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ABSTRACT

Academics' Attitudes toward Engaging in Public Discussions – Experimental Evidence on the Impact of Engagement Conditions*

Academics are increasingly expected to engage in public discussions. We study how engagement conditions affect academics' engagement attitudes via a survey experiment among 4,091 tenured professors in Germany. Consistent with the crowding-out of intrinsic motivation, we find less-positive attitudes when emphasizing public authorities' demands and public expectations regarding science's societal relevance. Effects are particularly strong among professors endorsing science–society relations. Moreover, effects are similar when highlighting risks associated with engagement, but more pronounced for females, and absent when emphasizing public support for academics' engagement. We conclude that considering individual incentive structures and safeguarding against repercussions may promote academics' engagement.

JEL Classification: I23, O33

Keywords: science communication, public engagement, professor, survey experiment, intrinsic motivation

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1 Introduction

Amidst a shift in the relation between science and society, the conditions of academics' engagement in public discussions have changed in several respects. The complexity of challenges facing society and the pervasiveness of science-based innovations have made the expertise of academics an important input for public opinion formation and political decision-making. Against this backdrop, policy makers have begun to pay greater attention to the academics' engagement with the public and to devise policies that promote it (Burchell 2015; Mejlgaard 2018; Weingart and Joubert 2019). Similar expectations and support for academics' activities in this area have been voiced by the public (Funk et al. 2019; 2020). At the same time, risks associated with academics' exposure to the public have become apparent. Especially in areas of debate, public appearances and statements can trigger negative repercussions for the professional and even private lives of academics. Although these developments can be readily observed, their impact on academics remains an open question.

Academics' willingness to engage with the public is strongly driven by their personal attitudes, presumably owing to a lack of integration of engagement activities into the academic profession. For example, scientists frequently attribute low priority to engagement activities (Rose et al. 2020; The Royal Society 2006), and career benefits commonly trail other motives in terms of their perceived importance among those who do engage (Kreimer et al. 2011; The Royal Society 2006; Torres-Albero et al. 2011). Whereas this suggests that engaging with the public is more a matter of personal conviction, there are signs that this might be changing. In addition to the importance ascribed to engagement by stakeholders of the science system and among the public, some academics do indeed report deriving career benefits from such engagement (Nisbet and Markowitz 2015; Peters et al. 2008). In line with this ambiguous character of engagement activities, academics' personal attitudes have been identified as a particularly relevant predictor of their engagement (Dudo 2013; Besley et al. 2012; Besley et al. 2018; Poliakoff and Webb 2007). This makes academics' attitudes a useful object of inquiry when considering how changing conditions may influence their engagement behavior.

To investigate the influence of conditions on academics' attitudes toward engagement in public discussions, we conducted a survey experiment as a randomized controlled trial (RCT) among 4,091 professors in Germany. The survey was implemented between October and November 2020 and covered professors' perspectives on the relation between science and society and their activities in this area. A section of the survey was dedicated to the impact of the COVID-19 pandemic on respondents and comprised the experiment. The survey targeted all professors at German higher education institutions governed by the state (except for civil service institutions) or by religious institutions. In our analysis, we focus on tenured professors

with permanent contracts (i.e., associate and full professors at salary grades W2/C3 and W3/C4). These professors have considerable freedom to choose the activities they engage in. Due to the comprehensiveness of the survey, the sample comprises professors from more than 240 higher education institutions, professors from all academic disciplines, professors from all age groups and professors with different personal views on science–society relations.

In the experiment, we ask respondents whether they would favor a reduction or an increase in academics' engagement in public discussions in the future, and we examine how their answer behavior changes when we frame the question differently and provide selected pieces of information. For this, we randomly allocated respondents to either a control group receiving no further information or framing or one of four treatment groups. The first treatment covered demands implicit in the legal framework. It informed respondents that legislators have included knowledge and technology transfer as a general duty of higher education institutions in the higher education laws in all German federal states but one (Berghäuser 2017). The second treatment covered expectations concerning academics' engagement among the public. It emphasized that public expectations directed at academics have increased in recent times and informed respondents that a majority of the German population (67 percent) support basing decisions regarding science and research on their expected contribution to solving societal problems (Wissenschaft im Dialog 2019). The third treatment covered public support for academics' engagement with the public. In addition to emphasizing this issue, it informed respondents that a majority of the German population (75 percent) support academics speaking out in public when political decisions do not take research results into account (Wissenschaft im Dialog 2019). The fourth treatment covered the risks associated with academics being exposed to the public. It emphasized the existence of these risks and mentioned two prominent cases where distinguished professors of virology were confronted with death threats and lawsuits related to their public engagement during the COVID-19 pandemic. Before the treatments, we elicited respondents' prior knowledge of the information provided in the first three treatments. This allows us to investigate whether the novelty of the information provided or the emphasis put on a specific frame is the mechanism behind any potential treatment effects.

Overall, we find high levels of support for an increase in academics' engagement in public discussions. In the control group, 52 percent of respondents favor more engagement, and an additional 24 percent favor much more engagement.[1] However, an emphasis on higher edu-

[1] A comparison to other data sources reveals that our sample is likely positively selected in terms of preferences for the engagement behavior of professors. In further analyses, we show that the treatment effects are rather weak for professors who consider direct relations between science and society less

cation institutions' legal duties (treatment 1) and on expectations among the public (treatment 2) have a negative impact on these positive attitudes. These two treatments significantly decrease the probability of being a strong supporter by approximately 7 and 6 percentage points, respectively. We furthermore find that this negative impact is particularly strong for professors who have a positive stance on exchange relations between science and society. We rationalize these findings as the result of an oppositional behavior of professors and, in line with motivation crowding theory (Frey 1997; 2000; Frey and Jegen 2001), of a negative impact of external demands and expectations on their intrinsic motivation. Less surprisingly, an emphasis on the risks associated with being exposed to the public (treatment 4) also leads to less-positive attitudes, lowering the probability of supporting an increase in engagement by approximately 7 percentage points. This effect is particularly strong for younger and female professors. We thus consider it plausible that the stakes of being exposed to the public are higher for these two groups. Professors at earlier career stages might be particularly concerned about reputation damage, and female professors might encounter greater hostility than their male counterparts. In contrast, an emphasis on support from the public (treatment 3) does not have a discernible impact. Across all treatments, it appears that the provision of a specific framing, not the respondents' level of prior knowledge, is the primary mechanism behind our findings.

Our findings contribute to the scientific literature on relations between science and society, current science and higher education policy and management discussions, and the methodology of science and higher education research. First, previous research on the engagement of academics with the public has treated academics' attitudes mainly as a predictor for engagement (for an exception, see Dudo 2013). We show that these attitudes can also be investigated as an object of external influences and that engagement conditions currently in change are among the relevant influences. It can be expected that the influences we observe for the case of engagement in public discussions apply to other activities of academics in nonacademic environments as well. Second, the results of our study provide points of reference for science and higher education policy design and management. Especially at the policy level, recent attempts to promote academics' engagement with nonacademic environments have often been embedded in a narrative referring to a change in expectations directed at science and to new duties of academics. Based on our findings, we question whether alluding to new expectations and duties is a sensible strategy, particularly as it appears to deter those who are generally open to engagement activities. Our results suggest that a more promising strategy to

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important. We therefore argue that our selected sample captures the relevant population of professors for whom the treatments should matter. Section 3.4 provides a more detailed discussion of this point.

foster relations between science and the public consists of devising institutional incentive structures that are in line with the intrinsic motivation of professors. Moreover, universities and public authorities should provide safeguards against the potential negative repercussions that can derive from academics' exposure to the public. This seems to be true especially for female professors, who respond more strongly to the potential risks than their male counterparts do. Third, our study highlights the usefulness and broader applicability of survey experiments. These have rarely been used for investigations covering academics thus far. Exceptions include primarily survey experiments using hypothetical scenarios such as curricula vitae (see, for instance, Carlsson et al. 2020; Ceci 2018) or publication lists (see Powdthavee et al. 2018) that are varied systematically. Going beyond this approach, we show that using treatments inducing framing effects to gather insights into the relevance of specific considerations works with highly educated individuals in scientific fields.

The remainder of the paper proceeds as follows. Section 2 elaborates on our research focus and interest. Section 3 describes the design of the survey experiment and the data used in the analysis. Section 4 reports the empirical results, followed by a discussion in Section 5. Section 6 concludes the paper.

2 Background: Academics' Public Engagement

2.1 Changing Conditions

Since the second half of the 20th century, policy discussions have paid increasing attention to academics' communication and, later on, direct engagement with broader audiences. These activities have found their way into science and higher education policy agendas in many countries (Burchell 2015; Mejlgaard et al. 2012; 2018; Weingart and Joubert 2019; Chikoore et al. 2016; Torres-Albero et al. 2011). Differences among national contexts notwithstanding, this reality is evident in the relevance ascribed to science communication and engagement in political strategizing, the adjustment of research funding mechanisms, and the establishment of numerous support initiatives. These efforts of governments are in many cases reinforced by those of other stakeholders, such as learned societies and foundations.

The orientation in the policy sphere is complemented by similar sentiments within societies more generally. Overall trust in science remains high or has even increased in many countries (Funk et al. 2020). Moreover, significant portions of the population expect science to contribute to societal development and show support for academics' engagement in public debates (BEIS 2020; Funk et al. 2019; Wissenschaft im Dialog 2019). In Germany, for instance, 67 percent of respondents to a 2019 public opinion poll agreed with the statement that the expected contributions to solving societal problems should guide decisions regarding science and research

(Wissenschaft im Dialog 2019, 28). A public opinion poll conducted in the same year in the USA revealed that 60 percent of respondents believed that scientists should be actively involved in policy debates related to scientific issues (Funk et al. 2019, 9).

As demands and expectations directed at academics have intensified, challenges associated with their public engagement have become increasingly visible. The logics and dynamics of public discussions differ and can even contradict those of communication within the scientific community. These differences have been amplified by the diversification of communication channels. The expansion of online media, and social media in particular, has ended the position of legacy media – such as print media and television – as the main link between science and public discourse. In addition to science being covered in online media, academics themselves, especially younger scholars (Besley et al. 2018), are using online channels of communication. In blogs, microblogs, and social networks, they communicate research results to audiences outside of the scientific community and engage in public discussions (Jensen 2011; Hamlyn et al. 2015; Jünger and Fähnrich 2020; see also Sugimoto et al. 2017). These new channels enhance the opportunities academics have to communicate and directly interact with broader audiences and provide additional possibilities for immediate feedback. This, however, implies that those who engage can be confronted with hostility in debates concerning contentious and polarizing issues. As a result, there is a constant risk that academics might experience negative repercussions that can extend to their professional and even private lives.

2.2 Individual Perspective

From the perspective of academics themselves, engaging with audiences outside of the scientific community is different from other academic activities. On the one hand, it appears that this engagement, in its various forms, is more a matter of personal conviction than a genuine part of the academic profession. The perception that it is accorded a low priority, including by academic peers, is common (see Rose et al. 2020; see also Hamlyn et al. 2015; The Royal Society 2006). This view corresponds to the motives academics in various countries report having for engagement (Kreimer et al. 2011; Peters et al. 2008; The Royal Society 2006; Torres-Albero et al. 2011; see also Burchell 2015; Poliakoff and Webb 2007). Motives related to the standing of science in society, such as informing the public and improving its perspective on science, are usually considered more relevant than those related to academic career advancement. On the other hand, there are signs that public engagement activities have become more accepted as genuinely academic activities. Another important motive frequently reported by academics is that of fulfilling a perceived duty. Moreover, personal career benefits have been found to be relevant in some studies, especially with regard to academics' engagement via the mass media (Besley et al. 2013; Nisbet and Markowitz 2015; Peters et al. 2008).

