An Empirical Analysis of Local Opposition to New Transmission Lines Across the EU-27

Jed Cohen,[a,b]* *Klaus Moeltner,*[b] *Johannes Reichl,*[a] *and Michael Schmidthaler*[a]

ABSTRACT

The current European Union vision for a low carbon electricity system requires a large-scale expansion of overhead transmission lines to integrate renewable energy sources and ensure a secure electricity supply for the future. Recently, new installations of overhead transmission lines across Europe have been stymied by local opposition, which causes long delays in project completion and occasional cancellations. This study presents and analyzes data from an unprecedented survey on the social acceptance of transmission lines that was conducted in the EU-27. We find that auxiliary information regarding the positive effects of a grid development project can have a substantial impact in decreasing the opposition of local stakeholders. In particular, emphasizing any long-term carbon reduction potential or economic benefit of a particular project will, on average, decrease the likelihood that a local resident is strongly opposed to the project by 10–11%.

Keywords: Social acceptance, Local opposition, Transmission lines, Electricity grid, European Union

http://dx.doi.org/10.5547/01956574.37.3.jcoh

1. INTRODUCTION

The European Union (EU) pursues an ambitious vision of its energy future. This vision is codified in the EU 2020 and 2050 initiatives which seek to increase the share of renewable sources in gross final energy consumption to 20% by 2020, and reduce greenhouse gas emissions by 80% by 2050, while ensuring stable electricity provision for the future (European Commission, 2010, 2011). For EU energy goals to be realized a massive investment, estimated at €150 billion by 2030, in electricity infrastructure and primarily new overhead transmission lines is required (ENTSO-E, 2014). A study undertaken by the European Network of Transmission System Operators for Electricity (ENTSO-E), found that 18,000 km of overhead lines are necessary to accommodate the changing electricity landscape, 80% of which are directly due to the increase in renewable generation sources (ENTSO-E, 2014). Renewable generation technologies are, by nature, more disparate than conventional generators, as generation is often spread across large areas and far from centers of demand in order to maximize wind or solar exposure. The nature of renewable generation necessitates an expansion of the electricity transmission network that will link generation sites with centers of demand and enable greater market integration which will allow electricity to be shared between regions during periods of surplus production (ENTSO-E, 2014).

a The Energy Institute at Johannes Kepler University, Altenberger Strasse 69, 4040 Linz, Austria.

b Department of Agricultural and Applied Economics, Virginia Tech, 250 Drillfield Dr., Blacksburg, VA 24061, USA.

* Corresponding author. E-mail: jedcohen@vt.edu

Local opposition to new energy infrastructure developments has proven to be one of the central obstacles confronting renewable energy advancement and the effort to reduce greenhouse gas emissions from the electricity sector in Europe. Despite impressive technical advances in wind and solar power generation, new technologies often face public opposition that can no longer be ignored (Kintisch, 2010). This fact is recognized by the European Commission: "The current trend, in which nearly every energy technology is disputed and its use or deployment delayed, raises serious problems for investors and puts energy system changes at risk" (European Commission, 2011, pg. 17). The lack of social acceptance is often attributed to a "not in my backyard" (NIMBY) attitude, since the majority of Europeans support the development of renewable technologies yet those near proposed sites often oppose such developments (European Commission, 2006). It is important to recognize that local opposition stems from legitimate concerns over the potential negative effects of new developments; effects that have been shown to create a real welfare loss to residents, for example in the form of decreased property values (Sims and Dent, 2005, 2007). Other notable causes of negative welfare effects from power lines are: diminished viewsheds, electromagnetic pollution and landscape alteration, among others (Cohen et al., 2014).

While the issue of social acceptance hinders the expansion of many types of energy infrastructure, the controversy surrounding electricity transmission grid expansion is especially poignant given the fact that, as currently envisioned, both electricity supply security and the 'greenification' of the electricity grid hinge on increased grid connectivity (ENTSO-E, 2012). The ENTSO-E report states, with respect to grid enhancement, that "[o] verall, there has been material delay to the delivery of one third of the investments, mostly because of social resistance [. . .]" (ENTSO-E, 2012, pg. 14). To make matters more difficult, pylons are the industrial structure that is most strongly perceived as a negative landscape element[1] (Soini et al., 2011).

Previous research efforts regarding local opposition to transmission lines have focused on identifying the causal factors of resistance, understanding residents' perspectives, and studying the procedural aspects of development projects (e.g. Cotton and Devine-Wright (2012); Elliott and Wadley (2012); Furby et al. (1988); Soini et al. (2011); Devine-Wright and Batel (2013); Devine-Wright (2012, 2008); Wuestenhagen et al. (2007)).[2] However, relatively little research has assessed implementable strategies for improving social acceptance of transmission lines and minimizing delays in grid expansion (Cohen et al., 2014).

This paper begins to fill this gap by empirically testing the effect that auxiliary positive information regarding new transmission line projects has on the level of acceptance of residents. We first assess the current climate of local acceptance of new transmission line installations by implementing a survey across the EU-27.[3] This survey includes a built-in experiment to ascertain how additional positive information about the new transmission line will change the acceptance of locals. We analyze data obtained from the survey with a statistical model. Our results suggest that positive information about new transmission line developments can improve acceptance of these projects. This implies that information campaigns have a role to play in reducing delays in the energy system transition envisioned by the European Commission.

The paper proceeds as follows: the next section describes the survey and presents summary statistics. Section 3 explains the statistical models used to analyze survey data and section 4 presents

1. Among those tested including telemasts and major roads.

2. For a full discussion of the causes of local opposition to transmission lines and the negative welfare impacts from them see Cohen et al. (2014).

3. Our survey was conducted before Croatia joined the EU, thus we refer to the "EU-27".

Table 1: Household-level Variables Taken from Survey

Variable	Description	Sample Mean
income	annual income in 1000's of Euros net taxes	17.7
male	1 if respondent is male	0.493
age35t45	1 if repsondent is age 35–45	0.237
age46t60	1 if repsondent is age 46–60	0.306
over60	1 if repsondent is older than 60	0.251
college	1 if respondent completed college	0.405
posutil	1 if respondent has a positive view of their energy provider	0.465
negutil	1 if respondent has a negative view of their energy provider	0.058
satisfied	1 if repondent is satisfied with their level of supply security	0.904
urban	1 if respondent considers their neighborhood urban	0.312
yearsinhome	number of years repondent has lived at current address	18.526
needgrids	1 if respondent thinks grid expansion is necessary	0.557

N = 7,659

the results from this analysis. A discussion of the relevance and policy implications of these results is included in section 4.1, while section 4.2 presents a second-stage auxiliary model. Concluding remarks follow. Additional results and robustness checks are given in the Appendix.

2. SOCIAL ACCEPTANCE SURVEY

Data on the social acceptance of grid expansion projects come from an unprecedented survey conducted during 2012 in all EU-27 nations.[4] This massive survey effort encompassing over 13,000 interview hours and over 400,000 contact attempts yielded over 8,000 completed questionnaires with around 300 survey responses per nation. The survey obtained demographic, energy usage, and energy perception information from each individual. The survey process included strict quotas to ensure a representative sample among the population of each EU-27 nation. The variables taken from the survey and used in this analysis are summarized in table 1.

The final survey data set included 8,336 complete observations. The data then underwent a cleaning process and some recoding to create econometrically useful variables, leaving 7,659 observations used in the final analysis.[5]

As seen in table 2, variable means vary greatly between nations illustrating the international heterogeneity present in the EU. However, The means of *age* and *male* are similar between nations as these were two of the dimensions that had strict quotas in place during surveying in order to ensure a representative sample. A representative sample was also taken from different income levels within each country, but due to unequal wealth distribution between countries the means of *income* are different.

As previous research has shown that residents' perceptions influence their level of opposition we hypothesize that positive information regarding nearby infrastructure projects will move

4. See Gutierrez et al. (2013) for detailed information on survey methodology, sample statistics and a full English version of the questionnaire.

5. Observations were dropped when an omitted value or response of "don't know" was encountered for the following survey questions: supply security satisfaction (43 lost), the acceptance question (335 lost), rural/urban window perspective (18 lost), years in current home (58 lost), or refusal to provide income information (223 lost).

Table 2: Country Comparison of Household-level Variable Means

	income[a]	*male*	*age*[b]	*college*	*posutil*	*negutil*	*satisfied*	*urban*	*yearsinhome*	*needgrids*
France	26.378	0.43	46.26	0.44	0.52	0.05	0.95	0.31	13.39	0.28
Germany	25.098	0.55	47.22	0.40	0.60	0.05	0.98	0.25	16.79	0.67
Italy	20.871	0.49	47.49	0.30	0.49	0.07	0.93	0.34	19.88	0.46
UK	22.804	0.49	47.97	0.36	0.53	0.05	0.99	0.14	15.54	0.62
Austria	25.750	0.52	47.70	0.26	0.52	0.02	0.99	0.23	20.80	0.41
Belgium	25.470	0.51	47.94	0.48	0.47	0.09	0.94	0.37	15.30	0.32
Denmark	30.949	0.59	49.11	0.38	0.46	0.04	0.99	0.29	13.50	0.36
Finland	25.662	0.50	50.42	0.42	0.50	0.02	0.96	0.20	12.82	0.75
Netherlands	23.741	0.49	48.48	0.32	0.57	0.02	0.98	0.25	14.86	0.42
Spain	17.985	0.51	46.89	0.41	0.39	0.16	0.78	0.54	15.95	0.52
Sweden	23.445	0.54	47.27	0.40	0.48	0.02	0.97	0.25	11.53	0.60
Portugal	12.888	0.50	46.75	0.38	0.46	0.08	0.92	0.38	15.98	0.54
Ireland	28.462	0.53	47.93	0.35	0.56	0.04	0.98	0.14	16.03	0.58
Luxembourg	45.884	0.53	48.49	0.36	0.50	0.02	0.98	0.19	16.50	0.36
Bulgaria	4.144	0.45	47.02	0.62	0.30	0.16	0.75	0.63	24.39	0.65
Czech	9.104	0.47	48.67	0.32	0.45	0.04	0.96	0.29	21.97	0.53
Estonia	8.584	0.42	48.30	0.45	0.39	0.04	0.82	0.25	17.97	0.58
Hungary	5.090	0.49	48.95	0.29	0.51	0.07	0.94	0.20	23.36	0.62
Latvia	6.165	0.37	48.05	0.48	0.55	0.04	0.85	0.32	20.18	0.58
Lithuania	6.084	0.48	48.21	0.64	0.41	0.02	0.91	0.31	20.44	0.56
Poland	6.034	0.48	46.47	0.36	0.44	0.03	0.88	0.39	22.09	0.64
Romania	2.794	0.46	48.89	0.50	0.48	0.07	0.79	0.58	23.73	0.77
Slovakia	7.468	0.45	48.30	0.37	0.54	0.03	0.98	0.34	24.09	0.51
Greece	15.706	0.49	42.94	0.58	0.26	0.11	0.74	0.41	18.30	0.76
Cyprus	23.255	0.54	50.28	0.45	0.28	0.10	0.67	0.28	17.85	0.69
Slovenia	14.508	0.48	49.24	0.34	0.47	0.03	0.96	0.28	25.19	0.42
Malta	14.919	0.56	50.91	0.31	0.36	0.11	0.77	0.29	22.21	0.80
Average	17.750	0.49	48.00	0.41	0.46	0.06	0.90	0.31	18.54	0.56

