

1 **Don't send us your waste gases:**
2 **Public attitudes toward international carbon dioxide transportation and storage in Europe**

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13
14 *Abstract*

15 Large-scale deployment of Carbon Capture and Storage (CCS) is part of the pathways for limiting
16 global warming to 1.5°C and yet, negative public perceptions of CCS have challenged the realization
17 of several projects in Europe over the last decade. This study is the first to look at the effect of exporting
18 or importing CO₂ on public perceptions. We conducted a fractional factorial survey experiment in
19 Germany and Norway varying the nationality of the CO₂ source and of the storage site of a hypothetical
20 CCS project. We find that respondents from both countries do not evaluate offshore and onshore storage
21 differently but otherwise we find substantial differences between countries. Norwegian respondents
22 react to the experimental manipulation: despite an overall more positive attitude toward CCS, they
23 evaluate a project where foreign sourced CO₂ is stored in Norway substantially more negatively
24 compared to a project where domestically sourced CO₂ is stored in Norway. By contrast, German
25 respondents are not affected by the variation of the nationality of emissions or the storage site. We
26 connect this finding to construal level theory, arguing that Germans are more psychologically distanced
27 from CCS than Norwegians due to differences in general familiarity with CCS and the political support
28 for CCS; this makes them less sensitive to our experimental manipulation. The uncovered decrease in
29 public support for CCS when CO₂ is exported from Germany to Norway challenges the feasibility of
30 the current plans of Northern European states for a CO₂ transport and storage infrastructure.

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32
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34 acceptability

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36
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46

47 1. Introduction

48 Carbon capture and storage (CCS) is an important element in the scenarios for limiting global warming
49 to 1.5°C. According to the IPCC's illustrative model pathways, 550-1017 Gt CO₂ would have to be
50 stored by the end of the century [1]. This includes CCS for the mitigation of residual emissions from
51 sources like waste incineration or cement production and at varying scales negative emissions from the
52 combination of bio-energy generation combined with CCS. Today about 40 million t of CO₂ are
53 captured [2]. An IPCC [3] special report on CCS from 2005 assessed storage in depleted oil and gas
54 fields as a well-understood technology and enhanced oil recovery as economically feasible. Fifteen
55 years later, CCS with the explicit aim to mitigate emissions has not yet moved beyond the level of
56 demonstration projects. Main barriers for large-scale deployment are found in the economic, political
57 and societal sphere: the costs along the entire value chain have not yet been assessed, which renders
58 commercialization uncertain and leaves public acceptability unclear. Both factors have potentially
59 negative effects on the political support for CCS [4,5].

60 However, after a period of stalemate, the International Energy Agency [2] sees new momentum building
61 up with changes in international law and new investments into CCS development. Following the
62 initiative of Norway and the Netherlands, the London Protocol was amended to allow cross-border
63 transportation and storage of CO₂. The European Commission has identified several projects for cross-
64 border CO₂ transportation as Projects of Common Interest (PCI) to accelerate infrastructure
65 development [6]. This opens up the possibility to establish a cross-border market for CO₂ storage in
66 Europe. One of the PCIs is the Northern Lights project where Norway, in their second phase of the
67 project starting in 2025, plans to import CO₂ from capture sites in Scotland, Belgium, Germany, Sweden
68 and England and to store it in the North Sea.[7] CO₂ captured at industrial sites in Europe will be
69 collected by ship, offloaded at an onshore site and then sent by pipeline to an offshore injection site in
70 the North Sea. Within the next decade the goal is to set up a European system of CO₂ transport and
71 storage, paving the way for cost reductions and substantial scale-up of CCS. The geological storage
72 sites for CO₂ are unevenly distributed across countries. In European CCS strategies the North Sea is
73 identified as the largest share of European offshore storage potential – with about 56 Gt CO₂ on
74 Norwegian territory and around 78 Gt CO₂ on British territory. [2]

75 We studied two countries, Germany and Norway, which have in common a commitment to the Northern
76 Lights project but have very different preconditions when it comes to the support for CCS among the
77 public and politicians. While there has been a push across party lines for the development of CCS for
78 decades in Norway and the public has been supportive, German public opposition led to German CO₂
79 storage projects being essentially forbidden by law in 2016 [8].

80

81 *Public perceptions of CCS*

82 In general, the level of awareness of CCS in the public is low [9–11], the exception being Norwegian
83 respondents who in previous studies have reported relatively high levels of awareness [12]. Despite the
84 wide-spread ignorance, the lack of public acceptance, especially of onshore storage [10] has been a
85 major barrier to the development of CCS in Europe in the past. The support for CCS is relatively high
86 in Norway [12,13], whereas it is low in Germany [14]. The German government's plans to use CCS for
87 emission abatement hinge for the time being on the feasibility of exporting CO₂ for storage [15], while
88 Norwegian plans for up-scaling depend on the import of CO₂ for storage. It is, however, unclear how
89 the aspect of importing or exporting, respectively, influences the public's perceptions of the technology.

90 We conducted the first survey experiment to assess the effect of the nationality of emissions and of the
91 storage site for the acceptability of CCS among German and Norwegian laypeople. More specifically,

92 we wanted to find out whether perceptions of CCS would vary depending on the factors
93 (1) onshore/offshore storage, (2) foreign/domestic sourcing of CO₂, and (3) storage on foreign/domestic
94 territory. Our experimental treatment varies the spatial and psychological distance from the CO₂-source
95 and the storage site, in terms of nationality and location. The mental construction of psychological
96 distance as defined by construal-level theory is influenced by temporal, spatial, and social distance in
97 addition to how hypothetically a situation or an event is perceived. The four dimensions are largely
98 interrelated. A higher psychological distance leads to more abstract thinking and lowers risk perception;
99 objects are evaluated more globally only using core characteristics [16,17].

100 A review of studies on public acceptability of CCS suggests effects of national culture [18–20],
101 religious faith [21], perceived risks and benefits [22–25], trust [9,24–27], education [28], knowledge
102 about CO₂ [29,30], perceived naturalness [31], values/emotions [32,33], and communicative framing
103 [34,35] on the support for CCS. Despite the practical relevance of the question, there is – to the best of
104 our knowledge – no study on the influence of the nationality of emissions or the storage site on
105 perceptions, yet. There is, however, a substantial body of work on the effects of geographical proximity
106 to CCS infrastructure.

107 The findings on the influence of geographical proximity to CCS sites on acceptability are mixed.
108 Several studies find that the spatial proximity to proposed or current CCS facilities is important [12,36–
109 39]. Among others, Krause et al. [38] find that 21.3 % of initial proponents of a hypothetical CCS site
110 became more negative toward it after the project was framed as being promoted in their neighbourhood.
111 In a US study, the probability of voting for CCS increased along the distance of the facility to residential
112 areas [40]. Combining survey data on public perceptions of CCS with data on the exact locations of all
113 potential CCS sites, Braun (2017) shows that respondents that live close to a potential CCS site have
114 significantly lower acceptance rates than those that do not. To avoid this NUMBY (Not Under My
115 Backyard) effect, political authorities have focused their efforts on offshore storage over the last decade
116 [41]. Thus, our first hypothesis reads as follows:

117 H1: Offshore storage is evaluated more positively compared to onshore storage.

118 Still, past results on CCS perceptions do not fully support such a hypothesis. There are only small
119 differences in the perceptions of geological onshore and offshore CO₂ storage. Studies have shown
120 either a small positive effect for offshore storage [42,43] or no substantial difference [44,45].

121 Exporting CO₂ for storage to other countries could be perceived more positively, as NUMBY reactions
122 should not occur, as the storage site is geographically and thus psychologically more distant. But
123 especially in large countries, people might actually not live close to a domestic storage site. In addition
124 to an implicit spatial proximity, specifying the nationality of a storage site could also result in
125 differences in the psychological distance between domestic and foreign storage sites. Thus, storage on
126 foreign territory might be evaluated more positively in comparison to domestic – spatially and
127 psychologically closer – storage because the risk of being affected by leakage is lower. Based on these
128 insights, we establish the following second hypothesis that only focuses on the perception of storage
129 neglecting any additional influence of the nationality of emissions:

130 H2: Storage on domestic territory is evaluated more negatively compared to storage on foreign territory.

131 Studies furthermore show that public attitudes vary depending on the part of the CCS value chain
132 citizens live close to. Whitmarsh et al. [12] find different levels of CCS acceptability for CO₂ capture
133 and storage sites: Proximal communities are more positive toward carbon capture than the general
134 public, reporting a degree of YIMBYism (Yes, In My Backyard) around proposed capture facilities,
135 while they also find the expected NUMBY effect among citizens living close to proposed storage sites.
136 Acceptability of the CO₂ source increases when it is not a fossil-fuel power plant but a bioenergy or

137 biogas power plant [31,46,47]; this even partially offsets the NUMBY effect [46]. As it is the storage
138 part of the value chain that is identified as inducing most risk to the system in terms of leakage, this
139 distinction in perceptions makes sense. It remains, however, unclear whether the more positive
140 perception of capture facilities compared to storage sites is also connected to a belief that proximal
141 facilities should reduce their CO₂ emissions and contribute to mitigation. The differences in past
142 findings might also highlight that NIMBY/NUMBY-framings are used in politically contested
143 situations to downplay concerns by local communities that are directly affected and that the framing
144 oversimplifies more complex social concerns [48–50].

