimator that need to hold before the results can be trusted. The first two tests are the Arellano-Bond AR(1) and AR(2) tests, which test for autocorrelation in the errors. In order for these tests to be valid, there should not be any cross-county correlation. For this reason it is necessary to run the Arellano-Bond estimator with time dummies (Roodman, 2009). In addition, there is the Sargan and Hansen test for instrument validity. In contrast to the Sargan test the Hansen test is robust but weakened by many instruments. A rule-of-thumb is that the number of instruments should be less than the number of counties.

Qualitatively, I find no differences to the previous results. There are marginal quantitative differences, for example the coefficient on the Hazard index is larger when accounting for endogeneities. Results with the first-difference estimator and Arellano-Bond estimator are approximately the same. The differences between the models is that the first-difference estimator in model (9) does not include time dummies while model (10) does. The results of model (10) conform very closely to those of models (6) and (8). Models (11) and (12) are based on the Arellano-Bond estimator and differ only in the choice of instruments. While both pass the instrument validity tests, model (12) shows somewhat lower levels of significance for the schooling variable, for income per capita, and the share of untilled area is statistically insignificantly different from zero.

[17] This means that $E(\epsilon_{it}|\alpha_i, x_{i1}, ...x_{it})$, where ϵ_{it} is the error term at time t, α_i the fixed effects, and $x_{i1}, ...x_{it}$ the observations on the explanatory variables prior to date t. This weakened assumption, in contrast to that for the FE estimator, allows future values of the explanatory variables to be correlated with the error term.

[18] Though this estimator is generally used for dynamic panels, it is equally-well applicable to static ones, see e.g. Blundell et al. (1992).

As an overall conclusion from the panel data, I suggest to take the following away. Proximity to nuclear sites should increase the fear of one's own inability to react on time in case of nuclear disasters. The econometric results suggest that the closer voters live to nuclear sites the more likely they are to vote for the green party. Using the results from model (11), when holding all other variables at the sample mean, we find that moving from the minimum value of the Hazard index to its average level increases green voting by two percentage points. In addition, lower levels of education are associated with lower green votes, suggesting that educational attainment plays the role of information provision or an increased critical thinking. Reducing the share of less educated in a county from the maximum to the average leads to an increase in green votes of one percentage point. Further, net income per capita tends to have a positive impact on the share of green votes in a county, implying that only wealthier households who actually have the ability to be green[19] also support that their attitudes turn into government policies. Also, green parties tend to focus less strongly on economic growth and financial remunerations. Consequently, poorer individuals may prefer to vote for parties that focus more strongly on income-generating policies. Increasing the net income per capita from its minimum to its average level while keeping all other variables constant increases the share of green votes by 2.4 percent. The share of untilled area in a voter's county may play the role of diminishing incentives for green voting, though this result is not statistically robust across the different specifications. Relying on model (11) again, a reduction from the maximum to the average level of the untilled area increases green voting by 2.2 percent.

3.2 The cross-sectional dataset #1

This first cross-sectional dataset is based on the Eurobarometer study ZA3861 from 2002. This dataset is specifically designed to understand voters' attitudes in Germany before and after the 2002 election. It is based on a questionnaire where interviewers tried to elicit the expected voting behavior before the election, and also the actual voting behavior after the election. Furthermore, a set of control questions is available. The summary statistics are collected in Table 4, and the complete variable description is given in Table 6.

[19] For example, ecolabeled products tend to be more expensive than their conventional, brown counterparts.

There are three main advantages of this dataset compared to the one from the World Value Survey, cross-sectional dataset #2. The first advantage is a question on the attitude towards nuclear energy. Basically, respondents are asked to state whether they want the use of nuclear energy in Germany to be further increased, or whether they prefer an immediate stop of nuclear power plants. While the panel dataset was only able to control for the distance to a nuclear power plant, or the potential hazard of living close one (or several), it is now possible to know the general attitude of individuals and how this may affect the voting behavior. The second advantage is that this survey gives information on which federal state respondents live in. Hence we can control for fixed effects that may be specific to a federal state. The third advantage is that, in the dataset from the World Value Survey, the only information on voting that we have is what party respondents vote for. However, we do not know whether this applies to elections for the Lower House, the Upper House, or for European voting. Thus, in terms of responses, this dataset and the panel one are, at least theoretically, more easily comparable.

