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# The Role of Information Provision for Attitudes Towards Immigration: An Experimental Investigation.

## Abstract

We conduct a survey experiment on the effect of information provision on attitudes towards immigration in Germany. The focus lies on two theory-based economic channels, labor market and welfare state concerns, and immigration policy preferences. Using probability-based representative survey data, we experimentally vary the quantity and the type of information provided to respondents. We find that a bundle of information on both the share and the unemployment rate of foreigners robustly decreases welfare state concerns about immigration. There are slightly less pronounced effects on the labor market and policy channels. Further data-driven analyses reveal heterogeneity in treatment effects. Our findings therefore suggest that careful composition and targeting of information interventions can increase their effectiveness in the public debate on immigration.

JEL-Codes: C900, D830, F220, J150.

Keywords: immigration attitudes, survey experiment, information provision, belief updating, welfare state, labor market, machine learning.

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# 1 Introduction

Immigration is a salient topic in policy debate. During the recent decade, economic nationalism and public opposition towards immigration have increased across Western societies (Colantone and Stanig 2019). In conjunction with this development, it has been shown that immigration to several European countries is causally linked to observed increases in right-wing voting behavior (Barone et al. 2016; Edo et al. 2019; Halla et al. 2017), and that the debate on immigration seems to be a relevant determinant of voting intentions (Barrera et al. 2020). While these findings may reflect a general increase in anti-foreigner sentiments, native populations in both Europe and the United States also tend to be considerably misinformed about key facts about immigration, such as the share and the unemployment rate of foreigners (Alesina et al. 2018; Citrin and Sides 2008).

Biases in beliefs about immigrants may result in negative political, social and economic attitudes towards them, potentially aggravating their integration in host societies. Against this background, it is of high relevance to better understand the relationship between beliefs, factual information, and immigration attitudes. The aim of this paper is to study the effect of information provision on attitudes towards immigration by means of a survey experiment, focussing on potentially differential effects depending on the quantity and type of information provided and the economic and policy channels considered.

The methodology of information provision experiments allows for the identification of causal effects of information on preferences and attitudes and has been applied to a wide variety of topics. For instance, recent work studies the effects of information provision on preferences for redistribution and governmental education spending (Cruces et al. 2013; Kuziemko et al. 2015; Lergetporer et al. 2018), but also on more specific attitudes in relation to news consumption or payment for human organs (Chopra et al. 2019; Elias et al. 2015).[1]

Very recently, information provision experiments have also been employed to examine the causal impact of information on attitudes towards immigration, presenting mixed evidence on treatment effects. While effects have been found regarding the provision of a large bundle of information (Grigorieff et al. 2020), there is no evidence, so far, that a similar effect related to the provision of a single piece of information exists (Hopkins et al. 2019). Other studies

[1]See Haaland et al. (2020) for a comprehensive survey on the methodology and literature in the context of information provision experiments.

have concentrated on attitudes towards refugees and asylum seekers, presenting both sizeable treatment effects as well as consistent null effects of information provision (Getmansky et al. 2018; Lergetporer et al. 2017; Hayo and Neumeier 2020).

Considering the previous literature, the question arises whether this observed heterogeneity in treatment effects is based on the quantity of information or its type, or on both of these dimensions. In addition, previous studies have so far mostly focused on more general measures of immigration attitudes and policy preferences. We therefore extend the existing literature in several ways: First, we experimentally vary both the quantity and the type of information provided based on two key statistics about immigration: the share and the unemployment rate of foreigners. Second, we investigate the effect of information provision on the two theory-based economic channels of attitudes towards immigration emphasized in the seminal model by Facchini and Mayda (2009): the labor market and the welfare state channels. We expand this analysis by also accounting for immigration policy preferences. Third, we explicitly analyze the hypothesized link between information provision, belief updating, and attitudinal change based on the share and the unemployment rate of foreigners.

We find that a bundle of information on both the share and the unemployment rate of foreigners provided to respondents robustly decreases their welfare state concerns about immigration. The effects of information provision on the labor market and policy channels are slightly less pronounced. In addition, we present evidence that larger, i.e. more biased beliefs about the unemployment rate of foreigners are negatively linked with attitudes towards immigrants. While our findings hence suggest the type of information to be a relevant determinant of treatment effectiveness based on the distribution of prior beliefs in the population, the quantity of interrelated information provided seems to be the decisive factor for attitudinal change.

Further data-driven analyses of conditional average treatment effects (CATE) following Athey and Imbens (2016, 2019) reveal that treatment effectiveness varies considerably across different societal groups. This raises important implications for policy measures aiming to reduce biases in beliefs about immigration: Precise targeting of societal groups and a careful composition of information provided to the population have the potential to increase the effectiveness of governmental information campaigns in the context of the current debate on immigration.

The paper proceeds as follows: The experimental design and our hypotheses are introduced in the following section. Section 3 presents the data and section 4 the main results of our information provision experiment. While section 5 examines the relevance of belief updating as a driver for the observed effects of our information treatments, section 6 expands the discussion by following a data-driven approach to uncovering treatment effect heterogeneity, and by investigating the persistence of treatment effects over time. Concluding remarks can be found in section 7.

## 2 Design and Hypotheses

In this section, we will introduce the experimental design of our information provision experiment. In conjunction with our experimental design, we also discuss main hypotheses which we aim to investigate in our empirical analysis.

### 2.1 Experimental design

To allow for a causal identification of the effects of information provision on attitudes towards immigration, we design and conduct a survey experiment. Our experimental design is based on prior work by Grigorieff et al. (2020), Hopkins et al. (2019), and Lergetporer et al. (2017). We extend their designs by disentangling potentially heterogeneous effects with respect to the information provided. For that purpose, we experimentally vary both the quantity and the type of information between our treatment arms and embed our experiment in a probability-based representative population survey. Our experimental design consists of four stages and three treatment arms. A graphical overview of our experimental design is depicted in figure 1.

In the *first stage*, we elicit respondents' beliefs about two key statistics of immigration: the share and the unemployment rate of foreigners.[2] In addition, we elicit respondents' beliefs about the general unemployment rate which serves as a benchmark for their overall beliefs about federal statistics.

[2]We follow a two-stage elicitation procedure in order to reduce the number of missing values in prior beliefs. Specifically, respondents are first asked to submit their beliefs as integers in the range from 0 to 100. Respondents not willing to submit narrow integer beliefs are asked to alternatively state their beliefs based on an interval scheme. For our analysis, we pool the data on beliefs based on the interval scheme.

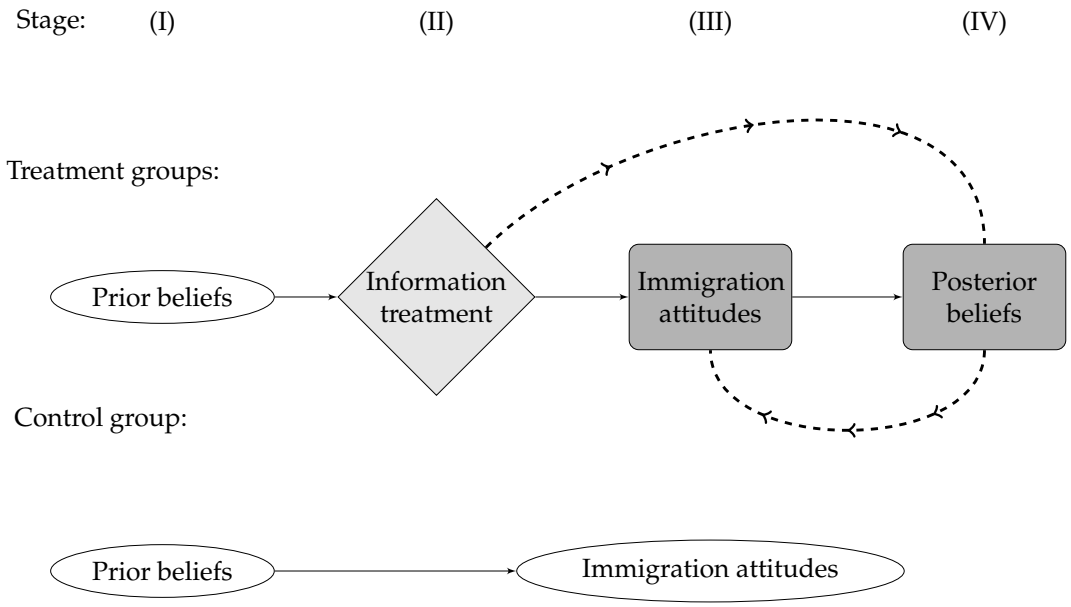


Figure 1: Setup of the experiment.