[a] 1000's of Euro

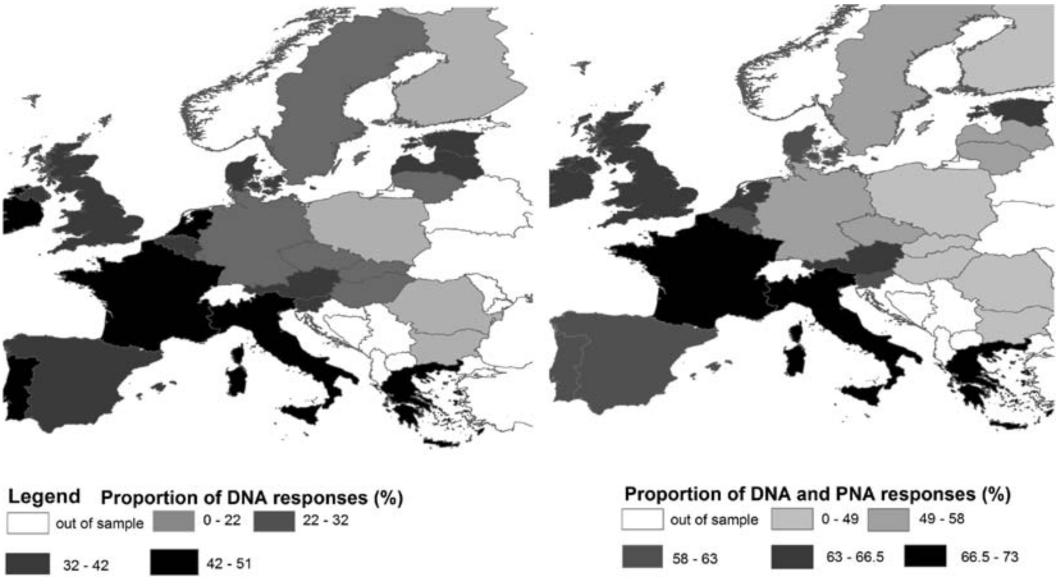
[b] age mean constructed from 4 age categories by taking the middle value of the selected category and using 68 for those over 60.

locals closer to acceptance (e.g. Gross, 2007; Devine-Wright, 2011; Kaldellis, 2005). To test this hypothesis the survey included a built-in experiment in the form of a question regarding the acceptance of a hypothetical grid expansion project. A single project scenario, describing a hypothetical new transmission line, was presented to all respondents, with 40% of respondents receiving *only* the baseline scenario. Some respondents additionally received one of the three treatment scenarios, each describing a benefit of the infrastructure project. The scenarios are described in detail below:

Baseline—"Long term reliability of the electricity system can only be ensured by a bundle of measures, such as—but not exclusively—the construction of new power lines and pylons. Please imagine that your local government announced a large program of local infrastructure investments, contributing to the enhancement of the power grid in the whole of your country. As part of this program, during the next year a high-voltage power line with standard pylons would be built in your neighborhood. This power line (including pylons) would be up to 60 meters high and be built at a distance of 250 meters from your home."

Economic Treatment (T1)—This infrastructure program has significant benefits for your country's economy including, enhanced economic growth, especially in your region,

Figure 1: Proportion of Opposition Responses to the Acceptance Question



resulting in the creation of new jobs and in greater independence from foreign energy supplies.

Environment Treatment (T2)—This infrastructure program has significant benefits for the environment and complements your country's measures to fight climate change—the strengthening of the national electric infrastructure being necessary for increased use of renewable energy sources, such as wind power.

Community Treatment (T3)—The government and electricity company would compensate you and your community by providing budget for measures to improve the quality of life in your neighborhood. Possible improvements could include the construction of recreational areas and parks, or equipment for local schools. All people living in the community would have the chance to determine how this extra budget should be used by popular vote.

Next, respondents were asked the **acceptance question**: "How do you think YOU would react to the announcement of this power infrastructure program?" With the ability to choose between four possible reactions: *"definitely not accept without opposition"* (DNA), *"probably not accept without opposition"* (PNA), *"probably accept without opposition"* (PYA), and *"definitely accept without opposition"* (DYA). Table 5, in the appendix, shows the proportion of each response by nation as well as the sample size for each country. Table 6, also in the appendix, shows a comparison of the means of household level variables across the four treatment subsamples. There is no substantial variation in variable means between subsamples showing that our study is unlikely to suffer from sampling bias.

An initial look at the survey responses from the full sample in figure 1 illustrates the social acceptance problem, with high proportions of DNA responses in many EU nations.[6] Overall, 34%

6. Higher proportions of DNA responses correlate to higher proportions of PNA responses with a correlation coefficient of 0.12. Thus nations with higher proportions of DNA responses often have higher proportions of PNA responses and higher levels of opposition overall.

of respondents indicated they would definitely not accept the new project without opposition while only 12% said they would definitely accept. Furthermore, as shown by the second panel of figure 1, for all but 6 of the 27 EU nations the proportion of responses of either DNA or PNA is greater than half. Also of note is the high level of diversity in response trends between nations, with some countries exhibiting much higher levels of acceptance than others.

3. METHODS

Econometric methods are used to analyze the survey data and compare the effect of the three treatment scripts on acceptance of new transmission lines. The statistical model also gives insight into which characteristics and perceptions of respondents lead to greater acceptance of new developments. The comparison presented in this text is based on the effect that variables and treatments have on the probability that an individual gives a *"definitely not accept without opposition"* (DNA) response to the hypothetical new transmission line development nearby their home. It is likely that those who will *"definitely not accept without opposition"* (DNA) new power lines, will be difficult to bring to the table for negotiation and more unwilling to consider compromise. These tendencies are likely to increase delays and social costs in gaining acceptance for grid expansion projects. Opening up a communication line with locals so they can be properly informed about the different construction options and possible local benefits is a crucial step in paving the way for the low-carbon society currently envisioned by the European Commission.

The four-tiered response structure of the acceptance question lends itself to econometric modeling using an ordered probit approach. The ordered probit is a standard modeling approach for ordinal data that leads to intuitive and easily interpretable results. The ordered probit model, as specified in equation 1, is motivated by a continuous, unobserved latent variable y_i^* that exists for each individual i. In this case it is useful to think of y_i^* as respondent i's perceived change in indirect utility[7] due to the development. The respondent then selects DYA and PYA, for higher values of y_i^*, and PNA or DNA for lower values of y_i^*. Survey answers are the *observed response*, which we denote as y_i. The latent variable y_i^* maps the observed response, such that if y_i^* falls between two thresholds y_i takes a certain value. This is shown in equation 1.

$$
\begin{aligned}
& y_i^* = \mathbf{X}_i\beta + \epsilon_i \quad \epsilon \sim N(0,1) && (1)\\
& y_i = 1(\text{DNA}) \quad \text{iff} \quad y_i^* \le v_1 \\
& y_i = 2(\text{PNA}) \quad \text{iff} \quad v_1 < y_i^* \le v_2 \\
& y_i = 3(\text{PYA}) \quad \text{iff} \quad v_2 < y_i^* \le v_3 \\
& y_i = 4(\text{DYA}) \quad \text{iff} \quad y_i^* \ge v_3,
\end{aligned}
$$

where β is a vector of slope coefficients for the explanatory variables included in $\mathbf{X}_i$, and v_1, v_2 and v_3 are threshold values that are estimated along with β.

As discussed in Kobayashi et al. (2012), the level of the observed response elicited from a given respondent is directly related to the perceived likelihood that their indirect utility under the proposed infrastructure scenario exceeds or falls below their indirect utility under the status quo of no new development. We assume that respondents take both the baseline and the treatment script

7. Indirect utility is the level of well-being for a given individual after she has optimized over the consumption of all other goods and services.

(if applied) as credible. Respondents who receive a treatment script (which is applied directly after the baseline script) then update their implicit cost-benefit analysis and choose a response to the survey question according to their perception of the project's effect on their level of indirect utility.[8]

Two ordered probit models were employed in this study, distinguished by slightly different matrices of explanatory variables. Both employ a country fixed effects approach which amounts to the inclusion of country indicator variables for all nations in the EU-27, excluding France which is omitted as the baseline category. These function as spatial fixed effects and capture heterogeneity between nations that may not be accounted for by other explanatory variables. These country variables are then interacted with the treatment variables (*T1–T3*), yielding a group of indicator variables which will allow for heterogeneous effects from treatment scripts across nations.

The "full" model includes treatment indicators, country indicators, country—treatment interaction terms, and all explanatory variables shown in table 1. This model is used primarily to calculate the marginal effects of these household-level explanatory variables. The "reduced" model includes only treatment indicators, country indicators, and the interactions of the two. This model is used to calculate the marginal effects of treatment scripts which form the main results of interest. Inter-country variation in explanatory variables is accounted for by the country fixed effects, yielding a clean and easily interpretable estimation of treatment script efficacy.

