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ORIGINAL PAPER

Media Exposure to Highly Skilled Immigrants and Attitudes Toward Immigration

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Abstract

Can exposure to successful immigrants in the mass media affect perceptions of immigrants and alter attitudes toward immigration? To address this question, I study the case of Ozlem Tureci and Ugur Sahin, the co-developers of the Pfizer-BioNTech COVID-19 vaccine, and children of Turkish immigrants in Germany. I first demonstrate that German media favorably highlighted the Turkish roots and migration history of vaccine developers. Leveraging the quasi-experimental setting with the announcement of the success of the vaccine, I then posit that the wide broadcasting of the vaccine's success and its developers' identity should have positive spillover effects on public attitudes towards immigration. Amongst those who were exposed to this announcement, compared to those who were not, there is a 4 percentage-point increase in support of easing immigration opportunities. I suggest that this effect is driven by a change in perceptions and knowledge on issues relating to immigration and integration. These findings imply that promoting successful immigrants in the media has the potential to diminish prejudice; however, it is crucial to address varying biases toward different immigrant groups.

Keywords Immigration attitudes · Highly skilled immigrants · Perceptions · Extended contact · Media exposure · Unexpected events

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Introduction

Immigration is widely regarded as one of the most divisive and polarizing issues in Western Europe (Hobolt, 2016; Grande et al., 2019; Lutz & Bitschnau, 2022). When it comes to attitudes toward immigration, it has been demonstrated that the media plays an important role in shaping opinions and persuading voters (Bartels, 1993; Brader et al., 2008; Abrajano & Singh, 2009; Dunaway et al., 2010). Recent studies have also shown that media bias increases polarization (Martin & Yurukoglu, 2017), influences voting and elections (DellaVigna & Kaplan, 2007; Bernhardt et al., 2008) and fosters a perceived threat between in- and out-groups (Conzo et al., 2021). The media is effective at generating support for out-groups (ter Wal, 2002), but immigration coverage of the media is often negative (Schemer, 2012; Conzo et al., 2021) and polarized (Schneider-Strawczynsk & Valette, 2021). While there is no doubt that the media shapes public opinion and contributes to polarized issues such as immigration, there is little evidence on how media framing influences public attitudes when the framing is consistent across otherwise polarized channels. This research question calls for an extraordinary event which pertains to immigration and is framed similarly across all available media, regardless of editorial stance or target audience.

On 9 November 2020, BioNTech and Pfizer announced that a vaccine for the coronavirus developed by Dr. Sahin and Dr. Tureci was more than 90 percent effective in preventing the disease among trial volunteers (Editorial, 2020c). Around noon that day, BioNTech's value reached 23 billion euros, surpassing companies such as Deutsche Bank. After the announcement of the vaccine's success, Ugur Sahin and Ozlem Tureci received extensive press attention, with a particular spotlight on their Turkish roots. "Our world can be saved. From Mainz. By children of migrants," was a headline in Bild, the most popular tabloid in Germany, which has long been critical of immigration in general terms (Editorial, 2020d). Many German newspapers framed the vaccine's success as an example of successful integration. For instance, the conservative business site Focus, wrote "...with this couple, Germany has a shining example of successful integration" (Editorial, 2020b). By November 10, the couple's success (coupled with their immigrant roots) was the subject of widespread international attention. For example, The New York Times reported that "in Germany, where immigration continues to be a fractious issue, the success of two scientists of Turkish descent was cause for celebration" (Gelles, 2020). As a result of the company's increase in value after the announcement, Sahin and Tureci became *the first* Germans with Turkish roots among Germany's 100 wealthiest people (Oltermann, 2020). Figure 1 plots Google search trends of Ugur Sahin and Ozlem Tureci in Germany. As can be seen in this figure, after the announcement of the vaccine's success on November 9, the search trends of the couple peaked already on November 10 (see, also, Appendix Figure 13 for Twitter trends on November 9).

The literature presents varying perspectives on how media exposure to information about immigrants affects societal attitudes. Studies have shown that positive media representation of minorities can lead to more favorable feelings toward outgroups (Dasgupta & Greenwald, 2001). However, negative information is often found to have a stronger and more pervasive effect on attitudes than positive information (Kahneman & Tversky, 1979; Avdagic & Savage, 2021). Additionally, research

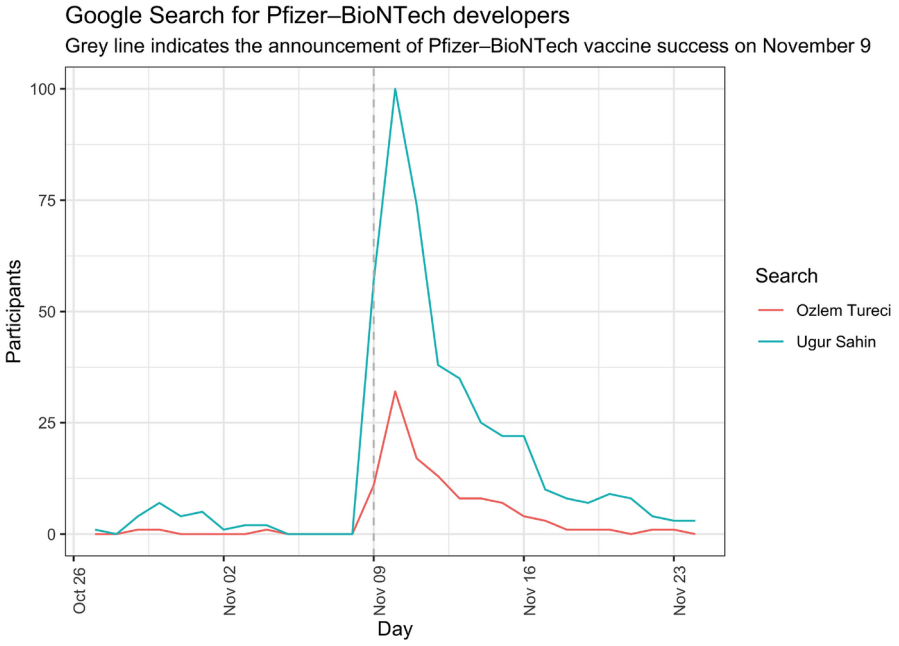


Fig. 1 Google search trends

indicates that while media coverage of immigrants may correct misperceptions, it does not necessarily result in corresponding shifts in related attitudes (Hopkins et al., 2019) or policy preferences (Grigorieff et al., 2016).

Most of the literature studying how exposure to out-group personalities can have an impact on public attitudes comes from survey experiments (Power et al., 1996; Gilliam & Iyengar, 2000; Dixon & Azocar, 2007; Rosenzweig & Zhou, 2021) and from studies focusing on soccer and prejudice. Lago and Lago-Peñas (2021) show that the more foreign players there are in a season-winning soccer team, the more favorable attitudes toward immigrants are in the region associated with that club, that year. Likewise, Alrababa'h et al. (2021) study how hate crimes towards out-groups in Liverpool have dropped after Mohamed Salah – an Egyptian professional footballer – joined Liverpool FC. Depetris-Chauvin et al. (2020) show that after an important victory of their country's national team, respondents are less likely to identify primarily with their ethnic group, and more likely to trust other ethnicities.

In this paper, I examine the Tureci-Sahin success to explore how positive media exposure to highly skilled immigrants influences public attitudes towards immigration. Since the main news was the vaccine discovery and the couple's background emerged as a by-product, and considering the variation in German media's coverage of immigration (Wellbrock, 2011), it is essential to understand the media narrative before analyzing its impact. Word frequency and sentiment analysis of newspaper articles from November 2020 show that the media consistently emphasized the vaccine developers' Turkish background while maintaining a uniformly positive tone across various outlets. I suggest that the media's consolidation around the couple's

success reflects both the vaccine's universal significance and the contextual importance of their heritage in Germany. This forms the first part of my argument.

In the second step, I examine the impact of this event on immigration attitudes. I make use of the German Internet Panel Wave 50 (Blom et al., 2021) in conjunction with unexpected events during survey design (UESD) (Muñoz et al., 2020), leveraging the random timing of interviews with respect to the vaccine announcement. The results show that the success of the vaccine and the widespread reporting on the immigrant roots of its creators contributed to increasing positive attitudes toward immigration, irrespective of political leaning. I show that this effect is specific to the area of immigration policy and not a general rally-around-the-flag phenomenon. The results also indicate a decrease in perceived own knowledge on immigration issues post-announcement, which is also specific to immigration policy. I suggest that positive media exposure to highly skilled and high-profile immigrants might have prompted a sense of 'self-reflection' on negative stereotypes.

These findings provide an important addition to the body of research on attitudes regarding immigration in three ways. First, this study demonstrates that one-off exposure to successful immigrants, when combined with a favorable media framing, can have a short-term positive effect on immigration attitudes (Schiappa et al., 2005). Second, this paper expands beyond previous research by exploring how media framing influences public attitudes when there is a departure from typical editorial biases. It examines a unique instance-the universally positive framing of a vaccine announcement and its developers with immigrant roots - offering an opportunity to study the impact of positive media framing on immigration attitudes. Finally, the findings of this study add to the existing literature on knowledge and perceptions about immigrants and their impact on anti-immigration attitudes (Grigorieff et al., 2016).