In the *second stage*, we provide random subsets of respondents with true information about the share and the unemployment rate of foreigners.[3] Specifically, our treatment arms *A*, *B*, and *C* differ in terms of the provision of these key statistics: while respondents in the first and second arms *A* and *B* receive information only on either the share or the unemployment rate of foreigners, respectively, respondents in the third treatment arm *C* receive a bundle of information containing both statistics. In addition to the true information, our information treatments involve conditional feedback on respondents' prior beliefs, revealing wether they correctly estimated the respective statistic, or wether they underestimated or overestimated it. In contrast, respondents in the control group neither receive feedback nor information on the true values.

In the *third stage*, we employ literature-based survey measures of welfare state concerns, labor market concerns and immigration policy preferences to investigate the causal effect of information provision on attitudes towards immigration. The welfare state and labor market channels of immigration attitudes have been emphasized by theory (Facchini and Mayda 2009) and are widely discussed in the empirical literature (Scheve and Slaughter 2001; Ortega and Polavieja 2012; Dahlberg et al. 2012; Hainmueller and Hiscox 2010; Naumann et al. 2018). We therefore focus on these two economic channels of attitudes towards immigration.

[3]Note that we do not provide the true value for the general unemployment rate within our information treatments.

Following the notion of Facchini and Mayda (2009), the welfare state channel describes concerns of the native population about adverse effects of immigration on taxation, the welfare state, and public good provision. The labor market channel on the other hand relates to concerns of native individuals about increasing labor market competition as a consequence of immigration. We expand our analysis by also investigating the effects of information provision on immigration policy preferences.

In the *fourth stage*, we elicit posterior beliefs about the share and the unemployment rate of foreigners for respondents who received one of our information treatments. To reduce concerns about experimenter demand, the elicitation of posterior beliefs takes place at the very end of the survey. Specifically, respondents in treatment arm *A* are asked again about their beliefs about the share of foreigners, respondents in treatment arm *B* are asked again about their beliefs about the unemployment rate of foreigners, and respondents in treatment arm *C* are asked again about both of their beliefs. In addition to our main experiment, we conduct a follow-up survey to investigate whether changes in beliefs caused by our information treatments persist over time.

In our analysis, section 4 concentrates on the direct effects of our information treatments on attitudes towards immigration. As an extension to this reduced-form analysis, we examine the channel of belief updating as a driver behind treatment effects in section 5. Treatment effect heterogeneity and the follow-up study are discussed in section 6.

### 2.2 Hypotheses

Despite posterior beliefs of respondents being elicited at the final stage of the experiment, we assume respondents to update their beliefs immediately after the receipt of information. This hypothesized channel of belief updating is visually indicated by the dashed line in figure 1, representing an immediate update of beliefs translating into attitudinal change.

Concerning the potential attitudinal change as a consequence of our information intervention, we distinguish hypotheses about treatment effects based on the three outcomes investigated. To derive our hypotheses, we concentrate on the case of overestimation, i.e. beliefs of respondents which are positively biased on average. This assumption is supported both ex ante by the literature on misperceptions about immigration (Alesina et al. 2018; Citrin and

Sides 2008; Grigorieff et al. 2020), as well as ex post based on our results presented in section 4. In this setting, we expect our information treatments to induce an exogenous downward shift in respondents' beliefs about the share and the unemployment rate of foreigners, on average. Based on this assumption, we derive the following hypotheses on the effects of information provision:

*Hypothesis 1 – Welfare state channel:* Information provision translates into a more positive assessment of immigrants' welfare state contribution and hence lower welfare state concerns when respondents learn about a smaller size of the immigrant population and/or higher employedness of immigrants than believed ex ante on average.

*Hypothesis 2a – Labor market channel I:* Information provision translates into *lower* concerns of respondents about labor market competition when they learn about a smaller size of the immigrant population and/or higher employedness of immigrants than believed ex ante on average. In this setting, this is perceived as *less current* competition on the job market.

*Hypothesis 2b – Labor market channel II:* Information provision translates into *the same or larger* concerns of respondents about labor market competition when they learn about a smaller size of the immigrant population and higher employedness of immigrants than believed ex ante on average. In this setting, the higher employedness of immigrants is perceived as *larger potential* competition on the job market, while the smaller size of the immigrant population is, again, perceived as *less current* competition on the job market, with both effects potentially offsetting each other.

*Hypothesis 3 – Immigration policy preferences:* Information provision translates into more positive immigration policy preferences of respondents when they learn about a smaller size of the immigrant population and/or higher employedness of immigrants than believed ex ante on average.

We revisit these hypotheses in sections 4 and 5 and assess them based on the treatment effects of information provision and the process of belief updating observed.

## 3 Data

Our information provision experiment was implemented into a tailored representative population survey of 1000 individuals within the Eastern German State of Thuringia in September

Table 1: Demographic comparison of Thuringia and Eastern and Western German state averages.

| | Thuringia | Eastern Germany | Western Germany |
|---|---|---|---|
| GDP per capita | 29883 | 29739 | 43826 |
| Household net income | 1648 | 1644 | 1882 |
| Population density | 132 | 123 | 947 |
| Age (mean) | 47.2 | 47.2 | 44.0 |
| Household size (mean) | 1.91 | 1.91 | 1.97 |
| Unemployment rate | 5.3 | 6.2 | 5.6 |
| Share of foreigners | 5.4 | 5.3 | 15.1 |
| Unemployment rate of foreigners | 14.9 | 17.1 | 14.0 |

*Notes:* The demographic statistics presented are based on current data availability, spanning years from 2017 to 2019.

and October 2019. The survey contained attitudinal measures related to the general economic situation, the perception of immigrants and interculturalism, the economic impact of immigration, immigration policy, and general political and social attitudes. The survey measure used to assess pre-treatment concerns about immigration is related to the German Socioeconomic Panel (SOEP). The survey measures employed to investigate the labor market and the welfare state channels of immigration attitudes are based on the European Social Survey (ESS).

For the measurement of immigration policy preferences, we follow a wording based on questions used in previous work studying preferences over immigration policy. Specific wording differs slightly between survey sources, such as in the ESS used by Card et al. (2012), in the National Identity module of the International Survey Program (ISSP) studied by Mayda (2006), in the National Election Studies (NES) employed by Scheve and Slaughter (2001), or in related work by Grigorieff et al. (2020).[4] In essence, however, these questions ask respondents to assess the number of immigrants that should be allowed to migrate to the host country. A descriptive overview of the survey measures employed in our analysis is presented in table A1 in the appendix.

Following the literature, our outcome variables are coded such that a higher value indicates a more positive attitude towards immigration. Labor market and welfare state concerns are measured on an 11-point scale, and immigration policy preferences are measured on a 5-point scale, respectively. The survey was implemented as Computer Assisted Telephone Interviews (CATI) administered by a professional survey company. The use of CATI enables us to draw a probability-based sample of the general population and allows for a reliable regional classifi-

[4]Note that while these studies sometimes differentiate between the origin country, ethnicity, or legal status of immigrants, the survey measure discussed here refers to immigration in general.

cation of respondents.[5] In addition to the main survey, we conducted a follow-up survey with 200 individuals from the first survey round.

To assess how our sample compares to other Eastern German states (excluding Berlin), table 1 presents a descriptive comparison of demographic statistics. This comparison suggests that Thuringia is suited to serve as a benchmark for the average characteristics of Eastern German states. In particular, economic performance, household income, the share of foreigners, and the general unemployment rate are highly comparable, with a slight deviation in terms of the unemployment rate of foreigners by about 2 percentage points. The comparison of Thuringia to the average of Western German states shows, unsurprisingly, notable differences in terms demographics. We therefore interpret our sample as comparable to the general Eastern German population, but stay careful concerning a comparison to Western Germany.

# 4 Main Results

We, first, check for balance in covariates between treatment and control groups. Second, we explore what determinants influence biases in beliefs about immigration statistics and investigate whether respondents in the treatment arms update their beliefs based on the information provided. We then proceed to estimate the causal effect of our information treatments on the welfare state and the labor market channels as well as on immigration policy preferences.

## 4.1 Experimental balance

To assess balance across experimental groups, table A2 in the appendix shows tests for experimental balance in terms of observable characteristics.[6] The experimental groups are well

[5]We employ representativity weights throughout the analysis. Specifically, our data are weighted based on official statistics by age, gender, educational background, household size, and BIK-class, a regional classification scheme in the context of CATI. Some respondents were not able to provide their prior beliefs about immigration statistics or did not answer some of our survey questions. For the part of our analysis examining exogenous treatment effects, we recode missing values of our covariates as 0 and simultaneously include indicators controlling for missingness in all specifications.