145 One study indicates that positive expectations about the contribution of CCS to climate change
146 mitigation lead to more positive evaluations of the technology [41]; people see the mitigation of CO₂
147 emissions as a main benefit of CCS [10] and a stronger concern about climate change leads to more
148 favourable views of CCS [9]. These findings may be well-aligned with the perceptions of international
149 burden sharing rules: people think that states should be held accountable for their (historic) emissions,
150 i.e., the polluter pays principle [51,52]. While this framing of accountability narrowly focuses on
151 financial payments, it might also speak to broader concerns about universal justice and responsibility.
152 Transboundary transport of CO₂ can be compared to the export of nuclear or chemical wastes [53].
153 Even though CO₂ is neither toxic, radioactive nor explosive, it is often perceived as waste [54]. Shipping
154 CO₂ to other countries for long-term storage could therefore raise concerns about multinational justice
155 as it shifts (intergenerational) risks and burdens from one country to another [53]. We thus formulate
156 H3 about the differentiated effect of the source of emissions on the perceptions of CO₂ storage on
157 domestic territory:

158 H3: Storage of domestically sourced CO₂ on domestic territory is evaluated more positively compared
159 to (i) an unspecified source and compared to (ii) foreign sourced CO₂.

160 It implies that people would perceive domestic storage more positively because it means that domestic
161 CO₂ emissions are taken care of, while perceptions are more negative when other countries export their
162 CO₂ and thus the responsibility for their emissions to other countries. H3 extends beyond the aspect of
163 spatial distance in H1 and H2 adding the social distance of the benefit of the mitigation of national
164 emissions and of taking responsibility for them.

165 Regions or people in Germany that are more familiar with the oil and gas sector or large industrial
166 installations have been found to be more open toward CCS demonstration projects [55]. Wong-Parodi
167 and Ray [56] found that positive experiences with the natural gas sector like benefits for the community
168 positively influenced the local perceptions of CCS. At the same time, Broecks et al. [41] did not find
169 an effect of spatial proximity to industrial installations or of the perceived proximity to industry on CCS
170 perceptions among survey participants from the Netherlands and the UK. The differences in the direct
171 experiences with the oil and gas sector might, however, be relevant when comparing Germany and
172 Norway. In 2018, 2.0% of Norwegian employees worked directly in oil and gas extraction or in
173 supporting activities and the country built its wealth on fossil-fuel extraction, whereas this share was
174 only about 0.01% in Germany.¹ Compared to Germany, Norway also has a longer history of public
175 discussion about CCS, support from politicians is strong across the political spectrum and infrastructure
176 build-up has been going on for much longer [8]. We thus expect that the overall familiarity with CCS
177 is higher in Norway compared to Germany. This should also have an impact on the evaluation of CCS,

¹ Eurostat: Industry by employment size class (NACE Rev. 2, B-E), Persons employed in Extraction of crude petroleum and natural gas + Support activities for petroleum and natural gas extraction by employees in all sectors <https://bit.ly/3sKjo6n>, retrieved 2 April 2021.

178 as familiarity and perceived realism lower psychological distance which should lead to less abstract
179 thinking and more differentiated evaluations [16,17,57].

180 H4: A higher level of familiarity with the technology and/or a higher level of perceived realism of CCS
181 deployment will lead to more differentiated evaluations of CCS projects.

182 This implies that Norwegians should pay more attention to specifications of a CCS project, while
183 Germans should evaluate the technology more generally.

184 In the remainder of the paper, we test the four hypotheses focusing on the influence of the nationality
185 of the emissions and the storage site. Keeping the temporal dimension constant, we look at experimental
186 variations offshore vs. onshore storage, the nationality of the source and the storage location in a CCS
187 value chain. In addition, we look at differences in the attitudes toward technology, the perceived
188 benefits, i.e., the effectiveness of CCS for mitigating emissions, worry about climate change, familiarity
189 with oil and gas extraction and the perceived realism of the deployment of CCS.

190

191 2. Methods and Data

192 We fielded the survey experiment in Norway and Germany in October and November 2019. In Norway,
193 the experiment was part of the 16th wave of the Norwegian Citizen Panel (NCP) [58]. NCP is a
194 university-owned panel based on a randomly selected sample of the Norwegian population, drawn from
195 the Norwegian Population Registry and recruited offline through mail.² In Germany, the experiment
196 was run with participants recruited via the commercial panel provider Consumerfieldworks using quotas
197 for age, gender, and level of education. As the online recruitment in Germany would potentially have
198 led to the misrepresentation of older respondents, we restricted the sample in both countries to
199 participants aged between 18 and 65 years.

200 By using an experimental design, we can avoid deficiencies of traditional survey questions when the
201 purpose is to make claims about causality. Notably, regression analysis on cross-sectional data cannot
202 rule out potential problems of endogeneity. By contrast, experiments embedded in surveys, where
203 randomized sub-samples of the population receive divergent versions of the same question, while
204 keeping everything else equal, significantly enhance external validity [59].
205

² The data applied in the analysis are based on Norwegian Citizen Panel wave 16, 2019. The survey was financed by the University of Bergen (UiB). The data are provided by UiB, prepared and made available by Ideas2Evidence, and distributed by Norwegian Centre for Research Data (NSD). Data are freely available at the Norwegian Centre for Research Data (NSD)
http://www.nsd.uib.no/nsddata/serier/norsk_medborgerpanel_eng.html.

Carbon capture and storage is a process that stores CO₂ (carbon dioxide), which is captured from industrial sources and power plants that emit large amounts during production. The captured CO₂ is transported and stored deep underground to keep it out of the atmosphere, where it would contribute to climate change. This technology is already in use today. Research suggests that the technology can be expanded so that large amounts of CO₂ can be captured and stored in the future. On a large scale, carbon capture and storage can play an important role in limiting climate change.

Imagine a proposal where large amounts of CO₂ from

[source]

(1) [not specified], (2) German/Norwegian [domestic], (3) German [foreign], (4) European installations are to be stored deep

(I) underground, (II) under the sea-bed

on

[storage]

(i) [blank], (ii) German/Norwegian [domestic], (iii) Norwegian [foreign], (iv) European territory.

207 In our study, respondents were randomly allocated into 24 experimental groups. They all read the same
 208 explainer about CCS. This was followed by a description of a proposal for a CCS project that contained
 209 the experimental variation (see Box 1). In our 4x4x2 factorial design the nationality of the source of the
 210 CO₂ (4 levels), the nationality of the storage site (4 levels), and whether the storage site was offshore or
 211 not (2 levels) was varied. We excluded two unrealistic attributes – for German respondents Norway as
 212 a source of CO₂, for Norwegian respondents storage on German territory.

213 After reading the description, respondents had to indicate how they evaluated the project on a 4-point-
 214 Likert-scale from very negative to very positive; the option don't know/no opinion was also available.
 215 They were asked whether they found the project realistic or not realistic and whether they thought that
 216 CCS was an effective way to limit global warming (yes/no/don't know). We asked Norwegian
 217 respondents whether they or their relatives work(ed) in the oil and gas sector and German respondents
 218 whether they or their relatives work(ed) in the energy sector as the oil and gas sector is of negligible
 219 size in Germany.

220 In addition to demographic variables, we elicited views on the statement “Technological innovation
 221 will solve climate change” (strongly agree [1] – strongly disagree [7]), and how worried they are about
 222 climate change (not worried at all [1] – very worried [5]).

223 The full sample contained 3469 (NOR) and 2979 (GER) uninterrupted survey completions. We
 224 excluded speeders who spent less than 10 seconds as well as those who spent more than 1999 seconds
 225 reading the vignette text and answering the question about the CCS project (NOR: 125; GER: 14). In a
 226 final step we removed observations with incomplete items to have identical samples in all stepwise
 227 regressions (NOR: 115; GER: 5). The full sample for analysis including “don't know”-answers to the
 228 question evaluating CCS is 3229 in Norway and 2960 in Germany. Due to the limited panel capacity
 229 only about a third of the Norwegian sample received the control questions on worry about climate
 230 change and technological innovation (N=906). We report the results of the factorial design for the full
 231 Norwegian sample (M1 and M2 in Table 2); for the additional analyses that include these other variables
 232 we use the reduced Norwegian sample (M3 in Table 2). For the German sample, the number of
 233 observations is identical across all models.

234 Based on the full sample, the median age category is between 40 and 49 years in Germany and between
235 50 and 59 years in Norway. About half the respondents are female (GER: 49%; NOR: 52%). The share
236 of respondents with a higher education entrance certificate is 38% in the German sample and 60% in
237 the Norwegian sample (Table A-1). Participants were randomly allocated to the 24 treatment groups.
238 Figures A-1 to A-4 provide an overview of the share of female respondents, the share of highly educated
239 respondents and the mean age category in the treatment groups. Despite random allocation, there are
240 groups that have substantially different values for these characteristics. Statistically, this is not
241 surprising because the number of groups is large.

242 On average, 16.5% of respondents selected the option "*No opinion/don't know*" to the question about
243 the CCS project. These respondents were not included in the analysis. Their share is significantly higher
244 among Norwegian respondents (GER: 15.5%; NOR: 17.5%; one-sided binomial test: $p = 0.002$). While
245 the shares do not vary significantly between treatment groups, they are influenced by gender, education,
246 perceived realism of the proposed project, worry about climate change and technology perception
247 (compare appendix Table A-2).

