Biased Beliefs about Immigration and Economic Concerns*

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Abstract

We conduct an information provision experiment to investigate the relevance of statistical information for economic attitudes towards immigration. Our experimental design is embedded into a large-scale representative online survey in Germany. We randomize the provision of information on the share and the unemployment rate of immigrants, representing facts about the size and economic characteristics of the immigrant population. When exposed to factual information about immigration, individuals systematically update their prior beliefs. We further find that information provision decreases economic concerns related to welfare state and labor market effects as well as immigration policy preferences. These effects exert heterogeneity in terms of the specific information provided and are more pronounced for individuals with overestimation biases in beliefs about immigration.

JEL classification: C90, D83, F22, H20, J15.

Keywords: immigration attitudes, information provision experiment, belief updating, welfare state, labor market, preferences for redistribution.

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1 Introduction

Economic nationalism and public opposition towards immigration have recently been found to be important determinants of political attitudes and voting behavior (Barone et al. 2016; Halla et al. 2017). While these relationships are related to a surge in populism across western societies (Colantone and Stanig 2019), the literature also consistently reports a tendency of native populations to be misinformed about factual information about immigration, e.g. in relation to the share and the unemployment rate of immigrants (Barrera et al. 2020; Citrin and Sides 2008).

Given these biased beliefs of individuals, a recent strand of literature evaluates the effect of information provision on immigration attitudes and policy preferences, presenting mixed evidence on its effectiveness (Grigorieff et al. 2020; Hopkins et al. 2019). Other studies investigate whether misperceptions and information about immigration influence natives' preferences for redistribution (Alesina et al. 2018), while presenting evidence for null effects in terms of information about the share and origins of immigrants. This mixed evidence raises the question whether these observed differences in effects of information provision are based on the quantity or type of information which is provided to individuals. Previous studies also mostly focus on attitudes towards immigration and policy preferences which are more general in nature, or do not provide statistical information on the economic characteristics of immigration.

We extend the literature by experimentally evaluating potential differences concerning the quantity and the type of information provided, focussing on two key facts about immigration: the share and the unemployment rate of immigrants. We focus our analysis on two prominent economic channels emphasized in the seminal model by Facchini and Mayda (2009), highlighting concerns of individuals about potentially adverse effects of immigration on the welfare state and labor market. We expand this analysis by also accounting for immigration policy preferences and preferences for redistribution in a joint setting.

Using a survey experiment embeded into a large-scale representative online survey in Germany, we find that providing respondents with information about immigration statistics decreases their economic concerns about immigration. This effect is more pronounced for individuals who jointly overestimate both the share and the unemployment rate of immigrants. In addition, these respondents also develop more positive preferences for future immigration

to their country. Further analyses suggest, however, that with respect to redistribution, the effect of information provision may have an adverse impact on redistributive preferences.

With respect to the type of information provided, we observe differences in effect sizes between our outcome variables of interest. While the results concerning the welfare state channel are in line with an earlier study focussing on Eastern Germany (Bareinz and Uebelmesser 2020), we provide evidence that information on the share of immigrants exerts effects on labor market concerns and immigration policy preferences. In general, our results suggest the distribution of prior beliefs about immigration in a society to be decisive for the effectiveness of information interventions in the context of immigration attitudes. This also emphasizes implications for policy suggesting that interventions providing information about immigration statistics should be targeted based on the specific characteristics of the society of interest.

The remainder of this paper is structured as follows: section 2 presents the pre-registered design and hypotheses of our information provision experiment. While the data set used in our analysis is described in section 3, section 4 provides the main empirical results of our experiment. Further analyses and discussion are presented in section 5. Section 6 concludes.

2 Experimental Design and Hypotheses

In this section, we introduce our pre-registered experimental design and hypotheses following the descriptions in our pre-analysis plan.[1] Our experimental design draws from prior work by Alesina et al. (2018), Grigorieff et al. (2020), Hopkins et al. (2019), and Lergetporer et al. (2017). We extend their designs by systematically disentangling treatment effects of the quantity and type of statistical information provided to survey respondents.

Specifically, we experimentally vary the quantity and the type of facts about immigration provided between treatment arms, incorporating information on both the size and economic characteristics of the immigrant population. In the following, we will introduce the details of our experimental design, which consists of four stages and three treatment arms. The following descriptions largely draw from an earlier study which focussed on Eastern Germany (Bareinz and Uebelmesser 2020).

[1]The pre-registration and our corresponding pre-analysis plan are available at: www.socialscienceregistry.org-/trials/6819.

Our survey experiment also contains a fifth experimental group. This group is similar to the passive control group in that it receives no information. However, we randomize the order of a question block on the COVID-19 crisis between the control group and the fifth group to investigate whether there exist priming effects on our outcome variables related to the ongoing health and economic crisis. In the following, we will refer to our information provision experiment as the *main* experiment, while the investigation related to our fifth experimental group is described as the *priming* experiment.