In line with this peculiar role, academics' personal attitudes toward engaging with the public have been identified as one of the most important and persistent predictors of their engagement (Besley et al. 2012; Besley et al. 2018; Poliakoff and Webb 2007; Dudo 2013; see also Dunwoody et al. 2009). For example, Besley et al. (2018) use survey data collected in 2015 and 2016 on 4,703 natural scientists in the USA to show that the perceived impact and, in particular, scientists' general attitude toward engagement are the most relevant predictors of their willingness to engage. Furthermore, the effects these authors observe hold across the three modes of engagement considered, namely, face-to-face communication, communication via the media and communication via online channels.

Despite their ability to predict engagement, academics' attitudes have rarely been investigated as subject to external influences. A few studies conjecture that these attitudes may be shaped by other beliefs (Dudo 2013; Besley et al. 2012), norms (Poliakoff and Webb 2007) or factors such as media consumption (Dudo 2013) and may thereby act as a mediator for effects on academics' willingness to engage. Based on a survey of 363 biomedical researchers in the USA, Dudo (2013) indeed finds evidence for such a mediating effect for (see also Besley et al. 2020), among others, the consumption of print media. However, the extent to which academics' attitudes are open to external influences and which factors are relevant in this regard have not been investigated systematically thus far.

3 Research Design and Data

3.1 Experimental Design

To investigate the impact of conditions on academics' attitudes toward engaging in public discussions, we conducted a survey experiment as an RCT with four treatment groups and one control group through an online survey of professors in Germany (see Figure 1 for an overview of the experimental design).[2] The experiment consisted of two questions eliciting all respondents' prior knowledge of the information provided by three of the four treatments and one question, into which the four treatments are embedded, producing the experiment's outcome. The survey comprising the experiment addressed the relation of respondents with the nonacademic environment (see Appendix Figure A.1 for an overview of the structure of the survey). The main topics included respondents' perspective on the relations between science and society and their own involvement in activities in the areas of knowledge and technology transfer, con-

[2] The experiment is preregistered in the American Economic Association's registry for randomized controlled trials (AEARCTR-0006565, https://doi.org/10.1257/rct.6565-1.0). IRB approval was received from the Central Ethics Committee of Leibniz University Hannover (EV LUH 18/2020, 17.12.2020).

tinuing education and societal engagement. A section toward the end of the survey was dedicated to the impact of the COVID-19 pandemic on the respondents and comprised the experiment.

< Figure 1 >

The outcome of the experiment consisted of an indicator of respondents' attitudes toward engagement in public discussions. Following an introductory sentence transitioning from the topic of the COVID-19 pandemic and stating that *the relevance of science and scientific findings for public opinion formation and political decisions has also increased outside the context of crises*, all respondents were asked the following question: *If you consider academics from your own discipline, should these academics become less or more involved in public discussions in the future?* Responses were given on a 5-point scale ranging from *much less* to *much more* (with *the same amount* as the mid-point). One randomly selected group of respondents received only this question and serves as the control group. The four other randomly selected groups received altered framings of the question and additional pieces of information as treatments (for the exact wording in German, see Appendix Figure A.2).

The first treatment focused on the uptake of science–society relations in the legal framework for higher education and the demands directed at academics that at least implicitly derive from this. Citing a recent research article (namely, Berghäuser 2017), the treatment informed respondents that in addition to the general relevance of science for the public, *legislators have included knowledge and technology transfer as a general duty of higher education institutions in the higher education laws of all German federal states except for Hamburg*. This treatment might induce more positive attitudes if academics perceive the demands as a signal that engaging in public discussions has become a valued academic activity. However, if the demands are perceived as intruding on academics' professional autonomy, they might just as easily induce more negative attitudes.

The second treatment referenced expectations within the population concerning the relation between science and society. It reframed the question by pointing out that the general relevance of science for the public *is also mirrored in the German population's expectations of science*. It then informed respondents that *in a poll conducted in 2019, 67 percent of respondents stated that they agree with the following statement: "Decisions on science and research should primarily be based on their contribution to solving societal problems"*; the source of the data was also mentioned (i.e., Wissenschaft im Dialog 2019). This treatment might also induce either more positive or more negative attitudes depending on whether the public's expectations are perceived as a reassurance of the value attributed to academics' engagement or as an infringement on academics' autonomy.

The third treatment referenced public support for academics' engagement in public discussions. It reframed the question by pointing out that in addition to the general relevance of science for the public, *there is broad support among the German population for academics' public engagement*. It then referenced the same informational source (i.e., Wissenschaft im Dialog 2019), stating that *in a poll conducted in 2019, 75 percent of respondents stated that they agree with the following statement: "Academics are right to speak out in public when political decisions do not take research results into account"*. If anything, we would expect this treatment to shift academics' attitudes in a more positive direction.

The fourth treatment covered the risks associated with academics' engagement in public discussions. It reframed the question by pointing out that *the public engagement of academics also entails risks*. It then provided two examples of these risks, referring to two scientists who played a prominent role during the COVID-19 pandemic in Germany comparable to the role Anthony S. Fauci played in the USA. It stated that *Professor Christian Drosten, Director of the Institute of Virology at the Charité Berlin, reported receiving death threats in relation to his public appearance in the context of the COVID-19 pandemic* and that *Professor Hendrik Streeck, Director of the Institute of Virology at the University Hospital Bonn, was sued in relation to a study on the COVID-19 pandemic*. Two newspaper articles (i.e., Zeit Online 2020a; 2020b) were provided as the sources of this information. Aside from physical violence, death threats are among the most negative repercussions that an individual can face. We therefore interpret this treatment as a test of the upper negative bound that can be expected from emphasizing the risks associated with academics' engagement in public discussions.

By providing a specific framing of the question as well as selected pieces of information, the treatments can influence the outcome via two mechanisms. First, via the framing provided, they increase the salience of certain considerations concerning academics' engagement in public discussions among respondents during the response process (for a discussion of framing effects, see Chong and Druckman 2007; see also Zaller and Feldman 1992). Second, via the information provided, they might correct respondents' prior knowledge about the issue referred to by the treatment. If the issue covered by the treatment is relevant to the respondent, both mechanisms could alter the opinions expressed. To be able to discern the two mechanisms, we consider in further analysis the respondents' prior knowledge about the quantifiable information included in the first three treatments.

3.2 Data Collection

The target population of the survey included all professors at German higher education institutions governed by the state (except for civil service institutions) or by religious institutions. We identified 45,635 individuals belonging to the target population based on two sources. For

professors at universities and some art and music colleges, we used the online version of the *Hochschullehrer Verzeichnis 2019* (DHV 2019), a regularly updated register of professors edited by the German Association of University Professors and Lecturers (*Deutscher Hochschulverband*). For professors at institutions not covered by this register, we reverted to institutions' websites. No adequate contact details could be obtained for 502 professors, and 501 professors were included in a pretest of the survey questionnaire[3], leading to a gross sample of 44,632 individuals.

The survey was distributed online between October 5 and November 15, 2020. All individuals in the gross sample received an invitation via e-mail or via an online contact form. Those who had not yet completed the survey received a reminder 8 and 22 days after the initial invitation. In 1,844 cases, all three contact attempts failed due to, among other reasons, inactive e-mail addresses or spam filters. An additional 703 cases were identified as not belonging to our target population based on feedback during the field phase and the survey results. This led to an adjusted gross sample of 42,085 individuals.

Overall, the survey yielded 4,726 valid responses, amounting to a net response rate of 11.2 percent. This response rate is similar to that of two recent Germany-wide scientific surveys by the *German Centre for Higher Education Research and Science Studies* (DZHW). Those surveys obtained response rates from professors, excluding those at universities of applied sciences, of 10.0 percent in 2016 (Neufeld and Johann 2018) and 12.4 percent in 2019/2020 (Ambrasat et al. 2020). For the purpose of this analysis, we restricted the sample to the 4,173 tenured professors. That is, we kept associate and full professors (salary grades W2/C3 and W3/C4) and dropped from the analysis assistant professors (salary grade W1/C2), professors with fixed-term contracts and respondents who did not specify the type of professorship. Tenured professors possess a high level of autonomy in regard to deciding which activities to engage in. This should allow us to observe the effects of the treatments with as few confounding influences as possible. Out of this group, 80 observations were removed from the analysis because of missing responses to the question forming the experiment's outcome. We checked the remaining observations for sufficient data quality, speeding, and straightlining. None of these observations exhibited a share of missing values for the main survey items above 40 percent or a response time below one-third of the median. A check of the survey's

[3] The pretest examined the technical implementation of the survey and the design of the questionnaire. We used insights gained from the pretest to finalize the design of the main item batteries (i.e., to decide upon the number of items and the use of scales versus binary response options), to adapt the response categories and wording of selected questions, and to change the structure of the survey. However, the design of the experiment, including the wording of the questions and treatments as well as the timing of the questions, was not affected by the pretest.

six main item batteries for straightlining revealed that the response pattern varied across at least half of the batteries in all except two cases, which were therefore excluded from the analysis. Thus, our analytical sample contains 4,091 observations.

3.3 Variables

The experiment's outcome is transformed from the original 5-point scale format, as the distribution of the outcome variable is concentrated at the upper end of the scale. In the control group, 51.6 percent of respondents support more engagement, and an additional 23.8 percent support much more engagement. The outcome therefore enters the analysis in two forms: as a dummy variable indicating support in general (i.e., those advocating more or much more engagement) and as a dummy variable indicating strong support (i.e., exclusively those advocating much more engagement).

We add three sets of covariates as control variables. These include information on respondents' engagement with the nonacademic environment, basic features of their academic employment, and demographic characteristics. Accounting for basic differences between these groups allows us to increase the precision of our estimates. We furthermore consider respondents' personal characteristics a potential source of effect heterogeneity and thus analyze the effects of our treatments separately for subgroups based on the demographic and engagement characteristics.

Information on respondents' engagement with the nonacademic environment covers their attitudes and actual engagement. Two variables cover the importance that respondents ascribe to knowledge and technology transfer and to societal engagement as part of a professorship from their personal perspective. These assessments were transformed from a 5-point scale to two groups, contrasting those who consider these activities *not at all*, *not that* or only *somewhat important* with those who consider them *very* or *extremely important*. A second set includes three dummy variables designating whether respondents used the following three channels for communicating scientific findings to audiences outside of the scientific community in 2019: press, radio or television; lectures or panel discussions; and online social networks.

As basic features of respondents' academic employment, we include the type of professorship (associate professor, i.e., those at the W2/C3 salary grade; full professor, i.e., those at the W3/C4 salary grade) and five groups of academic disciplines: engineering sciences; law, economics, social sciences and sports science; humanities and arts; mathematics and natural sciences; and medicine, health sciences, veterinary medicine, agronomy, forestry and nutrition science. We also add the type of institution (university; university of applied sciences; college

of art/music) and its location in West Germany or East Germany. As demographic characteristics, we include gender (male; female[4]) and the age group (up to 44 years; 45 to 54 years; 55 or older) of respondents.

3.4 Descriptive Statistics

Our analytical sample shows a rather positive stance on the preferred extent of academics' engagement in public discussions (see Table 1). In the control group, which serves as the benchmark in the following analysis, only 3.1 percent (= 0.7 percent + 2.4 percent) of respondents advocate a reduction in engagement, and only 21.5 percent do not see a need for changing the current level. Instead, 51.6 percent are in favor of *more* engagement and 23.8 percent are even in favor of *much more* engagement.