248 Therefore, we combined descriptive analysis with OLS regressions to analyse the effect of the different
249 experimental variations on CCS acceptance. This enables us to rule out sampling and selection biases
250 in our results: we control in all models for the demographic variables and test for interaction effects
251 between the treatment and the demographic variables (compare Table 3). In addition, we do not use
252 sampling weights; Instead, we include the variables used to construct the proportional weights in the
253 NCP as controls in the analysis: age, gender, level of education and geographical region. This model-
254 based approach can be used uniformly in the analysis of all (sub-)samples and prevents losing too much
255 statistical power in the analysis. All variables making up the weights for NCP are available to us,
256 allowing us to specify our model correctly.

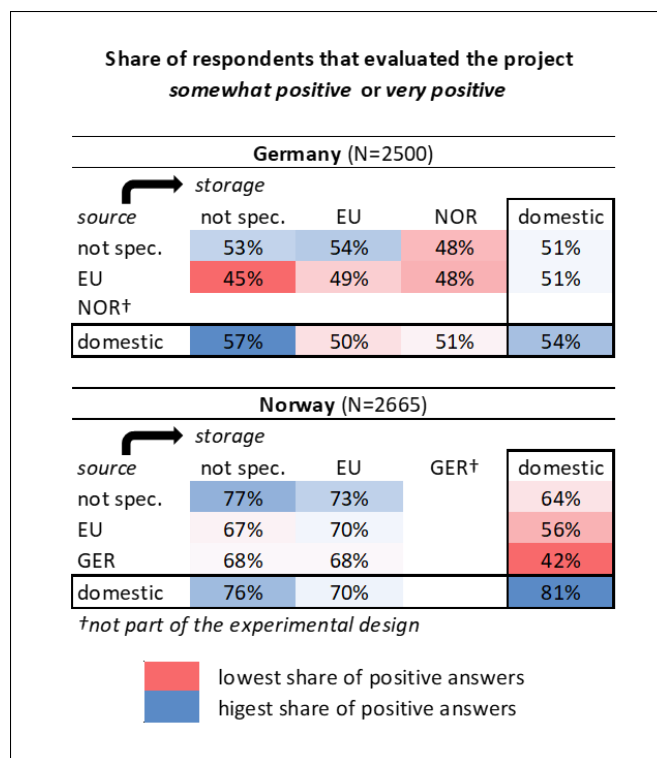
257

258 3. Results

259 Neither in the Norwegian nor the German sample did it make any difference whether storage was merely
260 defined as underground or as offshore (see Table 2), thus *rejecting Hypothesis 1*. We do not find any
261 (positive) effect of specifying the storage location as offshore.

262 Table 1 shows the share of respondents who evaluate the CCS project presented to them as "somewhat
263 positive" or "very positive". H2 postulated that storage abroad should be evaluated more positively
264 compared to domestic storage. We do not find support for this hypothesis. Neither the shares of
265 "somewhat positive" and "very positive" responses (Table 1), nor the linear predictions from OLS
266 (Figure 1) consistently show more negative evaluations. We thus *reject Hypothesis 2*.

267 *Table 1: Share of respondents that evaluated the project as "somewhat positive" or "very positive"*
268 *by the treatment combination of source location and storage location. Adds up to 100% together with*
269 *the responses in the categories "somewhat negative" and "very negative"*

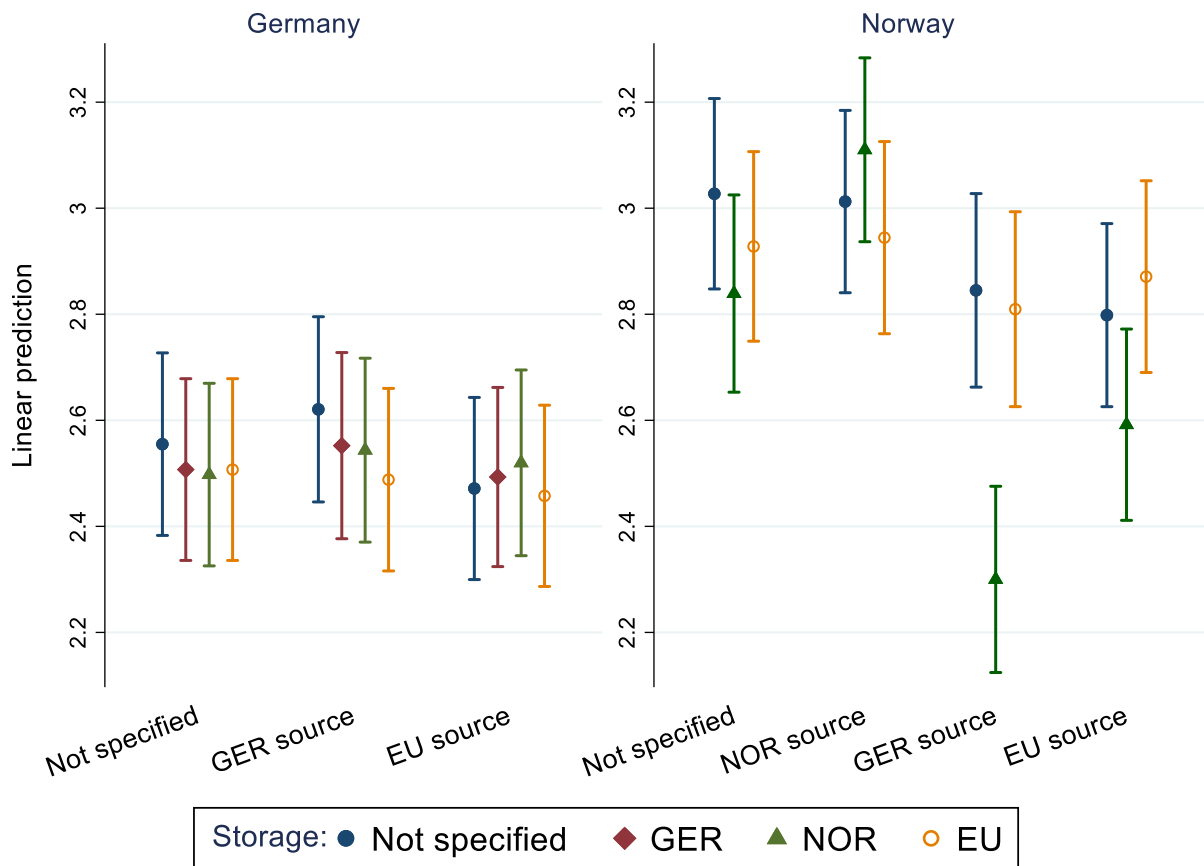


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271

272 Instead, we observe that 81% of Norwegians are positive towards a project where Norwegian sourced
 273 CO₂ is stored on Norwegian territory. In contrast, the support is reduced to half (42%) when Germany
 274 is explicitly mentioned as the source country and Norway is the storage country. This result is also
 275 statistically significant different from the setting where CO₂ from Europe is stored in Norway
 276 (Bonferroni adjusted *p*-values for multiple comparison: *p* = 0.018). This finding is robust across
 277 different specifications and controlling for alternative explanatory variables (Figure 1 and Table 2). For
 278 Germany, there are no significant differences between any of the treatment conditions.

279 *Figure 1: Linear prediction and 95% confidence intervals for OLS regressions of attitude toward a*
 280 *CCS project (scale: 1 very negative – 4 very positive) for German and Norwegian samples (compare*
 281 *M1 Table 2)*



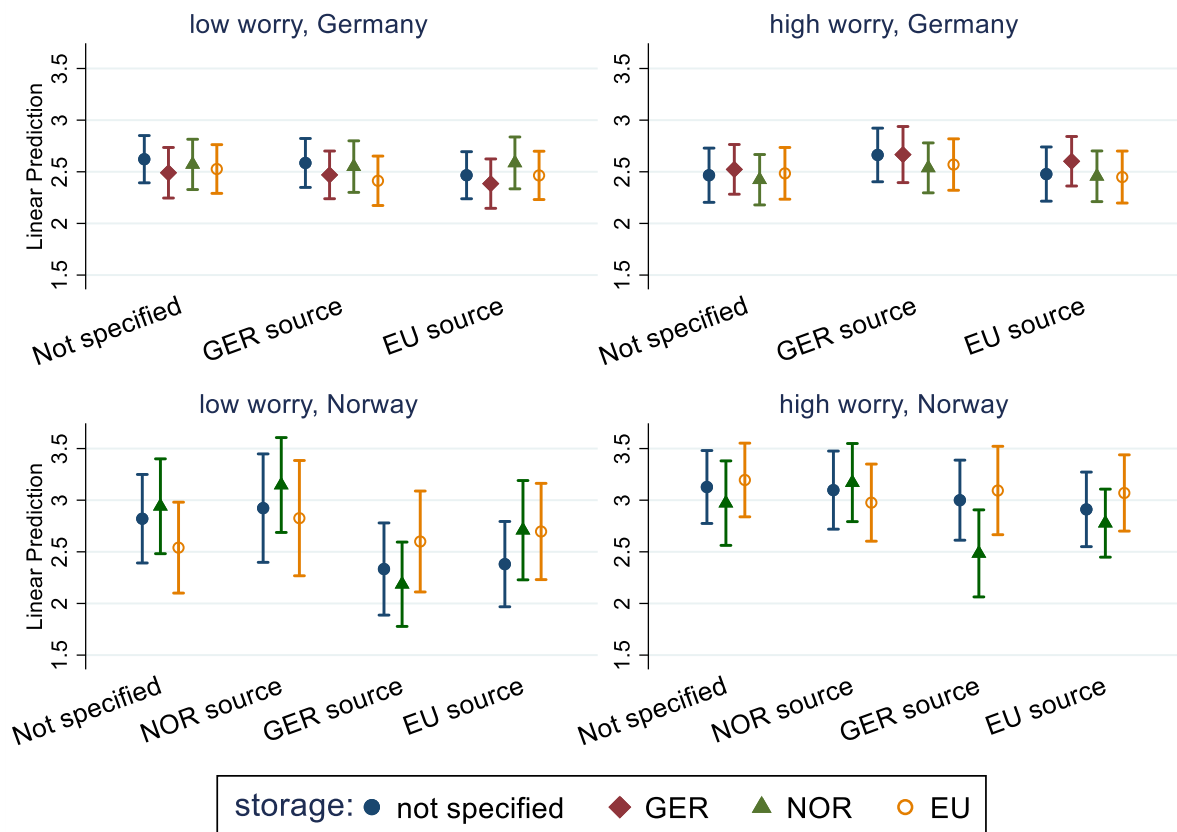
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 283 *Note: The source countries on the horizontal axis are sorted by distance: not specified, domestic,*
 284 *foreign specific, foreign unspecific (EU)*
 285