Overall there are 2,835 respondents in our sample. The percent of green voters is 6.9. This matches well the county-average percent of green votes in the panel dataset, which is 6.06. I resort to a logit estimator since the dependent variable is dichotomous. Standard errors are corrected via the Huber and White sandwich estimator, which is able to correct some misspecification as long as observations are independent. To insure independence, I cluster at the federal state level. Estimation results are depicted in Table 5, and odds ratios are presented. Half of the respondents were sampled before the election, while half were sampled afterwards. Hence, around 50% of respondents stated their expected voting behavior, while the others stated the vote they actually casted. To control for potential differences I add a dummy variable called *election*, which takes the value of zero for a pre-election interview, and the value of one for a post-election interview.[20]

In order to test for model misspecification, I make use of the Hosmer-Lemeshow test (HL test) with 10 groups, as well as the Langrange Multiplier test (LM test), also known as Stukel

[20] I also ran separate regression, one constrained to the pre-election sample, one to the post-election sample, and compared coefficients across the regressions. There were never any significant differences. Thus, intended voting behavior is sufficiently close to actual voting behavior, such that it makes sense to combine the information in one regression.

score. The HL test has the null hypothesis that the sample frequency of the dependent variable is the same as the one of the fitted probabilities of observation subgroups. The ML test analyses whether a generalized h-family logit model fits the data better, with the null hypothesis being that the model is correctly specified.[21] The p-value in the ML test corresponds to the p-value of the non-linear regressor. In all cases apart from model (15) it is not possible to reject the null hypothesis. In model (15) the p-value for the ML test is 0.04, which is below the critical value, and the null hypothesis of correct model specification should be rejected. However, the only difference between model (15) and model (16) is that model (16) includes federal state dummies. Both the sample and the regression results are the same, and it is not possible to reject the null hypothesis of the ML test in model (16). Consequently, it is unlikely that model (15) is mis-specified, despite the test results.

Models (13) and (14) present the benchmark case, where the explanatory variable is the subjective attitude towards nuclear energy. The coefficient on nuclear energy is highly statistically significant (coeff 4.404***). It implies that for someone who believes nuclear energy in Germany should be stopped the odds for voting the green party are 4.4 times higher than for someone who believes nuclear energy is useful for Germany. This is a result that we would also expect based on Hypothesis 1 and the results from the panel dataset. In model (14) I add federal state dummies in order to control for fixed effects like eastern-western disparities, regional differences in traditions or natural sites that are not surveyed in the interview and may drive the results. As one can see, this has no significant impact on the estimation results.

In models (15) to (17) I add additional controls. The first set of controls in models (15) and (16) are the educational attainments, stated interest in politics, satisfaction with the previous government, and how often respondents watch news on national TV. In addition, model (16) includes the federal state dummies, which leads to no significant differences in results. The benchmark for educational attainment is having passed lower secondary education. As one would expect, there are no differences in voting behavior between those who are still in school and completed their lower secondary education. However, for increasing levels of educational attainments, the odds for voting the green party increases, with all coefficients being highly

[21] Both the HL test and the ML test are explained in Cameron and Triveda (2009).