Different groups of professors are well represented in our sample (see the remaining rows of Table 1), even though the distribution in the sample differs from that in the population in some cases (see Appendix Table A.1). The sample is 75.2 percent male and 24.8 percent female professors, which corresponds to the respective shares in the population. Professors in the highest age group (55 years old or older) account for 45.8 percent of the sample, compared to 39.1 percent (45-54 years) and 15.1 percent (44 years or younger) in the two lower age groups. The majority of respondents hold an associate professorship (64.2 percent), which is 4.1 percentage points higher than in the population, with the remainder (35.8 percent) holding full professorships. In terms of academic disciplines, the highest share is found among the groups including the engineering sciences (30.6 percent) and the fields of law, economics, social sciences and sports science (28.5 percent), followed by the humanities and arts (17.1 percent) and by mathematics and the natural sciences (15.6 percent). The remaining group, which includes medicine, health sciences, veterinary medicine, agronomy, forestry, and nutrition science, accounts for the smallest share (8.2 percent). This share is 3.1 percentage points lower than that in the population, constituting the most pronounced deviation among all academic discipline groups. As in the population, the majority of professors in the sample are employed at a university (46.3 percent) or a university of applied sciences (48.5 percent). However, the share of university professors is 9.5 percentage points lower than that in the population, whereas that of professors at universities of applied sciences is 9.3 percentage points higher. The remaining 5.2 percent of the sample come from colleges of art and music, a share that is similar to that in the population. With regard to the region in which the institutions are

[4] In addition to the categories of male and female, respondents could state that they are unable or unwilling to assign themselves to one of these two genders. As only 83 respondents chose this category, which does not allow for a meaningful analysis, such a selection was recoded as a missing value.

located, the distribution of 79.4 percent of professors from West Germany and 20.6 percent from East Germany is again close to that in the population.

The majority of professors in the sample have a positive stance on relations between science and society and have themselves been engaged with the public. Knowledge and technology transfer is considered a very or extremely important activity by 73.0 percent of professors, and 54.9 percent think similarly about societal engagement. In the year preceding the survey, 48.1 percent of professors engaged with the press, radio or television, and 72.1 percent gave lectures or participated in panel discussions to disseminate their research results to the public. Another 27.8 percent used online social networks for this purpose.

While we cannot rule out that the openness to the nonacademic environment exhibited by the professors in our sample could also be partly due to the questions about the extent of public engagement presented before, we provide some evidence that the answer behavior is likely a result of self-selection into the survey. To gauge the extent of self-selection, we compared the levels of engagement with actors outside of the scientific community in our sample to those found in another survey with a similar target group. As part of the *Academic Profession in Knowledge Societies* (APIKS) research project (Schneijderberg and Götze 2020), academics in Germany were surveyed about their general employment and working conditions. Given this thematic focus, the results of the APIKS survey should provide us with a suitable reference point for assessing the particularities of our sample in terms of professors' engagement with the nonacademic environment. Even though differences in sample composition and measurement pose challenges for a direct comparison, we do observe markedly higher shares of professors engaged in contract research and consulting and in exchanges with the public in our sample than that found in the one of the APIKS survey (see Appendix Table A.2). In addition, the questions covering the importance respondents ascribe to knowledge and technology transfer and societal engagement were located at the very beginning of the survey and should therefore be less affected by demand effects. The fact that the responses to these questions conform to the general picture concerning professors' openness to the nonacademic environment also suggests that self-selection into the survey may well explain respondents' openness.

The generally positive stance on exchange relations with society and the comparatively high levels of engagement with the nonacademic environment in particular suggest that professors with negative views on engagement in public discussions are underrepresented in our sample. Because randomization into the treatment groups occurred after self-selection into the survey, the internal validity of our estimates presented below is not affected. However, the selected sample creates potential issues for the external validity of the results. Arguably, the sample covers well the population that is of interest for our analysis because we do not believe that our treatments are so powerful that they can change the minds of those who are staunchly

opposed to public engagement activities.[5] We nevertheless conduct further analyses to assess the relevance of our sample composition: In Section 4.2, we replicate our main estimations using survey weights based on data for the population. Moreover, in Section 4.4, we examine the treatment effects for subgroups in our sample.

4 Empirical Results

4.1 Balancing Treatment Groups

Two balance checks confirm that the random assignment of respondents to the experimental groups was successful. In the first check, we test whether the composition of the treatment groups in terms of observable characteristics differs from that of the control group. We do this by regressing each of the covariates in our set of control variables separately on each of the four treatment indicators, using the subsamples consisting of the control group and the respective treatment group. Out of the 108 coefficients in the estimations (see Table 1), 5.6 percent are significant at a 5 percent confidence level, which is similar to what would be expected by chance. In the second check, we regress each of the four treatment indicators on all control variables together, again using the subsamples consisting of the control group and the respective treatment group. In all four cases, the F-test for joint significance of all covariates is insignificant, and the coefficients of determination are close to zero (see Table 1). We can thus infer that there is no systematic variation in the observable and unobservable characteristics among the experimental groups, which allows us to identify the causal effects of the treatments.

< Table 1 >

4.2 Main Treatment Effects

In the main analysis, we investigate whether the four treatments influence the probability that respondents support an increase in academics' engagement in public discussions. The first panel in Table 1 already previews the results by showing descriptively that strong support for increasing the engagement in public discussions is significantly reduced for the legal duty treatment (Column (2)), the public expectations treatment (Column (3)), and the examples risk treatment (Column (5)). For the examples risks treatment, we additionally observe a more general decrease in the support of academics' public engagement.

[5] In Section 4.4, we provide some evidence that the treatments are not effective for individuals who have a more critical stance on exchange relations between science and society.

To examine these relationships more rigorously, we measure the treatment effects by estimating linear probability models regressing each of the two outcome variables, i.e., the indicators for general support and strong support, on the treatment indicators and the control variables using the full sample. The main results are presented in Table 2 and Figure 2. Panel A in both the table and the figure shows whether the respondent *generally* supports an increase in public engagement by professors. Panel B refers to the second outcome variable, which measures whether the respondent *strongly* supports an increase. The inclusion of the control variables covering demographic, occupational and engagement characteristics in the estimations increases the precision of our estimates.

< Figure 2 >

< Table 2 >

The treatment pointing out the legal duties of higher education institutions has a negative impact on support for an increase in engagement but only with those who strongly support such an increase. With regard to support in general, the treatment has only a negligible and insignificant effect. When focusing on strong support, however, the effect is strongly negative and highly significant. The treatment reduces the probability of being a strong supporter by 6.6 percentage points. With 23.8 percent of professors in the control group strongly supporting an increase in engagement, this amounts to a drop in the share of strong supporters by 27.7 percent.

A similar impact derives from the treatment emphasizing public expectations directed at academics. With regard to support in general, the treatment has a negative impact that is only marginally significant. The effect on strong support, on the other hand, is highly significant, reducing the probability of being a strong supporter by 6.2 percentage points. This again amounts to a greater than 25% decrease in the share of strong supporters compared to the control group.

There is no discernible impact from the treatment emphasizing public support for academics' engagement in public discussions. For both support in general and strong support, the treatment effects are small and not significant. In addition, the sign of the treatment indicator's coefficient is positive in one case and negative in the other.

A negative effect derives from the treatment emphasizing the risks associated with academics being exposed to the public. The treatment has a strongly negative and highly significant impact on support for an increase in public engagement in general. It reduces the probability of belonging to the group of supporters by 6.7 percentage points. When compared to the 75.4 percent of supporters in the control group, this amounts to a decrease in the group of

supporters by 8.9 percent. The treatment's impact on strong support is smaller and only marginally significant.

To check the impact of the composition of our sample on the results, we also estimate the models with survey weights. The weights are based on data on the population from the Federal Statistical Office of Germany (see Appendix Table A.1). The data cover the population totals by gender, type of professorship, group of academic disciplines, institutional type, and geographic location, as defined by our control variables (see Section 3.3). We construct the weights using the raking-ratio method implemented in Stata. Applying the survey weights to the sample does not alter our findings in any meaningful way (see Appendix Table A.3).

4.3 Effect Mechanism

A question remains as to the extent to which the main effects of the treatments derive from the framing or from the information given. This analysis is restricted to the three treatments containing quantifiable information, that is, those referring to legal duties (treatment 1), public expectations (treatment 2), and public support (treatment 3). For all three treatments, we elicited the prior knowledge of all respondents before the treatment stage (see Figure 1).[6] These are the estimated number of German federal states stipulating knowledge and technology transfer as a general duty of higher education institutions and the estimated shares of the German population agreeing with the two statements on the relation between science and society from the public opinion poll. For the analysis, we recoded all impossible values as missing values, that is, estimates of the number of federal states greater than the maximum of 16 (which affected 15 observations) and estimates of the two population shares greater than 100 percent (which affected 3 and 2 observations, respectively).

Respondents' prior estimates of the information provided by the treatments exhibit a fair amount of variation within the subsamples consisting of the control group and the respective treatment group, which are relevant for the following analysis. The respondents' estimates of the number of federal states that have included knowledge and technology transfer in their higher education laws have a mean of 10.8 – the true value is 15 – and a standard deviation of 4.9. The estimates of the share of respondents to the public opinion poll who support deci-

[6] Due to the structure and requirements of the survey in which the experiment was embedded, the questions eliciting respondents' prior knowledge were located in the same section as the treatments. Thus, it was possible for respondents to correct their prior estimate after the truth was revealed to them. In Appendix B, we discuss this issue and show that the results from this analysis do not qualitatively change when we, for example, exclude observations where the elicitation estimate is exactly the same as the true value.

sions on research and science being made on the basis of their contribution to societal development have a mean of 57.9 – the true value is 67 – and a standard deviation of 20.6. The estimates of the share of respondents to the public opinion poll who support academics' engagement in public discussions have a mean of 62.0 – the true value is 75 – and a standard deviation of 21.1.

In Table 3, we include the absolute value of the difference between respondents' elicitation estimate and the true value in the main estimation model. An interaction term between that variable and the treatment indicator should be significantly different from zero if the treatment effect is systematically related to whether the treatment provided respondents with new, relevant knowledge *on average*. As the treatment referring to risks (treatment 4) is not covered by this analysis, we exclude the observations in this treatment group from the estimation. The results do not show a significant interaction term for any of the combinations of the three treatments and the two outcome variables. Only in the case of the treatment referring to public support in combination with support in general do we observe a significant interaction term, and this interaction term is only marginally significant. Thus, we conclude that the increased salience of the issues emphasized by the treatments is the primary mechanism behind the treatment effects.

< Table 3 >

In further analyses, we estimate the linear probability models of the main analysis separately for subgroups formed by splitting the sample based on the respondents' elicitation estimates. One group comprises the respondents whose estimates correspond to the true value or are at least close to it. These respondents are compared to those who either under- or overestimate the true value (for details of the group assignment, see Table 4). Three conditions should be fulfilled to conclude that the respondents' prior level of knowledge is relevant for the treatment effects. First, there should be no treatment effects for those respondents whose elicitation estimates are (almost) correct. Second, we should observe treatment effects for those respondents who under- or overestimated the true value, at least in those cases where we observed treatment effects in the main analysis. Third, the direction of the treatment effects should differ between these two groups. Focusing on the two cases where we observed significant treatment effects in the main analysis, the three conditions are only partly fulfilled (see Table 4). The effect of the treatment referring to legal duties on strong support is indeed comparatively strong and highly significant for those underestimating the true value but still markedly negative and at least marginally significant among those whose estimates are (almost) correct. In the case of the treatment referring to public expectations and strong support, the respondents overestimating the true value show a particularly strong and significant treatment

effect. However, the coefficient of the treatment indicator is negative for the other two groups as well, even though it is not significant. In the case of the treatment referring to public support, where we did not observe an effect in the main analysis, it is actually those whose estimates are (almost) correct who show a significant effect of the treatment on their support in general. Overall, we conclude that the evidence is too weak to argue that the respondents' prior level of knowledge is systematically related to the treatment effects.