[6]Note that political attitudes and generalized trust were measured post-treatment. However, we assume these to be rather stable personal attitudes which are likely to be inelastic to our information interventions, which is supported by the balance tests.

Table 2: Determinants of biases in prior beliefs.

| | Share of foreigners | | Unemployment rate of foreigners | |
|---|---|---|---|---|
| Concerns about immigration | 0.02** | (0.01) | 0.08*** | (0.01) |
| Prior beliefs: general unemployment rate | 0.12*** | (0.01) | 0.01 | (0.01) |
| Political attitude | −0.01 | (0.02) | 0.00 | (0.02) |
| Generalized trust | −0.04*** | (0.01) | −0.02 | (0.02) |
| Age group | 0.01 | (0.03) | 0.10*** | (0.03) |
| Female | 0.27*** | (0.07) | 0.25*** | (0.07) |
| Employed | −0.09 | (0.08) | 0.15* | (0.08) |
| Household size | −0.02 | (0.03) | 0.03 | (0.03) |
| Education: high | −0.14*** | (0.05) | −0.10 | (0.07) |
| Migration background | −0.04 | (0.11) | −0.03 | (0.12) |
| Rural district | −0.03 | (0.07) | 0.02 | (0.08) |
| Number of observations | 881 | | 879 | |

*Notes:* The dependent variables have been standardized in terms of their mean and standard deviation. Biases in beliefs are defined in absolute terms. Robust standard errors are displayed in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All regressions employ survey weights.

balanced and we only observe few marginal imbalances.[7] We are hence confident that our data allows for a causal interpretation of treatment effects.

### 4.2 Determinants of prior beliefs

As a preliminary step in our analysis, we explore which factors are associated with respondents' prior beliefs about the share and the unemployment rate of foreigners. For that purpose, we transform our data on prior beliefs such that it represents the biases in beliefs in absolute terms.[8] Table 2 presents the estimation results for biases in beliefs.

As the results show, pre-treatment concerns about immigration are strongly positively associated with biases in beliefs about the share and the unemployment rate of foreigners. In addition, prior beliefs about the general unemployment rate are positively correlated with biases in beliefs about the share of foreigners, but not with biases in beliefs about the unemployment rate of foreigners. These results suggest that respondents with larger immigration concerns report more strongly biased beliefs in general, and that prior beliefs about the general unemployment rate may serve as a benchmark for prior beliefs about the share of foreigners.

[7] In our specifications, we account for heterogeneity in prior beliefs by controlling for prior beliefs about the share and the unemployment rate of foreigners, thereby taking into account their marginal imbalances for treatment group $A$.

[8] To assess robustness, table A3 in the appendix presents results for only those individuals who are overestimating the respective statistics.

Higher levels of generalized trust are highly statistically significantly associated with lower biases in beliefs about the share, but not with beliefs about the unemployment rate of foreigners. Regarding socio-demographics, higher education is associated with lower biases in beliefs about the share of foreigners. Older respondents tend to report more biased beliefs about the unemployment rate of foreigners. The same association is observed for employed respondents. Female respondents' beliefs are on average more biased compared to male respondents in both cases. Interestingly, we observe no heterogeneity in biases in prior beliefs with respect to rural as compared to urban districts.

### 4.3 Updating of prior beliefs

We expect that respondents update their prior beliefs based on the information received during treatment and form posterior beliefs about the share and the unemployment rate of foreigners which are closer to the true values. Figure 2 depicts a graphical comparison between prior and posterior beliefs of respondents within treatment arms. The average prior beliefs about the share of foreigners are about 5 percentage points above the true value of 5 percent and the unemployment rate of foreigners, which true value amounts to 15 percent, is overestimated by about 35 percentage points on average.[9]

As to posterior beliefs, respondents in the treatment arms, on average, clearly update their beliefs about the share and the unemployment rate of foreigners according to the true information received. The within-subject differences between prior and posterior beliefs are significantly different from one another, both for the share and the unemployment rate of foreigners.[10] Our data therefore suggest that, on average, respondents overestimate both the share and the unemployment rate of foreigners prior to treatment, and that they update their beliefs based on the information received during treatment.

[9]Note that the governmental statistics of the share and the unemployment rate of foreigners used in our information treatment are based on citizenship. This is reflected by the question on the share of foreigners (see table A1 in the appendix). Respondents are on average relatively well informed about this statistic which suggests that they employ this definiton also for their beliefs about the unemployment rate of foreigners.

[10]Specifically, the p-values of a paired t-test are significant on the 1-percent level in both cases.

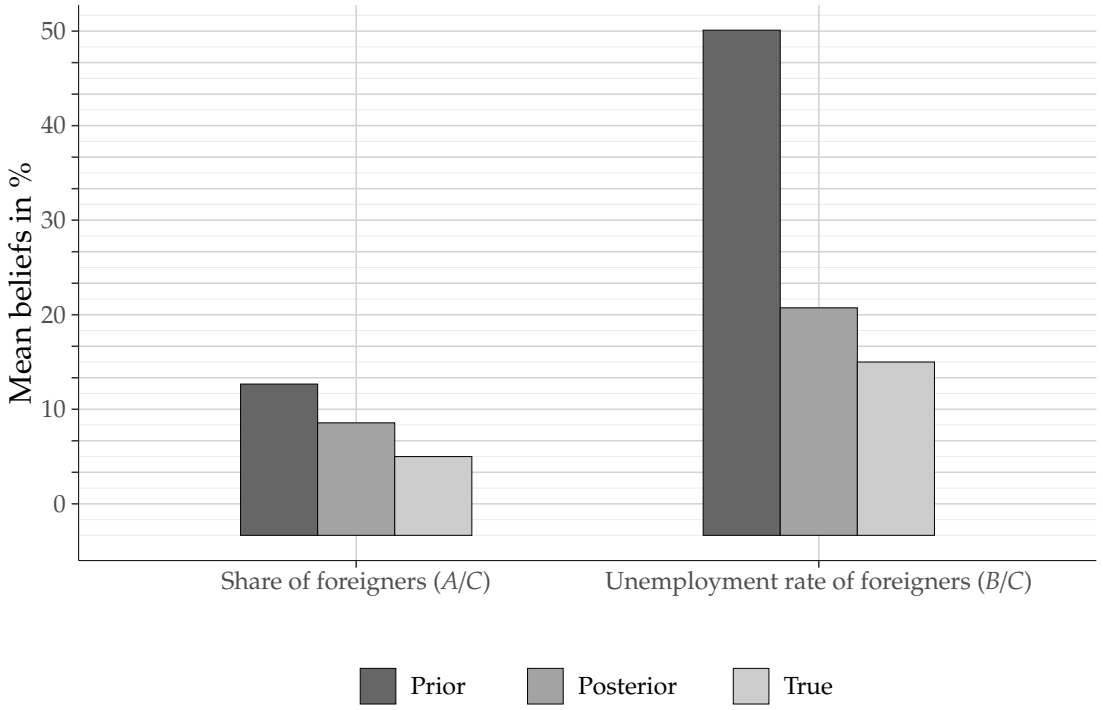


Figure 2: Comparison of beliefs within treatment arms.

### 4.4 Effects of information

We analyze the causal effect of our information treatments on the two economic channels of attitudes towards immigration – welfare state and labor market concerns – and on immigration policy preferences by estimating the following equation:

$$y_i = \gamma_0 + \gamma_1 A_i + \gamma_2 B_i + \gamma_3 C_i + \gamma^T X_i + \varepsilon_i, \tag{1}$$

where $y_i$ represents the outcome variable, $A_i$, $B_i$, and $C_i$ are treatment indicators for the different treatment arms, $X_i$ contains socio-demographic and attitudinal controls, and $\varepsilon_i$ is the error term.

Table 3 shows the estimation results for welfare state and labor market concerns about immigration as well as immigration policy preferences. Regarding the treatment indicators, treatment *C*, comprising of information on both the share and the unemployment rate of foreigners, positively affects respondents' assessment of the welfare contribution of immigrants, i.e. reduces their welfare state concerns. This effect is of high statistical significance and suggests that respondents in treatment *C* develop a more positive attitude towards welfare state contributions of immigrants after the receipt of information.