Media Exposure and Immigration Attitudes

A growing body of research has demonstrated the effect of media coverage on attitudes toward immigrants (Boomgaarden & Vliegenthart, 2007; Vliegenthart et al., 2012; Schlueter & Davidov, 2013; Hilbig & Riaz, 2021). Mastro et al. (2009) illustrate how even a one-off exposure to negative information can lead to a deterioration in attitudes and behavior towards a social group. Observational studies have shown that media reporting on immigration-related topics increases the aggregate share of vote intention for anti-immigrant parties (Boomgaarden & Vliegenthart, 2007; Schlueter & Davidov, 2013). Experimental research has also established a link between positive (negative) media framing and public attitudes toward immigration (Brader et al., 2008; Dunaway et al., 2010; Merolla et al., 2013; Blinder & Jeannet, 2018; Avdagic & Savage, 2021).

How does exposure to positive news about highly skilled immigrants affect attitudes toward immigration? 'The extended contact hypothesis' states that contact with out-groups through media can reduce prejudice in a manner similar to direct contact (Schiappa et al., 2005). The authors suggest that "...dissonance and attitude change results from a combination of factors, including new information about a minority

group and a sense of trust, respect, or attraction with representatives of a minority group." Furthermore, we know that citizens select which media sources to consume (Kinder, 1998), and their media preferences may be endogenous to their political beliefs. Thus, experimental or quasi-experimental contexts make it easier to determine the causal relationship between media framing and attitudes. An accurate test of media effects would either be one in which (i) just a few channels fail to report on the issue due to exogenous events or (ii) all potential channels report the news similarly so that everyone who has been exposed gets treated. While the former has been used by Foos and Bischof (2022), this paper adopts the latter approach.

Recent experimental and quasi-experimental research suggests that persuasion effects can manifest under favorable scope conditions: when audiences are not self-selecting into receiving political messages but are instead receiving them as a by-product (Arceneaux & Johnson, 2013), when the issue is new (Arceneaux & Kolodny, 2009) or when messaging is one-sided (Jäger, 2020). The vaccine success announcement satisfies all of these conditions because (i) the main news was that the vaccine was developed, and information about the ethnic background of the developers was a by-product, (ii) the vaccine's success was new to the world, and (iii) the reporting was consistent across all channels (see Appendix Section C). Building the the extended contact theory, the hypothesis thus states the following:[1]

> **H1**: Media exposure to highly skilled immigrants has positive effects on attitudes toward immigration.

One potential explanation for how positive media exposure influences attitudes towards immigration stems from the updated perceptions and knowledge about immigration issues and immigrants in general. A meta-analysis conducted by Pettigrew and Tropp (2006) has identified three mechanisms through which out-group contact can facilitate change in attitudes. Firstly, out-group contact can increase *knowledge* about the out-group, and thus challenge negative stereotypes and reduce prejudice, a concept initially proposed by Allport. Secondly, it can diminish anxiety associated with interacting with out-group members. Thirdly, out-group contact can lead to greater empathy and perspective-taking towards the out-group (for further elaboration on the mechanisms, see the discussion by Paler et al. (2020)). It is posited here that, in this context, the mechanism of knowledge likely plays a pivotal role.It has been established in the literature that misperceptions and knowledge significantly impact attitudes towards immigrants (Hooghe & de Vroome, 2015). Common misperceptions include overestimating the proportion of immigrants residing in a country (Sides & Citrin, 2007), the proportion of crimes committed by foreigners (Semyonov et al., 2008), and assuming significant cultural or geographical differences between immigrants and the native population (Alesina et al., 2022). Another misperception concerns the skill sets and education levels of immigrants (Blinder, 2015). Research has demonstrated that public perceptions often misrepresent the demographics of

[1] While a better test would be to check the impact of the announcement of the vaccine's success on attitudes towards migrants with a Turkish background, there are no surveys currently available asking about attitudes towards differential out-groups at the time of the announcement.

immigrants, underestimating their economic and educational status (Alesina et al., 2022). The literature also indicates a general preference for higher-skilled migration, a trend observed across various demographics, including both the rich and the poor, as well as respondents with high and low skill levels (Hainmueller & Hiscox, 2010; Naumann et al., 2018). Media exposure to vaccine developers, who are highly skilled immigrants, may have contributed to updating these perceptions and knowledge in line with public preferences, thus affecting attitudes.

Research Design

Media Coverage

In order to understand the media coverage of vaccine news in Germany in relation to its developers, I obtain a sample of articles about Ugur Sahin and Ozlem Tureci using Lexis Uni. I download all German articles published between November 1st and 30th, 2020, containing the keywords 'Ugur Sahin' and 'Ozlem Tureci'.[2] The final sample consists of 90 articles from 46 newspapers. Appendix Fig. 6 displays the distribution of articles by date, with most reporting occurring within the first week of the vaccine's success announcement. Before automated text analysis, a research assistant hand-coded the political leanings of the newspapers. The sample exhibited a diverse ideological range, with 6% left-wing, 22% centre-left, 22% centre, 22% centre-right, and 28% centre-right to right-wing.

For the automated text analysis, newspaper content is translated to English using DeepL. Punctuation, extra spaces, numbers, misspelled words, and stop words (common words with no intrinsic meaning) are all removed. Repeated proper nouns such as vaccine developers' names and company names are also removed. The remaining words are lemmatized to group a word's inflected forms.

The visual representations of word clouds based on newspaper content are depicted in Figure 2. As illustrated, newspapers' framing revolves around the story that the vaccine success news came from a company in Mainz founded by Germans with Turkish roots and a history of migration. Further supplementary analyses are available in Appendix C, including a German word cloud derived from the original source material, a sentiment dictionary that determines the articles' positive emotional tone, and an evaluation of newspaper framing similarity using Wordfish.

Sample

In the next step, the paper uses German Internet Panel (GIP) Wave 50 that was fielded between 1 November to and 30 November, 2020. The GIP collects panel data about individual attitudes and preferences, which are important for political and economic decision-making, using incentivized web surveys with rigorous sampling processes (Blom et al., 2021). The questionnaire included questions about attitudes towards and

[2] Contrary to the Google Trends data, there were not significantly more newspaper articles referring only to Ugur Sahin. Only about 5% of all articles exclusively mentioned Dr. Sahin.



Fig. 2 Word clouds with word frequency above 20 based on newspaper content

preferences on policies regarding immigration, environment, and finance as well as other political attitudes and preferences.

There are two reasons to use this survey. First, their fieldwork overlapped with the announcement of the Pfizer-BioNTech vaccine success on November 9. Their web-based data collection continued as usual. This can be seen when the daily distribution of the respondents is plotted in Fig. 3. Due to email invitations being sent out on the first day of each month, there was an initial spike in responses on November 1st.[3] Second, the GIP uses rigorous statistical methods to recruit individuals offline using a random probability sample of the general German population between the ages of 16 and 75. This eliminates potential imbalance problems that may have arisen from quota sampling.[4]

Balance test by announcement treatment for the covariates can be found in Appendix Tables 1. Summary statistics of key outcome variables are available in Table 3.

Empirical Design

I use questions CE50461 and CE50456 of GIP Wave 50 as dependent variables to capture attitudes toward immigration. CE50461 asked *"In your opinion, should the possibilities for foreigners to move to Germany be made easier or restricted?"*. CE50456 asked *"Are Germany's crime problems increasing or decreasing due to*

[3] GIP sent three email reminders on November 6, 13, and 16.

[4] Nevertheless, there are imbalances in some of the demographic covariates between treatment and control groups. I implement entropy weighting (Hainmueller & Xu, 2013) to weight the two groups based on key covariates. Section 3.3 provides more details about this procedure.

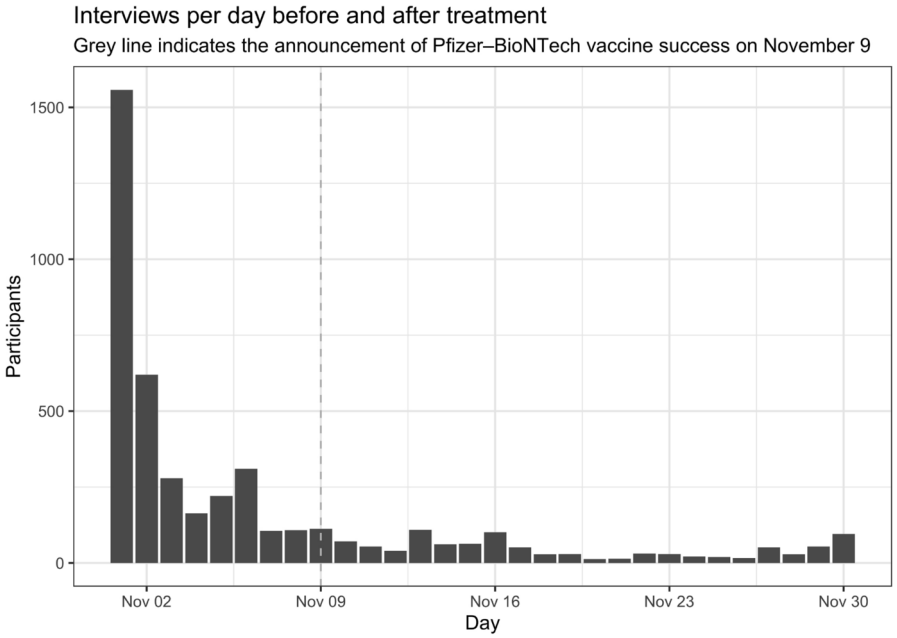


Fig. 3 Data collection around the Pfizer-BioNTech vaccine success announcement

immigrants?". The first dependent variable captures attitudes towards immigration with a specific policy proposal about welcoming more immigrants. The second dependent variable focuses on a specific aspect of immigration, namely the perception that immigrants bring crime, which is a common stereotype and a source of concern for many people.