statistically significant. For example, the odds for voting for the green party are between 4.698 and 5.067 higher for someone with a university degree than for someone with a lower secondary education. This result is in line with the one from the panel dataset. Educational attainment plays a role for green voting behavior. This is most likely the case because more highly educated have a better knowledge of the environmental problems and the way mankind impacts the environment. Or they are more strongly used to critical thinking or influenced by the social norms of their educational class. Another possibility could be that more highly educated respondents are also likely to have a higher income and thus a higher willingness-to-pay for the environment. To see which explanation is the more likely one I added the variable social status in model (17). As it turns out, this variable is statistically insignificantly different from zero. Similarly, income classes (results available from the author) turn out to be unable to explain differences in voting behavior.[22] As a consequence, this empirical analysis suggests that we should align ourselves with the explanation that is based on knowledge differences. This result is in line with those on educational attainments in e.g. Blomquist and Whitehead (1998), Engel and Pötschke (1998), Danielson et al. (1995) and Schumacher (2013b), but it somewhat contradicts results on the impact of wealth or social class on the willingness to undertake prevention expenditure in other studies, e.g. Stevens et al. (1994), Popp (2001), Isael and Levinson (2004) and Schumacher (2013b). Furthermore, it contradicts the findings from the panel dataset, where net income per capita turned out to be a significant driver of green voting behavior across counties. One reason for the differences in results is that the panel dataset includes final income per capita which is available for consumption or investment expenditure, while in the cross-sectional dataset the only information available is the social status or the income class (before taxes). Differences in social status may not be a good proxy for income differences since that is a subjective assessment and may not e.g. correspond fully to the ability to undertake e.g. green expenditure. Also, income classes may not be highly correlated with net income per capita if there are important regional differences between net

[22]One could imagine that educational classes in the cross-sectional dataset 1 are able to provide more information than in the panel dataset and this information is highly correlated to income classes or the social class. However, even without educational classes in the cross-sectional regression, neither income nor social class has a statistically significant impact. I also tried different ways of including income into the model, linear and non-linear, as individual income group dummies and as a simple dummy. None showed up statistically significantly different from zero.

available income and income classes.

The interest in politics is highly statistically significant, with a coefficient in the range of 1.613 to 1.697. Thus, the odds of voting green increase by a factor of roughly 1.65 for those interested in politics compared to those that show little interest. As for the variable government satisfaction, someone who was satisfied with the previous government, namely the coalition between SDP and the green party, would have been expected to vote for the green party also in the 2002 election. This is also what the estimation results suggest. The odds of voting green are between 5.3 to 5.6 times higher for someone who was satisfied with the green party's performance during the last governmental cycle compared to someone who was unsatisfied. This result is highly statistically significant. Finally, those voters who regularly watch national news on TV are less likely to vote for the green party. Indeed, the odds for voting green are now below one (between 0.635 and 0.642) for those who follow national news regularly. This highly statistically significant result is, nevertheless, not too surprising. The news program on those two TV channels has always had a rather conservative approach. For example, the style of the news program on the first and second channel has been basically the same for the past 60 years since these TV channels have been established.

Finally, model (17) includes additional standard controls, namely sex, marital status, social status, all of which turn out to be statistically insignificantly different from zero. I also include a variable asking the opinion of voters whether they view the party programs as being different from each others. This last variable also turns out to be unable to explain differences in green voting. Neither of these additional controls has an impact on the previous statistical results.[23]

3.3 The cross-sectional dataset #2

The second cross-sectional dataset utilizes the 2005-2008 wave of the World Value Survey, with responses from 1,343 individuals in Germany. With this second dataset one can control further for individual-specific effects, but does not have the advantages of a panel structure. Thus, while it is not possible to take into account potential endogeneities or control for fixed effects, this dataset includes more detailed information on individual-specific drivers of voting

[23]The sample size for model (17) is lower than for the other models due to missing observations in these controls. Re-running models (13) to (16) based on the sample of model (17) does not lead to different results.

decisions. Also, it is possible to exploit different environmental variables that are unavailable in the other datasets. They can serve as a control for the previous results. A detailed description of the variables is given in Table 7, with their summary statistics in Table 8. Just like for the cross-sectional dataset 1, I ran tests for model misspecification. Both the HL and ML tests for models (18) to (21) do not indicate that the models in Table 9 suffer from misspecification.