286 Higher worry about climate change leads to more positive evaluations of CCS in Norway but not in
 287 Germany. In Norway, respondents that indicated higher levels of worry about climate change were
 288 significantly more likely to evaluate the proposed project positively, while we found no significant
 289 relationship for German respondents (M3 Table 2). On average, Norwegians are slightly more
 290 concerned about climate change than Germans (one-sided *t*-test: $\bar{x}_{GER}=3.4$, $\bar{x}_{NOR}=3.6$, $p=0.000$).
 291 Furthermore, those who are more worried are also more likely to think of CCS as an effective way to
 292 mitigate climate change. For example, 44% of Norwegian respondents that are very concerned about
 293 climate change think that CCS is effective. The German equivalent is 33 %. This indicates that
 294 Norwegian respondents on average perceive benefits from CCS for climate change mitigation, while
 295 German respondents do not see these benefits.

296 We also find that the negative effect of importing CO₂ for storage from Germany is especially
 297 pronounced among the more worried Norwegians (Figure 2). These respondents seem to believe that
 298 Germany, just like Norway and other European countries, should capture carbon, and that Norway, like
 299 other European countries, should store carbon – but they do not necessarily agree that German CO₂
 300 should be stored on Norwegian territory. This differentiated result is driven by the respondents that are
 301 worried about climate change (Table 3). Those who are not worried about it show a broader scepticism
 302 about the scenarios with the German-source specification independently of the nationality of the storage
 303 site. Note, however, that ‘worry’ is not included in the experimental design and the moderating effect

304 of this variable might therefore be confounded. Nevertheless, we *accept Hypothesis 3 for Norway and*
 305 *reject it for Germany.* It hypothesizes that domestic storage of domestically sourced CO₂ is evaluated
 306 more positively compared to the storage of imported CO₂.

307
 308 *Figure 2: Linear prediction and 95% confidence intervals for OLS regressions by subgroups with a*
 309 *low level or a high level of worry about climate change (scale: not worried at all (1) – very worried*
 310 *(5); low: worry = 1, 2, 3; high: worry = 4, 5) on attitude toward a CCS project (scale: 1 very*
 311 *negative – 4 very positive) for German and Norwegian sample (compare Table A-5)*



312
 313 Overall, we find that Norwegian respondents assess the CCS project more positively and that the
 314 variation of the assessment across treatment groups is higher compared to Germany. The share of
 315 positive evaluations across different conditions ranges between 42% and 81%, while in Germany it only
 316 ranges between 45% and 57%. The more positive evaluations and the stronger differentiation between
 317 treatment scenarios can be explained by differences in the perceived hypotheticality and uncertainty of
 318 CCS and the familiarity with the technology and the sector.

319 Both country samples show that higher perceived effectiveness and realism increase the evaluation of
 320 CCS (Table 2) but the average perceptions are different between countries. More Norwegians think of
 321 CCS as more effective and of the project as realistic in the next 5–10 years. In Norway, about 40% think
 322 that CCS is an effective technology to mitigate emissions, 25% think it is not effective and the remaining
 323 35% respond “don’t know”. In Germany, 31% think that CCS is an effective technology to mitigate
 324 emissions, 48% think it is not effective and 21% respond “don’t know”. Thus, the perception of CCS
 325 effectiveness is significantly different in the two countries (chi²-test: $\chi^2(2) = 318.83; p=0.000$). In
 326 addition, Norwegians are more likely to perceive the proposed project as realistic (55%) compared to
 327 Germans (47%; chi²-test: $\chi^2(1) = 36.82; p=0.000$). We find a positive effect of working in the oil and
 328 gas sector on the evaluation of CCS in the Norwegian sample. In Germany, we find no such effect for

329 working in the energy sector; there, we did not ask about the oil and gas sector specifically, as its size
 330 is negligible.

331 *Table 2: Results from OLS regression for attitude towards the described CCS project (scale: 1 very*
 332 *negative – 4 very positive) for Germany and Norway.*

	Germany			Norway		
	M1	M2	M3	M1	M2	M3
source*storage (base = not spec.*not spec.)						
<i>not specified</i> *GER	-0.051	-0.082	-0.08			
<i>not specified</i> *NOR	-0.052	-0.036	-0.039	-0.163	-0.04	0.141
<i>not specified</i> *EU	-0.048	-0.048	-0.055	-0.093	-0.026	-0.062
GER * <i>not specified</i>	0.053	0.005	-0.004	-0.191*	-0.116	-0.250*
GER * GER	0.005	-0.032	-0.038			
GER * NOR	-0.016	-0.04	-0.043	-0.726***	-0.576***	-0.541***
GER * EU	-0.067	-0.108	-0.107	-0.223*	-0.101	-0.056
NOR * <i>not specified</i>				0.005	0.022	-0.036
NOR * NOR				0.071	0.064	0.11
NOR * EU				-0.077	-0.01	-0.01
EU * <i>not specified</i>	-0.085	0.031	0.027	-0.208*	-0.112	-0.163
EU * GER	-0.078	-0.082	-0.089			
EU * NOR	-0.046	-0.077	-0.08	-0.405***	-0.254***	-0.166
EU * EU	-0.096	-0.037	-0.04	-0.169	-0.073	-0.019
offshore (base = onshore)	-0.038	-0.019	-0.026	-0.026	-0.017	0.005
realistic (base = no)		0.169***	0.151***		0.214***	0.189***
effective (base = yes)						
<i>no</i>		-1.073***	-1.018***		-1.200***	-1.000***
<i>don't know</i>		-0.394***	-0.368***		-0.576***	-0.456***
innovation will save climate			0.071***			0.052**
worry about climate change			-0.017			0.126***
working in energy (GER) / oil&gas (NOR) sector			0.083			0.282**
controls	<i>included</i>					
constant	2.676***	3.158***	2.848***	3.472***	3.692***	2.977***
N	2500	2500	2500	2665	2665	906
df	30	33	36	20	23	26
log likelihood	-3203.243	55.611	-2633.097	-3603.767	89.753	-1016.403
R ²	0.013	0.35	0.362	0.115	0.384	0.411

333 *Note: control variables are age, gender, education and geographical region (see Table A-3).*
 334 *Norwegian sample in M3 is smaller because the variables ‘innovation will save climate change’ and*
 335 *‘worry about climate change’ were only elicited from a subset of respondents. Estimations for M1 and*
 336 *M2 with the small Norwegian sample see Table A-4. * p<.05; ** p<.01; *** p<.001*

337 There is a strong difference in public awareness about CCS as a technology between the two countries.
 338 While only 15% of Norwegian respondents report that they have never heard about CCS, this share is
 339 63% in Germany, where 6% have already heard a lot about CCS compared to 26% in Norway. The
 340 share of respondents that have heard a little about it is 58% in Norway and 30% in Germany [60].³ As
 341 these strong differences in familiarity were expected, we included a more general measure of the
 342 attitudes toward technology as a means to counteract climate change. Agreement with the statement
 343 that technological innovations will solve the problems related to climate change positively influences
 344 the evaluation of the CCS project in both country samples (M3 Table 2). At the same time, the share of
 345 respondents that at least somewhat agree with this statement is 50% in Germany and 70% in Norway
 346 (one-sided t -test: $p=0.000$), indicating again strong differences on the aggregate level between the two
 347 countries.

348 We conclude that the psychological distance from CCS in terms of uncertainty about CCS and its
 349 benefits, attitudes toward technology, and familiarity is on average lower in Norway compared to
 350 Germany. We find abstract evaluations among the German respondents who do not pay attention to the
 351 details in our project specification, whereas Norwegian respondents show differentiated evaluations.
 352 We thus *accept H4 on the between-country level*.