The treatment variable $T_i \in \{0, 1\}$ is a dummy variable taking the value 1 if the individual was surveyed on the day of and after the Pfizer-BioNTech vaccine success announcement, and 0 otherwise.[5] The number of participants within the treated and control groups for the main dependent variables are as follows: $n_{\text{Control}} = 1561$ and $n_{\text{Treated}} = 443$. The minimum detectable effect size has been calculated and shown through a sensitivity analysis in Figure 11. The treatment effect is estimated with OLS using the following specification:

$$Y_i = \alpha + \beta T_i + \gamma X_i + \mu_c + \epsilon_i \tag{1}$$

where β is the main coefficient of interest, μ_c captures federal state fixed effects, and ϵ is the error term. Standard errors are clustered by day to account for unobserved heterogeneity due to daily changing news cycles. X_i represents demographic control variables and includes gender, age, education, employment, occupation, and German

[5] The vaccine success announcement was made early in the morning at 06:45 am (Editorial, 2020c). Newspapers already reported the news with reference to developers' 'Turkish roots' and 'successful integration' on 9 November (see Wrede (2020)). Therefore, I assume that respondents interviewed that day were already treated with this information on 9 November. I relax this assumption in Table 6. The results remain substantively the same.

citizenship. Since there are subgroup imbalances between the treatment and control groups in some of the demographic covariates (see Appendix Table 1), I use entropy weighting to weight the control group so that the moment conditions of each covariate match the one of the treatment group in the main specifications (Hainmueller & Xu, 2013).According to Muñoz et al. (2020), research designs can leverage unexpected events for causal interpretation when the shock is unexpected and salient, there are no problems with reachability, non-compliance, or imbalances caused by quota sampling. The vaccine success announcement was highly salient. It led to a global surge in stock markets (Editorial, 2020a). While the ongoing Pfizer-BioNTech collaboration to develop a vaccine was known before 9 November, the ethnic background of the developers was unknown.

Results

Main test

Figure 4 displays the treatment effects for the two dependent variables capturing attitudes towards immigration.[6] The top panel demonstrates the treatment effects for the first dependent variable (Welcome) and the bottom panel shows it for the second dependent variable (Crime). Regarding welcoming immigrants, there is a 4 percentage-point increase for those who are exposed to vaccine success announcement compared to those who were not (or approximately one-sixth of a standard deviation). This effect is robust to include state-fixed effects, control variables, day-level clustered standard errors, and entropy balancing weights. Regarding crime, there is a 3 percentage-point decrease in associating immigrants with crime among those who were exposed to the announcement. Again, the magnitude and sign of this effect are robust to include state-fixed effects, control variables, day-level clustered standard errors, and entropy balancing weights. These results confirm H1, that the vaccine success announcement had a positive (spillover) effect on public attitudes toward immigration.

Robustness Checks

I conduct a series of robustness checks to ensure the robustness of the main findings. First, I examine whether the results remain consistent when excluding November 1st, the day with the initial spike in responses, from the analysis. The findings remain substantively unchanged, albeit with slightly smaller effect sizes. Second, I exclude non-German residents from the sample to ensure the results are not driven by those with an immigration background. This corresponds to 243 respondents being excluded from the analysis and the results remain exactly the same. Third, it was assumed that respondents were treated on 9 November as the vaccine success was widely

[6] From hereafter, the dependent variable 'Immigration opportunities should be made easier' will be referred to as 'Welcome' and the dependent variable 'Crime is increasing due to immigrants' will be shortened to 'Crime'.

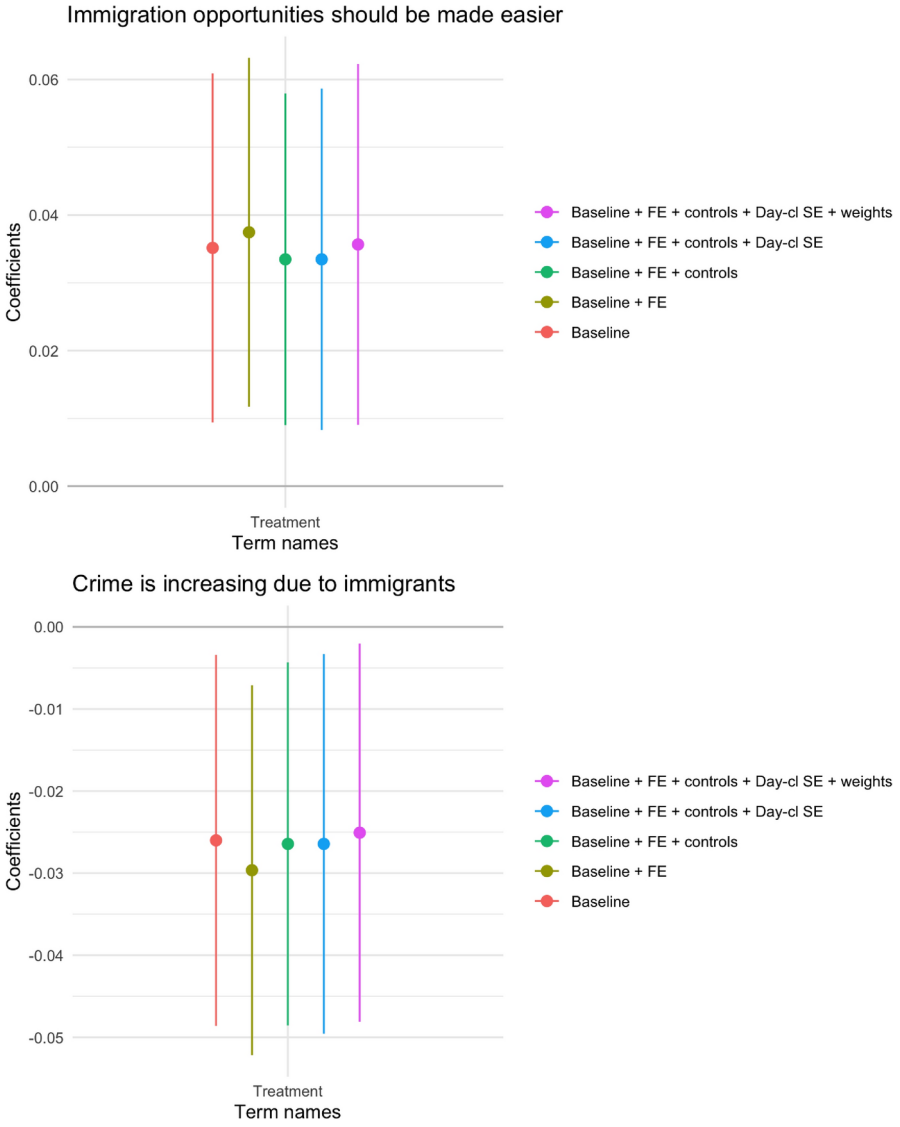


Fig. 4 Pfizer-BioNTech vaccine success announcement and attitudes towards immigration. Full estimates can be found in Appendix Tables 4 and 5. The outcome variables are normalized to vary between 0 and 1 for ease of interpretation

announced by noon that day. Results remain exactly the same when this assumption is relaxed. All three tests are summarized in Table 6.

Next, I check treatment effects on policy areas other than immigration. Theoretically, one should not see an effect of the announcement of vaccine success on the salience of other policy areas. Tables 7 and 8 and Figure 12 display these results for policy areas 'environment' and 'finance', respectively. There is no treatment effect on the salience of these policy areas, reinforcing the main findings. This robustness

test also serves to rule out a general rally-around-the-flag effect (e.g. Hetherington & Nelson, 2003) resulting from the delivery of good news about the vaccine.

I also examine placebo treatment effects on citizens' perception of the state of the world. Since only the vaccine's success-not its roll-out-was announced, respondents should not perceive a reduced COVID-19 threat. I use two variables: personal threat from COVID-19 and likelihood of getting ill. Table 11 displays these results. The vaccine announcement had no effect on respondents' evaluation of the pandemic's severity, ruling out placebo effects. Moreover, when a randomly selected sample of placebo questions are analyzed, no treatment effects are detected on these variables, as can be seen in Tables 9 and 10.

Next, to make sure that results are not driven by the natural time interval between the treatment until the survey ends, Table 12 provides the treatment effects over alternative intervals (7, 15, and 21 days). The magnitude of the effect remains similar for both dependent variables. Figure 10 further illustrates this trend by day. The results suggest that the treatment effect gets larger as more days pass, particularly within the 2-week period. This trend could be explained by the intensity of treatment exposure. As more days passed, the media collected more information on the background of the developers, and 'the immigrant success' framing was more widely established and reported. Next, in Table 13, I assign fictitious treatment dates to ensure the robustness of the main findings. I move the treatment by intervals of 5 days until the end day of the survey. I do not find any effect of these fictitious treatments.