< Table 4 >

4.4 Effect Heterogeneity

In the last step, we analyze treatment effect heterogeneity along individual characteristics, such as gender and age, and along individual attitudes toward science-society relations and the actual engagement in this area (see Section 3.3).[7] For this, we use the same linear probability models as in the main analysis but estimate them separately for the subgroups. The patterns observed in the subgroup analysis mostly confirm those observed in the main analysis (for an overview of all subgroups, see Appendix Tables A.4 and A.5). Where treatment effects were found in the main analysis, the majority of subgroups showed effects in the same direction, even though the effects were not always significant. The same absence of treatment effects found in the main analysis is found for most subgroups as well. However, three differences among the subgroups are pronounced and consistent enough to warrant closer consideration.

A first noteworthy finding is that we observe stronger treatment effects for female professors (see Figure 3 and Appendix Table A.4). Whereas their support for an increase in engagement is higher than that found among male professors (81.6 percent versus 73.2 percent for general support and 31.1 percent versus 20.7 percent for strong support within the control group), the treatments referring to the legal duties of higher education institutions and to the public's expectations both reduce the probability of being strong supporters of an increase in academics' engagement in public discussions by more than 10 percentage points for female professors. Even if the generally higher levels of support in this group are considered, these effects remain far stronger than the effects for male professors, which are both below 5 percentage points. Set in relation to the share of 31.1 percent of strong supporters among the female professors in the control group, this amounts to a drop in the share of strong supporters by almost half due to the legal duty treatment and by around one third due to the expectations

[7] The following subgroup analyses were not prespecified in the preregistration of the experiment.

public treatment. The differences are even more pronounced with regard to the treatment emphasizing risks. For male professors, this treatment has only a marginally significant negative effect on support in general and no effect on strong support. This stands in stark contrast to the strong and significant effects on both general and strong support among female professors. The effects amount to a reduction in the share of supporters in general by 14.7 percent and in the share of strong supporters by 27.7 percent if considered in relation to the respective shares among the female professors in the control group.

Appendix Table A.4 also shows differences for all three treatments among the different age groups. In the case of the treatments referring to legal duties and public expectations, the negative effect on strong support is driven by the highest age group of professors (55 years of age or older). This is the only age group for which we observe significant treatment effects in the subgroup analysis, and these effects are also markedly stronger than those in other age groups. The effect of the treatment emphasizing risks is driven by the youngest age group, as it is the only subgroup with a significant effect. In this group, the treatment reduces the probability of generally supporting an increase in engagement by 15.7 percentage points, compared to insignificant effects of only slightly more than 5 percentage points in the other two age groups.[8] Given that 80.8 percent of those younger than 45 years in the control group support an increase in general, the effect of the examples risks treatment amounts to a drop in the share of supporters in general by 19.4 percent.

A last pattern emerging from the subgroup analysis is that professors with a positive stance on exchanges with society are particularly strongly affected by two of the three treatments (see Appendix Table A.5). Professors who consider knowledge and technology transfer and societal engagement to be very important parts of their job as professors drive the negative impact of the treatments referring to legal duties and public expectations. The effects of both treatments are highly significant within these two subgroups but are either not significant or only marginally significant for those who consider such activities only somewhat important or not important at all.

5 Discussion

Our results show that academics' attitudes toward engaging in public discussions can indeed be shaped by the prevailing conditions. An emphasis on the indirect demands codified in higher

[8] Furthermore, for the youngest age group, we observe a strongly negative and significant effect of the treatment referring to public expectations on support in general, for which we did not observe a treatment effect in the main analysis.

education legislation as well as on expectations voiced by the public induces less-positive attitudes. We also document a negative effect on academics' attitudes when the risks associated with being exposed to the public are made more salient. In this case, we interpret the result as an upper bound of the effect, as the examples of death threats and lawsuits referred to are extreme examples of the potential negative repercussions. This may also explain why we find an impact of risks, whereas these risks have previously not been found to matter for academics' engagement with the public (Poliakoff and Webb 2007). Finally, we do not find an effect from emphasizing high levels of public support for academics' engagement in public discussions. The absence of an effect of this treatment is underscored by the fact that we do find an effect for the treatment referring to public expectations because these two treatments were designed similarly and reference the same public opinion poll.

A likely explanation for our findings is that external demands and their potential consequences trigger oppositional behavior among professors. Both the demands implicit in higher education legislation and the expectations voiced by the public can be perceived as forces that ultimately shape the immediate working conditions of academics. Given that engaging in public discussions is not necessarily considered a necessary component of academic duties and can even be viewed as being at odds with scientific norms, professors might perceive those demands as an undue infringement on their professional autonomy. Reactions to this in the form of oppositional behavior may be reinforced by the lack of explicit rewards for engaging with the public and insufficient insurance against the risks involved.

Factoring in the differences among the subgroups in terms of professors' stance on the relations between science and society, it is possible to attribute some oppositional behavior to a crowding out of intrinsic motivation. The negative effects deriving from an emphasis on external demands and expectations concern mainly those who strongly advocate an increase in engagement, and these effects are driven by professors who personally consider it important to engage with those outside of academia. Assuming that these professors exhibit a strong intrinsic motivation to engage, our findings correspond to what is expected from the perspective of motivation crowding theory (Frey 1997; 2000; Frey and Jegen 2001). These findings could thus be interpreted as deriving from a conflict between the interventionist character of external demands and professors' intrinsic motivation to engage with the public. This would explain why we observe strong effects for those who are presumably highly intrinsically motivated but hardly any effects for those who are not. An interpretation from this perspective is particularly reasonable because professors are often assumed to be driven by intrinsic motivation (Ringelhan et al. 2015; Osterloh 2010). This might be even truer for activities outside the core academic activities (see Dunwoody et al. 2009; Lam 2015), such as engaging in public discussions.

A closer look at the impact of the risks associated with engaging in public discussion suggests that differences in the associated costs might mediate the strength of such impact. The mere fact that risks, especially the drastic risks referred to by our treatments, have a negative impact on professors' attitudes is not surprising per se. This makes it even more interesting to observe strong differences depending on the gender and age of professors. With regard to the markedly stronger impact of risks on female professors, it might be conjectured that the hostility they encounter, especially in an online environment, can be comparatively more severe. This is in line with a recent study by Dupas et al. (2021), who find that female presenters in economic conferences and workshops receive more hostile questions than male presenters. It furthermore agrees with findings on differential risk of encountering hostility faced by female and male politicians and the amplifying effect that visibility in the media might have in this regard (Håkansson 2021). In the case of younger professors, who also react to risks more strongly than their older peers do, the potential costs might also be higher. The negative repercussions of engaging with the public may be perceived as more threatening by younger professors, as they are still building their academic careers and can be affected more strongly by a loss in reputation. Older professors, by contrast, might have already built up a greater reputation as well as a certain amount of resilience, leading them to perceive the risks as less threatening.

Two aspects are worth considering with regard to the broader applicability of our findings. First, it seems that our sample is biased toward professors who are generally more open to engaging with those outside academia. As shown by the subgroup analysis, the professors who are particularly open to such engagement are the most susceptible to the influences we investigate. We thus assume that our sample covers that part of the population of professors that is of interest for the focus of our study, as underrepresented professors would have hardly been affected by the treatments. Second, our investigation was designed as a one-time experiment and we are not able to observe actual changes in the engagement behavior of professors.[9] However, the conditions covered by our treatments are prevalent in the everyday working life of academics, which makes us confident that the effects we observed are relevant beyond the specific context of our study.

[9] However, we doubt that behavioral changes in the area investigated by us could be observed within a period of time appropriate for a follow-up survey. Moreover, a follow-up survey would likely have suffered from high attrition due to the time constraints and frequent survey requests that professors receive.

6 Conclusion

The findings of our study contribute to previous research on academics' engagement with the public and could be relevant for research on relations between science and society more broadly. They show that it is worthwhile to complement research on attitudes as predictors for academics' engagement with investigations that elucidates how these attitudes are affected. In terms of the conditions of academics' engagement in public discussions, we identify an initial set of factors that are relevant in this regard. Going beyond this specific area of activities, our findings might also inform studies on academics' other forms of engagement with the public and the nonacademic environment in general. Several of the activities in this area have recently received greater attention from policy makers and the public, confronting academics with similar demands to those investigated in this study. Given that these activities are not necessarily considered a genuine part of academics' duties either, the role of intrinsic motivation and related cost considerations are likely to be relevant in this context as well.

Our study also has methodological implications for the field of science and higher education research, as it highlights the usefulness and broader applicability of survey experiments. Adding to those of previous studies, our results confirm that survey experiments are a valuable complement to other methods and extend the scope of issues that can be investigated via survey research. We have furthermore shown that experiments that induce framing effects work with highly educated individuals in scientific fields. This opens up new avenues for investigating attitude formation and decision-making processes in such fields.

Finally, our results provide several points of reference for science and higher education policy and management. Especially at the policy level, recent attempts to promote academics' engagement with the nonacademic environment have often been embedded in a specific narrative highlighting the new duties of scientists. Based on our findings, we question whether alluding to such new duties is a sensible strategy, particularly as doing so appears to deter those who are generally open to engagement activities. Such deterrence is relevant with regard to not only the perspective of individual academics but also the broader acceptance of any policy and management initiative in this area. A more promising strategy to foster relations between the scientific community and the public might include developing institutional incentive structures in such a way that they align with rather than counteract the intrinsic motivation of academics. Moreover, universities and public authorities should provide safeguards against the negative repercussions that can derive from academics' exposure to the public. This seems to be especially warranted for female professors, who seem to be more severely affected by the hostility they may encounter. Given that other groups of professors, including those in the

early stages of their career, might also be disproportionally deterred by risks, such safeguards could promote an adequate representation of the diversity of scientists with the public.