353

354 *Table 3: Likelihood ratio tests for respective variable added as simple term to M1 vs. respective*
 355 *variable added as an interaction with (source*storage) to M1*

	Germany		Norway	
	p	χ^2	p	χ^2
Realistic	0.138	16.087	0.774	7.298
Effective	0.169	28.202	0.134	29.382
Innovation	0.098	81.247	0.210	72.849
Worry	0.072	58.352	0.009	66.469
Working in energy (DE) / oil&gas (NO) sector	0.104	17.143	0.331	12.441
Female	0.611	9.117	0.453	10.882
Age	0.370	49.602	0.307	51.346
Education	0.656	8.630	0.437	11.080

356

357 However, neither perceived effectiveness, realism of CCS, technology perception nor working in the
 358 oil and gas sector can explain the differences in the reactions to the experimental variation of the
 359 nationality of the source and the storage site within the country samples. The fit of the baseline model
 360 (M1, Table 2) plus the simple term of perceived effectiveness or realism does not improve significantly
 361 when adding the three-way interaction term of source, storage, and effectiveness or realism, respectively
 362 (Table 3). For example, the group of respondents that perceive the project as less realistic do not show
 363 different evaluation patterns compared to those who think it is realistic. Taken together this leads to a
 364 *rejection of H4 on the within-country level* as our variables for psychological distance do not improve
 365 explanatory power.

³ Norwegian shares are based on $N = 3068$ from wave 18 of the Norwegian Citizens' Panel in 2020, 60. German shares are based on our own sample.

366 We controlled for demographic variables. Women are less likely to evaluate the project positively. The
367 effect is more pronounced in Norway compared to Germany. Unlike in Germany, a higher level of
368 education significantly increases positive evaluations in Norway and increasing age has a downward
369 impact on evaluations (*Table 2*). The variables do not interact significantly with the treatment as shown
370 by the lack of significant improvement in model fit when they are included as a three-way interaction
371 with storage and source (*Table 3*).

372

373 4. Discussion

374 We conducted a survey experiment in Germany and Norway where we were interested in the support
375 for a hypothetical CCS project and where we varied the nationality of the source of CO₂ emissions, the
376 nationality of the storage site for a CCS project and whether the storage site is onshore or offshore. The
377 treatment manipulates the psychological distance in terms of spatial distance and nationality. The two
378 study countries are very different with respect to the general population's familiarity, the level of
379 development and the existence of a political discourse on CCS, adding further variation in the
380 psychological distance.

381 In line with prior research, respondents in Norway and Germany evaluated the project on average
382 differently [12–14]. While Norwegians perceived the project as somewhat positive or very positive,
383 Germans evaluated it more reluctantly as somewhat positive. Specifying the storage location as offshore
384 does not change perceptions in either of the two countries. Also, the specification of a storage location
385 abroad does not lead to more positive evaluations of CCS. This contradicts our hypotheses that an
386 increase in the spatial distance for storage – either by moving it offshore or abroad – would lead to more
387 positive evaluations by reducing the risk perceptions. The lack of importance of the spatial dimension
388 also contradicts NIMBY/NUMBY framings but points towards more nuanced drivers of CCS
389 perceptions that extend beyond seemingly selfish motives for local opposition [50] and underlines the
390 importance of psychological distance over spatial proximity in construal level theory.

391 Though the nationality of the storage site does make a difference in combination with the nationality of
392 the CO₂-source: Norwegians are most positively inclined toward storing CO₂ from Norwegian sources
393 on Norwegian territory. The support is significantly lower for projects where imported CO₂ is stored on
394 Norwegian territory – especially when the source is described as German, but also when it is described
395 more broadly as European. This is a consistent pattern; we observe the strong negative effect of
396 Germany as a source especially among Norwegian respondents that are worried about climate change.
397 Contrary to Norwegian respondents, German respondents do not evaluate the proposed CCS-project
398 differently depending on the nationality of emissions or of the storage site. It seems that these
399 differences do not matter to them. Considering the low level of familiarity with CCS, the lower beliefs
400 about its effectiveness against climate change and the higher perceived hypotheticality of the proposed
401 CCS project among German respondents compared to Norwegian respondents, we conclude that
402 Germans' psychological distance from CCS is high, while it is low for Norwegians. This is consistent
403 with the hypothesis that more distant objects are evaluated in a more abstract way.

404 Norwegian respondents' negative evaluation of the domestic storage of German and European sourced
405 CO₂ could derive from various factors. They might be concerned about the safety of cross-border CO₂
406 transport or hold a belief that every country should take responsibility for its own emissions and should
407 not “dump” them on Norwegian territory. CO₂ is often perceived as waste [54] and Germany's reliance
408 on coal might be perceived as problematic by Norwegian respondents. In addition, the perceived
409 benefits from CCS might be higher, when the technology is used to reduce Norwegian emissions thus

410 adding to the positive perception of storing Norwegian CO₂ domestically. In the Norwegian public
411 debate, CCS is often framed as a national project adding to the domestic focus [61].

412 Our experimental results can, however, only provide a limited snapshot of public perceptions that are
413 based on our information text. That we did not find a difference between offshore and onshore storage
414 might, therefore have occurred because we compared offshore to a scenario that did not specify onshore
415 storage but merely underground storage. Especially for Norwegian respondents, who are mostly
416 familiar with the CCS projects underneath the North Sea this might not have made a difference as they
417 were thinking about offshore storage anyway. Furthermore, we can only speculate about the reasons
418 why Norwegian respondents differentiate between Europe and Germany as a source. It could be that
419 they question whether the CCS project should be limited to a single foreign source country, and they
420 might question whether Germany is the optimal candidate, or they might think of Norway as a part of
421 Europe, as we did not specify “other” European countries in the treatment. Our experiment cannot
422 capture political mobilization processes, media campaigns, and stakeholder responses that will to a great
423 degree influence the development of public perceptions.

424 Future research should explore the mechanisms that drive the effects of the nationality of emissions
425 especially looking at perceptions of international justice and CCS as a part of international climate
426 policy. It will be especially of practical relevance, whether such effects appear for other exporter-
427 importer relationships such as Sweden-Norway or Poland-UK, as they are part of the planned Northern
428 European infrastructure network.

429 Our findings mirror the diverging status of CCS in political discussions in Germany and Norway.
430 German authorities had taken a cautious to disapproving position for several years, before cautiously
431 opening up in 2019 [15], whereas the Norwegian government frames it as part of the solution to the
432 climate change problem and promotes the development of full-scale CCS [62]. Our study also reveals
433 potential problems for the establishment of a Northern European market for carbon storage: removing
434 the NUMBY-aspect for Germany by storing the CO₂ under the North Sea off the coast of Norway does
435 not improve acceptability. Adding the context of the nationality of emissions in Norway, lowers the
436 generally positive evaluation of CCS significantly there when the CO₂ for storage is imported. Low
437 levels of public acceptability of CO₂ exports in Germany and CO₂ import in Norway could challenge
438 the feasibility of current plans for CCS deployment of states bordering the North Sea, as this is indeed
439 one of the envisioned importer-exporter constellations.

440

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623 **Appendix**

624 *Table A-1: Descriptive statistics for the full sample (model in Table A-2), acceptance models (M1 and*
 625 *M2 Table 2 and Table A-4) and the reduced sample in Norway (M3, Table 2)*

	Germany			Norway			
	full	without NODK (M1 - 3)	population 18-65	full	without NODK (M1 & M2)	small sample (M3)	pop-ulation 19-65
median age category	40-49	40-49	40-49	50-59	50-59	50-59	40-49
women	48.9%	46.2%	49.4%	51.7%	48.3%	47.9%	48.8 %
higher level of education	38.1%	39.9%	36.7%	59.5%	60.8%	62.9%	40.1%
state							
<i>Baden-Württemberg</i>	11.4%	11.4%	13.1%				
<i>Bayern</i>	15.0%	15.4%	15.5%				
<i>Berlin</i>	6.1%	5.8%	4.1%				
<i>Brandenburg</i>	3.3%	3.3%	3.1%				
<i>Bremen</i>	0.8%	0.8%	0.8%				
<i>Hamburg</i>	3.1%	3.0%	2.1%				
<i>Hessen</i>	7.0%	7.2%	7.4%				
<i>Mecklenburg-Vorpommern</i>	2.5%	2.5%	2.0%				
<i>Niedersachsen</i>	8.5%	8.5%	9.7%				
<i>Nordrhein-Westfalen</i>	18.8%	18.8%	21.9%				
<i>Rheinland-Pfalz</i>	5.0%	5.0%	5.0%				
<i>Saarland</i>	1.3%	1.4%	1.2%				
<i>Sachsen</i>	7.1%	7.0%	5.1%				
<i>Sachsen-Anhalt</i>	3.1%	3.0%	2.9%				
<i>Schleswig-Holstein</i>	3.9%	3.8%	3.5%				
<i>Thüringen</i>	3.1%	3.1%	2.7%				
region							
<i>Oslo/Akershus</i>				27.6%	28.0%	25.4%	25.9%
<i>Østlandet</i>				23.2%	22.7%	25.1%	25.4%
<i>Sørlandet</i>				5.8%	5.6%	5.6%	5.6%
<i>Vestlandet</i>				26.6%	27.1%	26.4%	25.2%
<i>Trøndelag</i>				7.9%	7.8%	7.7%	8.7%
<i>Nord-Norge</i>				8.9%	8.9%	9.8%	9.2%
N	2,960	2,500	80,209,997	3,229	2,665	906	3,280,535

626 Sources for German population reference gender and education: VuMA Touchpoints (2019)

627 <https://bit.ly/3h2HgyW>, retrieved 5 May 2021; states: Federal Statistical Office (Destatis), 2021 | as of: 05 May

628 2021. Data for Norwegian population (19-65) calculated based on data from Statistics Norway (2019), [StatBank](#)

629 [Norway - SSB](#) retrieved 5 May 2021.