Estimation results for labor market concerns and immigration policy preferences also show positive coefficients for treatment *C* which are of marginal statistical significance. The coef-

Table 3: Treatment effects: main sample.

| | Welfare state | | Labor market | | Policy | |
|---|---|---|---|---|---|---|
| Treatment A: share foreign. | −0.03 | (0.09) | −0.03 | (0.09) | −0.04 | (0.07) |
| Treatment B: unemp. foreign. | 0.12 | (0.09) | 0.06 | (0.09) | 0.05 | (0.08) |
| Treatment C: share/unemp. | 0.23*** | (0.09) | 0.15* | (0.09) | 0.14* | (0.08) |
| Concerns about immigration | −0.12*** | (0.01) | −0.09*** | (0.01) | −0.15*** | (0.01) |
| Political attitude | 0.00 | (0.01) | −0.02 | (0.02) | −0.02 | (0.01) |
| Generalized trust | 0.06*** | (0.01) | 0.06*** | (0.01) | 0.06*** | (0.01) |
| Prior beliefs: share foreign. | 0.02* | (0.01) | 0.01 | (0.01) | 0.01 | (0.01) |
| Prior beliefs: unemp. foreign. | −0.01*** | (0.00) | 0.00 | (0.00) | −0.01*** | (0.00) |
| Sociodemographic controls | Yes | | Yes | | Yes | |
| Treatments A/C (pooled) | 0.04 | (0.06) | 0.03 | (0.07) | 0.02 | (0.06) |
| Controls | Yes | | Yes | | Yes | |
| Treatments B/C (pooled) | 0.19*** | (0.06) | 0.12* | (0.06) | 0.11** | (0.06) |
| Controls | Yes | | Yes | | Yes | |
| Number of observations | 926 | | 962 | | 955 | |

*Notes:* The dependent variables have been standardized in terms of their mean and standard deviation. Robust standard errors are displayed in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The sociodemographic controls comprise of a respondent's age group, gender, employment status, household size, and indicators for high education, high income, and family-based migration background. In addition, we include an indicator denoting rural areas on the district level. All regressions employ survey weights and further include a list of dummy variables indicating missing observations.

ficients for treatment *B* are robustly positive across specifications. They are, however, not statistically significant. In contrast, for treatment *A*, the coefficients are slightly negative and statistically insignificant across specifications. Interestingly, while larger prior beliefs about the unemployment rate of foreigners show a clearly negative, albeit relatively small, association with positive welfare state immigration attitudes and immigration policy preferences, prior beliefs about the share of foreigners do not seem to be associated with labor market concerns and immigration policy preferences. For the welfare state channel, we even observe a slightly positive effect of prior beliefs about the share of foreigners. This comparison is in line with the finding that respondents' updating with respect to the unemployment rate is larger than with respect to the share of foreigners, on average.

Table 3 also contains the effects for treatment arms *A* and *B*, pooled with treatment arm *C*, respectively. This pooling strategy allows us to differentiate the composition of the effect of treatment arm *C* with respect to the share and the unemployment rate of foreigners. The effects for pooled treatments *A* and *C*, now representing the share of foreigners, are slightly positive but statistically insignificant across specifications. In contrast, the effects of pooled treatments *B* and *C*, now representing the unemployment rate of foreigners, are robustly positive and of similar

statistical significance as for treatment C before. We interpret this evidence as suggestive for the unemployment rate of foreigners to be of higher relative importance concerning its contribution to the observed effect of treatment arm *C* as compared to the share of foreigners.

Our results hence suggest a robust global effect of information provision on attitudes towards immigration with respect to treatment arm *C*, containing both information on the share and the unemployment rate of foreigners. Recalling our hypotheses outlined in section 2, this finding strongly supports hypothesis 1, implying that respondents are less concerned about adverse effects of immigration on the welfare state after the receipt of information. Concerning the labor market channel, the results are suggestive in favor of hypothesis 2a, predicting that information provision translates into lower labor market concerns. As to immigration policy preferences, our findings are suggestively in line with hypothesis 3, stating that information provision leads to stronger preferences for increases in immigration.

We argue that our effects are driven by the observed belief updating of respondents regarding statistics about immigration. Still, the question remains *how* this belief updating of respondents translates into attitudinal change. In the following section, we therefore investigate the channel of belief updating itself and revisit differences between effects of information about the share and the unemployment rate of foreigners.

## 5 Process of Belief Updating

Respondents in the treatment arms significantly update their prior beliefs and form posterior beliefs more in line with the true values on average. For this belief updating channel to translate into immigration attitudes, it requires a link between beliefs about and attitudes towards immigration. So far, our analysis has concentrated on reduced-form effects of information provision on immigration attitudes, only implicitly accounting for the channel of belief updating. A direct empirical analysis of this potential link is, however, likely to suffer from prior beliefs being endogenously determined by attitudinal and socio-demographic characteristics. Conversely, the use of exogeneously treated posterior beliefs lacks the information of unshifted prior beliefs.

To further investigate the hypothesized link between beliefs, belief updating, and our outcome variables, we hence follow an instrumental variables (IV) strategy employing a two stage least squares (2SLS) approach similar to the one by Lergetporer et al. (2017, 2020), who apply

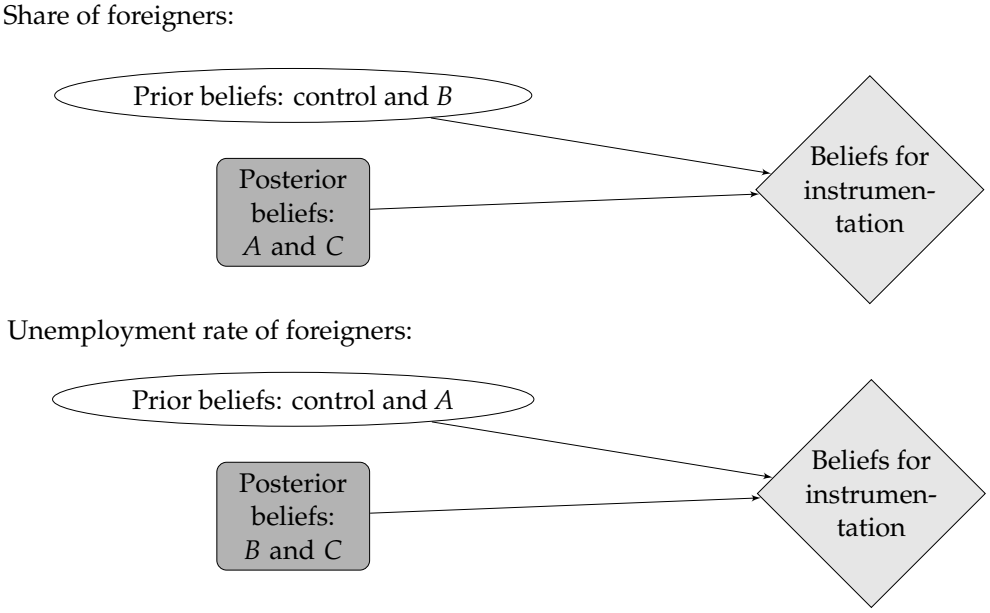


Figure 3: Construction of variables for instrumentation of beliefs.

it in the context of refugee migration and public education policy preferences, respectively. Following this strategy, we are able to exploit the exogenous shift in respondents' beliefs about immigration statistics caused by our information intervention to mitigate concerns about endogeneity. For that purpose, we construct two new variables on beliefs which combine prior beliefs of the control group and unaffected treatment arms with posterior beliefs of the affected treatment arms. A graphical representation of the construction of these variables is depicted in figure 3.[11]

The constructed variables on beliefs contain the exogenous shifts in beliefs of the share and the unemployment rate of foreigners, respectively, caused by our information treatments. We estimate these exogenous shifts by regressing the constructed beliefs on our treatment indicators within the 2SLS framework. Specifically, in the first stage, we instrument respondents' beliefs with our three exogenous information treatments and estimate the following first-stage equations:

$$S_i = \alpha_0 + \alpha_1 A_i + \alpha_2 B_i + \alpha_3 C_i + \delta^T X_i + \varepsilon_i \tag{2a}$$

$$U_i = \beta_0 + \beta_1 A_i + \beta_2 B_i + \beta_3 C_i + \delta^T X_i + \varepsilon_i, \tag{2b}$$

[11]Specifically, for beliefs about the share of foreigners, prior beliefs of the control group and treatment arm $B$ are combined with posterior beliefs of treatment arms $A$ and $C$. In contrast, for beliefs about the unemployment rate of foreigners, prior beliefs of the control group and treatment arm $A$ are combined with posterior beliefs of treatment arms $B$ and $C$.