2.1 Elicitation of prior beliefs

The *first stage* of our experiment consists of the elicitation of prior beliefs of respondents. As a benchmark for general beliefs about federal statistics, we first elicit their beliefs about the general unemployment rate in Germany. We then proceed to elicit respondents' prior beliefs about two key statistics about immigration to Germany: the share and the unemployment rate of immigrants.[2] The elicitation of prior beliefs enables us to differentiate between those respondents who exert biases in beliefs about immigration and those individuals who are already well informed about immigration statistics at the time of our intervention.

2.2 Treatment arms

In the *second stage* of our information provision experiment, random subsets of respondents are provided with true information about the share and/or the unemployment rate of immigrants. Specifically, we experimentally vary the amount and type of information provided across treatment arms:

Treatment arm A**:** Receives information on the share of immigrants (representing the size of the immigrant population).

Treatment arm B**:** Receives information on the unemployment rate of immigrants (representing the economic characteristics of the immigrant population).

Treatment arm C**:** Receives information on the share *and* the unemployment rate of immigrants (representing a bundle of both types of information).

[2] In conjunction with the definition which is used by German Federal Office of Statistics, we define immigrants based on their citizenship. All survey respondents are provided with this definition within the survey.

Control group: Does not receive any information intervention.

The two types of statistical information distinguish between facts about the size of the immigrant population, and information on its economic characteristics, represented by the unemployment rate of immigrants. In addition, treatment arm *C* allows us to investigate the dimension of quantity in terms of a bundle of both types of information. The information treatments further involve conditional feedback on respondents' prior beliefs for the three treatment arms, based on the statistic(s) which are provided in each case.[3]

In the following, we present the precise wording of our information interventions:[4]

Treatment arm *A*:

"We will take a brief look at your estimate of the share of immigrants in Germany:
The official share of immigrants in Germany is around 13 percent. Your estimate of [show estimate] was therefore [too low / quite accurate / too high]".

Treatment arm *B*:

"We will take a brief look at your estimate of the unemployment rate of immigrants in Germany:
The official unemployment rate of immigrants in Germany is around 15 percent. Your estimate of [show estimate] was therefore [too low / quite accurate / too high]".

Treatment arm *C*:

"We will take a brief look at your two estimates:
The official share of immigrants in Germany is around 13 percent. Your estimate of [show estimate] was therefore [too low / quite accurate / too high].
The official unemployment rate of immigrants in Germany is around 15 percent. Your estimate of [show estimate] was therefore [too low / quite accurate / too high]".

[3]We allow for a margin of error of ±1 percentage points for respondents to receive the feedback of correct estimation.

[4]In addition to the information treatments, we disclose the sources of the information provided to ensure its credibility. Specifically, the information on the share of immigrants stems from the German Federal Statistical Office, while the information on the unemployment rate of immigrants stems from the German Federal Employment Agency.

2.3 Outcome variables

In the *third stage* of our experiment, respondents are asked literature-based survey measures of attitudes towards immigration and preferences for redistribution. Specifically, we ask respondents survey questions related to the welfare state and labor market channels of immigration attitudes, immigration policy preferences, and preferences for redistribution.

With respect to economic attitudes towards immigration, the welfare state and labor market channels are emphasized by theory (Facchini and Mayda 2009) and have also been extensively investigated by empirical research (Scheve and Slaughter 2001; Ortega and Polavieja 2012; Dahlberg et al. 2012; Hainmueller and Hiscox 2010; Naumann et al. 2018). We follow the notion put forward by Facchini and Mayda (2009), in which the welfare state channel relates to concerns about adverse effects of immigration on taxation and public good provision, while the labor market channel reflects concerns about increases in labor market competition.

The wording of the survey measures of economics concerns about immigration is based on the European Social Survey (ESS):

Welfare state concerns: "Immigrants pay taxes and receive social benefits from the health care and social insurance systems. On balance, do you think that immigrants in Germany 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: "Do you think that immigrants rather take away jobs from workers in Germany, or that they rather help to create new jobs?". Answers range from 0 for "Take jobs away" to 10 for "Create new jobs".

In addition to economic concerns about immigration, we also investigate the effect of information provision on immigration policy preferences. Specfically, we employ the following wording which is often used in the related literature (Card et al. 2012; Grigorieff et al. 2020; Mayda 2006; Scheve and Slaughter 2001).[5]

[5]While it is sometimes differentiated between characteristics of the origin country, ethnicity, or legal status of immigrants, our employed survey measure refers to policy preferences about immigration in general.

Immigration policy preferences: "Do you think that the number of immigrants coming to Germany each year should be: decreased a lot / decreased slightly / stay the same / increased slightly / increased a lot?".