Attitudes towards immigration may be influenced by party affiliation. Using data from GIP Wave 43 (Sept 2019, question AA43043), Table 14 shows two models per each dependent variable: one where former party affiliation is controlled for and one where this variable is interacted with treatment. Controlling for party affiliation does not change the magnitude and sign of treatment effects for both dependent variables and no heterogeneous treatment effects are found by party affiliation.[7] Similarly, there are no significant differences by living in East vs. West Germany (see Table 15). Overall, the results do not seem to be driven by political tendencies. This is in line with the argument by Coppock (2022), who contends that partisan groups respond similarly to information.

Finally, I examine the heterogeneous treatment effects by media consumption. It is widely acknowledged that media framing tends to be more effective for individuals who consume more news. However, the GIP survey only asks about internet use, specifically, rather than general media consumption. Therefore, I use internet use as the best proxy to investigate heterogeneous treatment effects by media consumption, which is presented in Table 16. No significant heterogeneous treatment effects are found by media consumption. This finding is reasonable given the announcement's status as a major global news event that received widespread attention.

[7] It is worth noting that this result should be interpreted cautiously due to potential statistical power issues for the interaction or subgroup models. Sensitivity analysis for the main sample can be found in Figure 11.

Mechanism

As argued in the theoretical framework, one possible style of reasoning that might explain the results is a change in knowledge and perceptions about the immigrants. In order to check changes in perception as a result of vaccine announcement treatment, I use two variables: (i) respondents' personal assessment of crime in connection with immigration (CE50458) and (ii) perceived self-knowledge of immigration policy (CE50457). While the first variable captures the perception of immigrants, the second assesses the individual's perceived self-knowledge of critical policy issues.[8]

Figure 5 displays the effect of treatment on these two variables capturing perceptions. The announcement of the vaccine success has reduced both the perceived proportion of immigrants among all suspects of crime by 2 percentage-points ($p<0.05$) and the perceived own knowledge on issues relating to integration and immigration by 3 percentage-points ($p<0.01$). Interpreting the magnitude of the effect, the latter variable (perceived self-knowledge) appears to drive the impact of the treatment on attitudes more significantly than the former (perceived crime). This effect can be seen as a *self-evaluation* mechanism: the success story of vaccine developers with immigration background introduces positive media contact that contradicts with established negative stereotypes. It can be argued that this cognitive dissonance (i.e. the gap between 'perceived' and 'is') may have caused respondents to doubt their prior knowledge about immigration, making them less likely to report high knowledge on immigration issues post-treatment. This finding aligns with previous studies highlighting the mediating role of issue-specific information in the relationship between framing and attitudes (Schemer, 2012).

In order to check the robustness of this mechanism, I look into variables capturing perception on policy issues other than immigration. Perceptions of own knowledge was also asked for finance (CE50100) and environment (CE50464) policies. For the mechanism to remain robust, one should see an effect of the vaccine announcement on perceived own knowledge of immigration policy, but not on finance and environment policies. The treatment does not affect perceived self-knowledge in other policy areas, reinforcing the robustness of the mechanism. Table 18 displays these results.

Other Effects of the Vaccine Announcement

What other effects did the vaccine announcement have on attitudes? The widespread public discourse surrounding the COVID-19 crisis, including public discussions on lockdowns and public health measures, suggests that political attitudes could also be impacted. While studies have indicated that vaccine announcements have led to reduced political trust in some countries (Heap et al., 2021), the scenario in Germany, where the vaccine was developed, warrants an examination to determine if a similar trend was observed. Results show that the vaccine announcement signifi-

[8] Question CE50458 of GIP wave 50 reads *"We would now like to ask you about your personal assessment of crime in connection with immigration. In your opinion, how high was the proportion of immigrants among all suspects of bodily harm in Germany in 2018?"*. Question CE50457 reads *"Please indicate how much you agree with the following statement: I can understand and assess important political issues in the area of immigration and integration"*.

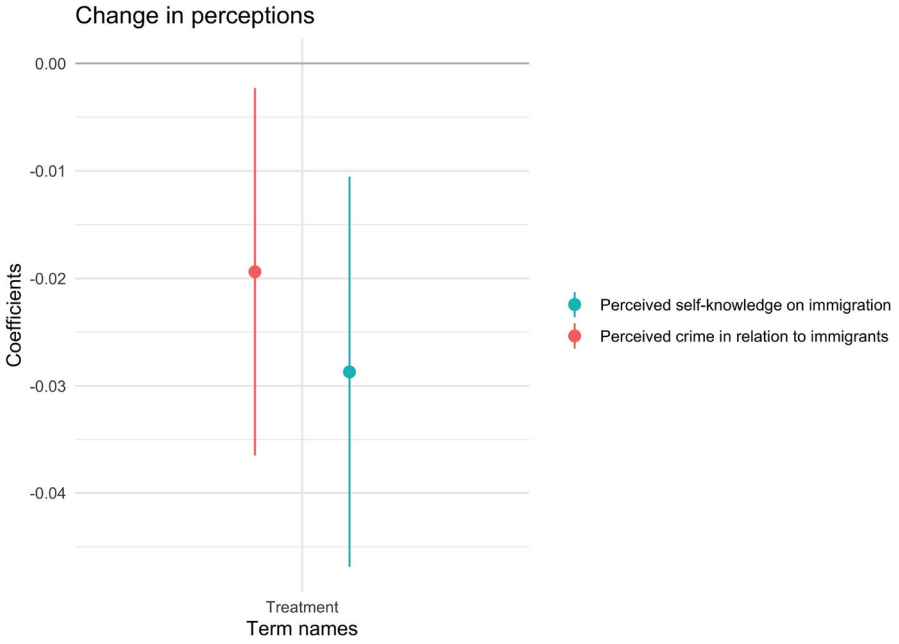


Fig. 5 Pfizer-BioNTech vaccine success announcement and perceptions regarding immigration and immigrants. Full estimates can be found in Appendix Tables 17. The outcome variables are normalized to vary between 0 and 1 for ease of interpretation

cantly increased political satisfaction with the governing coalition parties at the time, CDU/CSU and SPD, by 3 and 2 percentage-points each, as well as with the Green Party (also by 2 percentage-points), while it decreased satisfaction with the right-wing party AfD by 2 percentage-points. Success attribution might be a factor, as text analysis has shown that news coverage emphasized the vaccine's development in Germany. However, since the observed effects of the announcement are not exclusive to the governing parties, the positive news about the vaccine may have also served as a mechanism for party evaluation, rewarding parties based on their COVID-19 containment positions leading up to the vaccine's development. Exploring the specific mechanism behind the political consequences of the vaccine announcement, however, is beyond the scope of this paper.

Conclusions

Attitudes toward immigrants in the host society have long been studied in the literature. Despite this, we know little about how real-time positive media exposure to high skilled immigrants influences public attitudes. In this paper, I show how positive media exposure to successful out-group members can shape attitudes toward that group at large. I also show that perceived own knowledge on immigration was reduced, which indicates a mechanism of self-reflection on topics pertaining to immi-

gration and integration. Before discussing the broader implications of the findings, I point out a few caveats.

First, the paper has assumed that all respondents who took the survey after the vaccine announcement have been treated. However, we cannot be entirely certain that all respondents were exposed to the event, and the exact number of respondents who actually received the treatment may vary. For this reason, all the estimated effects must be interpreted as an Intent-To-Treat (ITT). Nevertheless, this assumption favors the estimates being conservative, as many more respondents might have had a more positive view of immigrants if we were certain they had been exposed to the information about the vaccine developers' immigrant backgrounds.

Second, the sample size constrains the depth of any subgroup analysis. While the sample is large enough to support the main analysis, as indicated by the sensitivity analysis, it falls short of providing a thorough evaluation of variability among subgroups. The two main heterogeneity analyses that have been conducted, focusing on media consumption and party identification because of their theoretical significance, should be viewed as indicative rather than definitive.

Third, the study only observes effects over a three-week period, preventing the identification of long-term impacts and whether changes in attitudes are temporary or lasting. Thus, the findings should be considered indicative of short-term effects rather than long-term changes. Long-term effects are unknown; however, given the literature on negativity bias and the tendency of negative frames to be stickier than positive ones (Avdagic & Savage, 2021; Ledgerwood & Boydstun, 2014), it is possible that the positive exposure effect was not enduring. Nevertheless, given that these results emerge from a single story, documenting such significant short-term effects remains noteworthy.

Finally, in explaining the findings, correlational evidence is presented for the proposed mechanism of change in perceptions of immigrants and self-knowledge about immigration. Heterogeneous effects cannot be tested due to the potential influence of other, possibly unobserved, confounders on perceptions. While this explanation aligns with the theoretical argument, it cannot be asserted that this mechanism perfectly describes the relationship between media exposure and attitudes. Consequently, I emphasize that evidence on the mechanism should be regarded as suggestive rather than conclusive.