While this dataset unfortunately does not include information on the respondents' attitude towards nuclear energy, there is further information on the respondents' attitude towards local and global environmental problems that is possible exploit. Specifically, the proxy for environmental quality is the subjective environmental belief of respondents. I construct three variables that include averages of the respondents' beliefs on local environmental problems, global environmental problems, and both combined. The variable gr_loc combines respondents' assessments of how serious they view problems of water quality, poor air quality, poor sewage and and sanitation in their community. The larger is gr_loc the less serious is the subjective view of the problems. Similarly, variable gr_glo combines views on global warming or the greenhouse effect, the loss of plant or animal species or biodiversity, and the pollution of rivers, lakes and oceans in the world. Again, the larger is gr_glo, the less serious is the subjective view. Finally, variable gr_i adds the replies to both variables.

In addition to variables that are similar to those from the cross-sectional dataset 1 (sex, marital status, religious, education, conf_gov, interest), this dataset allows to control for further effects via additional variables. These additional variables include a subjective health assessment, variable *health*, where a respondent scoring a one assesses his health status as being better than someone scoring a zero. The hypothesis here is that those respondents with a worse health situation would be more likely to vote for the green party.[24] In addition, I include a variable called *urban*, where respondents that score a one live in a city with more than 50,000 inhabitants (and thus in a more urban centre), while those living in an area with less than 50,000 inhabitants score a zero (and thus live more rural). The hypothesis is that respondents from urban centers are likely to have different views about environmental issues than those that live in more rural centers.

[24]For a supporting model see e.g. Balestra and Dottori (2012).

Furthermore, the green party in Germany has always had an approach and attitude of a group that wants to transform, wants to change traditions and wants to protest. For example, when the green party entered the Lower House in Germany for the first time, their members did not show up in suits but in every-day clothing, with long hair and beards. This was certainly unthinkable during that time. In addition to their outside appearance, their party program and their objectives were more radical, more oriented towards transforming the society than keeping up the old ways. Based on this one would believe that the green party would also be more likely to attract voters that hold these deviant or alternative views. In order to assess the importance of this potential explanation, I use two variables, *just_ deviant* and *just_ altern*. Variable just_deviant measures whether respondents find it justifiable to behave in a deviant way, including unrightful claiming of government benefits, avoiding a fare on public transport, cheating on taxes, or someone accepting a bribe. Variable just_altern measures whether respondents find homosexuality, prostitution, abortion, divorce or euthanasia justifiable. Thus, while variable just_deviant measures the potential for respondents to undertake deviant behavior[25] and, therefore, to overstep laws, with the variable just_altern it is possible to extract respondents' views on the importance of social norms and, consequently, whether they have different opinions or attitudes than the rest of society.

The regression results are presented in Table 5, the coefficients being the odds ratio. Model (18) is the benchmark case and includes the overall index of the respondents' assessment of environmental problems, the subjective health assessment and the educational attainment. All variables are highly statistically significantly different from zero. The results suggest that respondents who view environmental problems as being less serious are likely to vote less for the green party than those that view the problems as more serious (coeff 0.911). As in the cross-sectional dataset 1 and in the panel dataset, the results on educational attainment show that those respondents that are more highly educated are also more likely to vote for the green party. Surprisingly, model (18) suggests that those respondents that rate themselves as having a better health are also those that vote more for the green party (coeff 2.122). While this is counter-intuitive at first sight, the solution to this puzzle is given in model (19). Here we add

[25]This assumes that there is a sufficiently strong correlation between someone believing that it is justifiable to undertake deviant behavior and someone actually undertaking this behavior.

further controls and the only additional one that comes up as highly statistically significant is age. However, in model (19), and in contrast to model (18), the health measure is not anymore statistically significantly different from zero. The answer, thus, lies in the relationship between age and health. Within our sample, the correlation coefficient between age and health is -0.37 and it is highly statistically significant. Thus, younger respondents are, on average, blessed with a better (subjective) health status and are also more likely to vote for the green party (coeff 0.97). Consequently, health plays a role for green voting only insofar as it is affected by age, which itself is a determinant of green voting.