We expand our analysis by also investigating potential effects of information provision on preferences for redistribution. In a recent study, Alesina et al. (2018) investigate whether information on the share or origin of immigrants affects preferences for redistribution, finding no evidence for information effects. We aim to extend their analyses by including statistical information about economic characteristics of the immigrant population, represented by the unemployment rate of immigrants, in addition to information on its size, i.e. the share of immigrants. We hypothesize that inherintly economic statistical facts about immigration may translate differently into preferences for redistribution in host societies. For our measures of preferences for redistribution, we employ the following wording based on Alesina et al. (2018):

Preferences for redistribution: "Some people think that the government should not care about income differences between rich and poor people. Others think that the government should do everything in its power to reduce income inequality. What do you think?". Answers range from 0 for "Government should not care about income inequality" to 10 for "Government should do everything against income inequality".

We code all of our outcome variables such that a higher value indicates a more positive attitude towards immigration or a more supportive attitude towards redistribution, respectively. Labor market concerns, welfare state concerns, and preferences for redistribution are measured on an 11-point scale, and immigration policy preferences are measured on a 5-point scale, respectively.

2.4 Elicitation of posterior beliefs

In *fourth stage* of the experiment, we elicit respondents' posterior beliefs about the share and/or the unemployment rate of immigrants for respondents in one of the treatment arms. While respondents in treatment arms *A* and *B* state their posterior beliefs about the share or the unemployment rate of immigrants, respectively, respondents in treatment arm *C* are asked again about both statistics. We elicit posterior beliefs at the very end of the survey in order to reduce concerns about experimenter demand. The elicitation of posterior beliefs allows us

to investigate whether respondents in the treatment arms engage in belief updating after the receipt of facts about immigration.

2.5 Priming experiment

Since our survey field phase coincides with the ongoing COVID-19 crisis, we further conduct a dedicated *priming* experiment to investigate potential concerns about priming effects related to the health and economic crisis. Hence, we employ a fifth experimental group which resembles the passive control group from our *main* experiment in that respondents do not receive any information about immigration statistics. However, respondents in this group are primed by a question block on COVID-19 to think about the ongoing health and economic crisis before answering to our outcome measures on immigration. A similar design has been recently employed by Daniele et al. (2020) to investigate priming effects related to the crisis on political and social attitudes.

The order of appereance between the questions blocks on the COVID-19 crisis and immigration attitudes are randomized between the passive control group and the priming group. We then examine whether respondents in the priming group differ in terms of their immigration and policy attitudes when compared to the passive control group. This allows us both to account for the COVID-19 crisis in relation to our main experiment, and further enables us to directly investigate its potential effects on attitudes towards immigration and preferences for redistribution.

2.6 Main Hypotheses

In the following, we present our pre-registered hypotheses, which follow their original formulation in Bareinz and Uebelmesser (2020). We focus on the case of overestimation which is supported by findings in the recent literature on beliefs about immigration (Alesina et al. 2018; Barrera et al. 2020; Grigorieff et al. 2020; Hopkins et al. 2019). In this setting, respondents' beliefs about the share and the unemployment rate of immigrants are positively biased, on average:

Hypothesis I – 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 IIa – Labor market channel: scenario a.: 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 scenario, the higher employedness of immigrants and the lower size of the immigrant population are perceived as *less current* competition on the job market.

Hypothesis IIb – Labor market channel: scenario b.: 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 scenario, the higher employedness of immigrants is perceived as *larger potential* competition on the job market, while the lower size of the immigrant population is, again, perceived as *less current* competition on the job market, potentially offsetting each other.

Hypothesis III – 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.

Hypothesis IV – Preferences for redistribution: Information provision translates into more supportive preferences for redistribution 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.

3 Data

In this section, we describe the data set employed in our empirical analysis and introduce the general structure of the socio-economic covariates included in the survey. We further conduct tests for experimental balance across these covariates.

3.1 Data collection

We embed our information provision experiment into a large-scale representative online survey of 3000 invidividuals in Germany. The survey is representative with respect to age, gender, educational background, and federal state. The survey was fielded from end of November 2020 to mid of december 2020 and was distributed to respondents by the survey company *Respondi* via an online panel. Before answering to our survey, respondents further had to pass a standard attention screener (Chandler et al. 2019). For that purpose, we employ the formulation recently proposed by Haaland et al. (2020) in the context of information provision experiments.

Based on randomization, 2390 respondents were allocated to our *main* experiment, while 610 individuals have been assigned to the treatment group of our *priming* experiment. For our main experiment, we analyze data of 2358 respondents for which we have full information on the variables of interest. In our priming experiment, we consequently use data of 1196 respondents from the priming treatment as well as the passive control group.