Table 4: Instrumented beliefs: share and unemployment rate of foreigners.

| | Welfare state | | Labor market | | Policy | |
|---|---|---|---|---|---|---|
| Inst. beliefs: share foreigners | 0.02 | (0.08) | −0.08 | (0.09) | −0.03 | (0.07) |
| Inst. beliefs: unemp. foreigners | −0.02*** | (0.01) | −0.01 | (0.01) | −0.02*** | (0.01) |
| Concerns about immigration | −0.11*** | (0.02) | −0.07*** | (0.02) | −0.13*** | (0.02) |
| Political attitude | −0.01 | (0.02) | −0.04* | (0.02) | −0.04*** | (0.02) |
| Generalized trust | 0.06*** | (0.02) | 0.04* | (0.02) | 0.05*** | (0.02) |
| Sociodemographic controls | Yes | | Yes | | Yes | |
| Number of observations | 795 | | 822 | | 809 | |

*Notes:* The dependent variables have been standardized in terms of their mean and standard deviation. Robust standard errors are displayed in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The sociodemographic controls comprise of a respondent's age group, gender, employment status, household size, and indicators for high education, and family-based migration background. In addition, we include an indicator denoting rural areas on the district level.

where $S_i$ and $U_i$ represent the constructed variables on beliefs about the share and the unemployment rate, respectively, $A_i$, $B_i$, and $C_i$ are treatment indicators for the respective treatment arms, $X_i$ contains socio-demographic and attitudinal controls, and $\varepsilon_i$ is the error term.

We then proceed to estimate the following second-stage equation:

$$y_i = \gamma_0 + \gamma_1 \widehat{S_i} + \widehat{U_i} + \delta^T X_i + \varepsilon_i, \tag{3}$$

where $y_i$ represents the outcome variable, $\widehat{S_i}$ and $\widehat{U_i}$ are the instrumented beliefs about the share and the unemployment rate, respectively, and $X_i$ contains the same socio-demographic and attitudinal controls employed in the first stage.

For our instrumentation strategy to be valid, the exclusion restriction must hold, i.e. that our information treatments – if they do relevantly affect beliefs about immigration – must not affect our outcome variables other than via their effects on respondents' beliefs. While this assumption is untestable by construction, we cautiously assume that our exogenous information treatments, containing only the respective statistics as well as conditional feedback on prior beliefs, are suited to precisely affect targeted beliefs and outcome variables.

Our estimation results for the effect of instrumented beliefs on the welfare state and labor market channels and on immigration policy preferences are displayed in table 4.[12] The results show a negative and significant link between instrumented beliefs about the unemployment rate of foreigners and the welfare state channel and immigration policy preferences, but not for the

[12]First stage estimation results are displayed in table A4 in the appendix.

labor market channel. In contrast, we do not find evidence for a similar effect of instrumented beliefs about the share of foreigners. The estimated relationships suggest that, for beliefs about the unemployment rate of foreigners, respondents stating larger beliefs report more negative attitudes towards immigration on average. Given that the true value of the unemployment rate of foreigners is relatively small in size and that respondents overestimate on average, this implies that larger biases in beliefs affect immigration attitudes negatively.

Based on our results presented in tables 4 and A4 in the appendix, our information treatment induces a downward shift in respondents' beliefs about the unemployment rate of foreigners, and larger beliefs about this unemployment rate are negatively linked to immigration attitudes on average. We hence interpret this evidence to support that the effect of our information intervention on attitudes towards immigration is based on the channel of belief updating. However, we are not able to provide evidence for a similar relationship between beliefs about the share of foreigners and immigration attitudes, also taking into account the relatively low first-stage F-statistics for the share of foreigners.

# 6 Discussion

We further expand our analysis in two directions: First, we investigate and discuss potential heterogeneity in treatment effects based on attitudinal measures and sociodemographic characteristics by means of a data-driven approach. Second, we present an additional analysis based on our follow-up study.

## 6.1 Heterogeneity in treatment effects

In the previous sections, we investigated reduced-form and sequential treatment effects on respondents' attitudes towards immigration based on an updating of prior beliefs on a global scale. We suspect, however, that treatment effects may vary across different subgroups of the population.

Given the large set of potentially relevant societal groups, we narrow down a selection of subgroups exerting treatment effect heterogeneity by applying a machine learning approach developed by Athey and Imbens (2016, 2019) called causal tree analysis. This algorithm follows a recursive approach to uncovering treatment effect heterogeneity, sequentially partitioning

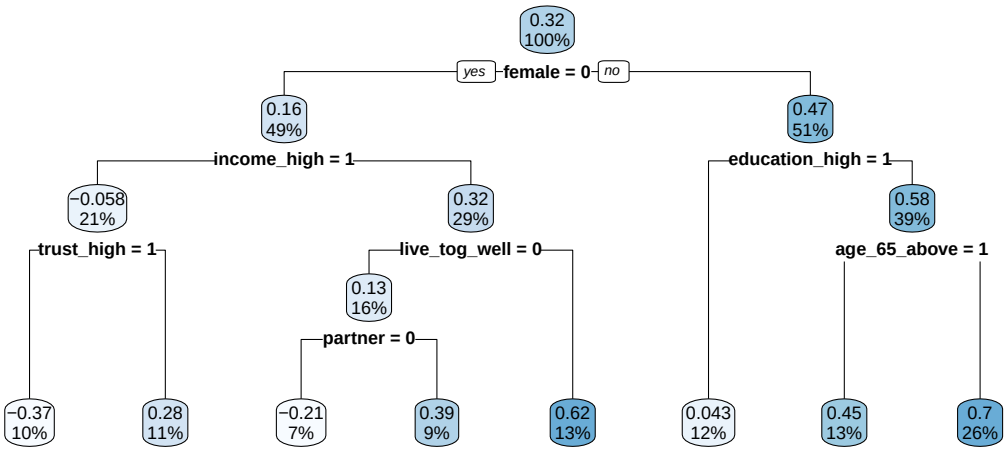


Figure 4: Causal tree: index of immigration attitudes.

the data into subgroups based on the mean-squared error (MSE) of the conditional average treatment effect (CATE). The resulting causal tree can then be visually displayed by means of a flow diagram. This approach to treatment effect heterogeneity has been applied to experimental evaluation, also in the context of information provision experiments (Grigorieff et al. 2020).

In our analysis, we incorporate socio-demographic characteristics and attitudinal measures into the algorithm. To globally evaluate the CATE on all three of our dependent variables, we construct an additive index measure by taking the sum of the variable values of welfare state concerns, labor market concerns, and immigration policy preferences for each individual. Since the algorithm is currently restricted to evaluate binary experimental groups only, we revisit our pooling strategy from section 4 and consequently pool treatment arms *B* and *C*, concentrating on the dimension of the unemployment rate of foreigners. This pooling strategy is supported both by the reduced-form effects of our information interventions as well as the results from our 2SLS approach. The resulting causal tree is displayed in figure 4.[13] It reveals considerable treatment effect heterogeneity, especially concerning socio-demographic characteristics such as gender, income, and educational background. In addition, we observe heterogeneity in terms of generalized trust, the assessment of intercultural living together, age, and family status.

[13]Note that we train the model to evaluate only subgroups of respondents of at least 50 individuals. In addition, all variables except generalized political attitude have been recoded into binary indicators in advance. For generalized political attitude, we let the algorithm choose the relevant cutoff points since a center split may not sufficiently account for stronger left-wing or right-wing attitudes.

Table 5: Heterogeneous effects: subgroup analyses.

| | Welfare state | | Labor market | | Policy | |
|---|---|---|---|---|---|---|
| Female respondents: | | | | | | |
| Treatments B/C (pooled) | 0.25*** | (0.09) | 0.31*** | (0.09) | 0.11 | (0.07) |
| Controls | Yes | | Yes | | Yes | |
| Observations | 457 | | 481 | | 484 | |
| Low and middle income: | | | | | | |
| Treatments B/C (pooled) | 0.19** | (0.07) | 0.16** | (0.08) | 0.17** | (0.07) |
| Controls | Yes | | Yes | | Yes | |
| Observations | 597 | | 627 | | 626 | |
| Low and middle education: | | | | | | |
| Treatments B/C (pooled) | 0.22*** | (0.08) | 0.14* | (0.08) | 0.12* | (0.07) |
| Controls | Yes | | Yes | | Yes | |
| Number of observations | 509 | | 524 | | 529 | |

*Notes:* The dependent variables have been standardized in terms of their mean and standard deviation. Robust standard errors are displayed in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. We include the same set of controls as in our main specification. All regressions employ survey weights and further include a list of dummy variables indicating missing observations.

The observed heterogeneities revealed by the causal tree motivate further analyses. We focus on the first two levels of the tree, i.e. heterogeneity in gender, income, and education. Estimation results for these subgroup analyses are displayed in table 5. Specifically, we concentrate on the subgroups of female respondents, of respondents with low and middle income as well as low and middle education. While we find that the results for the welfare state channel are largely similar to the results of our main specification across subgroups, we observe stronger positive effects for female, lower-income and lower-educated respondents for the labor market channel. The positive effect on the labor market channel is especially pronounced for female respondents. Concerning immigration policy preferences, we observe a more robust effect for lower-income respondents compared to the results in our main specification. The effects for the subgroup of lower-income individuals are slightly stronger when compared to our main specification.