In model (20) I split the environmental assessment variable into its local and global counterparts. While the previous results of model (19) are unaffected by this split-up, I find that only global environmental problems help in explaining green voting behavior (coeff 0.814). The worse a respondent's assessment of global environmental problems, the more likely will the respondent vote for the green party. Based upon this one could be inclined to believe that green voting is only related to global environmental problems. This would stand in contrast to the panel data results and those from the first cross-sectional dataset, where the hazard index or nuclear energy had a negative impact on green voting. This gives rise to two potential explanations. One, Germans do not necessarily view the hazards from nuclear energy as only a local problem, but a disaster may be seen as having global effects. Chernobyl is an example for this. Against this explanation would speak the statistically highly significant impact of the hazard index on green voting. Though physical distance to a nuclear site may also be interpreted as a psychological distance to a potential disaster, the more likely explanation is that individuals feel safer the further they are away from a nuclear site (in terms of disaster potential and health issues). Thus, local environmental issues should matter. And this is also what the significance of the second environmental variable in the panel dataset, the share of the untilled area in a voter's county, suggests. Hence, a second explanation could then be that the local environmental problems that are being asked for in the second cross-sectional dataset, namely water quality, poor air quality and poor sewage and sanitation, are negligible in Germany. And this is precisely what is the likely explanation. While the sample mean for global problems is at 5.08, the one for the local problems is at 9.23. The minimum for gr_loc

or gr_glo is 3, while the maximum is 12. Thus, most respondents view local problems as not being serious at all, while they find global environmental problems as being very serious.[26]

In the final model (21) the additional variables are just_deviant and just_altern. Both show up highly statistically significant and with a similar odds ratio (coeff 1.238 and 1.264). Thus, those respondents that find it justifiable to stretch or overstep legal boundaries, and those respondents that do not necessarily support existing social norms, are also those that are more likely to vote green. This result stresses that the green party is also used as a protest party. This is in line with results in Agnone (2007) who finds that environmental protest movement amplify public opinion and subsequently the passage of U.S. environmental legislation.

With respect to our set of controls (sex, marital, children, urban, religious), we find similar results to those obtained from dataset 1. Our additional variable age, which was unavailable in the previous dataset, shows up as an important determinant of green voting, and may partly work through the health effect of aging. However, the variable confidence in the government is not statistically significantly different from zero here. This stands in contrast to the results from dataset 1, where the satisfaction with the government was highly significant.[27] The difference may come from the fact that in the current dataset the question on confidence is more vague and may be interpreted as a general means to criticize (or support) democracy, while the question in dataset 1 was more precise and asking about the satisfaction with the work of the previous government.

4 Conclusion

In this article I have used three different datasets to investigate the links between ecological concern and green voting. I have shown that ecological concern determines green voting in a variety of ways and for several reasons. Firstly, I have constructed a hazard index that measures a voter's distance to nuclear sites and thus his potential fear of being caught up in

[26] As a consequence, these results on the local versus global problems and green voting are unlikely to extend to other countries where local problems might be evaluated as being more serious.

[27] Overall it should be noted that I cannot find support for an ecological fallacy, or aggregation bias, as was observed in Wu and Cutter (2011). This could be that the county data here is not as heterogeneous as the Californian data, or because I have a larger cross-section and thus the estimates are more consistent.

a disaster or being subject to increased radiation. The econometric results suggest that, even when accounting for potential endogeneities, the hazard index has a statistically significant and robust impact on green voting. Though one might have expected this result since the green party in Germany has always been known for its particularly strong anti-nuclear position, this is the first econometric investigation suggesting that a causal relationship exists.

In addition, the empirical findings suggest that, at least in Germany, local environmental problems, as measured by the share of the untilled area or subjective assessment of water and air quality, seem not to be important enough to drive green voting. This may be due to overall high environmental standards or little variation across counties. Thus, this result may not necessarily extend to other countries. Also, the fact that the hazard index is a robust and statistically highly significant determinant of green voting shows that proximity to local environmental problems may be a relevant explanatory variable for green voting if it is of sufficient concern for the voters. The results from the cross-sectional dataset show that global environmental problems are viewed as sufficiently serious and the belief on the extent of global environmental problems drives green voting. This may acknowledge the fact that issues of global warming tend to rank highly on citizen's concerns.[28]

As a third result, the attitude towards deviant behavior and alternative worldviews or norms shapes the decision to vote green. This result is able to further support the common belief that the green party has always been viewed as a type of protest party. However, since the green party has lost quite some of its protest status and lately became a more conventional party, it is likely that the number of voters from the liberal side will shrink.