Our survey contains measures related to the assessment of the general economic situation, beliefs about immigration, economic concerns about immigration, immigration policy preferences, preferences for redistribution, concerns about the COVID-19 crisis, general political and social attitudes, and a wide range of sociodemographic covariates. This allows us to evaluate experimental balance on a wide range of socio-economic covariates, and further enables us to systematically assess potential heterogeneity in information effects for different sociodemographic subgroups of the population.

3.2 Experimental balance

We conduct tests for experimental balance between experimental groups on a large set of socio-economic and sociodemographic covariates as indicated on our pre-analysis plan. The tests are based on between-subject t-tests and the results are presented in table A2 in the appendix. In general, we only observe few marginal imbalances in our wide range of socio-economic covariates.[6] As specified in our pre-analysis plan, we control for all variables exerting

[6]Most notably, treatment arm *B* exerts an imbalance in terms of pre-treatment concerns about immigration which we control for across specifications.

imbalances in our specifications.[7] We are hence confident that estimated treatment effects allow for a causal interpretation.

4 Main Results

In the following, we present our estimation strategy and discuss the main empirical results of our information provision experiment.

4.1 Global effects of information provision

To investigate the global, i.e. full-sample effects of our information treatments in our main experiment[8], we estimate the following equation which compares our outcome variables across treatment arms given exogeneity of the treatments:

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

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 additional covariates, and ε_i is the error term.

The estimation results are displayed in panel *I* of table 1. We find (marginally) significant treatment effects for all three of our outcomes related to immigration attitudes, but do not find evidence for a full-sample effect on preferences for redistribution. More specifically, for the full sample, we find that information on the unemployment rate of immigrants as well as a bundle of information on both statistics increases the assessment of the welfare state contribution of immigrants, i.e. reducing welfare state concerns about immigration. With respect to the labor market channel, we observe that information on the share of immigrants reduces labor market concerns about immigration. We find a similar effect on immigration policy preferences.

4.2 Conditional effects based on prior beliefs

While we observe full-sample effects of information provision on immigration attitudes, these effects are relatively small in size, amounting to an increase of about 9 percent of a standard

[7] Specifically, we control for all imbalances which are significant on the 10 percent level.

[8] Note that this investigation does not include our fifth experimental group related to our priming experiment in the context of the COVID-19 crisis.

Table 1: Treatment effects on channels of immigration attitudes.

	Welfare		Labor		Policy		Redistribution	
Panel *I*: full sample:								
Treatment *A*: share	0.06	(0.05)	0.08*	(0.05)	0.08*	(0.04)	0.02	(0.06)
Treatment *B*: unemployment	0.10**	(0.05)	0.04	(0.05)	0.05	(0.04)	0.07	(0.06)
Treatment *C*: share + unemployment	0.09*	(0.05)	0.02	(0.05)	0.05	(0.04)	0.04	(0.06)
Controls	Yes		Yes		Yes		Yes	
Observations	2358		2358		2358		2358	
Panel *II*: joint overestimation:								
Treatment *A*: share	0.16**	(0.07)	0.14**	(0.07)	0.23***	(0.06)	−0.09	(0.09)
Treatment *B*: unemployment	0.17**	(0.07)	0.11	(0.07)	0.12**	(0.06)	−0.01	(0.08)
Treatment *C*: share + unemployment	0.26***	(0.08)	0.04	(0.08)	0.16**	(0.06)	−0.15*	(0.09)
Controls	Yes		Yes		Yes		Yes	
Observations	1076		1076		1076		1076	

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 controls comprise of pre-treatment concerns about immigration and economic development, self-assessed contact with foreigners, attitudes towards cultural diversity, confidence in prior beliefs, trust in science and statistics, university education, and household size and partnership.

deviation. Recalling that we derived our hypotheses based on the assumption of joint overestimation of both immigration statistics by individuals, we therefore reestimate equation (1) for those respondents who exert biased beliefs about both the share and the unemployment rate of immigrants.[9]

The results for joint overestimation are displayed in panel *II* of table 1. We find that, in comparison to the full-sample results, treatment effects are considerably larger for those respondents who jointly overestimate the share and the unemployment rate of immigrants. The results for the welfare state channel are in line with hypothesis *I* and are qualitatively similar to those from an earlier study focussing on Eastern Germany (Bareinz and Uebelmesser 2020). Specifically, they imply that the combination of information on both the share and the unemployment rate of immigrants increase the assessment of immigrants' welfare state contribution considerably by about 26 percent of a standard deviation.