This two model approach was adopted to avoid arbitrary selection of fixed-values for the household characteristics in table 1, which would be necessary for the calculation of marginal treatment effects. Specifically, the mathematical expression for marginal treatment effects for the ordered probit model is a nonlinear function of all variables included in the model (Greene, 2012). This, in turn, poses the dilemma of which settings to choose for household characteristics, especially given the mix of binary and continuous variables in the full model. We thus prefer to derive consistent estimates of treatment effects from the reduced model, which does not require any imputations for demographic variables. This comes at the small cost of reduced efficiency, which, however, is negligible in our case as shown by the significance levels in table 12, given in the appendix.[9]

Coefficient estimates from the ordered probit models are transformed into marginal effects which relate the change in the predicted probability that the survey response (y) falls within a given category (m) due to a change in explanatory variables. In the case of the reduced model the changes in explanatory variables will be discrete, from 0 to 1, yielding:

$$\frac{\Delta prob(y=m\,|\,\mathbf{X})}{\Delta \mathbf{X}} = prob(y=m\,|\,\mathbf{X}_e) - prob(y=m\,|\,\mathbf{X}_s) \quad (2)$$

Where some dimensions of the $\mathbf{X}$ vector change from starting values ($\mathbf{X}_s$) to ending values ($\mathbf{X}_e$) and all other values of $\mathbf{X}$ must be held constant for this calculation to be meaningful. The

8. Another implicit assumption of our research is that the transmission grid expansion as currently envisioned is, on net, beneficial for EU society.

9. For instance, explanatory variables could be given the mean values of the sample for each particular nation, or EU sample means. However, this has a somewhat troublesome interpretation as then the $\mathbf{X}$ vector specifies values that cannot exist in reality, such as a fraction of a college diploma or a fraction of a positive view of the utility company. Another solution is to specify a standard citizen and input these values for all explanatory variables. For example one could construct a middle income male with no college degree who is satisfied with supply security and their utility company. This solution limits the results to specific populations and may not allow results to be generalized to some populations of interest. Calculating marginal effects using the in-sample values of explanatory variables would suffer from a similar problem in terms of generalizing to other populations.

Table 3: Marginal Effects of Household-level Variables from Estimation

Variable	Marg. Eff. Estimate	Marg. Eff. Std. Dev.	
income	−.00186	.000491	**
male	0.078	0.009	**
age35t45	−0.046	0.013	**
age46t60	−0.067	0.013	**
over60	−0.058	0.015	**
college	−0.020	0.009	**
posutil	0.023	0.009	**
negutil	−0.066	0.019	**
satisfied	0.025	0.016	
urban	0.018	0.010	*
yearsinhome	−0.001	0.000	*
needgrids	0.089	0.009	**

N = 7,659; X-matrix also includes treatment indicators, country indicators and country/treatment interaction indicators *estimate is significant at 10% level; **estimate is significant at 5% level; Marginal effect refers to change in the probability of **not** choosing DNA, (1-prob(DNA)).

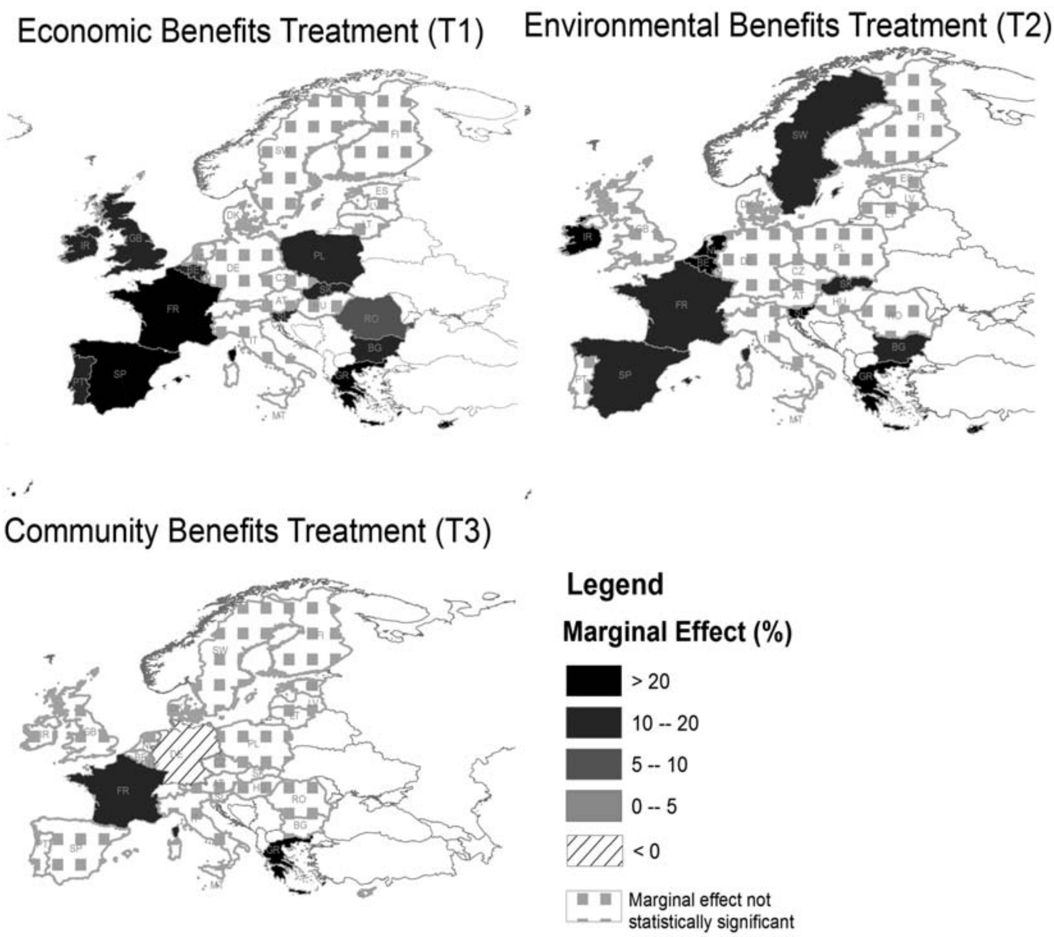
changes in predicted probabilities of primary interest in this study are those changes in the propensity to accept new infrastructure before and after the application of the treatment scripts. Recall that the **X** matrix from both models contains country indicators, treatment indicators, and the interactions of the two. To calculate the marginal effect of a treatment script in a given nation two variables must change between $\mathbf{X}_s$ and $\mathbf{X}_e$, the treatment indicator, and the interaction of that indicator with the country indicator, where the relevant values of the two matrices are: $\mathbf{X}_s = [0,0]$ and $\mathbf{X}_e = [1,1]$. The treatment indicator equates to the 'baseline' effect of treatment application (which in this case is the French effect), while the interaction term signifies the country-specific deviation from the baseline effect.

The country fixed-effects in the reduced model implicitly capture aggregate household-specific effects for a given nation, in addition to country-level unobservables. As shown in table 2, differences between nations in the sample means of explanatory variables can be stark. The country fixed effect captures these differences in a general way. For example, a high income Romanian will have a higher probability of a DNA response *vis a vis* a low income Romanian. However, on average income in Romania is lower than income in other EU nations, and thus Romanians will, on average, show a lower probability of a DNA response due to this income effect.

4. RESULTS

Coefficient estimates from both ordered probit models are given in table 12 of the Appendix. Results from the full ordered probit model (first three columns of table 12) confirm that demographics, perceptions and siting characteristics play a role in driving social acceptance. The marginal effects of these household-specific variables on the probability of **not** choosing a DNA response are shown in table 3. These marginal effects are interpreted as the change in the probability of **not** choosing DNA due to a unit increase in the corresponding variable. A positive sign for a given estimate indicates an increasing effect on acceptance, and a negative sign indicates a decreasing effect on acceptance. As can be seen from table 12, all household-level explanatory variables

Figure 2: Marginal Effect of Treatment Scenarios on Predicted Probabilities of *Not* Giving a "Definitely Not Accept" (DNA) Response



Marginal effects estimates are considered significant at the 10% level and below

show a statistically significant effect (at the 10% level or lower) on the probability of a DNA response, except for *satisfied*. This is likely due to low variation in this binary variable, as 90% of all respondents reported satisfaction with their level of supply security.

Results from the reduced ordered probit model are given in the last three columns of table 12, as explained above, they are used to calculate the nation-specific predicted probability of choosing DNA under the baseline scenario and three treatments. Results from the baseline scenario are shown in the appendix in table 7. The predicted probabilities are very similar to the sample proportions shown in figure 1, highlighting a wide range of acceptance levels. At the extremes, Romanians have a 12% predicted probability of choosing DNA, while Greeks have a 61% probability of making the same choice.

Figure 2 shows cartographically the estimated marginal effect of each of our three treatment scripts for each EU-27 nation where the marginal effect is statistically significant at at least the 10% level. Corresponding table 8, in the Appendix, gives the marginal effect for each treatment script and EU-27 nation. These treatment effects are interpretable as the change from the baseline to the treated scenario in the predicted probability that a respondent will **not** give a DNA response. As we see from figure 2 and table 8, the economic treatment script has a significant positive effect on acceptance in 14 EU-27 nations, while the environmental script has a significant positive effect on acceptance in 12 nations. In contrast, the community benefits treatment has a significant positive effect in only 2 nations and a significant negative effect in Germany.

Robustness checks for the results given in the main text are given in the appendix. It is shown that the interpretation of the marginal treatment effects is similar when the full model results are used for this calculation as opposed to the reduced model results. Also, we explore the results of our analysis focusing on the probability of giving a DNA *or* PNA response instead or only the probability of a DNA response.

4.1 Interpretation

We see from the results above that both household characteristics and the tested treatment scripts can drive the level of opposition encountered in our hypothetical scenario. To begin with household-level variables, the results in table 3 validate previous research and give evidence for possible strategies that can reduce the number of locals who will *"definitely not accept without opposition"*. From the demographic variables we estimate that older residents, those with higher income, and those with a college degree will be less accepting, while males will, on average, be more accepting. The directional effect on acceptance of these estimates is in line with past studies, most notably Devine-Wright (2012) who uses a similar survey regarding acceptance of power lines is England.[10] As noted in that study, trust in the developing entity, encapsulated in the variable *posutil*, can positively influence acceptance (Devine-Wright, 2012). The results here corroborate that finding, by estimating a 2.3% decrease in the probability of choosing DNA if the respondent holds a positive view of the local utility company. With the use of a small survey, developers could ascertain which local entities involved in the project are most trusted by local groups and include these entities in the presentation of the project.