This work builds upon previous studies that have focused on the influence of frequent or repeated media encounters with migrants on public attitudes (see, for instance, Alrababa'h et al., 2021). By examining the case of a one-time positive media exposure, like the success story of the Tureci-Sahin couple, this article contributes to the contact literature, emphasizing the power of extended contract through the media. It aligns with existing research that highlights the mediating role of issue-specific knowledge in the relationship between media framing and attitudes, stressing the significant, though short-term, effects of parasocial exposure, with effect sizes comparable to findings in the previous literature (Schemer, 2012; Hilbig & Riaz, 2021; Alrababa'h et al., 2021).

The implications of this study could extend to diverse groups of immigrants, and point to the influential role of media in shaping public attitudes. However, the generalizability of these findings demands careful consideration due to the unique circum-

stances surrounding the vaccine discovery in Germany by an immigrant couple. This scenario exemplifies a rather 'easy case' given the high achievements and skill sets of the individuals involved, which may not reflect the broader spectrum of immigrant backgrounds. This indicates that while positive media framing can play a key role in shaping attitudes, its impact may differ based on the characteristics of the featured individuals.

Finally, the study carries normative implications given the growing preference in European politics for highly skilled immigrants. This study examined the effort-based characteristics - achievement and integration in the host society - that can enhance the attitudes of the host population regarding immigration. However, education and effort-related traits may benefit already more favored immigrant groups, perpetuating disparities between immigrant groups based on education and integration. Thus, while positive media representation can lead to changes in attitudes, any policy on this would have to take into account different types of biases against various outgroups in order to be effective.

Appendix

A. Data Sources

The wave used in this panel can be found in this link. See fig. 6.

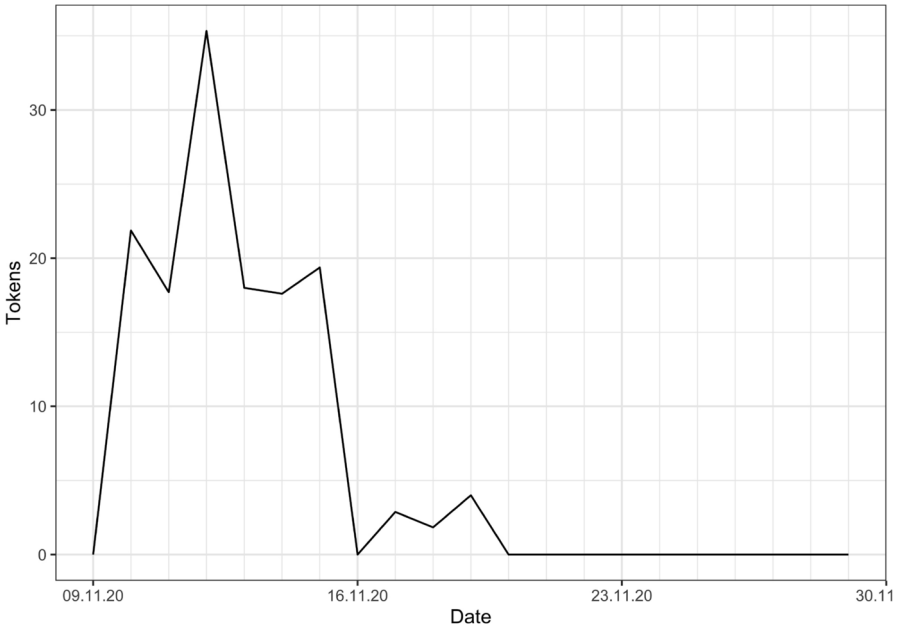


Fig. 6 The distribution of newspaper articles by date

B. Media Content Analysis

Figure 7 illustrates the frequency of positive and negative terms in 90 newspaper stories mentioning the vaccine developers. The sentiment analysis reveals that media coverage of the vaccine's creators was indeed positive. Except for one article, the frequency of positive terms is greater in all of the newspaper articles.

Next, to examine newspaper framing similarity across different outlets, I use Wordfish, a Poisson text scaling method (Slapin & Proksch, 2008). This method accounts for text length, word frequency, underlying position, and word weight in determining framing differences across ideological positions. Results, displayed in Appendix Fig. 8, show that most newspaper articles are centrist, with outliers on both

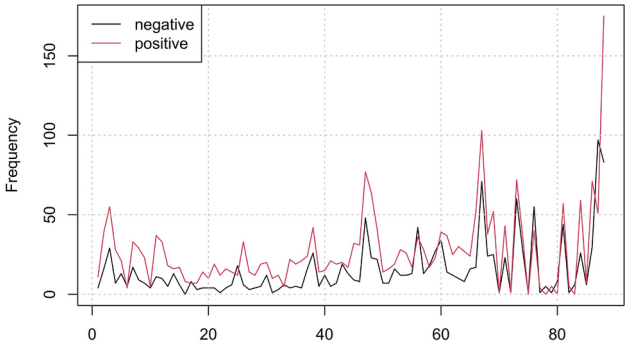


Fig. 7 Frequency of positive and negative words across newspaper articles

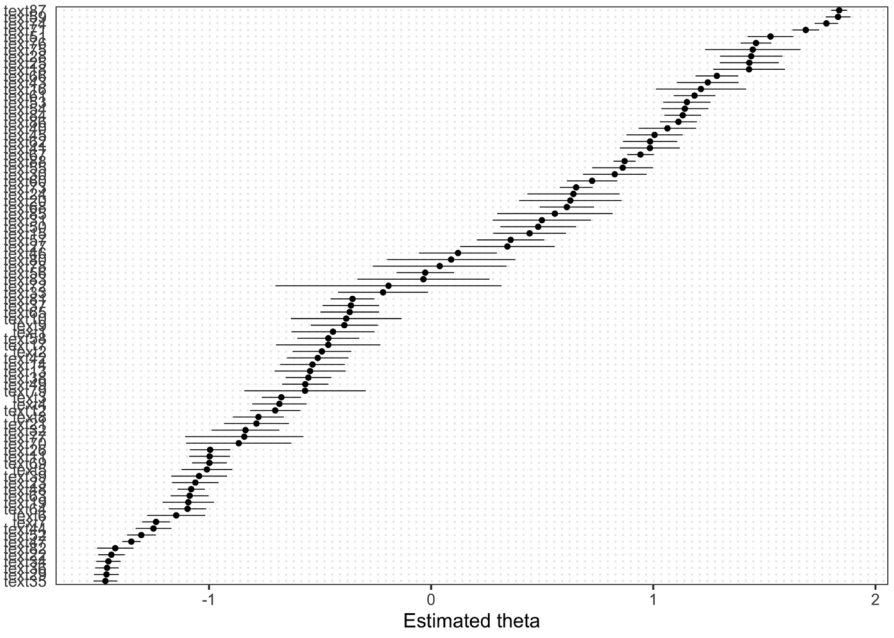


Fig. 8 Wordfish fitted scaling model of all newspaper articles

sides of the spectrum. I confirm this finding through hierarchical clustering in Appendix Fig. 9, which indicates the same set of outliers as the Poisson scaling method. These results support the idea of similar positive media framing across platforms and allow for further empirical analysis.