The positive effects of information provision on the labor market and policy channels are more pronounced as well. Interestingly, information on the share of the immigrant population exerts comparably larger effects on these outcome measures. Concerning the labor market

[9]This investigation is supported by the results of a systematic approach to the examination of treatment effect heterogeneity developed by Athey and Imbens (2016, 2019). The results are available upon request.

channel of immigration attitudes, this observation is qualitatively in line with hypothesis *IIa*, suggesting that a smaller size of the immigrant population is perceived as less *current* labor market competition. In contrast, we do not find a sizeable effect of the bundled information on labor market concerns.

This result hence hints at an offsetting scenario between the share and unemployment rate of immigrants in line with hypothesis *IIb*. However, this interpretation is not consistent with the observation of a positive, albeit insignificant coefficient for treatment arm *B* on the labor market channel. With respect to immigration policy preferences, we further observe evidence in line with hypothesis *III*. Specifically, we find that information provision increases preferences for further immigration to the host country for those individuals with positively biased beliefs about the size of the immigrant population and its economic characteristics.

In addition to effects of our information treatments on immigration attitudes, we also examine treatment effects on preferences for redistribution in case of joint overestimation. In contrast to hypothesis *IV*, we find suggestive evidence for a decrease in preferences for redistribution for respondents who are informed about the true values after having overestimated both immigration statistics.

This result hints at a trade-off scenario for individuals. On the one hand, respondents who initially overestimate both the size of the immigrant population and the unemployment rate of immigrants develop more positive attitudes towards immigration after being exposed to the factual information. On the contrary, however, these individuals also seem to reduce preferences for redistribution after being informed that the size of the immigrant population and their unemployment rate is smaller than believed ex ante.

5 Discussion

The analysis of direct effects of information provision represents a reduced-form approach to examining treatment effects. The underlying assumption is that respondents first update their beliefs according to the information received, and subsequently change their attitudes. In this section, we therefore discuss the channel of belief updating in more detail. In addition, we also present evidence with respect to our priming experiment.

5.1 Within-subject belief updating

We first investigate whether respondents who receive information on the share and/or the unemployment rate of immigrants update their beliefs after the receipt of information. Specifically, we compare their prior and posterior beliefs by means of within-subject t-tests. We find significant belief updating across treatment arms, which implies that respondents have processed the information provided during treatment, on average.[10]

5.2 Two-stage analysis of belief updating

In addition to within-subject belief updating and the evaluation of reduced-form effects of information, we further evaluate sequential treatment effects by means of a 2SLS strategy similar to Lergetporer et al. (2017, 2020). This allows us to investigate a potential causal link between biases in beliefs about immigration statistics and negative attitudes towards immigrants.

We therefore combine prior beliefs for those groups who did not receive the true values with posterior beliefs of respondents who did receive information on the respective immigration statistic. We regress this variable on our treatment indicators, representing the first stage of our 2SLS approach:

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

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

where S_i and U_i represent the combined variables on prior and posterior 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 additional covariates, and ε_i is the error term.

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

$$y_i = \gamma_0 + \gamma_1^{IV} \widehat{S_i} + \gamma_2^{IV} \widehat{U_i} + \delta^T X_i + \varepsilon_i, \tag{3}$$

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, X_i contains the same covariates from the first stages, and ε_i is the error term.

[10] Specifically, the p-values of within-subject t-tests are significant on the 1 percent level.

Table 2: Two-stage analysis of belief updating.

	Welfare	Labor	Policy	Redistribution
Panel *I*: second stage:				
Share: instrumented	−0.004 (0.005)	−0.006 (0.005)	−0.006 (0.004)	0.001 (0.007)
Unemp.: instrumented	−0.004* (0.002)	0.000 (0.002)	−0.001 (0.002)	−0.003 (0.003)
Controls	Yes	Yes	Yes	Yes
	Share		Unemployment	
Panel *II*: first stages:				
Treatment *A*: share	-6.396***	(0.768)	-0.451	(1.299)
Treatment *B*: unemp.	0.114	(0.862)	-14.032***	(1.034)
Treatment *C*: share + unemp.	-5.845***	(0.795)	-15.098***	(1.014)
Controls	Yes		Yes	
First-stage *F*-statistic	19.41		39.00	
Observations	2358	2358	2358	2358

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 controls comprise of pre-treatment concerns about immigration and economic development, self-assessed contact with foreigners, attitudes towards cultural diversity, confidence in prior beliefs, trust in science and statistics, university education, and household size and partnership.

Our information treatments are designed to specifically affect beliefs of respondents about the respective statistic(s) provided. In the context of our 2SLS strategy we therefore cautiously assume the exclusion restriction to hold, i.e. that our information treatments – if they do relevantly affect respondents' beliefs about immigration statistics – affect our outcome variables exclusively only via their effects on these beliefs.