The two included siting variables, *urban* and *yearsinhome*, suggest that sites chosen nearer to short-term residents and in urban areas will be met with less resistance.[11] The strongest positive effect on acceptance is exhibited by the *needgrids* variable. The estimate indicates that belief in the necessity of grid expansion will decrease the probability of a DNA response by 8.9%. Since, currently, only 56% of survey respondents believe that new pylons and power lines are necessary for a secure energy future (see table 1), information campaigns aimed at increasing this perception among the population could have substantial positive effects on national and EU-wide acceptance of transmission lines.

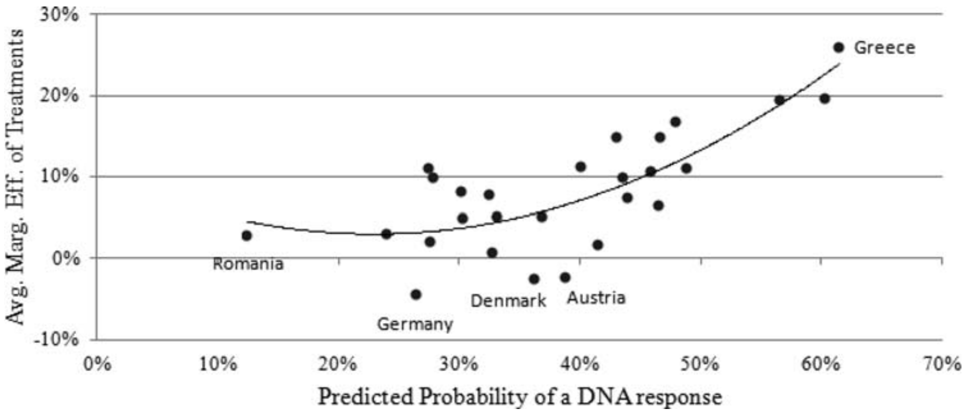
It is clear from figure 2 and appendix table 8, that when locals are informed that power lines will have a positive economic or environmental impact these projects will generally meet with less resistance than those having only benefits to the community in the form of compensation or public works.[12] The average (across nations) decrease in the probability of a DNA response for the economic, environmental and community treatments are 10.1%, 11%, and 3.6% respectively. All three improvements are significant at the 5% level, showing that any of the three benefits will, on

10. The referenced work does not include an income variable, however income is generally collinear with education.

11. Albeit urban areas may be difficult to develop due to congestion, land price, etc.

12. This is upheld by conventional Wald tests for the equality of coefficients, which reject the null that the T3 marginal effect equals the T1 and T2 marginal effects at the 1% significance level.

Figure 3: The Potential for a Saturation Point of Positive Information on Acceptance



average, improve acceptance and lead to fewer DNA responses. The relatively small marginal effect from the community compensation script is consistent with the previous finding that locals show ambivalence towards such benefit packages in the case of wind farm development (Cass et al., 2010; Cowell et al., 2011). Overall, the results of our study show that information on the positive benefits of a proposed project has the potential to substantially improve acceptance.

Upon deeper analysis of the results from our statistical model it can be seen that a strong positive relationship exists between the overall level of opposition in a nation and the effect of treatment scripts in that nation. This relationship is visualized in figure 3, which plots the predicted probability from the reduced model of a DNA response under the baseline scenario against the average marginal effect from treatment scripts[13] for each nation in our sample, fitted with a nonlinear trendline. Firstly, this curve is positively sloped and convex suggesting that information campaigns will yield greater positive impacts on acceptance in nations with high levels of opposition. Many nations in our sample have low average marginal effects of treatments. This may explain why the marginal effects of treatments are statistically insignificant for many of these nations, since it is more difficult to achieve statistical significance when the point estimate is closer to zero.

The positive slope of the curve in figure 3 also suggests that there may exist a saturation point beyond which information campaigns declaring the positive aspects of grid expansion are no longer very effective. Indeed in Germany, where acceptance in relatively high, the average marginal effect of treatments is negative and the marginal effect of the community compensation script is negative and statistically significant at the 5% level. The positive average marginal effects estimated for all EU-27 nations besides Germany, Austria and Denmark suggest that the saturation point has not yet been reached in the majority of EU states indicating that information campaigns can still have a positive effect on acceptance.

Recall both the economic and environmental benefits scripts specify national and global benefits as opposed to local benefits. The strong positive effects on acceptance induced by these two treatments suggest that many locals can overcome NIMBY sentiments when presented with the proper information. As noted above, both scripts have similar average effects on the probability of a DNA response, however their effects vary greatly between nations as shown in the figures.

13. Meaning the unweighted average of the marginal effects shown in the three columns of appendix table 8.

This suggests that there exists high levels of heterogeneity between nations in responses to both grid expansion projects and acceptance-improving strategies. This is consistent with previous studies of acceptance that have found evidence of strongly heterogeneous views between regions and individuals (Soini et al., 2011; Elliott and Wadley, 2012). Our results emphasize the need for developers to tailor their acceptance strategies to the specific nation and situation. Figure 2 shows which information will have the largest positive effect in each nation. For instance, any economic ramifications of new transmission lines should be touted in France and Spain, whereas any benefits to the environment should be focused on in the Netherlands and Belgium.

4.2 Understanding International Heterogeneity

In light of the strong heterogeneity in acceptance and treatment efficacy exhibited between EU nations the natural question that arises is, what drives this variation? Previous research has suggested that residents can become accustomed to infrastructure changes after a period of time, so it could be that this variation is due to varied levels of infrastructure density (Soini et al., 2011). However, nations with high concentrations of overhead power lines do not exhibit higher levels of acceptance in our survey data.[14]

As this is the first time a multinational, empirical comparison of social acceptance of energy infrastructure is possible we now take a closer look at the observed heterogeneity in acceptance levels across nations, focusing on aggregate drivers at the national level and using the 27 country fixed effects from the reduced model as dependent variables. Given the many potential variables that may affect the national level of acceptance and our small sample size, we opt for a Bayesian estimation approach for this analysis. As discussed *inter alia* in Koop (2003), Bayesian estimation focuses on the specific data at hand and does not rely on "large sample theory" for a legitimate interpretation of results. It does, however, require the specification of prior distributions for each parameter. We choose these to be vague (flat), to place the bulk of inferential weight on the actual data. The final output of Bayesian analysis is a posterior distribution for each parameter. These distributions can then be used for statistical inference, for example by reporting mean, standard deviation, percentiles, and other statistics of interest. As discussed in Koop et al. (2007), the posterior mean will converge to the Maximum Likelihood Estimator under increasing sample size.

In our particular application, the plethora of potential combinations of explanatory variables poses an additional challenge—what Bayesians refer to as "model uncertainty". We thus employ a Bayesian Model Search (BMS) computational algorithm that efficiently "visits" many candidate models, giving more weight to more promising models. Our version of this BMS routine is referred to as Markov Chain Monte Carlo Model Composition (MC^3).

The MC^3 approach is a Bayesian model search and selection method where each model is defined by the regressors included in it. The approach employs a Gibbs Sampler (a way to iteratively draw parameters from conditional densities) and a Metropolis-Hastings step (a technique to approximate unknown densities) where each iteration inspects and estimates a different candidate model.[15] The algorithm is designed so that models with more promising combinations of variables are estimated more often, and thus the most relevant variables are used in the highest proportion

14. Data on kilometers of overhead lines from (CEER, 2012), is available for 21 nations in our sample. Concentration is given as kilometer of overhead cable per square kilometer of land area.

15. Additional details of the MC^3 technique and its application here are given in the Appendix. We recommend Fernandez et al. (2001a) and Fernandez et al. (2001b) to the interested reader.

Table 4: Output of MC³

Regressor	Inclusion Probability	Mean	Std. Dev.	prob(>0)
constant	1	0.39182	0.257	0.939
investment freedom index	0.808	0.01584	0.01	0.805
property rights index	0.592	−0.0067	0.007	0.009
energy intensity	0.401	0.00042	0.001	0.39
RES five year change	0.334	−0.0084	0.014	0.013
government spending index	0.27	−0.0016	0.003	0.019
residential electricity price	0.193	0.00006	0.014	0.083
renewable energy share (RES)	0.151	0.00052	0.002	0.131
electricity consumption per capita	0.122	0.00576	0.035	0.086
total taxation	0.118	0.0003	0.005	0.068
financial freedom index	0.106	−0.0002	0.002	0.033
population density	0.098	−1E-05	0	0.035

N = 27; Dependent variable is the country fixed effect estimate from full ordered probit model. Inclusion probability of the constant term is 1 by construction. See table 11 in the Appendix for a description of the tested regressors and their sources.

of visited models. This allows for the generation of the inclusion probabilities, i.e. the empirical frequency with which each explanatory variable was included in a model. As an additional benefit of the MC³ procedure the posterior densities of slope parameters are automatically averaged across all estimated models and thus correctly reflect all underlying model uncertainty.

The results of this analysis are reported in table 4. The dependent variable of each considered model is the estimated fixed effect for each nation from the *full* ordered probit model (given in the first column of table 12 in the appendix). Recall that the full ordered probit model includes the household specific variables shown in table 3 and thus these fixed effect estimates have been purged of explanatory power related to these variables making the inclusion of similar variables at the second stage unnecessary. Instead, we examine the role of country-wide “macro” variables at fostering acceptance. The tested regressors are defined in table 11 in the appendix and include: national characterization indices, energy sector variables, and other national measures. The fixed effects estimates must be interpreted relative to each other with higher estimates reflecting a climate that is generally more accepting towards new transmission line installations. The baseline intercept estimate is that of France, and is −0.16, thus fixed effects estimates that are greater than −0.16 imply that the national climate is more accepting than that of France.