Overall, the consideration of heterogeneous treatment effects suggests a necessary distinction based on CATE. This indicates that different socio-demographic groups respond differently to our information intervention despite the presence of global effects. This observation also shows important implications for policy measures aiming to reduce biases in beliefs about immigration. While an overall measure seems promising, especially in conjunction with the

Table 6: Treatment effects: follow-up sample.

| | Welfare state | | Labor market | | Policy | |
|---|---|---|---|---|---|---|
| Treatments B/C (pooled) | 0.25* | (0.15) | −0.10 | (0.14) | 0.07 | (0.12) |
| Concerns about immigration | −0.08*** | (0.03) | −0.11*** | (0.03) | −0.13*** | (0.02) |
| Political attitude | −0.03 | (0.04) | 0.06* | (0.03) | −0.04 | (0.03) |
| Generalized trust | 0.04 | (0.03) | 0.07** | (0.03) | 0.10*** | (0.02) |
| Prior beliefs: share foreign. | −0.03 | (0.02) | −0.01 | (0.02) | 0.01 | (0.02) |
| Prior beliefs: unemp. foreign. | −0.01 | (0.01) | 0.02** | (0.01) | −0.01 | (0.01) |
| Sociodemographic controls | Yes | | Yes | | Yes | |
| Number of observations | 190 | | 198 | | 199 | |

*Notes:* The dependent variables have been standardized in terms of their mean and standard deviation. Robust standard errors are displayed in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The sociodemographic controls comprise of a respondent's age group, gender, employment status, household size, and indicators for high education, high income, and family-based migration background. In addition, we include an indicator denoting rural areas on the district level. All regressions employ survey weights and further include a list of dummy variables indicating missing observations.

welfare state channel, specific targeting of societal groups has the potential to further increase treatment effectiveness.

### 6.2 Follow-up Study

Building on the results obtained in the previous sections, we now expand our analysis by investigating our information intervention in the context of our follow-up study. Specifically, we aim to examine whether changes in respondents' beliefs caused by our information treatments persist over time. The follow-up sample was commissioned by the institute as a subset of 200 respondents which were drawn from the main sample and were surveyed again 1 to 2 months after their participation in the main survey.[14] The realized follow-up sample consists of 203 individuals.

As a first step, we test for experimental balance in the follow-up sample only. The results are shown in table A5 in the appendix and reveal again only marginal imbalances which we are able to control for in our specifications. In addition, we examine how respondents in the follow-up sample differ in terms of attitudes and characteristics in comparison with respondents in the main sample who did not participate in the follow-up survey. The results are shown in table A6 in the appendix.

[14]Note that we restrict participants of the follow-up sample to the second half of our main survey field phase in order to harmonize time differences between the two surveys.

We find considerable differences in terms of prior beliefs and socio-demographic characteristics between the main and follow-up samples. In contrast, we do not observe substantial differences in terms of attitudinal measures. More precisely, the results suggest that respondents in the follow-up sample in comparison with non-follow-up respondents are on average more informed about the general unemployment rate and the share of foreigners, are more likely to hold a university degree, are less likely to be female and to have a migration background, and are more likely to report negative attitudes towards cultural diversity. Against the background of the results concerning treatment heterogeneity related to gender, income and education discussed in the previous section, we expect that the composition of the follow-up sample – if it does affect the presence of treatment effects – tends to make treatment effects less salient.

Concerning belief updating based on the information received during treatment, figure A1 in the appendix displays qualitatively similar results to figure 2 only for those respondents who also participated in the follow-up study. The within-subject differences between prior and posterior beliefs and between prior and follow-up beliefs are again significantly different from one another, both for the share and the unemployment rate of foreigners.[15] Regarding average beliefs in the follow-up survey, respondents in treatment arms *A* and *C* state beliefs even closer to the true value as compared to the main survey. Respondents in treatment arms *B* and *C* are also closer to the true value of the unemployment rate of foreigners in the follow-up survey as compared to prior beliefs. However, they are less in line with the true value when compared to posterior beliefs in the main survey. Hence, the shift in beliefs caused by our information intervention persists in the follow-up survey for both types of information, while being, however, slightly less persistent concerning the unemployment rate of foreigners.

To evaluate treatment effects on welfare state and labor market concerns and on immigration policy preferences for the follow-up sample, we reestimate the treatment effect for pooled treatment arms *B* and *C*. The estimation results are displayed in table 6. We observe a positive effect of our information treatments with respect to the welfare state channel in the follow-up sample. This effect is of marginal significance, and the effect size is slightly larger than in the pooled results for the main sample. In contrast, we do neither observe a statistically significant effect for the labor market channel nor for immigration policy preferences. Taking into account that an interpretation of these effects should be taken carefully due to the reduced statistical

[15]Specifically, the p-values of a paired t-test are significant on the 5-percent level in all cases.

power in our follow-up sample, the results still hint that treatment effects on the welfare state channel persist over a longer period of time.

# 7 Conclusion

We investigate the causal effect of information provision on the welfare state and labor market channels of attitudes towards immigration and on immigration policy preferences. For that purpose, we design and conduct an information provision experiment in which we vary the quantity and the type of information provided to respondents based on two key statistics about immigration: the share and the unemployment rate of foreigners. We find that providing respondents with a bundle of information on both the share and the unemployment rate of foreigners robustly decreases their welfare state concerns about immigration, conversely translating into a more positive assessment of the welfare state contribution of immigrants in the host society.

We also find slightly less pronounced effects of information provision on the labor market and policy channels, which are stronger for female, lower-income and lower-educated respondents. In line with previous literature on the topic, our results suggest that the provision of information only on the share of foreigners has consistent null effects. In addition, our evidence supports that larger, i.e. more biased beliefs about the unemployment rate of foreigners are negatively linked with welfare state assessments in relation to immigration and immigration policy preferences.

Our findings suggest the type of information to be a relevant determinant of treatment effectiveness based on the distribution of prior beliefs in the population, while, however, the quantity of interrelated information provided to the population seems to be the decisive factor for attitudinal change. We apply further data-driven analyses on conditional average treatment effects, uncovering substantial treatment effect heterogeneity with respect to socio-demographic characteristics such as gender, income, and educational background. Our findings therefore also raise important implications for policy measures aiming to reduce biases in beliefs about immigration: Both precise targeting of societal groups and a careful composition of information provided to the population have the potential to increase the effectiveness of governmental information interventions in the context of the current debate on immigration.

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# Appendix

Table A1: Descriptive overview of employed survey measures.

| Variable name | Type | Description |
|---|---|---|
| Immigration policy preferences | Numerical (1–5) | Respondent's immigration policy preferences as measured by the following survey question: *"Do you think that the number of immigrants coming to Thuringia each year should be: decreased a lot / decreased slightly / stay the same / increased slightly / increased a lot?"*. |
| Welfare state concerns | Numerical (0–10) | Respondent's welfare state concerns as measured by the following question (based on ESS): *"Immigrants pay taxes and receive social benefits from the health care and social insurance systems. On balance, do you think that immigrants in Thuringia receive more social benefits than they pay taxes, or that they pay more taxes than they receive social benefits?"*. Answers range from 0 for "Receive more social benefits" to 10 for "Pay more taxes". |
| Labor market concerns | Numerical (0–10) | Respondent's labor state concerns as measured by the following question (based on ESS): *"Do you think that immigrants rather take away jobs from workers in Thuringia, or that they rather help to create new jobs?"*. Answers range from 0 for "Take jobs away" to 10 for "Create new jobs". |
| Prior beliefs: share of foreigners | Numerical (1–30) | Respondent's prior beliefs about the share of foreigners in Thuringia (true value 5%) based on the question: "Now it is about the share of foreigners in Thuringia. What do you think: What percentage of people living in Thuringia do not have German citizenship?". The measure comprises of intervals based on the following scheme: *0 to 3, 4 to 6, 7 to 9, 10 to 13 etc.*. |