The estimation results of our 2SLS approach for the full sample are displayed in table 2. We find a strong first stage of our instrumental variable strategy as indiciated by the first-stage F-statistics. Consisent with the design of our experiment, we further observe significant between-subject differences in beliefs for those treatment arms which receive a specific type of information. Overall, we, however, do not observe strong evidence for a negative effect of biases in prior beliefs on our outcome variables in the second stage. An exception to this is a marginally significant negative effect of instrumented beliefs about the unemployment rate of immigrants on the assessment of immigrants' welfare state contribution.

We hence conclude that, for the full sample, the relationship between beliefs about immigration and immigration attitudes is rather weak. This is in line with the observation of the relatively small full-sample treatment effects, which are, however, considerably more pronounced for the subsample of respondents who jointly overestimate both immigration statistics. We

Table 3: Two-stage analysis of belief updating: joint overestimation.

	Welfare	Labor	Policy	Redistribution
Panel *I*: second stage:				
Share: instrumented	−0.009** (0.004)	−0.004 (0.004)	−0.011*** (0.003)	0.009* (0.005)
Unemp.: instrumented	−0.005*** (0.002)	0.000 (0.002)	−0.001 (0.002)	0.001 (0.002)
Controls	Yes	Yes	Yes	Yes
	Share		Unemployment	
Panel *II*: first stages:				
Treatment *A*: share	-13.432***	(1.248)	-2.202	(1.738)
Treatment *B*: unemp.	-1.366	(1.273)	-27.715***	(1.422)
Treatment *C*: share + unemp.	-12.933***	(1.300)	-28.880***	(1.427)
Controls	Yes		Yes	
First-stage *F*-statistic	20.91		61.91	
Observations	1076	1076	1076	1076

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 controls comprise of pre-treatment concerns about immigration and economic development, self-assessed contact with foreigners, attitudes towards cultural diversity, confidence in prior beliefs, trust in science and statistics, university education, and household size and partnership.

therefore reestimate equations (2) and (3) again for those respondents who jointly overestimate both the share and the unemployment rate of foreigners.

The respective estimation results are displayed in table 3. The results for the first-stage estimations are very similar to the results obtained for the full sample, and show a stronger negative effect on between-subject beliefs as expected. Concerning the second-stage results, we find that for the welfare state channel, biases in beliefs about both the share and the unemployment rate of immigrants are negatively linked to immigration attitudes. While we do not observe similar evidence for the labor market channel, immigration policy preferences are affected negatively by biases in beliefs about the share of immigrants as well. Again, we observe suggestive evidence for an adverse effect on preferences for redistribution.

5.3 Determinants and updating of prior beliefs

In addition to the examination of treatment effects, we explore which determinants of respondents' characteristics are associated with biased beliefs about immigration. For that purpose, we estimate the following equation:

$$b_i = \delta_0 + \delta^T X_i + \varepsilon_i, \tag{4}$$

where b_i represents biases in beliefs about the share and the unemployment rate in absolute terms, respectively, X_i contains socio-demographic and attitudinal controls from the balance tests, and ε_i is the error term.

The results are displayed in table A1 in the appendix. Overall, we are able to explain 37 percent of the variation in beliefs about the share of immigrants, and 20 percent of the variation in beliefs about the unemployment rate of immigrants, respectively. We further find beliefs about the general unemployment rate in Germany as well as pre-treatment concerns about immigration to be good predictors of biases in beliefs about both immigration statistics.

Interestingly, a higher consumption of news is associated with more biased beliefs about the share of immigrants, while having more trust in the media is negatively correlated with biases in beliefs about the unemployment rate. With respect to the COVID-19 crisis, stronger financial concerns are associated with larger biases in beliefs update the unemployment rate of immigrants. In addition, we find several sociodemographic characteristics to be significant predictors of biases in beliefs about immigration, e.g. age, gender, eduational background, and place of residence in Eastern Germany.

5.4 Priming experiment

Since our information provision experiment was conducted in times of the COVID-19 crisis, we directly account for potential priming effects related to the ongoing crisis within a secondary robustness experiment.

In this *priming* experiment, we examine potential effects of priming respondents to think about the COVID-19 crisis on our outcome variables of interest. For that purpose, we estimate the following equation for respondents in the passive control group and the priming group:

$$y_i = \theta_0 + \theta_1 P_i + \delta^T X_i + \varepsilon_i, \tag{5}$$

where y_i represents the outcome variable, P_i is a treatment indicator for the priming treatment, X_i contains additional covariates, and ε_i is the error term.

The results of this estimation are displayed in table 4. Overall, we do not find evidence for considerable priming effects on immigration attitudes and preferences for redistribution in the context of our information provision experiment. Specifically, the estimated effect sizes are

Table 4: Effects of priming respondents about the COVID-19 crisis.