Figure A- 1: Number of observations in the treatment groups; all groups include No/Don't know-responses

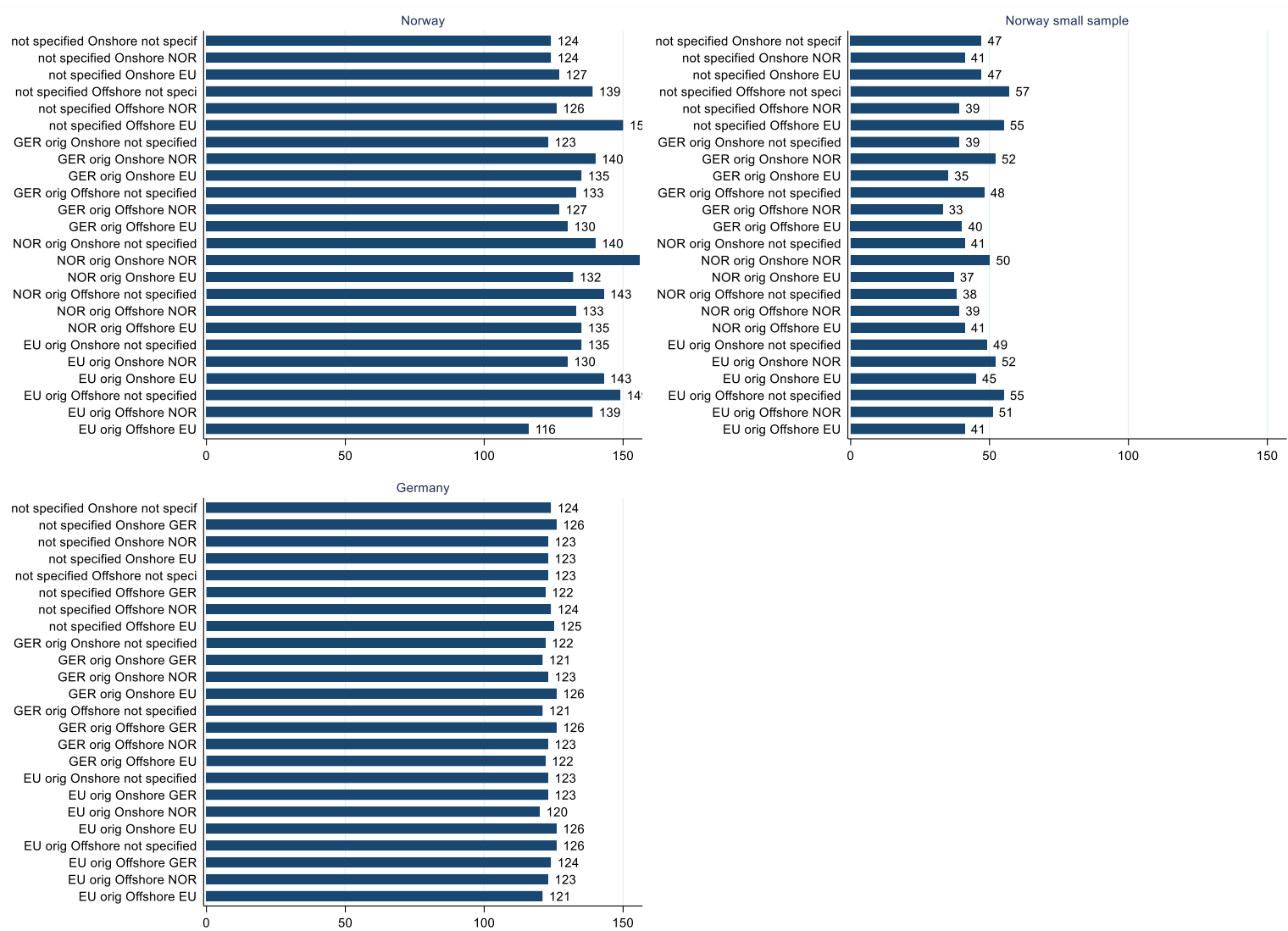


Figure A- 2: Share of female participants in the treatment groups with 95%-confidence intervals; red line indicates overall mean

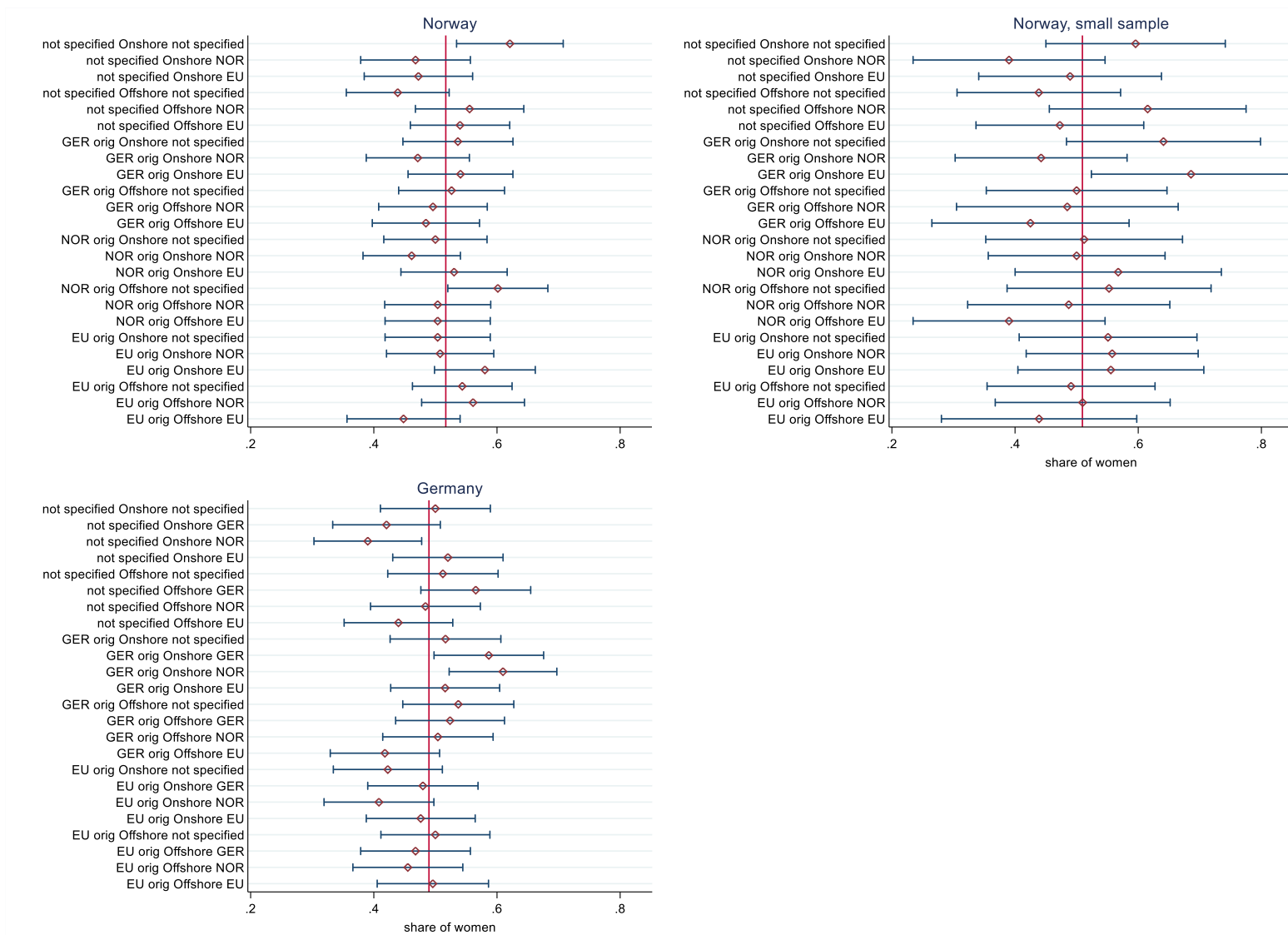


Figure A- 3: Share of highly educated participants in the treatment groups with 95%-confidence intervals; red line indicates overall mean