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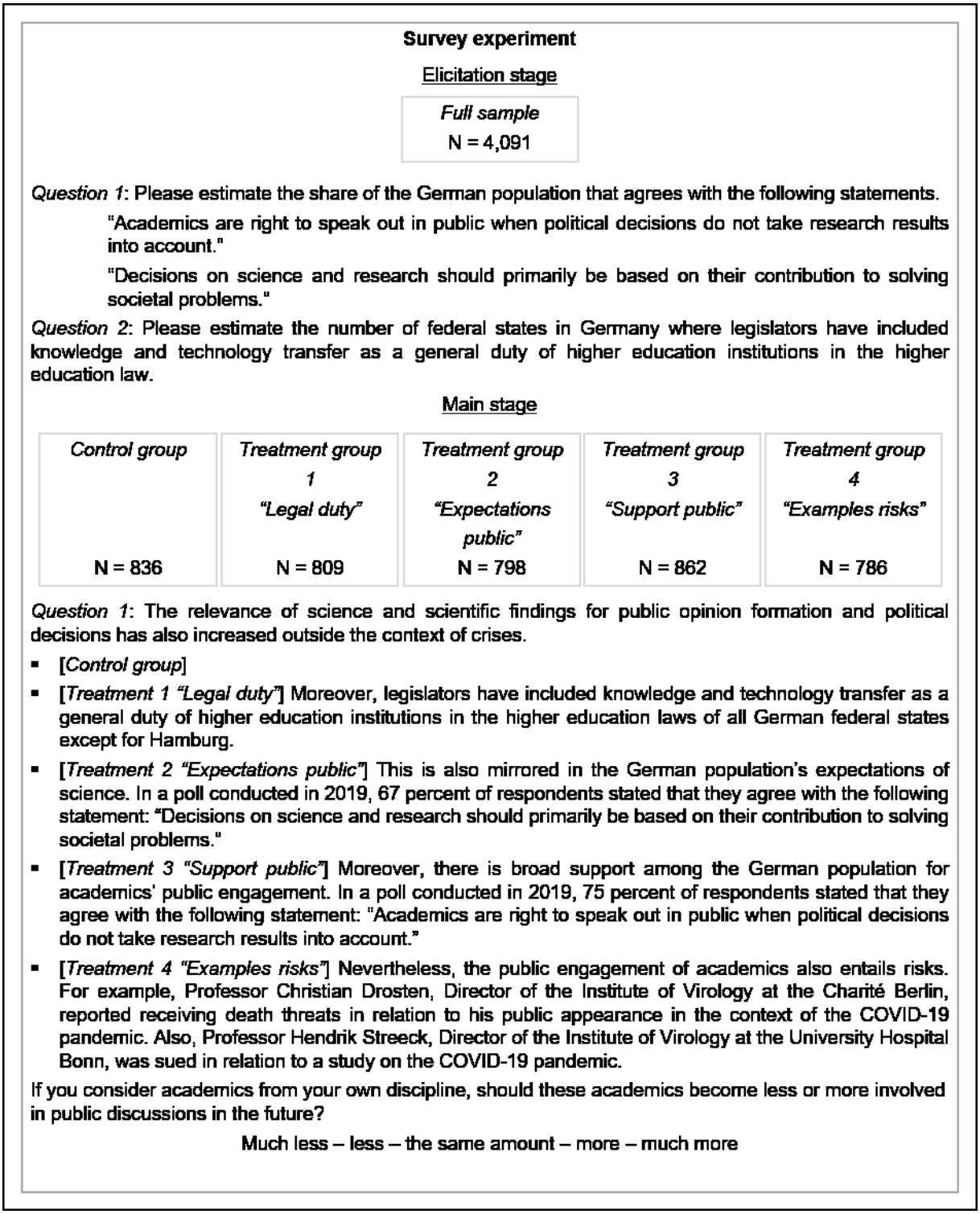
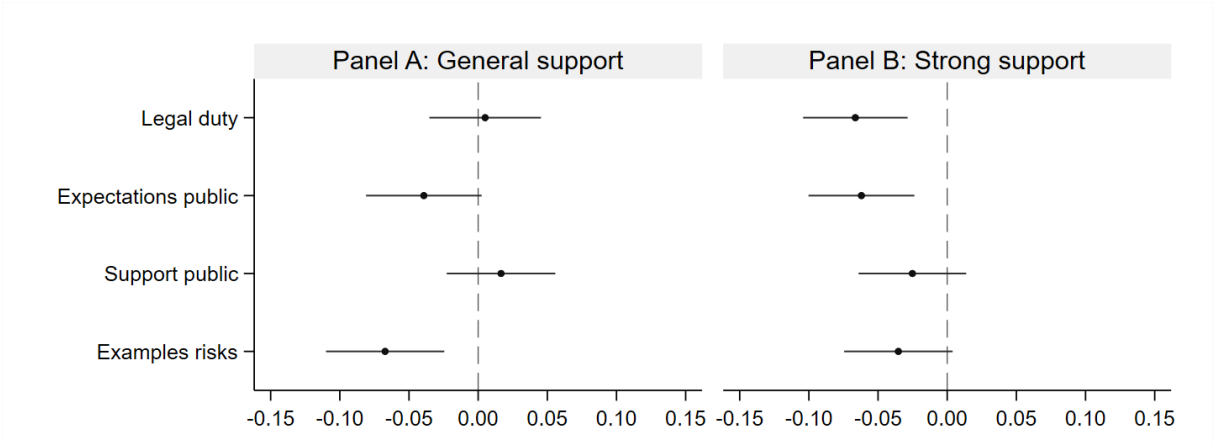
Figures and Tables

Figure 1: Experimental design



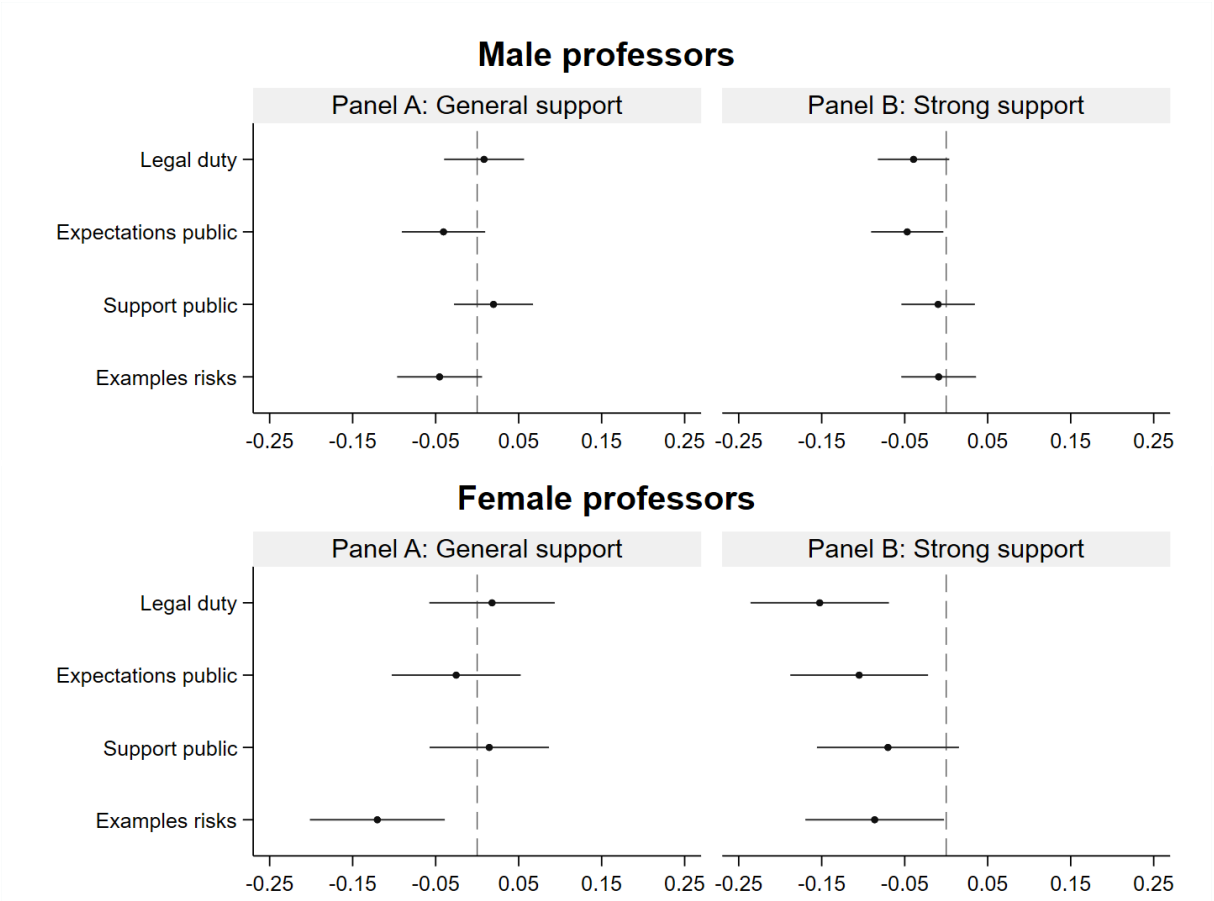
Notes: The figure shows the design of the survey experiment. Appendix Figure A.1 shows how the experiment was embedded in the overall survey; Appendix Figure A.2 shows the original German version.

Figure 2: Main effects of the treatments



Notes: The figure shows the point estimates and the 95 percent confidence intervals of the treatment indicators estimated from linear probability models (ordinary least-squares regressions with robust standard errors) regressing the dummy variable indicating respondents' (strong) support for an increase in engagement on the treatment indicators. Full sets of demographic, occupational, and engagement characteristics are always included. See Section 3.3 and Table 1 for details. Missing values for the control variables are imputed, and imputation dummies are included in the regressions. The point estimates represent the change in the probability of (strongly) supporting an increase in academics' engagement in public discussions due to receipt of the treatment. The average in the control group is 0.754 for the dummy variable for general support and 0.238 for the dummy variable for strong support. Number of observations = 4,091. The coefficient plot was produced using the Stata module *coefplot* (Jann 2014).

Figure 3: Main effects of the treatments by gender



Notes: The figure shows gender-specific point estimates and the 95 percent confidence intervals of the treatment indicators estimated from linear probability models (ordinary least-squares regressions with robust standard errors) regressing the dummy variable indicating respondents' (strong) support for an increase in engagement on the treatment indicators. Full sets of demographic, occupational, and engagement characteristics are always included. See Section 3.3 and Table 1 for details. Missing values for the control variables are imputed, and imputation dummies are included in the regressions. The point estimates represent the change in the probability of (strongly) supporting an increase in academics' engagement in public discussions due to receipt of the treatment. The average in the control group for the dummy variable for general support is 0.816 for females and 0.732 for males. For the dummy variable for strong support, the control group mean for females is equal to 0.311 and for males 0.207. Number of observations = 983 females and 2,985 males. The coefficient plot was produced using the Stata module *coefplot* (Jann 2014).

Table 1: Descriptive statistics and covariate balancing

	Control mean	Treatment			
		Legal duty	*Public expectations*	*Public support*	*Examples risks*
	(1)	(2)	(3)	(4)	(5)
Preferred extent of engagement in public discussions (outcome)					
Much less	0.007	-0.002	-0.001	0.001	0.002
		(0.004)	(0.004)	(0.004)	(0.004)
Less	0.024	-0.004	0.004	-0.004	0.003
		(0.007)	(0.008)	(0.007)	(0.008)
The same amount	0.215	0.000	0.029	-0.020	0.063 ***
		(0.020)	(0.021)	(0.020)	(0.021)
More	0.516	0.072 ***	0.026	0.044 *	-0.028
		(0.024)	(0.025)	(0.024)	(0.025)
Much more	0.238	-0.065 ***	-0.058 ***	-0.020	-0.040 *
		(0.020)	(0.020)	(0.020)	(0.020)
Observations	836	809	798	862	786
Gender					
Male	0.738	0.049 **	0.015	0.004	0.003
		(0.021)	(0.022)	(0.022)	(0.022)
Female	0.262	-0.049 **	-0.015	-0.004	-0.003
		(0.021)	(0.022)	(0.022)	(0.022)
Observations	810	780	783	830	765
Age group					
< 45 years	0.147	0.001	0.001	0.009	0.004
		(0.018)	(0.018)	(0.018)	(0.018)
45-54 years	0.401	-0.017	-0.012	-0.004	-0.014
		(0.024)	(0.024)	(0.024)	(0.025)
> 54 years	0.452	0.016	0.011	-0.006	0.010
		(0.025)	(0.025)	(0.024)	(0.025)
Observations	814	793	786	842	766
Type of professorship					
Associate professor	0.659	-0.006	-0.036	-0.041 *	-0.001
		(0.023)	(0.024)	(0.023)	(0.024)
Full professor	0.341	0.006	0.036	0.041 *	0.001
		(0.023)	(0.024)	(0.023)	(0.024)
Observations	836	809	798	862	786

(continued on next page)

Table 1 (continued)

	Control mean	Treatment			
		Legal duty	*Public expectations*	*Public support*	*Examples risks*
	(1)	(2)	(3)	(4)	(5)
Group of academic disciplines					
Engineering science	0.303	0.026 (0.023)	0.010 (0.023)	-0.025 (0.022)	0.004 (0.023)
Law, economics, social sciences and sports science	0.270	-0.005 (0.022)	0.035 (0.022)	0.020 (0.022)	0.024 (0.022)
Humanities and arts	0.198	-0.035 * (0.019)	-0.016 (0.019)	-0.030 (0.019)	-0.056 *** (0.019)
Mathematics and natural sciences	0.158	-0.003 (0.018)	-0.033 * (0.017)	0.005 (0.018)	0.024 (0.019)
Medicine, health sciences and others	0.071	0.018 (0.013)	0.003 (0.013)	0.031 ** (0.014)	0.003 (0.013)
Observations	832	803	795	857	781
Type of institution					
University	0.457	-0.001 (0.025)	0.004 (0.025)	0.027 (0.025)	-0.004 (0.025)
University of applied sciences	0.485	0.009 (0.025)	0.012 (0.025)	-0.021 (0.025)	0.006 (0.025)
College of art / music	0.058	-0.008 (0.011)	-0.016 (0.011)	-0.006 (0.011)	-0.002 (0.012)
Observations	807	791	784	835	761
Region					
West Germany	0.786	0.016 (0.020)	0.004 (0.021)	0.003 (0.020)	0.015 (0.020)
East Germany	0.214	-0.016 (0.020)	-0.004 (0.021)	-0.003 (0.020)	-0.015 (0.020)
Observations	809	783	781	838	766
Importance knowledge transfer					
Not / somewhat important	0.271	0.009 (0.022)	-0.012 (0.022)	-0.014 (0.021)	0.012 (0.022)
Very important	0.729	-0.009 (0.022)	0.012 (0.022)	0.014 (0.021)	-0.012 (0.022)
Observations	833	804	792	859	781
Importance societal engagement					
Not / somewhat important	0.460	-0.019 (0.025)	-0.020 (0.025)	-0.022 (0.024)	0.013 (0.025)
Very important	0.540	0.019 (0.025)	0.020 (0.025)	0.022 (0.024)	-0.013 (0.025)
Observations	834	804	791	859	783