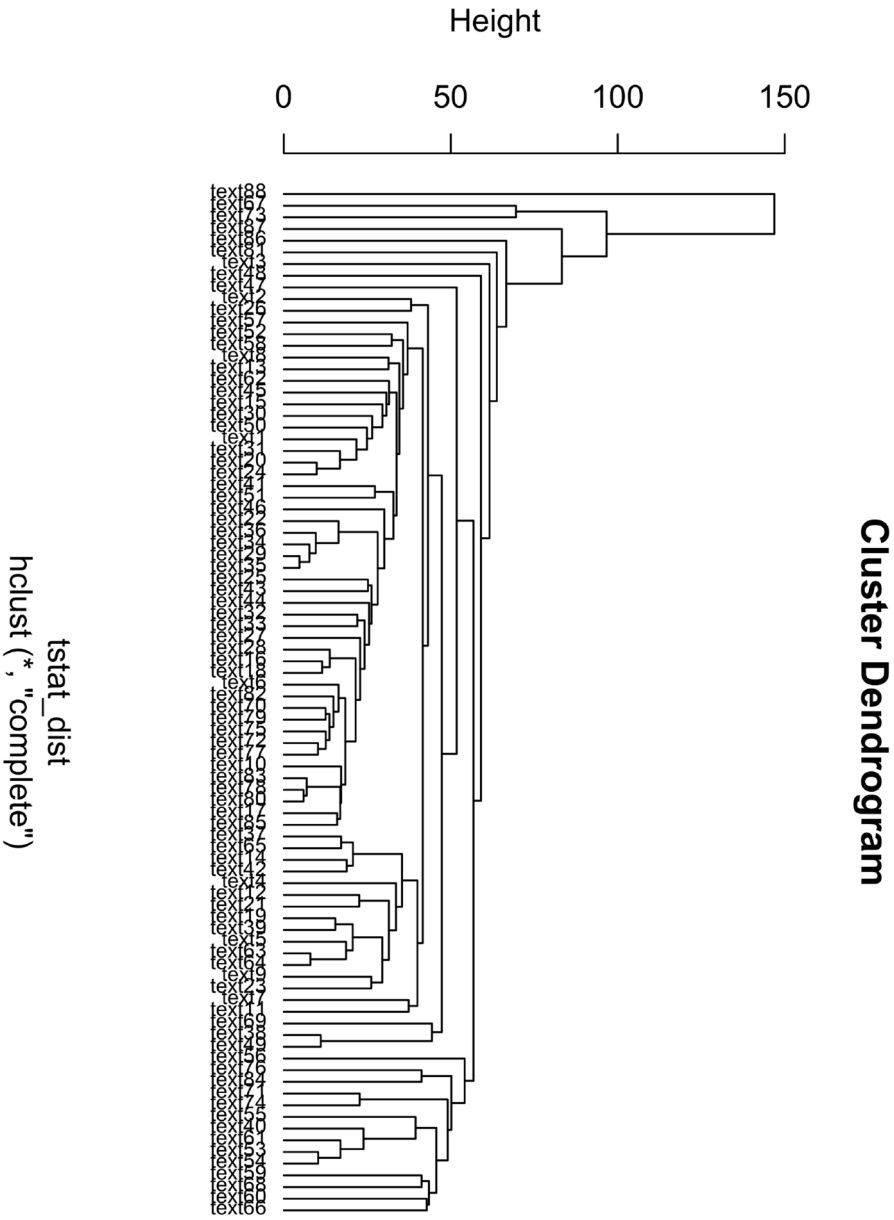


Fig. 9 Newspaper articles difference matrix based on Euclidean distance

C. Summary Statistics

C.1. Balance Test

See Table 1 and 2.

Table 1 Balance test of covariates by treatment

	0 (N=3365)	1 (N=1092)	Total (N=4457)	p value
Gender				0.397
N-Miss	3	0	3	
1	1749 (52.0%)	552 (50.5%)	2301 (51.7%)	
2	1613 (48.0%)	540 (49.5%)	2153 (48.3%)	
Age				0.504
Mean (SD)	54.912 (15.687)	54.546 (15.831)	54.822 (15.722)	
Range	22.000 - 87.000	22.000 - 87.000	22.000 - 87.000	
Job				0.504
1	105 (3.1%)	46 (4.2%)	151 (3.4%)	
2	11 (0.3%)	2 (0.2%)	13 (0.3%)	
3	110 (3.3%)	34 (3.1%)	144 (3.2%)	
4	1167 (34.7%)	411 (37.6%)	1578 (35.4%)	
5	233 (6.9%)	70 (6.4%)	303 (6.8%)	
6	80 (2.4%)	20 (1.8%)	100 (2.2%)	
7	413 (12.3%)	117 (10.7%)	530 (11.9%)	
8	152 (4.5%)	46 (4.2%)	198 (4.4%)	
9	341 (10.1%)	109 (10.0%)	450 (10.1%)	
10	564 (16.8%)	183 (16.8%)	747 (16.8%)	
11	92 (2.7%)	30 (2.7%)	122 (2.7%)	
12	97 (2.9%)	24 (2.2%)	121 (2.7%)	
Education				0.715
1	10 (0.3%)	3 (0.3%)	13 (0.3%)	
2	24 (0.7%)	6 (0.5%)	30 (0.7%)	
3	447 (13.3%)	138 (12.6%)	585 (13.1%)	
4	1009 (30.0%)	345 (31.6%)	1354 (30.4%)	
5	452 (13.4%)	138 (12.6%)	590 (13.2%)	
6	1340 (39.8%)	443 (40.6%)	1783 (40.0%)	
7	83 (2.5%)	19 (1.7%)	102 (2.3%)	

Table 2 Balance test of covariates by treatment

Occupation				0.584
N-Miss	8	3	11	
1	1483 (44.2%)	504 (46.3%)	1987 (44.7%)	
2	502 (15.0%)	168 (15.4%)	670 (15.1%)	
3	18 (0.5%)	9 (0.8%)	27 (0.6%)	
4	59 (1.8%)	19 (1.7%)	78 (1.8%)	
5	1 (0.0%)	0 (0.0%)	1 (0.0%)	
6	10 (0.3%)	2 (0.2%)	12 (0.3%)	
7	40 (1.2%)	14 (1.3%)	54 (1.2%)	
8	5 (0.1%)	0 (0.0%)	5 (0.1%)	
9	2 (0.1%)	2 (0.2%)	4 (0.1%)	
10	3 (0.1%)	2 (0.2%)	5 (0.1%)	
11	70 (2.1%)	18 (1.7%)	88 (2.0%)	
12	12 (0.4%)	4 (0.4%)	16 (0.4%)	
13	131 (3.9%)	48 (4.4%)	179 (4.0%)	
14	776 (23.1%)	227 (20.8%)	1003 (22.6%)	
15	81 (2.4%)	15 (1.4%)	96 (2.2%)	
16	51 (1.5%)	16 (1.5%)	67 (1.5%)	
17	113 (3.4%)	41 (3.8%)	154 (3.5%)	
Marital status				0.663
1	1997 (59.3%)	628 (57.5%)	2625 (58.9%)	
2	57 (1.7%)	17 (1.6%)	74 (1.7%)	
3	106 (3.2%)	30 (2.7%)	136 (3.1%)	
4	284 (8.4%)	104 (9.5%)	388 (8.7%)	
5	893 (26.5%)	303 (27.7%)	1196 (26.8%)	
6	23 (0.7%)	8 (0.7%)	31 (0.7%)	
7	3 (0.1%)	0 (0.0%)	3 (0.1%)	
9	2 (0.1%)	2 (0.2%)	4 (0.1%)	
German citizenship				0.094
1	3174 (94.3%)	1040 (95.2%)	4214 (94.5%)	
2	85 (2.5%)	31 (2.8%)	116 (2.6%)	
3	106 (3.2%)	21 (1.9%)	127 (2.8%)	
Former party affiliation				0.940
CDU/CSU	1990 (63.5%)	589 (64.4%)	2579 (63.7%)	
Die Grunen	447 (14.3%)	129 (14.1%)	576 (14.2%)	
Die Linke	123 (3.9%)	31 (3.4%)	154 (3.8%)	
FDP	94 (3.0%)	31 (3.4%)	125 (3.1%)	
Other	132 (4.2%)	35 (3.8%)	167 (4.1%)	
SPD	346 (11.0%)	100 (10.9%)	446 (11.0%)	

C.2. Summary Statistics

See Table 3.

Table 3 Summary statistics of the dependent variables

Statistic	N	Mean	St. Dev.	Min	Max
Immigration - crime	2,205	4.055	1.959	1	11
Immigration - welcome	2,200	6.581	2.430	1	10
Environment importance	2,205	3.160	1.942	1	10
Finance importance	4,099	3.949	0.906	1	5
Perceived crime - immigrants	2,191	19.712	19.333	0	100
Perceived self-knowledge - immigration	2,163	4.886	1.213	1	7
Perceived self-knowledge - finance	4,276	4.292	1.229	1	7
Perceived self-knowledge - environment	2,161	5.059	1.095	1	7

In the analysis, all the outcome variables are normalized to vary between 0 and 1 for ease of interpretation

D. Full Estimates

See Table 4 and 5.

Table 4 The announcement of the vaccine and attitudes towards immigration (Welcoming immigration)

	Model 1	Model 2	Model 3	Model 4	Model 5
(Intercept)	0.37***				
	(0.01)				
Treatment	0.04**	0.04**	0.03**	0.03*	0.04*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
State FE	-	✓	✓	✓	✓
Covariates	-	-	✓	✓	✓
Clustered SE	-	-	-	✓	✓
Weight	-	-	-	-	✓
R^2	0.00	0.03	0.14	0.14	0.14
Adj. R^2	0.00	0.02	0.13	0.13	0.13
Num. obs.	2200	2194	2193	2193	2193
RMSE	0.27	0.27	0.25	0.25	0.16
N Clusters				30	30

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\cdot}p < 0.1$

Table 5 The announcement of the vaccine and attitudes towards immigration (Immigrants increase crime)

	Model 1	Model 2	Model 3	Model 4	Model 5
(Intercept)	0.63***				
	(0.01)				
Treatment	− 0.03*	− 0.03**	− 0.03*	− 0.03*	− 0.03*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
State FE	-	✓	✓	✓	✓
Covariates	-	-	✓	✓	✓
Clustered SE	-	-	-	✓	✓
Weight	-	-	-	-	✓
R^2	0.00	0.03	0.10	0.10	0.09
Adj. R^2	0.00	0.02	0.08	0.08	0.08
Num. obs.	2191	2185	2184	2184	2184
RMSE	0.24	0.23	0.23	0.23	0.14
N Clusters				30	30

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\cdot}p < 0.1$

E. Robustness Checks

See Table 6.

Table 6 The announcement of the vaccine and attitudes towards immigration

	Excl. Nov. 1^{st}		Excl. non-Germans		Treat. on Nov. 10^{th}	
	Welcome	Crime	Welcome	Crime	Welcome	Crime
Treatment	0.03*	− 0.02*	0.04*	− 0.04**	0.04*	− 0.04**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
State FE	✓	✓	✓	✓	✓	✓
Covariates	✓	✓	✓	✓	✓	✓
Clustered SE	✓	✓	✓	✓	✓	✓
Weight	✓	✓	✓	✓	✓	✓
R^2	0.15	0.10	0.15	0.09	0.15	0.09
Adj. R^2	0.13	0.07	0.14	0.08	0.13	0.08
Num. obs.	1263	1257	1902	1897	2003	1995
RMSE	0.17	0.15	0.15	0.14	0.16	0.14
N Clusters	29	29	30	30	30	30

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\cdot}p < 0.1$

E.1. Treatment Effects on Other Policy Areas

See Table 7 and 8.