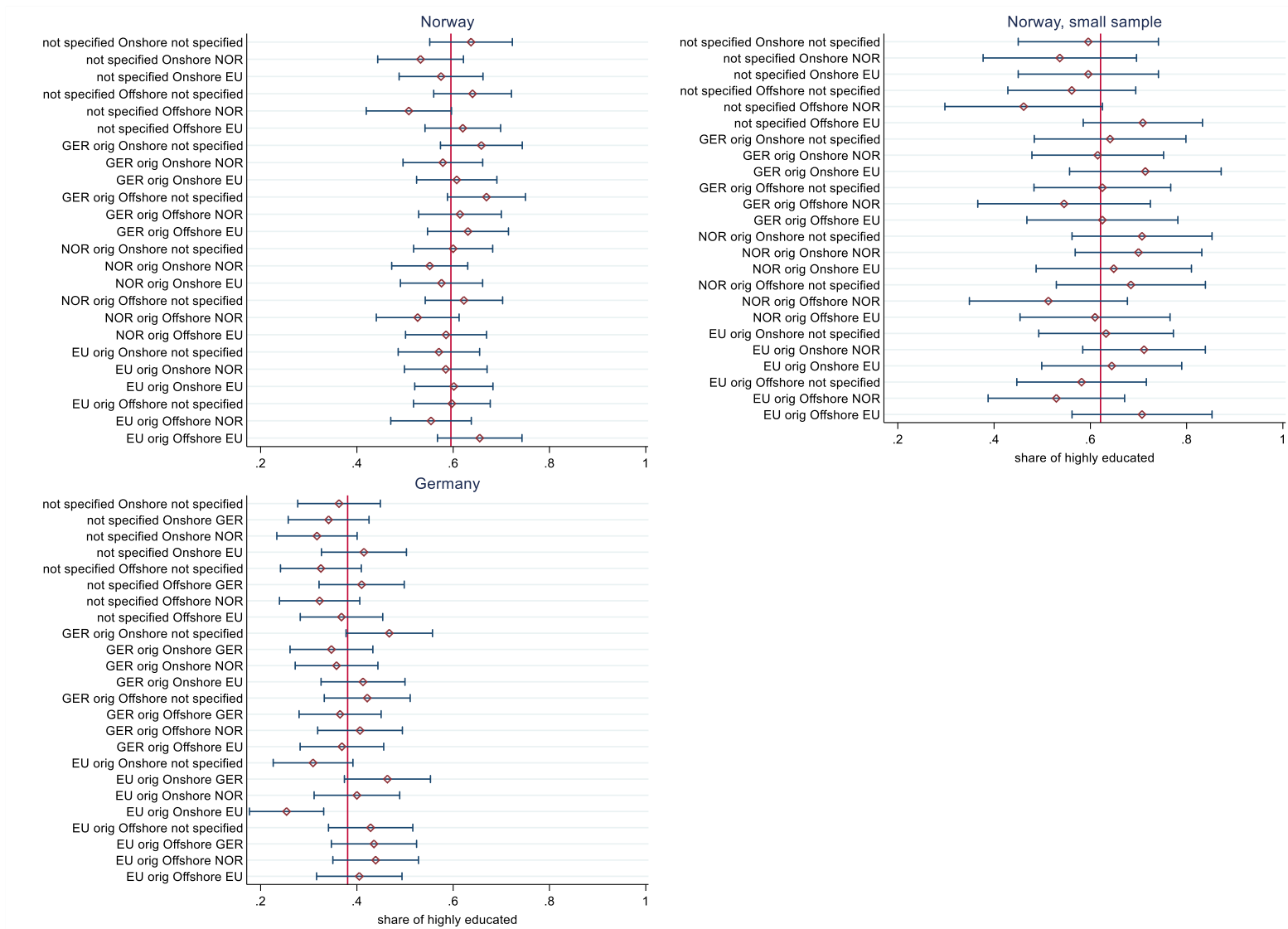


Figure A- 4: Mean age category in the treatment groups with 95%-confidence intervals; red line indicates overall mean

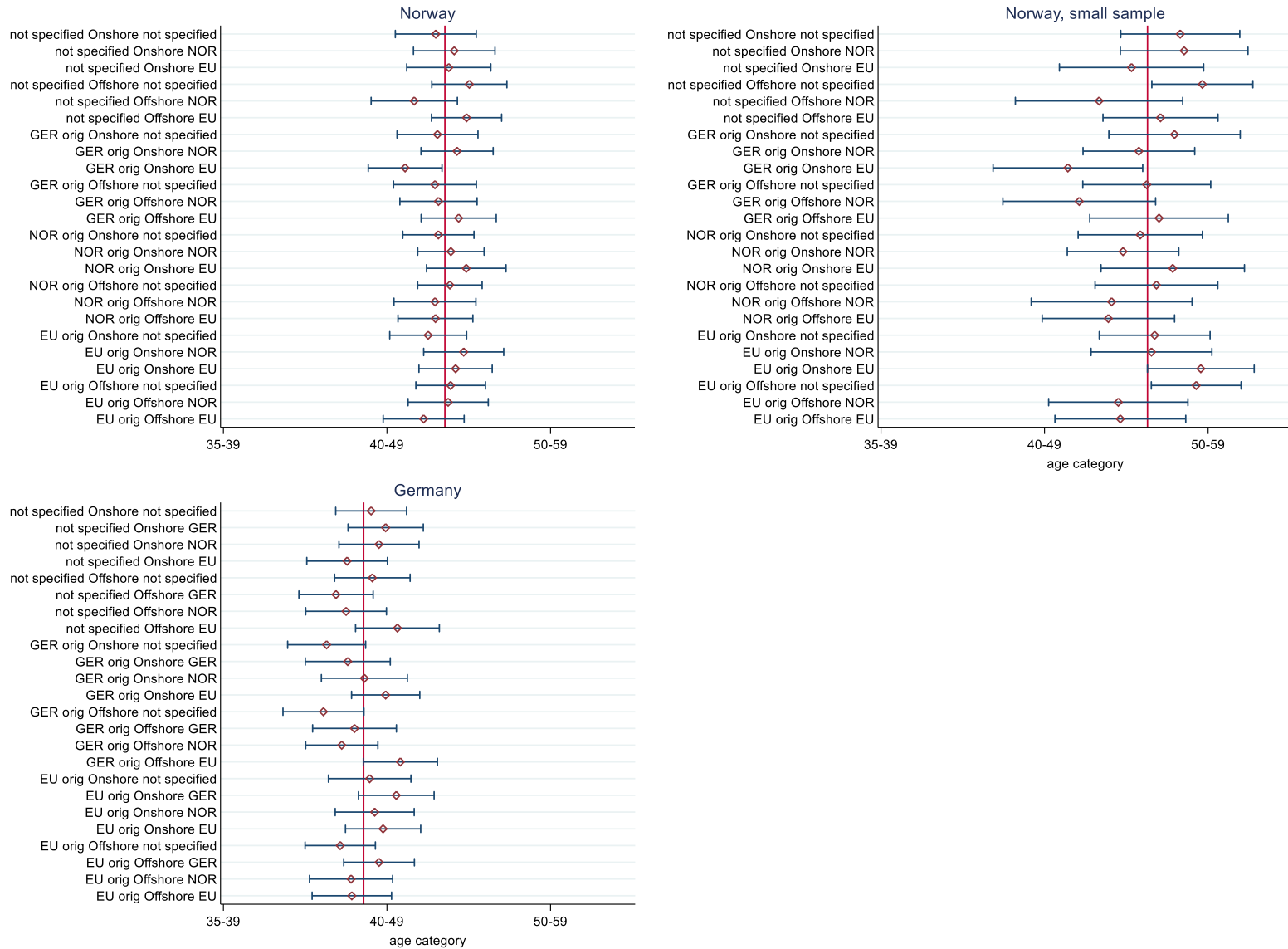


Table A-2: Results from logistic regression for the responding no response/don't know (NODK) in the question about the attitude towards the described CCS project (NODK=1) for German and Norwegian sample.

	Germany			Norway		
	M1	M2	M3	M1	M2	M3
source (base = not specified)						
<i>Germany</i>	0.11	0.063	0.054	-0.053	-0.071	-0.335
<i>Norway</i>				-0.044	-0.001	-0.008
<i>Europe</i>	-0.005	-0.031	-0.033	-0.074	-0.079	-0.124
storage (base = not specified)						
<i>Germany</i>	-0.044	-0.041	-0.036			
<i>Norway</i>	0.047	0.031	0.056	0.093	0.039	-0.13
<i>Europe</i>	-0.059	-0.127	-0.129	0.211	0.142	-0.039
offshore (base = onshore)	-0.178	-0.166	-0.155	-0.038	-0.042	0.098
realistic (base = no)		-0.419***	-0.366**		-0.101	-0.067
effective (base = yes)						
<i>no</i>		0.360*	0.203		0.752***	0.558
<i>don't know</i>		1.563***	1.511***		1.633***	1.616***
innovation will save climate			-0.135**			-0.085
worry about climate change			-0.206***			-0.200*
working in energy (GER) or oil&gas (NOR) sector			-0.727			0.069
female	0.726***	0.622***	0.653***	0.858***	0.652***	0.669***
high level of education	-0.610***	-0.650***	-0.596***	-0.364***	-0.269**	-0.14
age	-0.025	-0.054	-0.052	-0.037	-0.062	-0.044
geographic controls						
constant	-1.757***	-2.057***	-0.764	-1.845***	-2.608***	-1.579*
N	2960	2960	2960	3229	3229	1072
df	24	27	30	14	17	20
log likelihood	-1234.427	-1150.277	-1136.403	-1446.227	-1348.785	-413.287
pseudo R ²	0.035	0.1	0.111	0.033	0.098	0.106

Note: Norwegian sample in M3 is smaller because the variables innovation and worry were only elicited from a subset of respondents. * $p < .05$; ** $p < .01$; *** $p < .001$

Overall, 16.5% of respondents selected the option “No opinion/don't know” to the question about CCS acceptance (henceforth: NODK). The share of NODK is significantly higher among Norwegian respondents (GER: 15.5%; NOR: 17.5%; one-sided binomial-test: $p = 0.002$). Responding NODK may be explained either by the content of the CCS scenarios, by environmental and other attitudes, or by demographic factors. The shares do not vary significantly between the scenarios, though in Norway they tend to be higher when Europe is specified as the storage location ($\bar{x} = 19\%$; M1: $p = 0.068$).