The results from this exercise are given in table 4. The first column in the table shows the empirical inclusion probability for each candidate variable, sorted from highest to lowest. The second column gives model-averaged posterior means, while the third shows model-averaged posterior standard deviations. The final column, labeled *prob*(>0), gives the proportion of the estimated posterior density that is to the right of zero. A number close to one would indicate a predominantly positive effect for a given regressor, while a value close to zero would indicate a largely negative effect. As can be seen from the table, the variables with the highest inclusion probabilities are the *investment freedom* and *property rights* indices. The mean parameter estimate for *investment freedom* is positive suggesting that nations with fewer restrictions on capital flows have populations that are more accepting towards new transmission line developments. The posterior mean for *property rights* is negative, which suggests that stronger property rights laws are associated with higher levels of opposition. Also of interest are the results from the RES (renewable energy share) variables, which measure the percent of end-user energy consumption that is supplied by renewable sources

(PV, hydro, wind and biofuels). The variable *RES five year change* measures the change in RES share between 2007 and 2012 and may proxy as a measure of the intensity of recent infrastructure development. We see that this variable is negatively related with acceptance, with over 95% of the posterior distribution to the left of zero, implying a strong negative signal. This suggests that as more developments occur opposition to these developments increases, perhaps due to an increasing mass of citizens that are negatively affected. This may foster the formation of coalitions against developments and an increase in anti-development funding.

These results are exploratory and serve as an introduction to a vein of empirical research into social acceptance that remains untapped and is beyond the scope of this study. From the strong statistical signals and intuitive signs we receive from the *investment freedom* and *property rights* indices it is clear that these factors drive acceptance. Both of these variables are calculated based on the laws and institutions found in a particular nation. Thus, the specific mechanisms for improving acceptance in this regard remain murky. However, the results suggest that institutions matter and that more research into this issue would be fruitful.

5. CONCLUSION

This research investigates the social opposition phenomenon in the context of transmission grid expansion in the European Union. These infrastructure developments often result in negative impacts for nearby communities, and thus spur local resistance due to legitimate concerns for community welfare and site preservation (Wolsink, 2007; Devine-Wright, 2009). These concerns can potentially be assuaged with the use of proper siting, procedural, and compensatory means (e.g. Gross (2007); Jobert et al. (2007); Warren and McFadyen (2010); Devine-Wright (2012)). For these measures to be effective developers and local stakeholders must have the opportunity to negotiate; an opportunity that may be precluded by the 'definitely-opposed' attitude exhibited by many survey respondents.[16]

Previous research has shown that locals' perceptions will affect their level of opposition to a proposed project and thus we expect factual positive information regarding a project to improve acceptance (e.g. Gross, 2007; Devine-Wright, 2011; Kaldellis, 2005). We tested this notion through the application of three different treatment scripts in an EU-27-wide survey, collecting reactions to a nearby, hypothetical overhead transmission line. These treatment scripts specified an auxiliary benefit from the development. The auxiliary benefits tested are relevant to the envisioned EU energy system transition as the bulk of planned transmission lines will connect renewable sources of power to the grid and/or ensure a secure energy supply for the future (ENTSO-E, 2012). The results from the statistical models show a high level of heterogeneity between nations, in terms of overall acceptance levels, the probability of a *"definitely not accept without opposition"* (DNA) response, and the propensity to change this response based on an applied treatment.

It was shown that, on average, Europeans will be less opposed to projects that benefit either the regional economy or the fight against climate change and that these benefits will decrease the probability that a local is strongly opposed to the project by 10–11%. The benefit most preferred by Europeans varies between nations, but the results herein provide preliminary insights on which applicable information will likely elicit the greatest increase in acceptance for any EU-27 nation. Furthermore, our study shows that a belief in the necessity of grid expansion for a secure national

16. It is important to note that grid developers must also be predisposed to negotiation and compromise for community welfare concerns to be assuaged.

energy supply leads to a substantial (8.9%) decrease in the probability of a DNA response. However, only 56% of survey respondents exhibited this belief. These results taken together, imply that substantial gains to the public acceptance of new power pylons can be realized by advertising the positive benefits of a particular project, such as linking renewable sources to the electricity grid or ensuring electricity supply security for the future.

Our research is based on the assumption that survey respondents believed that both the hypothetical development scenario as well as the treatment benefit (if presented) were plausible. As a result, we interpret our estimated treatment effects as pure information effects—increasing (or in a few cases decreasing) perceived benefits from the new infrastructure compared to pre-information levels. Therefore, for our results to translate into reality, any actual information campaign also needs to be credible to local stakeholders. This will require care in the selection of the information vehicle—both in the sense of which organization takes the lead and the media outlet(s).

In total, our results support the hypothesis that project-related information on ancillary benefits can improve acceptance, and thus we corroborate past research suggesting that perceptions of project outcomes are crucial in influencing social acceptance of new developments. This implies an important role for information campaigns in improving social acceptance of new transmission line projects and paving the way for the low-carbon society envisioned by the European Commission.

ACKNOWLEDGMENTS

This research project was supported by the program "Regional Competitiveness Initiative Upper Austria 2007–2013", which was made possible by the European fund for regional development and the regional government of Upper Austria. Additional funding was provided through the research project SESAME (EU Framework 7 Programme, contract no. 261696). A special acknowledgment to Ann-Marie Greensmith and Chris Smith from Kudos Research for the excellent administration and implementation of the survey process. We would also like to thank three anonymous reviewers for their insightful comments.

REFERENCES

Cass, Noel, Gordon Walker, and Patrick Devine-Wright (2010). "Good Neighbors, Public Relations and Bribes: The Politics and Perceptions of Community Benefit Provision in Renewable Energy Development in the UK." *Journal of Environmental Policy and Planning* 12(3): 255–275. http://dx.doi.org/10.1080/1523908X.2010.509558.

CEER (2012). "5th CEER Benchmarking Report on the Quality of Electricity Supply 2011." Council of European Energy Regulators (CEER) report.

Cohen, Jed J., Johannes Reichl, and Michael Schmidthaler (2014). "Re-focussing Research Efforts on the Public Acceptance of Energy Infrastructure: A Critical Review." *Energy* 76: 4–9. http://dx.doi.org/10.1016/j.energy.2013.12.056.

Cotton, Matthew and Patrick Devine-Wright (2012). "Putting Pylons Into Place: a UK Case Study of Public Perspectives on the Impacts of High Voltage Overhead Transmission Lines." *Journal of Environmental Planning and Management* 56(8): 1–21.

Cowell, Richard, Gill Bristow, and Max Munday (2011). "Acceptance, Acceptability and Environmental Justice: The Role of Community Benefits in Wind Energy Development." *Journal of Environmental Planning and Management* 54(4): 539–557. http://dx.doi.org/10.1080/09640568.2010.521047.

Devine-Wright, Patrick (2008). "Reconsidering Public Acceptance of Renewable Energy Technologies: A Critical Review." In M. Grubb, T. Jamasb, and M. Pollitt, eds., *Delivering a Low Carbon Electricity System*. London: Cambridge University Press.

Devine-Wright, Patrick (2009). "Rethinking NIMBYism." *Journal of Community and Applied Social Psychology* 19: 426–441. http://dx.doi.org/10.1002/casp.1004.

Devine-Wright, Patrick (2011). "Enhancing Local Distinctiveness Fosters Public Acceptance of Tidal Energy: A UK Case Study." *Energy Policy* 39: 83–93. http://dx.doi.org/10.1016/j.enpol.2010.09.012.

Devine-Wright, Patrick (2012). "Explaining 'NIMBY' Objections to a Power Line: The Role of Personal, Place Attachment and Project-Related Factors." *Environment and Behavior* 45(6): 761–781. http://dx.doi.org/10.1177/0013916512440435.

Devine-Wright, Patrick and Susana Batel (2013). "Explaining Public Preferences for High Voltage Pylon Designs: An Empirical Study of Perceived Fit in a Rural Landscape." *Land Use Policy* 31: 640–649. http://dx.doi.org/10.1016/j.landusepol.2012.09.011.

Elliott, Peter and David Wadley (2012). "Coming to Terms With Power Lines." *International Planning Studies* 17(2): 179–201. http://dx.doi.org/10.1080/13563475.2012.673739.

ENTSO-E (2012). "Ten Year Network Development Plan 2012." European Network of Transmission System Operators for Electricity (ENTSO-E) report.

ENTSO-E (2014). "Ten Year Network Development Plan 2014." European Network of Transmission System Operators for Electricity (ENTSO-E) report.

European Commission (2006). "Energy Technologies: Knowledge-Perceptions-Measures." Eurobarometer report EUR22396.

European Commission (2010). "Energy 2020—A Strategy for Competitive, Sustainable and Secure Energy." Communication 639.

European Commission (2011). "Energy Roadmap 2050." Communication 885.

Fernandez, Carmen, Eduardo Ley, and Mark Steel (2001a). "Benchmark Priors for Bayesian Model Averaging." *Journal of Econometrics* 100: 381–427. http://dx.doi.org/10.1016/S0304-4076(00)00076-2.

Fernandez, Carmen, Eduardo Ley, and Mark Steel (2001b). "Uncertainty in Cross Country Growth Regressions." *Journal of Applied Econometrics* 16(5): 563–76. http://dx.doi.org/10.1002/jae.623.

Furby, Lita, Paul Slovic, Baruch Fischhoff, and Robin Gregory (1988). "Public Perceptions of Electric Power Transmission Lines." *Journal of Environmental Psychology* 8(1): 19–43. http://dx.doi.org/10.1016/S0272-4944(88)80021-5.

Greene, William (2012). *Econometric Analysis 7th Edition*. Pearson.

Gross, Catherine (2007). "Community Perspectives of Wind Energy in Australia: The Application of a Justice and Community Fairness Framework to Increase Social Acceptance." *Energy Policy* 35(5): 2727–2736. http://dx.doi.org/10.1016/j.enpol.2006.12.013.

Gutierrez, Fernando, Michael Schmidthaler, Johannes Reichl, Simona Voronca, and Tania E. Roman (2013). "Public Effects Knowledge Base—Deliverable D2.2 of the Project SESAME (Securing the European Electricity Supply Against Malicious and accidental thrEats)." Transelectrica and Politecnico di Torino report.

Jobert, Arthur, Pia Laborgne, and Solveig Mimler (2007). Local Acceptance of Wind Energy: Factors of Success Identified in French and German Case Studies. *Energy Policy* 35(5): 2751–2760. http://dx.doi.org/10.1016/j.enpol.2006.12.005.

Kaldellis, J.K. (2005). "Social Attitude Towards Wind Energy Applications in Greece." *Energy Policy* 33(5): 595–602. http://dx.doi.org/10.1016/j.enpol.2003.09.003.

Kintisch, Eli (2010). "Out of Site." *Science* 329: 788–789. http://dx.doi.org/10.1126/science.329.5993.788.