Table 7 Announcement of the vaccine success and attitudes towards environment (Environment and climate protection should be more important)

	Model 1	Model 2	Model 3	Model 4	Model 5
(Intercept)	0.76***				
	(0.01)				
Treatment	0.01	0.02	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
State FE	-	✓	✓	✓	✓
Covariates	-	-	✓	✓	✓
Clustered SE	-	-	-	✓	✓
Weight	-	-	-	-	✓
R^2	0.00	0.02	0.06	0.06	0.07
Adj. R^2	0.00	0.01	0.05	0.05	0.05
Num. obs.	2205	2203	2199	2199	2199
RMSE	0.22	0.21	0.21	0.21	0.13
N Clusters				30	30

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\cdot}p < 0.1$

Table 8 Announcement of the vaccine success and attitudes towards finance (Finance should be more important)

	Model 1	Model 2	Model 3	Model 4	Model 5
(Intercept)	0.26***				
	(0.00)				
Treatment	− 0.00	− 0.00	− 0.00	− 0.00	− 0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
State FE	-	✓	✓	✓	✓
Covariates	-	-	✓	✓	✓
Clustered SE	-	-	-	✓	✓
Weight	-	-	-	-	✓
R^2	0.00	0.00	0.05	0.05	0.05
Adj. R^2	-0.00	-0.00	0.05	0.05	0.05
Num. obs.	4099	4091	4086	4086	4086
RMSE	0.23	0.23	0.22	0.22	0.14
N Clusters				30	30

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\cdot}p < 0.1$

E.2. Placebo Treatment Effects

See Table 9, 10 and 11.

Table 9 Announcement of the vaccine success and randomly selected placebo variables (Part 1)

	ZF50232	CE50467	ZF50216	ZF50205	CE50452
Treatment	− 0.15	0.01	− 0.04	− 0.03	− 0.02
	(0.07)	(0.05)	(0.09)	(0.04)	(0.02)
State FE	✓	✓	✓	✓	✓
Covariates	✓	✓	✓	✓	✓
Clustered SE	✓	✓	✓	✓	✓
Weight	✓	✓	✓	✓	✓
R^2	0.20	0.13	0.05	0.05	0.04
Adj. R^2	0.17	0.11	0.02	0.02	0.03
Num. obs.	1014	1986	1003	1016	3984
RMSE	0.61	0.64	0.72	0.42	0.31
N Clusters	30	30	30	30	30

$p < 0.001$; $p < 0.01$; $p < 0.05$

ZF50232: Political efficacy, CE50467: Perception of environmental issues, ZF50216: Attitudes toward inequality (luck vs. effort), ZF50205: Attitudes toward labor unions, CE50452: Belief in fake news

Table 10 Announcement of the vaccine success and randomly selected placebo variables (Part 2)

	CE50466	CE50471	CE50047	ZF50238	CE50468
Treatment	− 0.03	− 0.19	− 0.01	− 0.15	− 0.12
	(0.05)	(0.14)	(0.04)	(0.08)	(0.10)
State FE	✓	✓	✓	✓	✓
Covariates	✓	✓	✓	✓	✓
Clustered SE	✓	✓	✓	✓	✓
Weight	✓	✓	✓	✓	✓
R^2	0.08	0.03	0.06	0.07	0.07
Adj. R^2	0.07	0.02	0.05	0.04	0.05
Num. obs.	1992	3857	3726	1010	1996
RMSE	0.50	1.81	0.55	0.58	1.17
N Clusters	30	30	30	30	30

$p < 0.001$; $p < 0.01$; $p < 0.05$

CE50466: Environmental attitudes, CE50471: Belief in fake news, CE50047: Importance of finance policy, ZF50238: Political efficacy, CE50468: Perception of environmental issues

Table 11 Announcement of the vaccine success and perception of threat from COVID-19

	Covid Threat	Covid Likelihood
Treatment	0.01	0.00
	(0.01)	(0.01)
State FE	✓	✓
Covariates	✓	✓
Clustered SE	✓	✓
Weight	✓	✓
R^2	0.05	0.20
Adj. R^2	0.05	0.20
Num. obs.	4282	3687
RMSE	0.18	0.21
N Clusters	30	30

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\cdot}p < 0.1$

E.3. Changing the Bandwidth

See Table 12.

Table 12 Alternative bandwidths post-treatment and attitudes towards immigration

	Welcome	Welcome	Welcome	Crime	Crime	Crime
Treatment7	0.04·			− 0.02		
	(0.02)			(0.02)		
Treatment14		0.04*			−0.03·	
		(0.02)			(0.01)	
Treatment			0.03**			− 0.03*
			(0.01)			(0.01)
State FE	✓	✓	✓	✓	✓	✓
Covariates	✓	✓	✓	✓	✓	✓
Clustered SE	✓	✓	✓	✓	✓	✓
Weight	✓	✓	✓	✓	✓	✓
R^2	0.14	0.14	0.14	0.09	0.09	0.09
Adj. R^2	0.13	0.13	0.13	0.08	0.07	0.08
Num. obs.	1961	2057	2193	1952	2048	2184
RMSE	0.14	0.15	0.25	0.13	0.13	0.14
N Clusters	16	23		16	23	30

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\cdot}p < 0.1$

E.4. Altering the Announcement Timing

See Table 13.

Table 13 Altering treatment day and attitudes towards immigration

	Welcome	Welcome	Welcome	Crime	Crime	Crime
Treatment = 16 Nov	0.01			− 0.02		
	(0.02)			(0.02)		
Treatment = 21 Nov		0.00			− 0.01	
		(0.02)			(0.02)	
Treatment = 26 Nov			− 0.02			0.02
			(0.03)			(0.02)
State FE	✓	✓	✓	✓	✓	✓
Covariates	✓	✓	✓	✓	✓	✓
Clustered SE	✓	✓	✓	✓	✓	✓
Weight	✓	✓	✓	✓	✓	✓
R^2	0.14	0.14	0.14	0.09	0.09	0.09
Adj. R^2	0.12	0.12	0.12	0.07	0.07	0.07
Num. obs.	2193	2193	2193	2184	2184	2184
RMSE	0.18	0.18	0.18	0.14	0.14	0.14
N Clusters	30	30	30	30	30	30

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\cdot}p < 0.1$

E.5. Heterogeneous Treatment Effects by Party Affiliation

See Table 14.

Table 14 Announcement of the vaccine success and attitudes towards immigration, HTE by party affiliation

	Welcome	Welcome	Crime	Crime
Treatment	0.04**	0.05*	− 0.03**	− 0.03*
	(0.01)	(0.02)	(0.01)	(0.01)
Party Affiliation Die Grunen	0.21***	0.22***	− 0.13***	− 0.13***
	(0.02)	(0.02)	(0.01)	(0.01)
Party Affiliation Die Linke	0.19***	0.19***	− 0.09**	− 0.08*
	(0.03)	(0.03)	(0.03)	(0.03)
Party Affiliation FDP	− 0.02	− 0.04	0.02	0.03
	(0.05)	(0.02)	(0.05)	(0.03)
Party Affiliation Other	− 0.19***	− 0.19***	0.16***	0.18***
	(0.03)	(0.03)	(0.03)	(0.03)
Party Affiliation SPD	0.13***	0.15***	− 0.10***	− 0.10***
	(0.03)	(0.02)	(0.02)	(0.01)
Treatment x Party Affiliation Die Grunen		− 0.02		0.02
		(0.03)		(0.02)
Treatment x Party Affiliation Die Linke		− 0.00		− 0.01
		(0.06)		(0.05)
Treatment x Party Affiliation FDP		0.03		− 0.03
		(0.11)		(0.10)
Treatment x Party Affiliation Other		− 0.00		− 0.05
		(0.06)		(0.05)
Treatment x Party Affiliation SPD		− 0.04		0.01
		(0.06)		(0.03)
State FE	✓	✓	✓	✓
Covariates	✓	✓	✓	✓
Clustered SE	✓	✓	✓	✓
Weight	✓	✓	✓	✓
R^2	0.24	0.24	0.16	0.17
Adj. R^2	0.23	0.23	0.15	0.15
Num. obs.	2003	2003	1995	1995
RMSE	0.16	0.16	0.13	0.13
N Clusters	30	30	30	30

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\cdot}p < 0.1$. The reference party affiliation category is CDU/CSU

E.6. Heterogeneous Treatment Effects by Living in East Germany

See Table 15.

Table 15 Announcement of the vaccine success and attitudes towards immigration, HTE by West vs. East Germany

	Welcome	Crime
Treatment	0.04*	− 0.03*
	(0.02)	(0.01)
East		
Treatment x East	0.01	− 0.01
	(0.03)	(0.03)
State FE	✓	✓
Covariates	✓	✓
Clustered SE	✓	✓
Weight	✓	✓
R^2	0.15	0.09
Adj. R^2	0.13	0.08
Num. obs.	2003	1995
RMSE	0.16	0.14
N Clusters	30	30

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\cdot}p < 0.1$. Ref: West Germany. East coef. absorbed by state FE

E.7. Daily Treatment Effects

See Fig. 10.