Respondents who are female or who do not know whether CCS is an effective method for climate protection are more likely to respond NODK when asked to assess the project. While respondents with a higher level of education are less likely to choose NODK. In Germany, the likelihood to answer NODK is also lower among respondents that think the described project is realistic, that are more worried about climate change, and that think technology will help to solve climate change (Table A-2).

Table A-3: Full models from Table 2 including coefficients of the controls, * $p < .05$; ** $p < .01$; *** $p < .001$

	Germany			Norway		
	M1	M2	M3	M1	M2	M3
source*storage (base = not spec.*not spec.)						
<i>not specified</i> *GER	-0.051	-0.082	-0.08			
<i>not specified</i> *NOR	-0.052	-0.036	-0.039	-0.163	-0.04	0.141
<i>not specified</i> *EU	-0.048	-0.048	-0.055	-0.093	-0.026	-0.062
GER * <i>not specified</i>	0.053	0.005	-0.004	-0.191*	-0.116	-0.250*
GER * GER	0.005	-0.032	-0.038			
GER * NOR	-0.016	-0.04	-0.043	-0.726***	-0.576***	-0.541***
GER * EU	-0.067	-0.108	-0.107	-0.223*	-0.101	-0.056
NOR * <i>not specified</i>				0.005	0.022	-0.036
NOR * NOR				0.071	0.064	0.11
NOR * EU				-0.077	-0.01	-0.01
EU * <i>not specified</i>	-0.085	0.031	0.027	-0.208*	-0.112	-0.163
EU * GER	-0.078	-0.082	-0.089			
EU * NOR	-0.046	-0.077	-0.08	-0.405***	-0.254***	-0.166
EU * EU	-0.096	-0.037	-0.04	-0.169	-0.073	-0.019
offshore (base = onshore)	-0.038	-0.019	-0.026	-0.026	-0.017	0.005
realistic (base = no)		0.169***	0.151***		0.214***	0.189***
effective (base = yes)						
<i>no</i>		-1.073***	-1.018***		-1.200***	-1.000***
<i>don't know</i>		-0.394***	-0.368***		-0.576***	-0.456***
innovation will save climate			0.071***			0.052**
worry about climate change			-0.017			0.126***
working in energy (GER) or oil&gas (NOR) sector			0.083			0.282**
female	-0.051	-0.101***	-0.077**	-0.437***	-0.437***	-0.513***
high level of education	0.07	0.052	0.049	0.211***	0.162***	0.123*
age	-0.025	-0.012	-0.004	-0.075***	-0.058***	-0.050*
federal state (base = Baden-Württemberg)						
Bayern	-0.013	0.012	0.019			
Berlin	-0.109	-0.066	-0.063			
Brandenburg	0.135	0.009	0.011			
Bremen	-0.055	0.083	0.077			
Hamburg	-0.135	-0.112	-0.111			
Hessen	-0.128	-0.102	-0.09			
Mecklenburg-Vorpommern	0.117	0.094	0.088			
Niedersachsen	-0.037	-0.03	-0.018			
Nordrhein-Westfalen	-0.031	0.02	0.02			
Rheinland-Pfalz	-0.022	0.021	0.047			
Saarland	0.129	0.125	0.109			
Sachsen	-0.108	-0.057	-0.059			
Sachsen-Anhalt	0.111	0.092	0.102			
Schleswig-Holstein	-0.017	-0.009	-0.005			
Thüringen	-0.116	-0.052	-0.041			
region (base = Oslo/Akershus)						
Østlandet				-0.138**	-0.076	-0.115
Sørlandet				-0.240**	-0.095	-0.144
Vestlandet				-0.105*	-0.039	-0.173*
Trøndelag				-0.196**	-0.151*	-0.162
Nord-Norge				-0.142*	-0.051	-0.105
constant	2.676***	3.158***	2.848***	3.472***	3.692***	2.977***
N	2500	2500	2500	2665	2665	906
df	30	33	36	20	23	26
log likelihood	-3203.243	55.611	-2633.097	-3603.767	89.753	-1016.403
R ²	0.013	0.35	0.362	0.115	0.384	0.411

Table A-4: Comparison of estimation results for large and small Norwegian sample

	Norway				
	M1	M1 small	M2	M2 small	M3
source*storage (base = not spec.*not spec.)					
<i>not specified</i> *NOR	-0.163	-0.01	-0.04	0.133	0.141
<i>not specified</i> * EU	-0.093	-0.128	-0.026	-0.072	-0.062
GER * <i>not specified</i>	-0.191*	-0.341*	-0.116	-0.279*	-0.250*
GER * NOR	-0.726***	-0.701***	-0.576***	-0.593***	-0.541***
GER * EU	-0.223*	-0.186	-0.101	-0.065	-0.056
NOR * <i>not specified</i>	0.005	0.038	0.022	-0.041	-0.036
NOR * NOR	0.071	0.124	0.064	0.075	0.11
NOR * EU	-0.077	-0.119	-0.01	-0.007	-0.01
EU * <i>not specified</i>	-0.208*	-0.318*	-0.112	-0.172	-0.163
EU * NOR	-0.405***	-0.225	-0.254***	-0.162	-0.166
EU * EU	-0.169	-0.112	-0.073	-0.027	-0.019
offshore (base = onshore)	-0.026	0.032	-0.017	0.01	0.005
realistic (base = no)			0.214***	0.222***	0.189***
effective (base = yes)					
<i>no</i>			-1.200***	-1.087***	-1.000***
<i>don't know</i>			-0.576***	-0.497***	-0.456***
innovation will save climate					0.052**
worry about climate change					0.126***
working in energy (GER) or oil&gas (NOR) sector					0.282**
female	-0.437***	-0.552***	-0.437***	-0.505***	-0.513***
high level of education	0.211***	0.277***	0.162***	0.178**	0.123*
age	-0.075***	-0.075**	-0.058***	-0.060**	-0.050*
region (base = Oslo/Akershus)					
<i>Østlandet</i>	-0.138**	-0.214*	-0.076	-0.14	-0.115
<i>Sørlandet</i>	-0.240**	-0.292*	-0.095	-0.122	-0.144
<i>Vestlandet</i>	-0.105*	-0.224**	-0.039	-0.173*	-0.173*
<i>Trøndelag</i>	-0.196**	-0.11	-0.151*	-0.163	-0.162
<i>Nord-Norge</i>	-0.142*	-0.232*	-0.051	-0.125	-0.105
constant	3.472***	3.515***	3.692***	3.739***	2.977***
N	2665	906	2665	906	906
df	20	20	23	23	26
log likelihood	-3573.767	-1208.077	89.753	-1035.275	-1016.403
R ²	0.115	0.158	0.384	0.385	0.411

The estimation results for the large and the small sample are robust to the extent that they are similar in magnitude and direction. Variations are to be expected because the small sample is two thirds smaller compared to the full sample. The significant effect for European source and Norwegian storage does not appear in the small sample, while the effect of German source and Norwegian storage is present in all sample variations.

Table A-5: OLS regressions by subgroups with a low level or a high level of worry about climate change (scale: not worried at all (1) – very worried (5); low: worry = 1, 2, 3; high: worry = 4, 5) on attitude toward a CCS project (scale: 1 very negative – 4 very positive) for German and Norwegian sample

	Germany		Norway	
	low worry	high worry	low worry	high worry
source*storage (base = not spec. *not spec.)				
not specified *GER	-0.129	0.047		
not specified *NOR	-0.032	-0.064	0.119	-0.106
not specified *EU	-0.09	0.012	-0.366	0.068
GER * not specified	-0.043	0.171	-0.592**	-0.066
GER * GER	-0.144	0.209		
GER * NOR	-0.076	0.062	-0.629**	-0.646***
GER * EU	-0.19	0.087	-0.306	-0.002
NOR * not specified			0.037	0.03
NOR * NOR			0.223	0.076
NOR * EU			-0.194	-0.097
EU * not specified	-0.139	-0.004	-0.406	-0.188
EU * GER	-0.235*	0.102		
EU * NOR	-0.031	-0.045	-0.175	-0.247
EU * EU	-0.139	-0.026	-0.207	-0.019
offshore (base = onshore)	-0.025	-0.049	0.09	-0.022
female	-0.023	-0.094	-0.573***	-0.609***
high level of education	0.085	0.05	0.232*	0.195*
age	-0.023	-0.033	-0.034	-0.076**
geographic controls	<i>included</i>			
constant	2.707***	2.649***	3.365***	3.615***
N	1319	1181	408	498
df	30	30	20	20
log likelihood	-1671.763	-1491.858	-538.016	-609.576
R ²	0.023	0.024	0.199	0.167

* $p < .05$; ** $p < .01$; *** $p < .001$