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Table 1 (continued)

	Control mean	Treatment			
		Legal duty	*Public expectations*	*Public support*	*Examples risks*
	(1)	(2)	(3)	(4)	(5)
Press, radio or television					
No	0.535	-0.017	-0.029	-0.032	0.002
		(0.025)	(0.025)	(0.024)	(0.025)
Yes	0.465	0.017	0.029	0.032	-0.002
		(0.025)	(0.025)	(0.024)	(0.025)
Observations	823	792	789	846	768
Lectures or panel discussions					
No	0.306	-0.018	-0.042 *	-0.054 **	-0.018
		(0.023)	(0.022)	(0.022)	(0.023)
Yes	0.694	0.018	0.042 *	0.054 **	0.018
		(0.023)	(0.022)	(0.022)	(0.023)
Observations	830	801	791	853	775
Online social networks					
No	0.733	-0.023	0.001	-0.028	-0.002
		(0.022)	(0.022)	(0.022)	(0.022)
Yes	0.267	0.023	-0.001	0.028	0.002
		(0.022)	(0.022)	(0.022)	(0.022)
Observations	812	790	778	843	765
F-test joint significance					
p-value		0.830	0.485	0.267	0.133
Observations		1,449	1,456	1,499	1,427
Adj. R-squared		-0.004	0.000	0.002	0.004

Notes: The table shows the coefficients and robust standard errors from separate ordinary least-squares regressions of the covariates listed on the treatment indicators for the subsamples consisting of the control group and the respective treatment group, and the number of observations in the respective treatment group included in these estimations in columns (2) to (5), and the means of the variables and the number of observations for the control group in column (1). The coefficients represent the differences in the mean between the control group and the respective treatment group. At the bottom, the table shows summary statistics for F-tests on the joint significance of the covariates when regressing the treatment indicator on all control variables for the subsample consisting of the control group and the respective treatment group. “others” includes agronomy, forestry, nutrition science and veterinary medicine. Significance level: * p < 0.1, ** p < 0.05, *** p < 0.01.

Table 2: Main effects of the treatments

	(1)	(2)	(3)	(4)
Panel A: General support				
Legal duty	0.007	0.010	0.009	0.005
	(0.021)	(0.021)	(0.021)	(0.021)
Expectations public	-0.032	-0.032	-0.033	-0.039 *
	(0.022)	(0.022)	(0.022)	(0.021)
Support public	0.024	0.024	0.025	0.017
	(0.021)	(0.020)	(0.021)	(0.020)
Examples risks	-0.068 ***	-0.068 ***	-0.068 ***	-0.067 ***
	(0.022)	(0.022)	(0.022)	(0.022)
Observations	4,091	4,091	4,091	4,091
R-squared	0.005	0.012	0.018	0.061
Panel B: Strong support				
Legal duty	-0.065 ***	-0.064 ***	-0.064 ***	-0.066 ***
	(0.020)	(0.020)	(0.020)	(0.019)
Expectations public	-0.058 ***	-0.056 ***	-0.057 ***	-0.062 ***
	(0.020)	(0.020)	(0.020)	(0.020)
Support public	-0.020	-0.020	-0.020	-0.025
	(0.020)	(0.020)	(0.020)	(0.020)
Examples risks	-0.040 *	-0.039 *	-0.038 *	-0.035 *
	(0.020)	(0.020)	(0.020)	(0.020)
Observations	4,091	4,091	4,091	4,091
R-squared	0.004	0.008	0.015	0.058
Sociodemographic characteristics		x	x	x
Occupational characteristics			x	x
Engagement characteristics				x

Notes: The table shows the coefficients and standard errors of the treatment indicators estimated from linear probability models (ordinary least-squares regressions with robust standard errors) regressing the dummy variable indicating respondents' (strong) support for an increase in engagement on the treatment indicators. *Demographic characteristics:* gender (2 categories) and age (3 categories). *Occupational characteristics:* type of professorship (2 categories), group of academic disciplines (5 categories), type of institution (3 categories), and region (2 categories). *Engagement characteristics:* importance of knowledge transfer (2 categories), importance of societal engagement (2 categories), press, radio, or television (2 categories), lectures or panel discussions (2 categories), and online social networks (2 categories). Section 3.3 provides details. Missing values for the control variables are imputed, and imputation dummies are included in the regressions. The average in the control group is 0.754 for the dummy variable for general support and 0.238 for the dummy variable for strong support. Significance level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 3: Effects of average respondents' estimates of treatment information

	General support			Strong support		
	(1)	(2)	(3)	(4)	(5)	(6)
Legal duty	0.004	0.003	0.003	-0.068 ***	-0.064 ***	-0.059 **
	(0.021)	(0.021)	(0.025)	(0.019)	(0.019)	(0.024)
Legal duty difference		-0.001	-0.001		0.004 **	0.004 **
		(0.002)	(0.002)		(0.002)	(0.002)
Legal duty x legal duty difference			0.000			-0.001
			(0.004)			(0.004)
Expectations public	-0.041 *	-0.042 **	-0.038	-0.063 ***	-0.064 ***	-0.092 ***
	(0.021)	(0.021)	(0.029)	(0.020)	(0.020)	(0.026)
Expectations public difference		-0.001 **	-0.001 *		0.000	0.000
		(0.001)	(0.001)		(0.001)	(0.001)
Expectations public x expectations public difference			0.000			0.002
			(0.001)			(0.001)
Support public	0.015	0.014	0.044 *	-0.026	-0.027	-0.025
	(0.020)	(0.020)	(0.026)	(0.020)	(0.020)	(0.025)
Support public difference		-0.001 ***	-0.001 *		0.000	0.000
		(0.000)	(0.001)		(0.000)	(0.001)
Support public x support public difference			-0.002 *			0.000
			(0.001)			(0.001)
Controls	x	x	x	x	x	x
Observations	3,305	3,305	3,305	3,305	3,305	3,305
R-squared	0.064	0.070	0.071	0.065	0.068	0.069

Notes: The table shows the coefficients and standard errors of the treatment indicators, variables comprising the absolute value of the difference between respondents' elicitation estimate of the information provided by the treatments and the true value (columns (2) and (3) and (5) and (6)), and the interaction term between these two variables (columns (3) and (6)) estimated from linear probability models (ordinary least-squares regressions with robust standard errors) regressing the dummy variable indicating respondents' (strong) support for an increase in engagement on the indicated variables for the subsample consisting of the control group and the treatment groups listed. Full sets of demographic, occupational, and engagement characteristics are always included. See Section 3.3 and Table 1 for details. Missing values for the control variables and elicitation estimates are imputed, and imputation dummies are included in the regressions. Significance level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: Effects of asymmetric respondents' estimates of treatment information

	General support			Strong support		
	Under	*Correct*	*Over*	*Under*	*Correct*	*Over*
	(1)	(2)	(3)	(4)	(5)	(6)
Legal duty	0.005	-0.010	-	-0.078 ***	-0.055 *	-
	(0.030)	(0.033)		(0.027)	(0.031)	
Controls	x	x	x	x	x	x
Observations	872	659	-	872	659	-
R-squared	0.068	0.121		0.088	0.097	
Control mean	0.758	0.763		0.248	0.222	
Expectations public	-0.052	-0.034	-0.040	-0.045	-0.055	-0.088 **
	(0.035)	(0.036)	(0.048)	(0.032)	(0.034)	(0.044)
Controls	x	x	x	x	x	x
Observations	641	561	362	641	561	362
R-squared	0.091	0.089	0.166	0.081	0.113	0.159
Control mean	0.750	0.780	0.730	0.208	0.255	0.260
Support public	-0.032	0.075 **	-0.010	-0.033	-0.018	0.054
	(0.030)	(0.031)	(0.070)	(0.029)	(0.032)	(0.074)
Controls	x	x	x	x	x	x
Observations	817	661	160	817	661	160
R-squared	0.088	0.121	0.169	0.086	0.099	0.226
Control mean	0.755	0.744	0.788	0.238	0.220	0.300

Notes: The table shows the coefficients and standard errors of the treatment indicators estimated from linear probability models (ordinary least-squares regressions with robust standard errors) regressing the dummy variable indicating respondents' (strong) support for an increase in engagement on the treatment indicator for subgroups based on respondents' elicitation estimates within the subsample consisting of the control group and the respective treatment group. Full sets of demographic, occupational, and engagement characteristics are always included. See Section 3.3 and Table 1 for details. The table also shows summary statistics of the model estimation and the mean of the dummy variable indicating respondents' (strong) support for an increase in engagement in the control group. Subgroups 'legal duty' (true value = 15): "under" = 0-13, "correct" = 14-16; subgroups 'expectations public' (true value = 67): "under" = 0-59, "correct" = 60-70, "over" = 71-100; subgroups 'support public' (true value = 75): "under" = 0-69, "correct" = 70-80, "over" = 81-100. Missing values for the control variables are imputed, and imputation dummies are included in the regressions. Significance level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Online Appendix (NOT FOR PUBLICATION)

A. Figures and Tables

Figure A.1: Structure and content of the survey

Introduction

A Data protection and declaration of consent

B Opinions on third mission activities and the relation between science and society
2 questions

C Academic career
8 questions

D Opinions on exchange relations with society and the economy
3 questions

E Networking and exchange activities
5 questions

F Collaborations
6 questions

G Research activities, publications and talks
5 questions

H Teaching and continuing education
4 questions

I Intellectual property rights
3 questions

J Secondary employment and entrepreneurship
4 questions

K COVID-19 pandemic
2 questions
Survey experiment: Elicitation stage
2 questions
Survey experiment: Main stage
1 question

Control group	*Treatment group 1 "Legal duty"*	*Treatment group 2 "Expectations public"*	*Treatment group 3 "Support public"*	*Treatment group 4 "Examples risks"*
N = 836	N = 809	N = 798	N = 862	N = 786

L Current employment
5 questions

M Demographics
4 questions

N Conclusion
1 question

Notes: The figure shows the structure and content of the survey, including the number of questions, and details of the experimental design. The number of questions stated includes filtered questions that were shown to a subset of respondents only; some of the questions include multiple items.

Figure A.2: Wording of the experiment's outcome and treatments

The relevance of science and scientific findings for public opinion formation and political decisions has also increased outside the context of crises.

[*Auch über Krisensituationen hinaus hat die Bedeutung der Wissenschaft und ihrer Erkenntnisse für die öffentliche Meinungsbildung und politische Entscheidungen zugenommen.*]

Control group

Treatment group 1 "Legal duty"

Moreover, legislators have included knowledge and technology transfer as a general duty of higher education institutions in the higher education laws of all German federal states except for Hamburg.