Kobayashi, Mimako, Klaus Moeltner, and Kimberly Rollins (2012). "Latent Thresholds Analysis of Choice Data under Value Uncertainty." *American Journal of Agricultural Economics* 94(1): 189–208. http://dx.doi.org/10.1093/ajae/aar129.

Koop, Gary (2003). *Bayesian Econometrics*. John Wiley and Sons Ltd.

Koop, Gary, Dave Poirier, and Justin Tobias (2007). *Bayesian Econometric Methods*. Cambridge University Press. http://dx.doi.org/10.1017/CBO9780511802447.

Sims, Sally and Peter Dent (2005). "High-Voltage Overhead Power Lines and Property Values: A Residential Study in the UK." *Urban Studies* 42(4): 665–694. http://dx.doi.org/10.1080/00420980500060541.

Sims, Sally and Peter Dent (2007). "Property Stigma: Wind Farms Are Just the Latest Fashion." *Journal of Property Investment and Finance* 25(6): 626–651. http://dx.doi.org/10.1108/14635780710829315.

Soini, Katriina, Eija Pouta, Maija Salmiovirta, Marja Uusitalo, and Tapani Kivinen (2011). "Local Residents Perceptions of Energy Landscape: The Case of Transmission Lines." *Land Use Policy* 28(1): 294 – 305. http://dx.doi.org/10.1016/j.landusepol.2010.06.009.

Warren, Charles R. and Malcolm McFadyen (2010). "Does Community Ownership Affect Public Attitudes to Wind Energy? A Case Study from South-West Scotland." *Land Use Policy* 27(2): 204–213. http://dx.doi.org/10.1016/j.landusepol.2008.12.010.

Wolsink, Maarten (2007). "Wind Power Implementation: The Nature of Public Attitudes: Equity and Fairness Instead of Backyard Motives." *Renewable and Sustainable Energy Reviews* 11: 1188–1207. http://dx.doi.org/10.1016/j.rser.2005.10.005.

Wuestenhagen, Rolf, Maarten Wolsink, and Mary-Jean Buerer (2007). "Social Acceptance of Renewable Energy Innovation: An Introduction to the Concept." *Energy Policy* 35: 2683–2691. http://dx.doi.org/10.1016/j.enpol.2006.12.001.

6. APPENDIX

Table 5: Survey Responses to the Acceptance Question by Country (%)

	DNA	PNA	PYA	DYA	No. Obs.
France	42.65	28.32	23.66	5.38	279
Germany	27.1	27.73	33.33	11.84	321
Italy	42.61	29.55	18.9	8.93	291
UK	38.41	26.16	27.15	8.28	302
Austria	39.51	25.87	28.32	6.29	286
Belgium	32.41	29.64	28.46	9.49	253
Denmark	38.72	24.81	27.07	9.4	266
Finland	15.44	27.02	47.02	10.53	285
Netherland	42.16	22.65	25.44	9.76	287
Spain	35.33	28.33	27.67	8.67	300
Sweden	26.71	30.14	32.88	10.27	292
Portugal	42.16	20.56	24.74	12.54	287
Ireland	44.48	22.07	24.48	8.97	290
Luxembourg	31.16	27.54	32.61	8.7	276
Bulgaria	20.43	23.66	32.97	22.94	279
Czech	28.47	24.07	32.88	14.58	295
Estonia	40.78	24.47	26.6	8.16	282
Hungary	23.59	25.91	39.2	11.3	301
Latvia	34.51	22.54	30.63	12.32	284
Lithuania	27.05	28.11	29.89	14.95	281
Poland	21.19	17.22	47.02	14.57	302
Romania	12.08	16.6	35.09	36.23	265
Slovakia	28.52	19.63	33.7	18.15	270
Greece	46.38	24.67	19.41	9.54	304
Cyprus	50.62	22.82	17.01	9.54	241
Slovenia	40.14	21.51	26.16	12.19	279
Malta	36.78	23.37	23.75	16.09	261
Average	33.68	24.63	29.48	12.21	284

N = 7659

Table 6: Comparison of Household-level Variable Means across the 4 Subsamples of Respondents

	income[a]	*male*	*age*[b]	*college*	*posutil*	*negutil*	*satisfied*	*urban*	*yearsinarea*	*needgrids*
Baseline Sample	17.455	0.498	48.300	0.394	0.474	0.051	0.909	0.310	18.963	0.553
T1 Sample	18.048	0.504	48.019	0.408	0.457	0.066	0.902	0.319	18.626	0.566
T2 Sample	17.598	0.494	47.785	0.403	0.465	0.059	0.904	0.321	18.401	0.548
T3 Sample	17.924	0.474	47.405	0.427	0.458	0.065	0.896	0.300	17.708	0.564
Full Sample	17.700	0.493	47.957	0.405	0.465	0.058	0.904	0.312	18.526	0.557

[a] 1000’s of Euro
[b] age mean constructed from 4 age categories by taking the middle value of the selected category and using 68 for those over 60.

Table 7: Predicted Probability of a DNA Response from Both Models under Baseline Scenario

	Reduced Model		Full Model	
	Estimate	**95% CI**	**Estimate**	**95% CI**
France	56.62	(47.94, 65.3)	53.51	(44.58, 62.44)
Germany	26.43	(20.2, 32.65)	25.69	(19.5, 31.89)
Italy	46.59	(38.86, 54.32)	44.17	(36.43, 51.91)
UK	45.95	(37.19, 54.72)	45.2	(36.37, 54.04)
Austria	38.78	(30.72, 46.84)	37.11	(29.06, 45.16)
Belgium	43.09	(35.1, 51.08)	38.99	(31.12, 46.87)
Denmark	36.22	(28.43, 44.01)	32.44	(24.79, 40.09)
Finland	23.96	(17.66, 30.26)	23.86	(17.49, 30.22)
Netherlands	44	(35.95, 52.05)	42.59	(34.49, 50.69)
Spain	46.72	(38.58, 54.85)	45.67	(37.5, 53.84)
Sweden	33.15	(26.06, 40.24)	34.34	(27.08, 41.6)
Portugal	43.52	(35.72, 51.32)	44.6	(36.71, 52.49)
Ireland	48.81	(40.76, 56.86)	46.51	(38.33, 54.7)
Luxembourg	36.91	(28.83, 44.99)	30.83	(22.87, 38.8)
Bulgaria	27.47	(20.28, 34.67)	27.6	(20.18, 35.02)
Czech	30.28	(23.91, 36.65)	31.45	(24.89, 38.01)
Estonia	41.52	(33.65, 49.4)	42.3	(34.3, 50.3)
Hungary	27.59	(21.12, 34.06)	30.72	(23.78, 37.66)
Latvia	32.81	(25.73, 39.88)	34.35	(27.03, 41.68)
Lithuania	32.54	(25.4, 39.68)	34.08	(26.65, 41.51)
Poland	27.92	(21.22, 34.61)	30.25	(23.18, 37.32)
Romania	12.49	(8.21, 16.76)	14.5	(9.62, 19.38)
Slovakia	30.17	(23.28, 37.06)	31.7	(24.57, 38.84)
Greece	61.5	(53.11, 69.89)	64.13	(55.77, 72.49)
Cyprus	60.31	(50.57, 70.05)	59.15	(49.25, 69.06)
Slovenia	47.99	(39.35, 56.63)	46.92	(38.22, 55.63)
Malta	40.05	(31.53, 48.58)	41.54	(32.88, 50.21)

Calculated using EU-wide sample means for household level variables in Full Model.

Table 8: Effect of Treatment Scripts on Probability of *Not* Giving a "Definitely Not Accept" (DNA) Response (%)

	T1		T2		T3	
France	30.66	**	15.38	**	12.68	*
Germany	0.00		−0.60		−12.89	**
Italy	3.55		8.00		7.75	
UK	13.57	**	9.24		9.08	
Austria	0.06		4.08		−11.31	
Belgium	12.13	*	21.88	**	10.71	
Denmark	0.11		−0.92		−6.67	
Finland	4.44		2.31		2.66	
Netherlands	1.27		22.28	**	−1.29	
Spain	20.85	**	14.85	**	9.17	
Sweden	5.69		10.58	*	−0.96	
Portugal	12.52	*	8.16		9.08	
Ireland	12.13	*	20.12	**	0.74	
Luxembourg	9.90		5.36		0.26	
Bulgaria	14.37	**	13.94	**	4.73	
Czech	8.21		5.83		0.58	
Estonia	−4.30		9.90		−0.61	
Hungary	2.99		5.37		−2.22	

(continued)

Table 8: Effect of Treatment Scripts on Probability of *Not* Giving a "Definitely Not Accept" (DNA) Response (%) *(continued)*

	T1		T2		T3	
Latvia	1.58		2.98		−2.04	
Lithuania	7.56		8.58		7.41	
Poland	14.42	**	7.57		7.65	
Romania	6.71	**	2.46		−0.80	
Slovakia	12.18	**	11.64	**	0.89	
Greece	28.25	**	23.07	**	26.96	**
Cyprus	23.44	**	25.67	**	9.83	
Slovenia	18.81	**	25.75	**	6.10	
Malta	11.76	*	12.19	*	9.93	
Average	10.11	**	10.95	**	3.61	**

* estimate is significant at 10% level; ** estimate is significant at 5% level
All treatment effect results flow from reduced model.

ROBUSTNESS CHECKS

This section investigates results of interest alternative to those presented in the main text as robustness checks. First, we show that the calculation of the marginal effects of treatment scripts gives similar insight when the full model is used rather than the reduced model. Second, we explore the results of the analysis when the focus is put onto a different probabilistic construct.

Table 9 reports the country specific marginal effects of treatment scripts calculated from the full model. The values for country indicators, treatment indicators and interaction terms were specified as a 0 or 1 to match the country and treatment in question, all other variables included in the full model (demographics, perceptions, etc.) had their values pegged to the EU wide sample mean. This is one of many possible reasonable specifications. However, as noted in section 3, this specification is intuitively troublesome due to the unrealistic values given to binary variables. Yet mathematically this specification is sound, and gives an estimate of the country-specific treatment effect on the probability of a DNA response for the 'average' European in our sample. The results from the full model in table 9 and those from the reduced model shown in table 8 are very similar in regards to the estimated marginal effects. The two approaches are also compared in table 7 which shows the predicted probability of a DNA response from both models. The average absolute values of the difference between the estimates from the two models are, 1.8 percentage points for the predicted prob(DNA), 1.2 percentage points for the *T1* marginal effect, 1.0 percentage point for the *T2* marginal effect, and less than 1 percentage point for the *T3* marginal effect. Overall, our reduced model produces very similar estimates of marginal effects and levels of significance compared to the full model indicating that our findings are robust to modeling choices.