Educational attainment and income seem to have a positive effect on green voting, though the results on income are less robust. While it was not possible to find a direct link between income and green voting in the the cross-sectional dataset, the link from income to green voting in the panel dataset was more robust. I am more inclined to believe the results from the panel dataset (this can control for more effects), and the results presented here suggest that green voting increases when voters get richer and more highly educated.

[28]For example, the recent special Eurobarometer 372 report concludes that climate change is viewed as the second most serious issue, just below fighting poverty, hunger and lack of drinking water, and ranks above the economic situation, terrorism, etc. For Germany, both global poverty and climate change are ranked about equally.

In contrast to the many studies that build upon the stated preference approach and analyze the link between demographic variables and the willingness to undertake prevention expenditure or ecological behavior, we here find very little role for those demographic variables in determining green voting. If ecological concern drives both the willingness to act green and green voting, then the results should be the same. Since they are not, then it is likely that that there are other factors that influence the stated preference results, since the stated preference method only inquires how someone would act, while the voting behavior is a more objective measure. For example, it is known that respondents to sensitive questions may over- or understate their true attitude or behavior (Bradburn, 1983; Tourangeau and Smith, 1996). Hence, the empirical results of the questionnaires on the willingness to undertake green expenditure may be subject to strategic answers, either consciously or subconsciously, through over- or understatement, while voting decisions can be more objective. This is, however, only a suggested explanation and requires further empirical investigation.

Finally, our assumption of green voting reflecting green preferences may be questionable because parties bundle objectives together. Also, green issues may only be of secondary importance for some voters. Since the voting outcome is either yes or no for the green party, then it is highly likely that our measure of green voting under-represents green attitude if being green is only a secondary objective of voters. As a consequence, our empirical results on ecological concern and green voting should be seen as a lower bound. Additionally, those who vote for the green party may have e.g. a stronger aversion to nuclear energy than those who vote for other parties. Thus, extrapolating to society may potentially over-estimate the effects.

In terms of future research, there is really one specific idea that came to mind when working on this project. The question is whether the gap between the ecological attitude, or the willingness to undertake green behavior, could be explained to a large extent by the fact that individuals fear that their efforts are in vain due to free-riding. In this case, those individuals that have a large gap between attitude and behavior due to free-riding fears should be those that vote more strongly in support of their preferences. Another extension could be to add an index of coal power plants, where the proximity to coal power plants might also

increase green voting.

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5 Tables

Table 4: Summary statistics: cross-section dataset 1

Variable	**Mean**	**Std. Dev.**	**N**
green_i	0.069	0.253	2,835
nuclear_i	0.483	0.5	2,835
education_d1_i	0.019	0.137	2,835
education_d2_i	0.303	0.46	2,835
education_d3_i	0.127	0.333	2,835
education_d4_i	0.134	0.341	2,835
interest_i	0.346	0.476	2,835
gov_sat_i	0.586	0.493	2,835
TVnews_i	0.758	0.429	2,835
election_i	1.492	0.5	2,835

Table 5: Cross-section dataset 1 (coefficients: odds ratios)