| Variable name | Type | Description |
|---|---|---|
| Prior beliefs: unemployment rate of foreigners | Numerical (1–30) | Respondent's prior beliefs about the unemployment rate of foreigners in Thuringia (true value 15%) based on the question: "Now it is about the unemployment rate of foreigners of working age in Thuringia. What do you think: How many percent of these people are unemployed?". The measure comprises of intervals based on the following scheme: *0 to 3, 4 to 6, 7 to 9, 10 to 13 etc.*. |
| Prior beliefs: general unemployment rate | Numerical (1–30) | Respondent's prior beliefs about the general unemployment rate in Thuringia (true value 5%) based on the following question: "Now it is about the unemployment rate in Thuringia. What do you think: What percentage of people of working age in Thuringia are unemployed?". The measure comprises of intervals based on the following scheme: *0 to 3, 4 to 6, 7 to 9, 10 to 13 etc.*. |
| Age group | Numerical (1–5) | Respondent's age group according to the ranges: *16 to 29, 30 to 39, 40 to 49, 50 to 64, 65 and older*. |
| Female | Binary | Indicates a respondent's gender. |
| Education | Categorical/binary | Respondent's education based on highest school-leaving certificate according to the ranges: *low, medium, high*. In regressions, we employ an indicator for high education. |
| University degree | Binary | Indicates whether respondent holds a university degree. |
| Employed | Binary | Indicates whether respondent is in employment. |
| Household net income | Categorical/binary | Respondent's household net income according to the ranges: *low, medium, high*. In regressions, we employ an indicator for high income. |
| Household size | Numerical (open) | Number of persons living in respondent's household. |
| Migration background | Binary | Indicates whether respondent or one of his/her parents were born outside of Germany. |
| Partnership | Binary | Indicates whether respondent lives in a partnership. |

| Variable name | Type | Description |
|---|---|---|
| Rural district | Binary | Indicates wether a respondent lives in a district classified as a rural area by the German Federal Institute for Research on Building, Urban Affairs and Spatial Development. |
| Political attitude | Numerical (0–10) | Measures a respondent's generalized political attitude (based on ESS) post-treatment on an 11-point scale from 0 for "Left" to 10 for "Right". |
| Generalized trust | Numerical (0–10) | Measures a respondent's generalized trust (based on ESS) post-treatment on an 11-point scale from 0 for "You cannot be too careful" to 10 for "Most people can be trusted". |
| Concerns about immigration | Numerical (0–10) | Measures a respondent's concerns about immigration pre-treatment (based on SOEP) on an 11-point scale from 0 for "Not at all concerned" to 10 for "Very concerned". |
| Concerns about immigration: social environment | Numerical (0–4) | Measures the concerns about immigration in the private social environment as assessed by the respondent on a 5-point scale from 0 for "None" to 4 for "Very many". |
| Concerns about economic development | Numerical (0–10) | Measures a respondent's concerns about economic development pre-treatment on an 11-point scale from 0 for "Not at all concerned" to 10 for "Very concerned". |
| Concerns about personal economic situation | Numerical (0–10) | Measures a respondent's concerns about his/her personal economic situation (based on SOEP) pre-treatment on an 11-point scale from 0 for "Not at all concerned" to 10 for "Very concerned". |
| Expectations about future personal economic situation | Categorical | Measures a respondent's expectations about his/her future personal economic situation on according to the ranges: *becomes worse*, *stays the same*, *becomes better*. |

| Variable name | Type | Description |
|---|---|---|
| Attitude towards cultural diversity | Numerical (0–10) | Measures a respondent's attitude towards cultural diversity (based on ESS) according to his/her agreement to the following statement pre-treatment: "It is better for a country when everyone shares the same customs and traditions." on an 11-point scale from 0 for "Disagree strongly" to 10 for "Agree strongly". |
| Assessment of anti-discrimination law | Numerical (0–10) | Measures a respondent's attitude towards a law against discrimination of foreigners based on (ESS) on an 11-point scale from 0 for "Very bad" to 10 for "Very good". |
| Assessment of intercultural living together | Numerical (1–4) | Measures a respondent's assessment of the living together of different cultures on a 4-point scale from 1 for "Very bad" to 4 for "Very good". |

Table A2: Tests for balance in covariates.

| | | Treated | | | | | |
|---|---|---|---|---|---|---|---|
| | Control | Treatment *A* | P-value | Treatment *B* | P-value | Treatment *C* | P-value |
| Prior beliefs: share of foreigners | 4.32 | 5.21 | 0.08* | 4.29 | 0.93 | 4.40 | 0.85 |
| Prior beliefs: unemployment rate of foreigners | 16.00 | 17.58 | 0.06* | 15.95 | 0.95 | 16.10 | 0.90 |
| Prior beliefs: general unemployment rate | 4.53 | 5.00 | 0.27 | 4.13 | 0.30 | 4.63 | 0.82 |
| Age group | 3.51 | 3.51 | 0.99 | 3.45 | 0.70 | 3.30 | 0.20 |
| Female | 0.48 | 0.56 | 0.13 | 0.46 | 0.67 | 0.54 | 0.22 |
| Education: categories | 2.07 | 2.00 | 0.22 | 2.04 | 0.60 | 2.07 | 0.96 |
| University degree | 0.31 | 0.29 | 0.62 | 0.26 | 0.22 | 0.26 | 0.26 |
| Employed | 0.57 | 0.57 | 0.96 | 0.56 | 0.92 | 0.55 | 0.75 |
| Household net income: categories | 1.98 | 2.00 | 0.77 | 2.15 | 0.05** | 2.04 | 0.43 |
| Household size | 2.46 | 2.45 | 0.95 | 2.52 | 0.62 | 2.45 | 0.96 |
| Migration background | 0.08 | 0.09 | 0.79 | 0.13 | 0.17 | 0.09 | 0.76 |
| Partnership | 0.69 | 0.66 | 0.47 | 0.69 | 0.93 | 0.69 | 0.98 |
| Rural district | 0.72 | 0.62 | 0.04** | 0.74 | 0.64 | 0.71 | 0.84 |
| Political attitude | 3.91 | 4.25 | 0.15 | 4.10 | 0.44 | 3.88 | 0.90 |
| Generalized trust | 4.84 | 4.61 | 0.42 | 5.13 | 0.27 | 5.01 | 0.56 |
| Concerns about immigration | 4.95 | 5.26 | 0.37 | 4.47 | 0.17 | 4.63 | 0.34 |
| Concerns about immigration: social environment | 2.57 | 2.67 | 0.35 | 2.48 | 0.40 | 2.46 | 0.31 |
| Concerns about economic development | 4.93 | 4.65 | 0.30 | 4.47 | 0.10* | 4.67 | 0.32 |
| Concerns about personal economic situation | 3.78 | 3.53 | 0.42 | 3.20 | 0.05* | 3.75 | 0.94 |
| Expecations future personal economic situation | 1.93 | 1.89 | 0.59 | 1.99 | 0.38 | 2.06 | 0.07* |
| Attitude towards cultural diversity | 5.12 | 5.36 | 0.51 | 5.33 | 0.56 | 4.75 | 0.29 |
| Assessment of anti-discrimination law | 6.69 | 6.59 | 0.76 | 7.00 | 0.33 | 6.72 | 0.92 |
| Assessment of cultural living together | 2.39 | 2.27 | 0.08* | 2.38 | 0.90 | 2.47 | 0.21 |

*Notes:* Comparisons of treatments and control; all comparisons employ survey weights; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Note that prior beliefs are coded according to an interval scheme and hence mean values shown here cannot be directly compared with true values.

Table A3: Determinants of biases in prior beliefs.

| | Share of foreigners | | Unemployment rate of foreigners | |
|---|---|---|---|---|
| Concerns about immigration | 0.04*** | (0.01) | 0.07*** | (0.01) |
| Prior beliefs: general unemployment rate | 0.09*** | (0.02) | 0.00 | (0.01) |
| Political attitude | −0.02 | (0.03) | 0.01 | (0.02) |
| Generalized trust | −0.04* | (0.02) | −0.02 | (0.02) |
| Age group | 0.01 | (0.04) | 0.09*** | (0.03) |
| Female | 0.37*** | (0.10) | 0.21*** | (0.07) |
| Employed | −0.18 | (0.13) | 0.09 | (0.08) |
| Household size | −0.02 | (0.05) | 0.03 | (0.03) |
| Education: high | −0.23*** | (0.09) | −0.13** | (0.07) |
| Migration background | −0.07 | (0.17) | −0.03 | (0.11) |
| Rural district | −0.17 | (0.12) | 0.01 | (0.07) |
| Number of Observations | 456 | | 748 | |

*Notes:* The dependent variables have been standardized in terms of their mean and standard deviation. Biases in beliefs are defined in absolute terms. Robust standard errors are displayed in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All regressions employ survey weights.