Now we turn our analysis away from changes in prob(DNA) to another construct of potential interest. Using this construct, [prob(DNA) + prob(PNA)], or equivalently [prob(DYA) + prob(PYA)], we can show the effect that our three treatment scripts have on moving respondents from opposition to acceptance without regard to the degree of opposition or acceptance. The results from this analysis, shown in table 10 include the point estimate of the predicted probability of these responses, and tell a similar story to those shown in the main text of the paper. Again the probability under the baseline scenario of opposition is very high in most EU nations, with a Greek citizen having the highest (83%) probability of opposing new power lines and a Romanian having the lowest (31%) probability of opposition.[17] It is still the case that the economic and environmental

Table 9: Full Model Marginal Effects of Treatment Scripts on Probability of Not Giving a "Definitely Not Accept" (DNA) Response (%)

	T1		T2		T3	
France	30.66	**	15.38	**	12.68	*
Germany	0.00		−0.60		−12.89	**
Italy	3.55		8.00		7.75	
UK	13.57	**	9.24		9.08	
Austria	0.06		4.08		−11.31	
Belgium	12.13	*	21.88	**	10.71	
Denmark	0.11		−0.92		−6.67	
Finland	4.44		2.31		2.66	
Netherlands	1.27		22.28	**	−1.29	
Spain	20.85	**	14.85	**	9.17	
Sweden	5.69		10.58	*	−0.96	
Portugal	12.52	*	8.16		9.08	
Ireland	12.13	*	20.12	**	0.74	
Luxembourg	9.90		5.36		0.26	
Bulgaria	14.37	**	13.94	**	4.73	
Czech	8.21		5.83		0.58	
Estonia	−4.30		9.90		−0.61	
Hungary	2.99		5.37		−2.22	
Latvia	1.58		2.98		−2.04	
Lithuania	7.56		8.58		7.41	
Poland	14.42	**	7.57		7.65	
Romania	6.71	**	2.46		−0.80	
Slovakia	12.18	**	11.64	**	0.89	
Greece	28.25	**	23.07	**	26.96	**
Cyprus	23.44	**	25.67	**	9.83	
Slovenia	18.81	**	25.75	**	6.10	
Malta	11.76	*	12.19	*	9.93	
Average	10.39	**	11.21	**	3.79	**

* estimate is significant at 10% level; ** estimate is significant at 5% level

treatments (*T1, T2*) have strong, positive influences on acceptance that are, on average, more or less equal. However, within a nation the magnitude of these two treatment effects can differ greatly and therefore the choice between the two treatments should be made in a country specific context and can be guided by the results presented here.

Thus, these alternative results have shown that the results presented in the main text are robust to changes in methodology, and the probabilistic construct of interest. The intuition and acceptance-improving strategies gained from these results are based on strong statistical signals in the data, which are not due to modeling choices. These alternative results also offer policy makers the flexibility to use different insights than those presented in the main text based on their varied policy goals.

6.1 Notes on the MC^3 Method and the Application Herein

For theoretical exposition of the MC^3 approach as well as a an investigation of its statistical properties please see Fernandez et al. (2001a). For a previous empirical application that is very similar to our application here please see Fernandez et al. (2001b).

17. Probability of opposition obtained by taking 100-prob(DNA + PNA); prob(DNA + PNA) is shown in table 10.

Table 10: Reduced Model Predicted Probability and Marginal Effects of Treatment Scripts for Probability of a Positive† Response (%)

	Baseline	T1		T2		T3	
France	20.29	28.91	**	12.59	**	10.15	
Germany	48.63	0		−0.73		−13.94	**
Italy	28.13	3.1		7.27		7.03	
UK	28.68	13.1	*	8.58		8.41	
Austria	35.22	0.05		4.08		−9.98	*
Belgium	31.19	12.16	*	24.18	**	10.59	
Denmark	37.75	0.11		−0.93		−6.38	
Finland	51.71	5.98		3.05		3.51	
Netherlands	30.38	1.13		24.28	**	−1.14	
Spain	28.02	21.29	**	14.33	**	8.4	
Sweden	40.95	6.43		12.58		−1.02	
Portugal	30.8	12.5	*	7.83		8.79	
Ireland	26.28	11.01		19.65	**	0.61	
Luxembourg	37.06	10.86		5.63		0.26	
Bulgaria	47.37	20.25	**	19.51	**	5.93	
Czech	44.11	10.08	**	6.98		0.66	
Estonia	32.62	−3.83		9.98		−0.56	
Hungary	47.23	3.67		6.76		−2.59	
Latvia	41.32	1.72		3.31		−2.15	
Lithuania	41.61	8.81		10.1		8.62	
Poland	46.84	20.12	**	9.7		9.81	*
Romania	68.66	13.17	**	4.42		−1.36	
Slovakia	44.23	15.68	*	14.89	**	1.01	
Greece	16.93	23.91	**	18.63	**	22.55	**
Cyprus	17.72	19.38	**	21.66	**	7.21	
Slovenia	26.96	18.4	**	27	**	5.32	
Malta	34	12.4		12.91	*	10.29	
Average	36.47	10.76	**	11.42	**	3.33	**

* estimate is significant at 10% level; ** estimate is significant at 5% level; significance determined using percentile bootstrap method with 200 iterations; significance is not calculated for baseline predicted probability; † refers to prob(DYA or PYA) response

In our application we test the relevance of 11 different regressors in explaining the country fixed effects from our full ordered probit model. Thus, $k-1=11$ with $k=12$, when the constant term is included, where k is the number or right-hand side variables. The $k-1$ vector of slope coefficients, call it β, is given a conjugate g-prior and the error-variance is given an improper prior as in Fernandez et al. (2001a). We set $g=k^2$ as is suggested in Fernandez et al. (2001a) for cases such as ours where $n<k^2$. We set the Gibbs Sampler to burn the first 1000 draws and keep the next 1,000,000 draws. Our algorithm visited 1,542 of the 2,048 candidate models. Convergence of the MC^3 method is tested in the manner described in Fernandez et al. (2001a), by calculating the correlation between empirical model probabilities and analytical probabilities calculated from the known marginal likelihoods. For the set of all visited models this correlation is 0.99 which is indicative of convergence. The mean estimate for the error variance is 0.066 with a standard deviation of 0.026. Table 11 provides a description of the tested regressors as well as the data sources.

Table 11: Description of Regressors Tested by the MC³ Method

Regressor	Description	Source
electricity consumption per capita	residential electricity consumption per capita MWh p.a.	Eurostat
total taxation	total taxes as a percent of GDP	Eurostat
residential electricity price	average residential electricity price Euro/kWh	Eurostat
energy intensity	Energy consumption per 1,000 Euros of GDP in kg oil equivalent	Eurostat
population density	people per sq. km	Eurostat
property rights index	measure of individuals ability to accumulate private property secured by clear, enforced laws (converted to percentage)	Heritage Foundation
government spending index	measure of the level of government expenditure as a percentage of GDP	Heritage Foundation
investment freedom index	measure of restrictions imposed on investment (converted to percentage)	Heritage Foundation
financial freedom index	financial and banking independence from government interference (converted to percentage)	Heritage Foundation
renewable energy share (RES)	pct. of electricity produced by renewable sources including wind, hydro, solar, biomass, and other renewable sources	Eurostat
RES five year change	difference in RES variable from 2012 to 2007	Author generated

All variables used for year 2012

Table 12: Raw Coefficient Results from Both Ordered Probit Models

Full Model				Reduced Model			
Variable	**Coef.**	**Std. Err.**		**Variable**	**Coef.**	**Std. Err.**	
T1	0.8829799	0.1917109	**	*T1*	0.8112962	0.1905869	**
T2	0.4604348	0.1881552	**	*T2*	0.3879566	0.1869979	**
T3	0.3348628	0.1725377	**	*T3*	0.3192758	0.1710979	*
income	−0.00545	0.00144	**	*Germany*	0.796889	0.1483173	**
male	0.2279808	0.0255697	**	*Italy*	0.2522072	0.1497995	*
age35t45	−0.1347821	0.0383124	**	*UK*	0.2682095	0.1590393	*
age46t60	−0.1978065	0.0384116	**	*Austria*	0.4516377	0.1552775	**
over60	−0.168928	0.0430065	**	*Belgium*	0.340815	0.152847	**
college	−0.0580264	0.0273508	**	*Denmark*	0.5191251	0.1543595	**
posutil	0.0686224	0.0262582	**	*Finland*	0.8741169	0.1525613	**
negutil	−0.1927851	0.0573071	**	*Netherlands*	0.3176129	0.1531294	**
satisfied	0.0746424	0.0458869		*Spain*	0.2490466	0.1532843	
urban	0.0530806	0.0285359	*	*Sweden*	0.6023761	0.1500688	**
yearsinarea	−0.0017258	0.0010018	*	*Portugal*	0.3297962	0.1510926	**
needgrids	0.2612203	0.0265695	**	*Ireland*	0.196403	0.1523356	
Germany	0.7409829	0.1498041	**	*Luxembourg*	0.500849	0.156628	**
Italy	0.2347414	0.1513893		*Bulgaria*	0.7652424	0.1571305	**
UK	0.2086113	0.1605972		*Czech*	0.6829611	0.1457832	**
Austria	0.4170684	0.1566947	**	*Estonia*	0.3806861	0.1523469	**
Belgium	0.3675707	0.1538481	**	*Hungary*	0.7616751	0.1494117	**
Denmark	0.5435239	0.1556778	**	*Latvia*	0.6118949	0.1502454	**
Finland	0.7989835	0.1541002	**	*Lithuania*	0.6192898	0.151073	**
Netherlands	0.2748813	0.1544533	*	*Poland*	0.7519073	0.1513374	**
Spain	0.19685	0.1552758		*Romania*	1.317644	0.1543139	**
Sweden	0.4913365	0.1516135	**	*Slovakia*	0.6861173	0.1508146	**
Portugal	0.2238853	0.1533882		*Greece*	−0.1257642	0.1586133	
Ireland	0.1756401	0.1538531		*Cyprus*	−0.0947548	0.1709972	
Luxembourg	0.5886706	0.1596295	**	*Slovenia*	0.2169665	0.1576083	
Bulgaria	0.682797	0.1626743	**	*Malta*	0.4185972	0.1589123	**
Czech	0.5713224	0.1490774	**	*GermanyT1*	−0.8113858	0.2492636	**