	Welfare	Labor	Policy	Redistribution
Priming COVID-19	0.04 (0.05)	0.01 (0.05)	0.06 (0.04)	0.06 (0.06)
Controls	Yes	Yes	Yes	Yes
Observations	1196	1196	1196	1196

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 controls comprise of pre-treatment concerns about immigration and economic development, self-assessed contact with foreigners, attitudes towards cultural diversity, confidence in prior beliefs, trust in science and statistics, university education, and household size and partnership.

very close to zero and statistically insignificant. Hence, the results of our priming experiment indicate that the relevance of questions about the COVID-19 crisis is limited with respect to our information provision experiment and do not imply a related bias.

6 Conclusion

We conduct an information provision experiment to examine the relevance of statistical information for economic attitudes towards immigration. Employing data from a large-scale representative online survey in Germany, we find that providing respondents with information about immigration statistics decreases their economic concerns about immigration. The magnitude of this effect depends on the distribution of prior beliefs in the population and is more pronounced for individuals who jointly overestimate both the share and the unemployment rate of immigrants.

In addition, respondents also develop more positive preferences for future immigration to their country. However, further analysis suggest an adverse effect on preferences for redistribution, hinting at a trade-off scenario for individuals. We further provide evidence suggesting a causal link between biases in beliefs about immigration and more negative attitudes towards immigration for those respondents who exert positively biased beliefs about both the share and the unemployment rate of immigrants. In terms of the specific information provided to respondents, we observe relevant differences with respect to the type and quantity of information. While the results concerning the welfare state channel of immigration attitudes are in line with an earlier study focussing on Eastern Germany (Bareinz and Uebelmesser 2020), we provide further evidence that information on the share of immigrants exerts effects on labor

market concerns and immigration policy preferences. These differences concerning the type of information provided are supported by the investigation of sequential treatment effects.

Our results hence suggest the distribution of prior beliefs about immigration in a society to be decisive for the effectiveness of information interventions in the context of immigration attitudes. This also emphasizes implications for policy aiming at reducing informational frictions in the context of immigration attitudes. In particular, our results suggest that interventions providing information about immigration statistics should be targeted based on specific characteristics of the society of interest to increase their effectiveness in reducing biases in beliefs about immigration.

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Appendix

Table A1: Determinants of biases in prior beliefs.

	Share		Unemployment rate	
Confidence: share of foreigners	0.60***	(0.14)	−0.94***	(0.24)
Confidence: unemployment rate of foreigners	−0.15	(0.13)	1.97***	(0.22)
Prior belief: general unemployment rate	0.40***	(0.02)	0.24***	(0.03)
Confidence: general unemployment rate	−0.36***	(0.12)	−0.70***	(0.17)
Pre-treatment concerns about immigration	0.33***	(0.10)	0.65***	(0.16)
Attitude towards cultural diversity	−0.03	(0.10)	0.17	(0.16)
Assessment of cultural living together	−0.14	(0.12)	−0.88***	(0.19)
Concerns about economic development	−0.13	(0.11)	−0.04	(0.17)
Concerns about personal economic situation	0.06	(0.09)	−0.17	(0.15)
Expectations about personal economic situation	0.08	(0.36)	−1.36**	(0.57)
News consumption	0.01***	(0.00)	0.00	(0.01)
Risk attitude	−0.03	(0.09)	0.01	(0.15)
Generalized trust	−0.07	(0.10)	0.07	(0.16)
Trust in institutions	−0.13	(0.12)	−0.33	(0.21)
Trust in statistics and science	−0.13	(0.11)	0.29	(0.20)
Trust in the media	0.01	(0.11)	−0.48***	(0.18)
Political attitude	0.17	(0.13)	0.10	(0.21)
General concerns COVID-19 crisis	0.06	(0.09)	−0.18	(0.15)
Financial concerns COVID-19 crisis	0.02	(0.08)	0.23*	(0.14)
Experience COVID-19 testing	−0.42	(0.57)	−0.52	(0.89)
Expectations about COVID-19 crisis	−0.14	(0.26)	−0.11	(0.46)
Age	−0.04**	(0.02)	0.04	(0.03)
Female	2.59***	(0.45)	0.38	(0.74)
East Germany	−1.52***	(0.55)	6.04***	(1.04)
Education	−1.02***	(0.30)	0.82	(0.51)
University degree	0.68	(0.54)	−0.40	(0.85)
Employed	1.14**	(0.46)	−0.12	(0.75)
Household size	0.13	(0.15)	0.04	(0.25)
Income	−0.31	(0.19)	−0.42	(0.33)
Partner	−0.37	(0.46)	−0.18	(0.77)
Migration background	−0.77	(0.50)	0.15	(0.79)
Contact with foreigners: familiy	0.24	(0.18)	−0.22	(0.29)
Contact with foreigners: neighborhood	0.31	(0.20)	−0.39	(0.31)
Population size in area of residence	−0.07	(0.14)	−0.37	(0.24)
Observations	2959		2959	
Adj. R^2	0.37		0.20	

Notes: Biases in prior beliefs are defined in absolute terms. Hence, coefficients are interpreted in terms of deviations away from the true value of the respective immigration statstic. Robust standard errors are displayed in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A2: Tests for experimental balance in covariates.