VARIABLES	(13) green	(14) green	(15) green	(16) green	(17) green
nuclear	4.404***	4.416***	3.285***	3.227***	2.784***
	(1.003)	(0.983)	(0.675)	(0.679)	(0.727)
education_d1			0.728	0.673	0.667
			(0.434)	(0.418)	(0.404)
education_d2			1.899***	2.149***	1.769**
			(0.339)	(0.412)	(0.392)
education_d3			3.528***	3.604***	2.702***
			(0.569)	(0.626)	(0.497)
education_d4			4.698***	5.067***	4.164***
			(0.838)	(0.966)	(0.940)
interest			1.697***	1.683***	1.613***
			(0.240)	(0.261)	(0.271)
gov_sat			5.306***	5.435***	5.580***
			(1.797)	(1.892)	(1.628)
TVnews			0.640***	0.642***	0.635**
			(0.0941)	(0.0934)	(0.126)
sex					1.255
					(0.208)
marital					0.854
					(0.132)
just					0.977
					(0.146)
status					1.192
					(0.143)
diff_d1					1.320
					(0.843)
diff_d2					1.284
					(0.768)
diff_d3					1.250
					(0.729)
diff_d4					1.358
					(0.880)
election	1.025	1.048	1.152	1.212*	1.201
	(0.112)	(0.115)	(0.123)	(0.130)	(0.138)
Constant	0.0277***	0.0246***	0.00426***	0.00353***	0.00239***
	(0.00800)	(0.00591)	(0.00225)	(0.00192)	(0.00137)
Observations	2,835	2,835	2,835	2,835	2,428
Pseudo R-sq.	0.059	0.084	0.173	0.196	0.184
Sample	Germany	Germany	Germany	Germany	Germany
Stand. Err.	rob. & clust.	rob. & clust.	rob. & clust.	rob. & clust.	rob. & clust.
Dummies		state		state	state
HL test (p-val)	0.791	0.71	0.537	0.399	0.226
ML test (p-val)	0.568	0.814	0.04	0.18	0.183

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6: Variable description - cross sectional dataset 1

Variable	**Description**
green	To which party did you give your second vote?[29] (0 - other parties; 1 - Bündnis 90/Die Grünen)
nuclear	Which opinion do you have on nuclear energy? (1 - further increase of nuclear energy, 7 - immediate stop of nuclear power plants), recoded as (1,2 and 3=0) and (4,5,6 and 7=1)
education	What is your highest educational level? reference level: lower secondary education, education_d1: still student; education_d2: ; education_d3: A-level; education_d4: university level education
interest	How strong is your interest for politics? (1 - very strong; 5 - no interest), recoded as (1 and 2 = 1) (3 to 5 = 0)
gov_sat	Were you satisfied with the previous government (SPD-Bündnis90/ Die Grünen) in Berlin? (+5 - completely satisfied; -5 - totally unsatisfied), recoded as (0 to +5 = 1) (-5 to -1 = 0)
TVnews	On average, on how many days of the week do you see news programs in the first and second program on TV?[30] answers range from 0 to 7 days; coded as (0 to 3 = 0) and (4 to 7 = 1)
sex	0 = male, 1 = female
married	0 = single, 1 = married
religious	How often do you attend religious services? (1- once a week or more; 6- never), recoded as (1,2 and 3=1) and (4,5 and 6=0)
class	To which social class do you attribute yourself to, working class, middle class or upper class? recoded as three dummies
election	dummy for 0 - before election; 1 - after election
diff_d1-diff_d4	There is a difference between parties? (diff_d1=1 if not true at all, diff_d2=1 if not true, diff_d3=1 if maybe, diff_d4=1 if mostly true, else all =0)