(continued)

Table 12: Raw Coefficient Results from Both Ordered Probit Models *(continued)*

Full Model				Reduced Model			
Variable	**Coef.**	**Std. Err.**		**Variable**	**Coef.**	**Std. Err.**	
Estonia	0.2824179	0.1558444	*	*GermanyT2*	−0.4062088	0.2495947	
Hungary	0.5919543	0.1537602	**	*GermanyT3*	−0.6785735	0.238072	**
Latvia	0.4909468	0.1541785	**	*ItalyT1*	−0.7214188	0.2562106	**
Lithuania	0.4983771	0.1555229	**	*ItalyT2*	−0.183545	0.2537425	
Poland	0.6053026	0.1554918	**	*ItalyT3*	−0.12129	0.2607215	
Romania	1.146409	0.1599679	**	*UKT1*	−0.4558437	0.2557336	*
Slovakia	0.5641889	0.1543419	**	*UKT2*	−0.1500313	0.256397	
Greece	−0.2738754	0.1624857	*	*UKT3*	−0.0857897	0.2436056	
Cyprus	−0.143382	0.1731609		*AustriaT1*	−0.809735	0.2624199	**
Slovenia	0.1653043	0.1599701		*AustriaT2*	−0.2797127	0.2562339	
Malta	0.3016939	0.1617209	*	*AustriaT3*	−0.6065997	0.2453923	**
GermanyT1	−0.9652465	0.2505598	**	*BelgiumT1*	−0.488409	0.267225	*
GermanyT2	−0.5131393	0.250834	**	*BelgiumT2*	0.2372476	0.26885	
GermanyT3	−0.7284373	0.2396965	**	*BelgiumT3*	−0.0363074	0.2505754	
ItalyT1	−0.8415264	0.2579826	**	*DenmarkT1*	−0.808304	0.2609892	**
ItalyT2	−0.2892144	0.2551775		*DenmarkT2*	−0.4124937	0.2719908	
ItalyT3	−0.1965923	0.2625804		*DenmarkT3*	−0.4926751	0.2468074	**
UKT1	−0.5127421	0.257075	**	*FinlandT1*	−0.6601256	0.2589832	**
UKT2	−0.2505279	0.2577594		*FinlandT2*	−0.3113225	0.2537697	
UKT3	−0.1261964	0.2451794		*FinlandT3*	−0.2308905	0.2390935	
AustriaT1	−0.795883	0.2637491	**	*NetherlandsT1*	−0.7789645	0.2649495	**
AustriaT2	−0.3174722	0.2573727		*NetherlandsT2*	0.2427056	0.2636865	
AustriaT3	−0.6365563	0.2473276	**	*NetherlandsT3*	−0.3518474	0.2398896	
BelgiumT1	−0.5283521	0.268239	**	*SpainT1*	−0.2463333	0.2530285	
BelgiumT2	0.1742394	0.2703815		*SpainT2*	0.0011704	0.2521332	
BelgiumT3	−0.0500827	0.2520014		*SpainT3*	−0.0843029	0.2494299	
DenmarkT1	−0.904167	0.2622928	**	*SwedenT1*	−0.6481748	0.2516744	**
DenmarkT2	−0.5616051	0.2735697	**	*SwedenT2*	−0.0707207	0.26027	
DenmarkT3	−0.4927663	0.2484406	**	*SwedenT3*	−0.3455495	0.24216	
FinlandT1	−0.7702582	0.2600861	**	*PortugalT1*	−0.4786269	0.2608715	*
FinlandT2	−0.3485175	0.2548506		*PportugalT2*	−0.1756116	0.2599629	
FinlandT3	−0.2553167	0.2404271		*PortugalT3*	−0.0819881	0.2462894	
NetherlandsT1	−0.8489121	0.2661375	**	*IrelandT1*	−0.5007431	0.2603599	*
NetherlandsT2	0.2022009	0.2650339		*IrelandT2*	0.1447545	0.2569728	
NetherlandsT3	−0.3376097	0.2415302		*IrelandT3*	−0.3005944	0.2502699	
SpainT1	−0.3015109	0.2542226		*LuxembourgT1*	−0.5329682	0.2584383	**
SpainT2	−0.0520644	0.2536248		*LuxembourgT2*	−0.2419758	0.2510341	
SpainT3	−0.1172272	0.2509346		*LuxembourgT3*	−0.3123426	0.2599271	
SwedenT1	−0.6808897	0.2527571	**	*BulgariaT1*	−0.2883168	0.2596948	
SwedenT2	−0.1158275	0.2615194		*BulgariaT2*	0.1148424	0.2546807	
SwedenT3	−0.3043581	0.2437841		*BulgariaT3*	−0.1705632	0.247894	
PortugalT1	−0.5789213	0.2622126	**	*CzechT1*	−0.5578591	0.2604505	**
PportugalT2	−0.2095234	0.2611823		*CzechT2*	−0.2123285	0.2574429	
PortugalT3	−0.1001549	0.2480606		*CzechT3*	−0.3027032	0.239863	
IrelandT1	−0.619799	0.2617551	**	*EstoniaT1*	−0.9204391	0.2674013	**
IrelandT2	0.0472534	0.2583597		*EstoniaT2*	−0.1239393	0.2521212	
IrelandT3	−0.3474477	0.252055		*EstoniaT3*	−0.3348042	0.2513783	
LuxembourgT1	−0.5273035	0.2601979	**	*HungaryT1*	−0.7191458	0.252953	**
LuxembourgT2	−0.2711655	0.2523265		*HungaryT2*	−0.2183529	0.2531837	
LuxembourgT3	−0.2816918	0.2616868		*HungaryT3*	−0.3843798	0.2397198	
BulgariaT1	−0.3792754	0.2608837		*LatviaT1*	−0.7672524	0.2587437	**
BulgariaT2	0.0367417	0.255946		*LatviaT2*	−0.3037786	0.263195	
BulgariaT3	−0.2461251	0.2491752		*LatviaT3*	−0.3749983	0.2421695	
CzechT1	−0.6074419	0.2618153	**	*LithuaniaT1*	−0.5888276	0.2590704	**

(continued)

Table 12: Raw Coefficient Results from Both Ordered Probit Models *(continued)*

Full Model				Reduced Model			
Variable	**Coef.**	**Std. Err.**		**Variable**	**Coef.**	**Std. Err.**	
CzechT2	−0.2587238	0.2585534		*LithuaniaT2*	−0.1331137	0.2598196	
CzechT3	−0.3122515	0.2413562		*LithuaniaT3*	−0.1016425	0.2420814	
EstoniaT1	−0.9681302	0.2686879	**	*PolandT1*	−0.2932178	0.2531841	
EstoniaT2	−0.1992045	0.2532936		*PolandT2*	−0.1439	0.2504184	
EstoniaT3	−0.3535343	0.2529066		*PolandT3*	−0.0723725	0.2422777	
HungaryT1	−0.7217791	0.2541191	**	*RomaniaT1*	−0.3888148	0.2603129	
HungaryT2	−0.2485603	0.2542421		*RomaniaT2*	−0.2589503	0.2651504	
HungaryT3	−0.3749439	0.2411708		*RomaniaT3*	−0.3575177	0.2536331	
LatviaT1	−0.8347372	0.260114	**	*SlovakiaT1*	−0.4152049	0.2618573	
LatviaT2	−0.347362	0.2645062		*SlovakiaT2*	−0.0122486	0.2578501	
LatviaT3	−0.3416145	0.2436019		*SlovakiaT3*	−0.2937075	0.2529824	
LithuaniaT1	−0.5968726	0.2601946	**	*GreeceT1*	−0.0858372	0.2585791	
LithuaniaT2	−0.2068817	0.2611313		*GreeceT2*	0.1987485	0.2553615	
LithuaniaT3	−0.1518334	0.2433404		*GreeceT3*	0.3709159	0.2491349	
PolandT1	−0.3568384	0.2546472		*CyprusT1*	−0.2146031	0.2776559	
PolandT2	−0.276866	0.251877		*CyprusT2*	0.2683839	0.2774585	
PolandT3	−0.0864301	0.2436379		*CyprusT3*	−0.0699674	0.2598328	
RomaniaT1	−0.4888046	0.2613876	*	*SloveniaT1*	−0.3135886	0.2711571	
RomaniaT2	−0.3410942	0.2661843		*SloveniaT2*	0.3258341	0.2543853	
RomaniaT3	−0.3254747	0.2546482		*SloveniaT3*	−0.1650148	0.2472193	
SlovakiaT1	−0.4615389	0.2628823	*	*MaltaT1*	−0.4889998	0.2695153	**
SlovakiaT2	−0.0793942	0.2589103		*MaltaT2*	−0.05298	0.2605123	
SlovakiaT3	−0.2627698	0.2541212		*MaltaT3*	−0.0503451	0.250021	
GreeceT1	−0.0838506	0.2601503		v_0	0.1666216	0.1125541	
GreeceT2	0.1369449	0.2570653		v_1	0.8311981	0.1127743	
GreeceT3	0.4208156	0.2511069	*	v_2	1.83791	0.1138388	
CyprusT1	−0.3063557	0.2789191					
CyprusT2	0.2389395	0.278612					
CyprusT3	−0.0706549	0.261214					
SloveniaT1	−0.4396681	0.2728327					
SloveniaT2	0.282228	0.2556346					
SloveniaT3	−0.1673877	0.2488906					
MaltaT1	−0.5775489	0.2710709	**				
MaltaT2	−0.1099344	0.2617904					
MaltaT3	−0.0799491	0.2514228					
v_1[a]	0.1638997	0.1300693					
v_2	0.846948	0.1301893					
v_3	1.872576	0.1312608					

[a] Statistical significance is not tested for estimates of threshold values