[*Zudem ist der Wissens- und Technologietransfer im Allgemeinen mittlerweile in allen Bundesländern außer Hamburg vom Gesetzgeber als Aufgabe von Hochschulen in den Landeshochschulgesetzen festgeschrieben worden.*]

Treatment group 2 "Expectations public"

This is also mirrored in the German population's expectations of science. In a poll conducted in 2019, 67 percent of respondents stated that they agree with the following statement: "Decisions on science and research should primarily be based on their contribution to solving societal problems."

[*Dies spiegelt sich auch in den Erwartungen der Bevölkerung in Deutschland an die Wissenschaft wider. So gaben 2019 in einer Umfrage 67 % der Befragten an, dass sie der Aussage „Entscheidungen über Wissenschaft und Forschung sollten vor allem vor dem Hintergrund getroffen werden, ob sie einen Beitrag zur Lösung gesellschaftlicher Probleme leisten." zustimmen.*]

Treatment group 3 "Support public"

Moreover, there is broad support among the German population for academics' public engagement. In a poll conducted in 2019, 75 percent of respondents stated that they agree with the following statement: "Academics are right to speak out in public when political decisions do not take research results into account."

[*Zudem findet ein öffentliches Engagement von Wissenschaftler*innen breiten Rückhalt in der Bevölkerung in Deutschland. So gaben 2019 in einer Umfrage 75 % der Befragten an, dass sie der Aussage „Es ist richtig, dass Wissenschaftler sich öffentlich äußern, wenn politische Entscheidungen Forschungsergebnisse nicht berücksichtigen." zustimmen.*]

Treatment group 4 "Examples risks"

Nevertheless, the public engagement of academics also entails risks. For example, Professor Christian Drosten, Director of the Institute of Virology at the Charité Berlin, reported receiving death threats in relation to his public appearance in the context of the COVID-19 pandemic. Also, Professor Hendrik Streeck, Director of the Institute of Virology at the University Hospital Bonn, was sued in relation to a study on the COVID-19 pandemic.

[*Gleichwohl verbinden sich mit einem öffentlichen Engagement von Wissenschaftler*innen auch Risiken. So berichtete Professor Christian Drosten, Direktor des Instituts für Virologie an der Charité – Universitätsmedizin Berlin, von Morddrohungen im Zusammenhang mit seinem öffentlichen Auftreten im Kontext der Corona-Pandemie. Auch wurde gegen Professor Hendrik Streeck, Direktor des Instituts für Virologie am Universitätsklinikum Bonn, Strafanzeige im Zusammenhang mit einer Studie zur Corona-Pandemie gestellt.*]

If you consider academics from your own discipline, should these academics become less or more involved in public discussions in the future?

[*Wenn Sie die Wissenschaftler*innen Ihrer Fachdisziplin betrachten: Sollten sich diese in Zukunft weniger oder mehr in den öffentlichen Diskurs einbringen?*]

□ much less	□ less	□ the same amount	□ more	□ much more
[*viel weniger*]	[*weniger*]	[*gleich*]	[*mehr*]	[*viel mehr*]

Notes: The figure shows the survey question forming the experiment's outcome and the treatments in English and in the original German version. The treatments included the exact references to the sources of the information provided via a mouseover (see Section 3.1).

Table A.1: Descriptive statistics for the sample

	Sample		Population		Chi-squared test	
	N	*%*	*N*	*%*	χ^2	*p-value*
	(1)	(2)	(3)	(4)	(5)	(6)
Gender					1.176	0.278
Male	2,985	75.2	29,470	75.9		
Female	983	24.8	9,345	24.1		
Age group					-	-
< 45 years	603	15.1	-	-		
45-54 years	1,565	39.1	-	-		
> 54 years	1,833	45.8	-	-		
Type of professorship					31.221	0.000
Associate professor	2,626	64.2	23,345	60.1		
Full professor	1,465	35.8	15,470	39.9		
Group of academic disciplines					51.998	0.000
Engineering science	1,243	30.6	11,015	28.8		
Law, economics, social sciences and sports science	1,160	28.5	10,175	26.6		
Humanities and arts	696	17.1	6,885	18.0		
Mathematics and natural sciences	635	15.6	5,870	15.3		
Medicine, health sciences and others	334	8.2	4,325	11.3		
Type of institution					171.284	0.000
University	1,841	46.3	21,675	55.8		
University of applied sciences	1,930	48.5	15,215	39.2		
College of art / music	207	5.2	1,925	5.0		
Region					4.021	0.045
West Germany	3,156	79.4	31,265	80.5		
East Germany	821	20.6	7,550	19.5		
Importance knowledge transfer					-	-
Not / somewhat important	1,098	27.0	-	-		
Very important	2,971	73.0	-	-		
Importance societal engagement					-	-
Not / somewhat important	1,835	45.1	-	-		
Very important	2,236	54.9	-	-		

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Table A.1 (continued)

	Sample		Population		Chi-squared test	
	N	*%*	*N*	*%*	χ^2	*p-value*
	(1)	(2)	(3)	(4)	(5)	(6)
Press, radio or television					-	-
No	2,086	51.9	-	-		
Yes	1,932	48.1	-	-		
Lectures or panel discussions					-	-
No	1,132	28.0	-	-		
Yes	2,918	72.1	-	-		
Online social networks					-	-
No	2,880	72.2	-	-		
Yes	1,108	27.8	-	-		

Notes: The table shows the absolute number and share of professors in the sample and, where publicly available, the population by selected characteristics (for details see Section 3.3), and the results of Pearson's chi-squared tests. Data on the population are based on official higher education statistics and were retrieved via the information system *DZHW ICEland* (data set 60102). In contrast to the sample, data for the population include professors without permanent contracts. Totals among characteristics differ due to differences in categorization between the survey and the secondary data as well as item non-response in the survey data. “others” includes agronomy, forestry, nutrition science and veterinary medicine.

Table A.2: Comparison of the sample used in the analysis with the APIKS survey sample

	Sample analysis							APIKS survey sample					
	Engineering sciences	Law, economics, social sciences and sports science	Humanities and arts	Mathematics and natural sciences	(Veterinary) medicine, health sciences, agronomy, forestry and nutrition science	Full sample		Hard fields of knowledge basic	Hard fields of knowledge applied	Soft fields of knowledge basic	Soft fields of knowledge applied	Full sample
	%	%	%	%	%	%		%	%	%	%	%
	(1)	(2)	(3)	(4)	(5)	(6)		(7)	(8)	(9)	(10)	(11)
Year survey	2020						*Year survey*	2018				
Cooperation	*Involvement previous full year*						**Cooperation**	*Involvement current / previous year*				
Contract research	57	38	17	37	52	41	Contract research	19	41	18	28	28
Consulting	61	63	45	41	65	56	Consulting	26	55	40	52	44
Public engagement	*Use previous full year*						**Public engagement**	*Involvement current / previous year*				
Speeches, talks or podium discussions	66	80	78	58	80	72	Public speeches or talks	48	55	67	65	59
Books, articles or grey literature	49	72	64	46	72	59	Publications for broader audiences	23	26	47	39	34

Notes: The table shows descriptive statistics of the engagement with the nonacademic environment of professors at public higher education institutions in the sample used in the analysis and in the German survey sample of the research project *Academic Profession in Knowledge Societies* (APIKS) based on Schneijderberg and Götze (2020, 32-33). The table shows the shares of professors engaged in activities in the areas of cooperation and public engagement, both by academic discipline. In the case of the APIKS survey data on third mission activities, scientific disciplines are grouped along two dimensions: the first dimension distinguishes between hard fields of knowledge (i.e., the natural and technical sciences) and soft fields of knowledge (i.e., the humanities and social sciences); the second dimension distinguishes between disciplines oriented toward basic research (e.g, chemistry, German philology, physics and sociology) and disciplines oriented toward application (e.g., business administration, mechanical engineering and social work) (Schneijderberg and Götze 2020, 31). The APIKS survey data includes professors below the associate professorship (i.e., below the W2/C3 salary grade), which are not included in our sample.

Table A.3: Main treatment effects with survey weights applied to the sample

	Full sample	Sample without imputation	
		Unweighted	Weighted
	(1)	(2)	(3)
Panel A: General support			
Legal duty	0.005	0.016	0.018
	(0.021)	(0.021)	(0.022)
Expectations public	-0.039 *	-0.033	-0.032
	(0.021)	(0.022)	(0.023)
Support public	0.017	0.021	0.026
	(0.020)	(0.021)	(0.021)
Examples risks	-0.067 ***	-0.071 ***	-0.071 ***
	(0.022)	(0.023)	(0.023)
Controls	x	x	x
Observations	4,091	3,797	3,797
R-squared	0.061	0.061	0.066
Panel B: Strong support			
Legal duty	-0.066 ***	-0.072 ***	-0.067 ***
	(0.019)	(0.020)	(0.020)
Expectations public	-0.062 ***	-0.063 ***	-0.066 ***
	(0.020)	(0.020)	(0.020)
Support public	-0.025	-0.032	-0.031
	(0.020)	(0.021)	(0.021)
Examples risks	-0.035 *	-0.039 *	-0.036 *
	(0.020)	(0.021)	(0.021)
Controls	x	x	x
Observations	4,091	3,797	3,797
R-squared	0.058	0.058	0.058

Notes: The table shows the coefficients and standard errors of the treatment indicators estimated from linear probability models (ordinary least-squares regressions with robust standard errors) regressing the dummy variable indicating respondents' (strong) support for an increase in engagement on the treatment indicators. Full sets of demographic, occupational, and engagement characteristics are always included. See Section 3.3 and Table 1 for details. While column (1) provides the baseline results for comparison, column (2) reports results for the restricted sample without missing values in any of the covariates that are used for weighting the sample. Column (3) uses population weights, which are based on gender, type of professorship, group of academic disciplines, institutional type, and geographic location, to weight each observation. The population totals are listed in Appendix Table A.1 (population totals for the groups of academic disciplines were scaled to equal the totals of the other characteristics). Missing values for the control variables are imputed, and imputation dummies are included in the regressions; this excludes the variables used for the survey weights in columns (2) and (3). Significance level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.4: Effect heterogeneity by demographic characteristics

	Treatment								Subgroup		
	Legal duty		*Expectations public*		*Support public*		*Examples risks*		Control mean		N
	General support	*Strong support*	*General support*	*Strong support*	*General support*	*Strong support*	*General support*	*Strong support*	*General support*	*Strong support*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Gender											
Male	0.008	-0.039 *	-0.041	-0.047 **	0.020	-0.010	-0.045 *	-0.009	0.732	0.207	2,985
	(0.025)	(0.022)	(0.026)	(0.022)	(0.024)	(0.023)	(0.026)	(0.023)			
Female	0.018	-0.152 ***	-0.025	-0.105 **	0.015	-0.070	-0.120 ***	-0.086 **	0.816	0.311	983
	(0.039)	(0.042)	(0.040)	(0.042)	(0.037)	(0.044)	(0.041)	(0.043)			
Age group											
< 45 years	-0.056	-0.027	-0.125 **	-0.032	-0.060	-0.057	-0.157 ***	-0.014	0.808	0.217	603
	(0.054)	(0.053)	(0.058)	(0.052)	(0.052)	(0.050)	(0.059)	(0.053)			
45-54 years	0.039	-0.042	-0.026	-0.050	0.039	0.019	-0.053	-0.025	0.742	0.227	1,565
	(0.034)	(0.031)	(0.035)	(0.031)	(0.032)	(0.032)	(0.035)	(0.032)			
> 54 years	0.003	-0.086 ***	-0.029	-0.076 **	0.030	-0.050	-0.053	-0.041	0.755	0.255	1,833
	(0.031)	(0.029)	(0.032)	(0.030)	(0.030)	(0.030)	(0.032)	(0.031)			