Table A4: Instrumented beliefs: first stage estimations.

| | Share of foreigners | | Unemployment rate of foreigners | |
|---|---|---|---|---|
| Treatment A: share of foreigners | −0.96** | (0.38) | 0.73 | (0.83) |
| Treatment B: unemp. foreign. | 0.10 | (0.37) | −8.77*** | (0.73) |
| Treatment C: share and unemp. foreign. | −0.61* | (0.36) | −9.33*** | (0.76) |
| Concerns about immigration | 0.14*** | (0.04) | 0.57*** | (0.11) |
| Political attitude | −0.06 | (0.08) | 0.02 | (0.13) |
| Generalized trust | −0.17*** | (0.06) | −0.04 | (0.12) |
| Sociodemographic controls | Yes | | Yes | |
| Number of Observations | 859 | | 872 | |
| F | 5.27 | | 46.20 | |

*Notes:* Robust standard errors are displayed in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The sociodemographic controls comprise of a respondent's age group, gender, employment status, household size, and indicators for high education, and family-based migration background. In addition, we include an indicator denoting rural areas on the district level.

Table A5: Tests for balance in covariates: follow-up sample.

| | | Treated | | | | | |
|---|---|---|---|---|---|---|---|
| | Control | Treatment *A* | P-value | Treatment *B* | P-value | Treatment *C* | P-value |
| Prior beliefs: share of foreigners | 3.66 | 3.99 | 0.73 | 3.65 | 0.99 | 3.54 | 0.87 |
| Prior beliefs: unemployment rate of foreigners | 15.75 | 19.12 | 0.04** | 17.18 | 0.45 | 16.58 | 0.68 |
| Prior beliefs: general unemployment rate | 3.63 | 4.47 | 0.21 | 3.58 | 0.93 | 4.26 | 0.44 |
| Age group | 3.34 | 3.17 | 0.60 | 3.56 | 0.50 | 3.18 | 0.65 |
| Female | 0.35 | 0.58 | 0.04** | 0.33 | 0.83 | 0.45 | 0.38 |
| Education: categories | 2.14 | 2.06 | 0.47 | 2.13 | 0.92 | 2.06 | 0.54 |
| University degree | 0.41 | 0.35 | 0.56 | 0.43 | 0.87 | 0.37 | 0.73 |
| Employed | 0.56 | 0.58 | 0.85 | 0.61 | 0.61 | 0.60 | 0.72 |
| Household net income: categories | 2.07 | 1.95 | 0.53 | 2.34 | 0.07* | 2.16 | 0.59 |
| Household size | 2.25 | 2.64 | 0.12 | 2.38 | 0.57 | 2.38 | 0.59 |
| Migration background | 0.02 | 0.03 | 0.90 | 0.11 | 0.10* | 0.11 | 0.10* |
| Partnership | 0.70 | 0.65 | 0.60 | 0.77 | 0.48 | 0.67 | 0.75 |
| Rural district | 0.77 | 0.71 | 0.54 | 0.70 | 0.47 | 0.73 | 0.70 |
| Political attitude | 3.79 | 3.80 | 0.99 | 3.71 | 0.88 | 4.05 | 0.68 |
| Generalized trust | 5.22 | 4.63 | 0.25 | 5.32 | 0.86 | 5.20 | 0.96 |
| Concerns about immigration | 4.83 | 5.42 | 0.42 | 3.31 | 0.04** | 4.54 | 0.71 |
| Concerns about immigration: social environment | 2.66 | 2.57 | 0.72 | 2.26 | 0.09* | 2.47 | 0.45 |
| Concerns about economic development | 4.62 | 4.36 | 0.68 | 4.41 | 0.74 | 4.85 | 0.71 |
| Concerns about personal economic situation | 3.62 | 3.26 | 0.57 | 3.02 | 0.35 | 4.22 | 0.40 |
| Expecations future personal economic situation | 2.03 | 1.87 | 0.32 | 2.12 | 0.51 | 2.15 | 0.47 |
| Attitude towards cultural diversity | 4.66 | 5.24 | 0.46 | 4.40 | 0.75 | 4.35 | 0.72 |
| Assessment of anti-discrimination law | 6.65 | 7.02 | 0.61 | 7.42 | 0.29 | 6.43 | 0.78 |
| Assessment of cultural living together | 2.45 | 2.19 | 0.12 | 2.40 | 0.76 | 2.53 | 0.57 |

*Notes:* Comparisons of treatments and control; all comparisons employ survey weights; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Note that prior beliefs are coded according to an interval scheme and hence mean values shown here cannot be directly compared with true values.

Table A6: Tests for differences between main and follow-up samples.

| | Sample: | | |
|---|---|---|---|
| | Main | Follow-up | P-value |
| Prior beliefs: share of foreigners | 4.76 | 3.71 | 0.00*** |
| Prior beliefs: unemployment rate of foreigners | 16.23 | 17.13 | 0.21 |
| Prior beliefs: general unemployment rate | 4.72 | 3.99 | 0.02** |
| Age group | 3.47 | 3.31 | 0.22 |
| Female | 0.53 | 0.43 | 0.03** |
| Education: categories | 2.03 | 2.10 | 0.18 |
| University degree | 0.25 | 0.39 | 0.00*** |
| Employed | 0.56 | 0.59 | 0.45 |
| Household net income: categories | 2.02 | 2.13 | 0.16 |
| Household size | 2.49 | 2.41 | 0.46 |
| Migration background | 0.11 | 0.06 | 0.04** |
| Partnership | 0.68 | 0.70 | 0.65 |
| Rural district | 0.68 | 0.73 | 0.25 |
| Political attitude | 4.09 | 3.84 | 0.25 |
| Generalized Trust | 4.85 | 5.09 | 0.30 |
| Concerns about immigration | 4.89 | 4.57 | 0.28 |
| Concerns about immigration: social environment | 2.55 | 2.50 | 0.57 |
| Concerns about economic development | 4.71 | 4.56 | 0.55 |
| Concerns about personal economic situation | 3.57 | 3.53 | 0.89 |
| Expecations future personal economic situation | 1.95 | 2.04 | 0.14 |
| Attitude towards cultural diversity | 5.26 | 4.68 | 0.06* |
| Assessment of anti-discrimination law | 6.72 | 6.87 | 0.62 |
| Assessment of cultural living together | 2.37 | 2.39 | 0.79 |

*Notes:* Comparisons of main and follow-up samples; all comparisons employ survey weights; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Note that prior beliefs are coded according to an interval scheme and hence mean values shown here cannot be directly compared with true values.

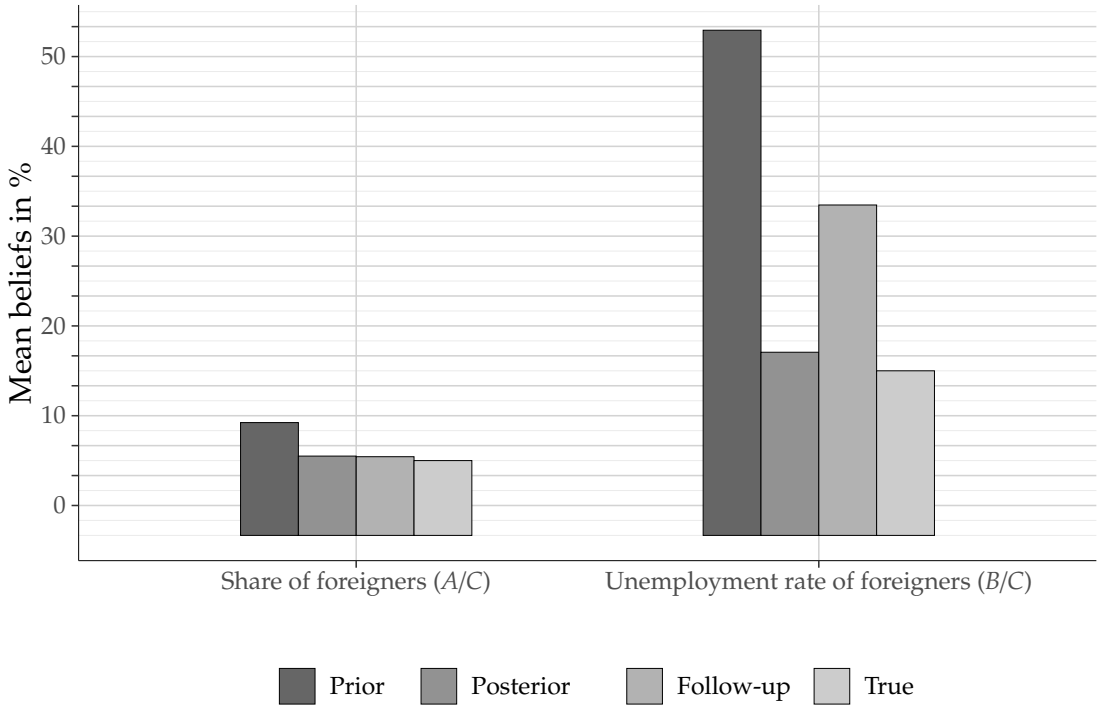


Figure A1: Comparison of beliefs within treatment arms: follow-up sample.