				Treated					
	Control	Treatment *A*	p-value	Treatment *B*	p-value	Treatment *C*	p-value	Priming COVID-19	p-value
Prior belief: share of foreigners	23.08	22.30	0.400	23.60	0.560	22.97	0.907	23.01	0.939
Confidence: share of foreigners	4.89	4.91	0.873	5.14	0.086	4.84	0.713	4.84	0.709
Prior belief: unemployment rate of foreigners	30.70	30.19	0.711	31.38	0.615	29.08	0.241	31.45	0.583
Confidence: unemployment rate of foreigners	4.57	4.65	0.604	4.81	0.115	4.59	0.934	4.63	0.685
Prior belief: general unemployment rate	15.24	15.30	0.951	16.07	0.361	15.91	0.462	15.88	0.486
Confidence: general unemployment rate	5.55	5.83	0.068	5.72	0.280	5.62	0.674	5.62	0.665
Pre-treatment concerns about immigration	6.48	6.77	0.119	7.00	0.005	6.76	0.157	6.78	0.107
Attitude towards cultural diversity	6.11	6.28	0.313	6.45	0.047	6.35	0.169	6.35	0.156
Assessment of cultural living together	5.99	5.88	0.409	5.93	0.681	6.03	0.800	6.00	0.950
Concerns about economic development	7.42	7.46	0.813	7.63	0.147	7.67	0.094	7.56	0.317
Concerns about personal economic situation	6.26	6.34	0.613	6.27	0.948	6.02	0.192	6.01	0.165
Expectations about personal economic situation	1.88	1.85	0.421	1.85	0.371	1.86	0.587	1.88	0.953
News consumption	70.95	74.84	0.351	72.87	0.661	68.55	0.559	72.82	0.651
Risk attitude	4.75	4.76	0.917	4.79	0.744	4.90	0.309	4.70	0.718
Generalized trust	5.09	5.25	0.308	5.08	0.948	5.19	0.548	5.31	0.158
Trust in institutions	5.93	5.89	0.805	5.71	0.155	5.91	0.890	6.05	0.419
Trust in statistics and science	5.79	6.04	0.100	5.77	0.863	5.97	0.271	6.10	0.040
Trust in the media	5.42	5.51	0.576	5.28	0.363	5.50	0.632	5.54	0.424
Political attitude	5.63	5.70	0.471	5.75	0.255	5.64	0.870	5.68	0.584
General concerns COVID-19 crisis	7.14	7.30	0.311	7.01	0.393	7.35	0.202	7.44	0.054
Financial concerns COVID-19 crisis	3.82	4.00	0.329	4.04	0.227	3.63	0.287	3.87	0.763
Experience COVID-19 testing	1.87	1.86	0.559	1.85	0.218	1.85	0.382	1.86	0.544
Expectations about COVID-19 crisis	1.93	1.94	0.953	1.96	0.488	1.98	0.250	2.02	0.056
Age	48.89	49.82	0.326	49.00	0.906	49.03	0.882	48.66	0.813
Female	0.53	0.49	0.224	0.48	0.125	0.53	0.842	0.50	0.353
East Germany	0.14	0.16	0.339	0.14	0.857	0.15	0.478	0.16	0.290
Education	1.94	1.93	0.850	1.92	0.654	1.97	0.558	2.01	0.149
University degree	1.78	1.76	0.442	1.77	0.544	1.76	0.482	1.74	0.073
Employed	0.51	0.52	0.736	0.53	0.506	0.51	0.807	0.50	0.601
Household size	2.04	2.16	0.085	2.21	0.055	2.09	0.481	2.12	0.263
Income	2.49	2.50	0.872	2.49	0.972	2.51	0.746	2.47	0.800
Partner	1.41	1.36	0.057	1.38	0.276	1.39	0.490	1.37	0.119
Migration background	1.80	1.77	0.118	1.78	0.325	1.76	0.105	1.78	0.264
Contact with foreigners: familiy	2.57	2.62	0.555	2.70	0.094	2.56	0.852	2.52	0.466
Contact with foreigners: neighborhood	2.76	2.71	0.534	2.84	0.238	2.71	0.536	2.71	0.528
Population size in area of residence	3.23	3.20	0.738	3.32	0.252	3.23	0.983	3.25	0.749

Notes: Comparisons of treatments and control groups. Note that the results with respect to the question block on the COVID-19 crisis for the priming treatment need to be interpreted with caution since the question block on COVID-19 is a treatment in itself.