Notes: In columns (1) to (8), the table shows the coefficients and standard errors of the treatment indicators estimated from linear probability models (ordinary least-squares regressions with robust standard errors) regressing the dummy variable indicating respondents' (strong) support for an increase in engagement on the treatment indicators. Full sets of demographic, occupational, and engagement characteristics are always included. See Section 3.3 and Table 1 for details. Missing values for the control variables (excluding those used for the sample split) are imputed, and imputation dummies are included in the regressions. In columns (9) to (11), the table shows the mean of the dummy variable indicating respondents' (strong) support and the number of observations in the subgroup. Significance level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.5: Effect heterogeneity by engagement characteristics

	Treatment								Subgroup		
	Legal duty		*Expectations public*		*Support public*		*Examples risks*		Control mean		N
	General support	*Strong support*	*General support*	*Strong support*	*General support*	*Strong support*	*General support*	*Strong support*	*General support*	*Strong support*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Importance knowledge transfer											
Not / somewhat important	0.004	-0.042	-0.036	-0.056 *	0.036	0.008	-0.074	-0.036	0.650	0.142	1,098
	(0.044)	(0.030)	(0.046)	(0.030)	(0.044)	(0.034)	(0.046)	(0.031)			
Very important	0.002	-0.080 ***	-0.044 *	-0.071 ***	0.006	-0.038	-0.070 ***	-0.036	0.794	0.275	2,971
	(0.023)	(0.024)	(0.024)	(0.024)	(0.022)	(0.024)	(0.025)	(0.025)			
Importance societal engagement											
Not / somewhat important	0.008	-0.042 *	-0.032	-0.038	-0.004	-0.011	-0.089 **	-0.022	0.675	0.138	1,835
	(0.034)	(0.024)	(0.034)	(0.024)	(0.033)	(0.025)	(0.035)	(0.024)			
Very important	-0.001	-0.083 ***	-0.049 *	-0.077 ***	0.023	-0.034	-0.053 *	-0.046	0.822	0.322	2,236
	(0.025)	(0.029)	(0.027)	(0.030)	(0.024)	(0.030)	(0.027)	(0.031)			
Press, radio or television											
No	-0.016	-0.078 ***	-0.046	-0.055 **	0.010	-0.042	-0.067 **	-0.019	0.736	0.205	2,086
	(0.030)	(0.025)	(0.030)	(0.025)	(0.029)	(0.026)	(0.031)	(0.027)			
Yes	0.019	-0.064 **	-0.033	-0.083 ***	0.024	-0.026	-0.069 **	-0.053 *	0.781	0.285	1,932
	(0.028)	(0.031)	(0.030)	(0.030)	(0.028)	(0.031)	(0.031)	(0.031)			
Lectures or panel discussions											
No	-0.011	-0.079 **	-0.025	-0.088 ***	0.037	-0.044	-0.030	-0.017	0.669	0.189	1,132
	(0.042)	(0.031)	(0.044)	(0.031)	(0.042)	(0.034)	(0.043)	(0.034)			
Yes	0.009	-0.060 **	-0.047 *	-0.051 **	0.012	-0.021	-0.076 ***	-0.039	0.790	0.260	2,918
	(0.023)	(0.024)	(0.024)	(0.024)	(0.023)	(0.024)	(0.025)	(0.025)			

(continued on next page)

Table A.5 (continued)

	Treatment								Subgroup		
	Legal duty		*Expectations public*		*Support public*		*Examples risks*		Control mean		N
	General support	*Strong support*	*General support*	*Strong support*	*General support*	*Strong support*	*General support*	*Strong support*	*General support*	*Strong support*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Online social networks											
No	-0.007	-0.072 ***	-0.025	-0.075 ***	0.011	-0.048 **	-0.060 **	-0.040 *	0.738	0.235	2,880
	(0.025)	(0.023)	(0.025)	(0.023)	(0.025)	(0.023)	(0.026)	(0.024)			
Yes	0.007	-0.071 *	-0.095 **	-0.040	0.020	-0.001	-0.080 **	-0.024	0.811	0.249	1,108
	(0.036)	(0.038)	(0.041)	(0.041)	(0.035)	(0.040)	(0.040)	(0.041)			

Notes: In columns (1) to (8), the table shows the coefficients and standard errors of the treatment indicators estimated from linear probability models (ordinary least-squares regressions with robust standard errors) regressing the dummy variable indicating respondents' (strong) support for an increase in engagement on the treatment indicators. Full sets of demographic, occupational, and engagement characteristics are always included. See Section 3.3 and Table 1 for details. Missing values for the control variables (excluding those used for the sample split) are imputed, and imputation dummies are included in the regressions. In columns (9) to (11), the table shows the mean of the dummy variable indicating respondents' (strong) support and the number of observations in the subgroup. Significance level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

B. Robustness Check Analysis Effect Mechanism

The analysis of whether an alteration of respondents' prior knowledge or an increased salience of the frame provided is the mechanism responsible for the treatment effects observed is complicated by the fact that some respondents apparently corrected their initial estimates after having learned the true value from the treatment. Due to the structure and requirements of the survey in which the experiment was embedded, the questions eliciting respondents' prior knowledge were located in the same section as the treatments. We check whether the resulting opportunity for correcting the initial estimates has been seized in two ways. First, we compare the shares of respondents who estimated exactly the true value between the treatment group to which the true value was revealed and the remainder of the sample. Second, we regress the absolute value of the deviation of respondents' estimate from the true value on the indicator for the treatment group to which the true value was revealed. The results suggest that the initial estimates were indeed corrected in some cases.

The extent of corrections of the initial elicitation estimates is particularly pronounced in the case of the treatment referring to the legal duties of higher education institutions. The share of respondents estimating the correct value of federal states that implemented knowledge and technology transfer in their higher education laws is markedly higher in the treatment group to which the true value was revealed (29.0 percent) than in the remainder of the sample (4.1 percent). The regression shows that the estimates in that treatment group are on average 1.6 units closer to the true value of 15 than in the remainder of the sample and that this difference is highly significant (see Table B.1). This is a sizeable difference in the light of an average deviation in the remainder of the sample of 5.4 units. One explanation for the extent of corrections could be that respondents encountered comparatively greater difficulties with this elicitation question. This is at least suggested by the number of 265 missing responses, which is about twice as high as the number of missing responses for the two other elicitation questions (156 and 135).

The extent of corrections is less pronounced in the case of the treatment referring to public expectations, but still visible. The share of respondents estimating the correct value of the share of respondents to the public opinion poll who expect science to contribute to societal development is higher in the treatment group to which the true value was revealed (4.4 percent) than in the remainder of the sample (0.1 percent). The regression shows that the estimates in that treatment group are on average 1.5 units closer to the true value of 67 than in the remainder of the sample and that this difference is statistically significant (see Table B.1). However, this difference is put into perspective by an average deviation in the remainder of the sample of 17.7 units.

The extent of corrections is negligible in the case of the treatment referring to public support. The share of respondents estimating the correct value of the share of respondents to the public opinion poll who support academics' engagement in public discussions is still higher in the treatment group to which the true value was revealed (8.8 percent) than in the remainder of the sample (5.8 percent). The regression shows that the estimates in that treatment group are on average 1.0 units closer to the true value of 75 than in the remainder of the sample, but this effect is not statistically significant (see Table B.1). Moreover, this difference is small compared to an average deviation in the remainder of the sample of 18.9 units.

The results of a robustness check confirm that respondents' retrospective corrections do not distort our analysis of the effect mechanism. For this check, we estimate the linear probability models including a variable based on the elicitation estimates and an interaction term between this variable and the treatment indicators of the original analysis, but exclude all observations where the elicitation estimate corresponds exactly to the true value of the information provided by the treatment. This omission strongly reduces the extent to which the average deviation of the elicitation estimates from the true value differs between the treatment group to which the true value was revealed and the remainder of the sample: for the number of federal states, from -1.6 to -0.3, and for the shares of respondents to the public opinion poll, from -1.5 to -0.8 and from -1.0 to -0.4, respectively. As shown by the results in Table B.2, adapting the sample in this way does not lead to relevant differences with the original analysis. The only change concerning the interaction terms, which are of interest in this analysis, is that the marginal interaction term including the treatment referring to public support in the case of support in general becomes significant at the five percent level. We can thus preclude that the retrospective corrections obfuscate our analysis of the effect mechanism.

Table B.1: Differences in the accuracy of the elicitation estimates among experimental groups

	Deviation estimates	
	(1)	
Legal duty	-1.636	***
	(0.178)	
Constant	5.436	***
	(0.081)	
Observations	3,811	
R-squared	0.021	
Expectations public	-1.488	**
	(0.578)	
Constant	17.719	***
	(0.260)	
Observations	3,932	
R-squared	0.002	
Support public	-0.961	
	(0.665)	
Constant	18.937	***
	(0.308)	
Observations	3,954	
R-squared	0.001	

Notes: The table shows the results of ordinary least-squares regressions (with robust standard errors) of the deviation of the elicitation estimate (i.e., the absolute value of the difference between respondents' estimate and the true value) on the treatment indicator for the full sample. The coefficients represent the average change in the deviation of the elicitation estimate from the true value due to belonging to the treatment group to which the true value was revealed; the constant represents the mean deviation within the remainder of the sample. Significance level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B.2: Robustness check of the effects of average respondents' estimates of treatment information

	General support				Strong support			
	Full sample		*Reduced sample*		*Full sample*		*Reduced sample*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Legal duty	0.004	0.003	0.008	0.025	-0.068 ***	-0.059 **	-0.055 **	-0.029
	(0.021)	(0.025)	(0.023)	(0.032)	(0.019)	(0.024)	(0.022)	(0.031)
Legal duty difference		-0.001		0.000		0.004 **		0.005 **
		(0.002)		(0.002)		(0.002)		(0.002)
Legal duty x		0.000		-0.003		-0.001		-0.005
legal duty difference		(0.004)		(0.005)		(0.004)		(0.004)
Expectations public	-0.041 *	-0.038	-0.048 **	-0.036	-0.063 ***	-0.092 ***	-0.072 ***	-0.095 ***
	(0.021)	(0.029)	(0.023)	(0.031)	(0.020)	(0.026)	(0.021)	(0.028)
Expectations public difference		-0.001 *		-0.001		0.000		0.000
		(0.001)		(0.001)		(0.001)		(0.001)
Expectations public x		0.000		-0.001		0.002		0.001
expectations public difference		(0.001)		(0.001)		(0.001)		(0.001)
Support public	0.015	0.044 *	0.019	0.063 **	-0.026	-0.025	-0.027	-0.021
	(0.020)	(0.026)	(0.021)	(0.028)	(0.020)	(0.025)	(0.021)	(0.028)
Support public difference		-0.001 *		-0.001		0.000		0.001
		(0.001)		(0.001)		(0.001)		(0.001)
Support public x		-0.002 *		-0.002 **		0.000		0.000
support public difference		(0.001)		(0.001)		(0.001)		(0.001)
Controls	x	x	x	x	x	x	x	x
Observations	3,305	3,305	2,773	2,773	3,305	3,305	2,773	2,773
R-squared	0.064	0.071	0.064	0.072	0.065	0.069	0.069	0.074

Notes: The table shows the coefficients and standard errors of the treatment indicators and, in columns (2), (4), (6) and (8), of the variables consisting of the absolute value of the difference between respondents' elicitation estimates of the information provided by the treatments and its true value and the interaction term between these two variables estimated from linear probability models (ordinary least-squares regressions with robust standard errors) regressing the dummy variable indicating respondents' (strong) support for an increase in engagement on the variables and the interaction terms indicated for the subsample consisting of the control group and the treatment groups listed. Columns (3), (4), (7) and (8) run the regressions on a reduced sample that drops all observations where an estimate of any of the elicitation questions is equal to the true value. Columns (1), (2), (5) and (6) provide the results on the full sample for comparison. Full sets of demographic, occupational, and engagement characteristics are always included. See Section 3.3 and Table 1 for details. Missing values for the control variables and the elicitation estimates are imputed, and imputation dummies are included in the regressions. Significance level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.