Table 7: Variable description - cross sectional dataset 2

Variable	Description
green	If there were a national/general election tomorrow, for which party on this list would you vote? (0 - other parties; 1 - Bündnis 90/Die Grünen)
gr_loc	This is the sum of each respondent's answers to the following question: I am going to read out a list of environmental problems facing many communities. Please, tell me how serious you consider each one to be here in your own community: 1) water quality, 2) poor air quality, 3) poor sewage and sanitation; 1- very serious, 4- not serious at all, gr_loc is the sum of answers to each question
gr_glo	This is the sum of each respondent's answers to the following question: Now letŠs consider environmental problems in the world as a whole. Please, tell me how serious you consider each of the following to be for the world as a whole. : 1) global warming or the greenhouse effect, 2) loss of plant or animal species or biodiversity, 3) pollution of rivers, lakes and oceans; 1- very serious, 4- not serious at all, gr_glo is the sum of answers to each question
gr_i	This variable is the sum of gr_loc plus gr_glo
health	All in all, how would you describe your state of health these days? Would you say it is (1 - very good, 4 - poor), recoded as (1 and 2 = 1) (3 and 4 = 0)
education	What is the highest educational level that you have attained?; reference level: lower secondary education, education2: incomplete A-level to A-level, education3: incomplete university to university degree
conf_gov	Could you tell me how much confidence you have in the government? (1 - a great deal, 4 - none at all), recoded as (1 and 2 = 1) (3 and 4 = 0)
just_deviant	The average across each respondent's answer to the following four questions: Please tell me for each of the following actions whether you think it can always be justified, never be justified, or something in between: 1) claiming government benefits, 2) avoiding a fare on public transport, 3) cheating on taxes, 4) someone accepting a bribe; (1 - never justifiable, 10- always justifiable)
just_altern	The average across each respondent's answer to the following five questions: Please tell me for each of the following actions whether you think it can always be justified, never be justified, or something in between: 1) homosexuality, 2) prostitution, 3) abortion, 4) divorce, 5) euthanasia; (1 - never justifiable, 10- always justifiable)
religious	How often do you attend religious services? (1- once a week or more; 6- never), recoded as (1,2 and 3=1) and (4,5 and 6=0)
age	corresponds to actual age of respondent
sex	0 = male, 1 = female
marital	marital status, 0 = single, 1 = married
children	number of children of respondent
urban	What is the size of the town you live in? takes a 1 for population larger than 50,000, 0 if population is less than 50,000.

Table 8: Summary statistics: cross-sectional dataset 2

Variable	**Mean**	**Std. Dev.**	**N**
green_i	0.077	0.267	1,343
gr_loc_i	9.229	2.963	1,343
gr_glo_i	5.079	1.704	1,343
health_i	0.686	0.464	1,343
education2_i	0.433	0.496	1,343
education3_i	0.158	0.365	1,343
conf_gov_i	0.275	0.447	1,343
just_deviant_i	2.003	1.337	1,343
just_altern_i	5.382	2.117	1,343
religious_i	0.195	0.396	1,343
urban_i	0.349	0.477	1,343
age_i	50.397	17.437	1,343
sex_i	0.551	0.498	1,343
marital_i	0.66	0.474	1,343
children_i	1.573	1.299	1,343

Table 9: Cross-section dataset 2 (coefficients: odds ratios)

VARIABLES	(18)	(19)	(20)	(21)
gr_i	0.911***	0.922***		
	(0.0240)	(0.0268)		
gr_loc			0.958	0.976
			(0.0334)	(0.0350)
gr_glo			0.814***	0.815***
			(0.0577)	(0.0590)
health	2.122***	1.503	1.539	1.430
	(0.588)	(0.449)	(0.462)	(0.432)
educlass2	2.148***	1.400	1.360	1.358
	(0.563)	(0.380)	(0.372)	(0.374)
educlass3	2.628***	2.551***	2.391***	2.090**
	(0.809)	(0.810)	(0.774)	(0.697)
confidence		0.754	0.748	0.777
		(0.195)	(0.193)	(0.207)
just_deviant				1.238***
				(0.0871)
just_altern				1.264***
				(0.0838)
religious		1.012	1.006	1.484
		(0.316)	(0.312)	(0.491)
urban		1.312	1.342	1.256
		(0.285)	(0.294)	(0.280)
age		0.970***	0.970***	0.978**
		(0.00814)	(0.00824)	(0.00897)
sex		1.272	1.209	1.208
		(0.283)	(0.274)	(0.278)
marital		0.866	0.843	0.891
		(0.206)	(0.202)	(0.217)
children		0.781*	0.784*	0.817
		(0.107)	(0.108)	(0.114)
Constant	0.0958***	0.634	0.840	0.0724***
	(0.0469)	(0.470)	(0.648)	(0.0703)
Observations	1,343	1,343	1,343	1,343
Pseudo R-sq.	0.056	0.12	0.126	0.157
Sample	Germany	Germany	Germany	Germany
Stand. Err.	robust	robust	robust	robust
HL test (p-val)	0.943	0.56	0.657	0.81
LM test (p-val)	0.951	0.487	0.595	0.899

Robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$