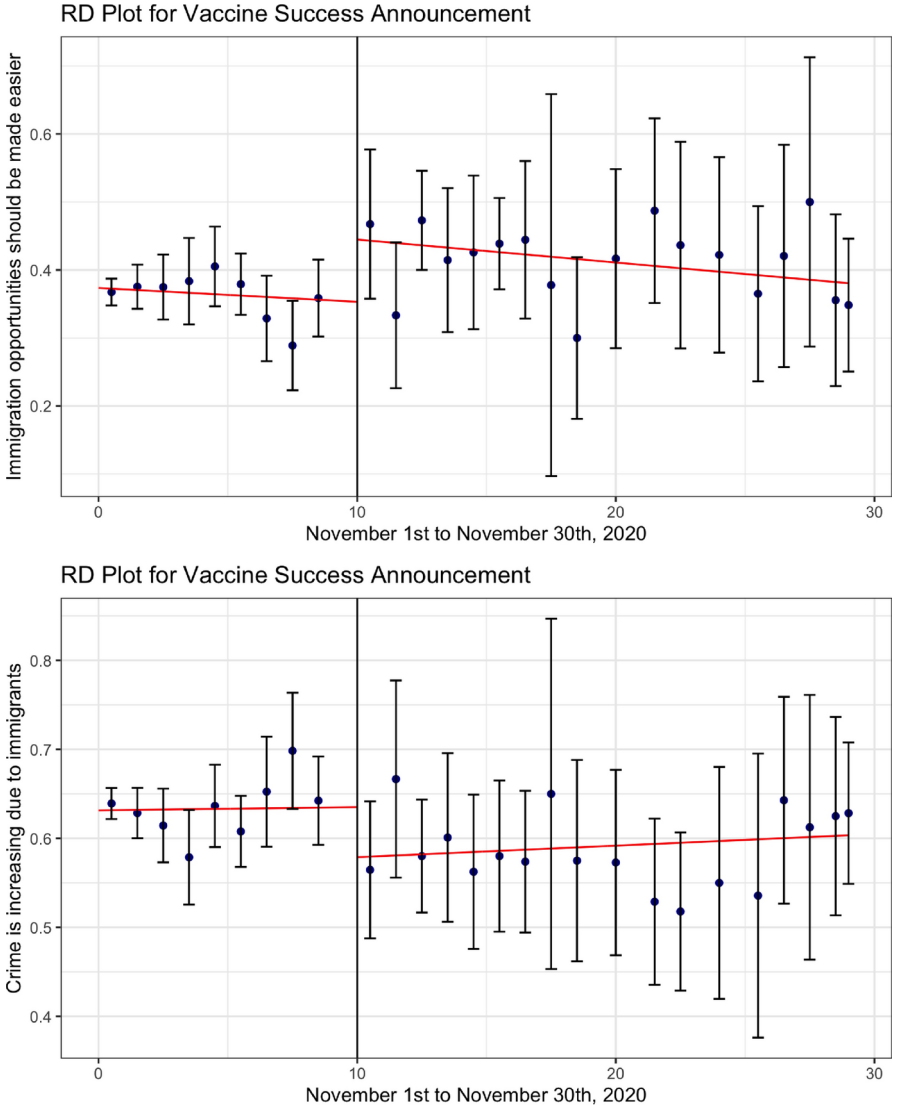


Fig. 10 RD plot for immigration variables. The regression discontinuity plot employs qsmv as the bin selection method and a uniform kernel to estimate the local average treatment effect at the discontinuity threshold

E.8. Sensitivity Analysis

See Fig. 11.

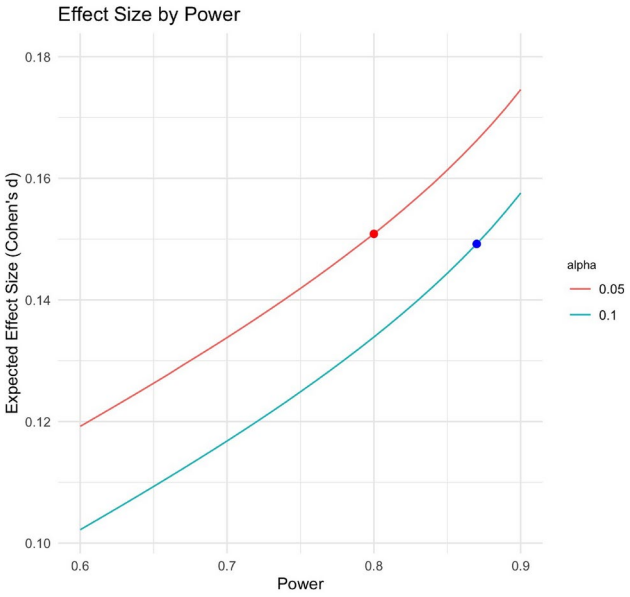


Fig. 11 Sensitivity analysis. This figure shows the relationship between power and detectable effect size (Cohen's d), given the sample sizes and an alpha of 0.05 and 0.1. Dots represent the actual standardized effect size of 0.15, placing the results within the expected power range (i.e. 0.8) for an alpha of 0.05

F. Media Consumption

See Table 16.

Table 16 Announcement of the vaccine success and attitudes towards immigration, HTE by media consumption

	Welcome	Crime
(Intercept)	0.58***	0.74***
	(0.10)	(0.07)
Treatment	0.04**	− 0.03*
	(0.01)	(0.01)
Internet use − Weekly	−0.03·	0.02
	(0.02)	(0.02)
Treatment x Internet use − Weekly	− 0.02	− 0.04
	(0.04)	(0.04)
State FE	✓	✓
Covariates	✓	✓
Clustered SE	✓	✓
Weight	✓	✓
R^2	0.13	0.07
Adj. R^2	0.12	0.06
Num. obs.	2003	1995
RMSE	0.16	0.14
N Clusters	30	30

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\cdot}p < 0.1$. The reference category is daily internet use

G. Mechanisms

See Table 17, 18, 19 and Fig. 12.

Table 17 Announcement of the vaccine success and perceptions on immigration

	Perceived crime by immigrants	Perceived self-knowledge on immigration
Treatment	− 0.02*	− 0.03**
	(0.01)	(0.01)
State FE	✓	✓
Covariates	✓	✓
Clustered SE	✓	✓
Weight	✓	✓
R^2	0.06	0.09
Adj. R^2	0.05	0.07
Num. obs.	2184	2156
RMSE	0.12	0.12
N Clusters	30	30

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\cdot}p < 0.1$

Table 18 Announcement of the vaccine success and perceived self-knowledge on other policy areas

	Finance	Environment
Treatment	− 0.01	− 0.01
	(0.01)	(0.01)
State FE	✓	✓
Covariates	✓	✓
Clustered SE	✓	✓
Weight	✓	✓
R^2	0.12	0.12
Adj. R^2	0.11	0.10
Num. obs.	4262	2155
RMSE	0.12	0.11
N Clusters	30	30

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table 19 Announcement of the vaccine success and political satisfaction

	CDU/CSU	SPD	die Grune	die Linke	AfD	FDP
Treatment	0.03**	0.02*	0.02*	0.00	− 0.02*	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
State FE	✓	✓	✓	✓	✓	✓
Covariates	✓	✓	✓	✓	✓	✓
Clustered SE	✓	✓	✓	✓	✓	✓
Weight	✓	✓	✓	✓	✓	✓
R^2	0.05	0.05	0.08	0.05	0.06	0.06
Adj. R^2	0.04	0.04	0.07	0.04	0.06	0.05
Num. obs.	3754	3616	3581	3121	3550	3206
RMSE	0.14	0.14	0.15	0.14	0.14	0.13
N Clusters	30	30	30	30	30	30

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\cdot}p < 0.1$

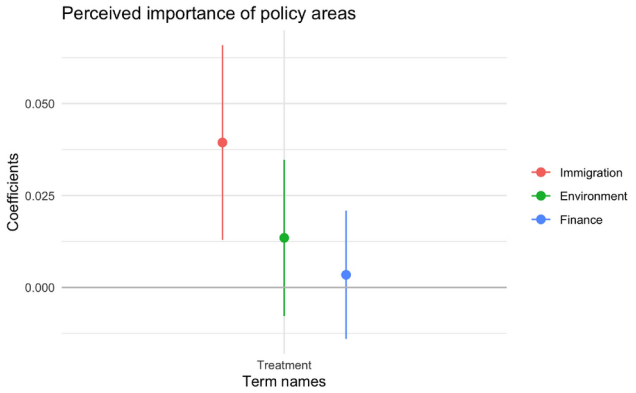


Fig. 12 Perceived importance of the three policy areas

H. Immigration Attitudes Combined Into an Index Variable

See Table 20.

Table 20 Announcement of the vaccine success and PCA variable of attitudes towards immigration

	PCA immigration
Treatment	0.03**
	(0.01)
State FE	✓
Covariates	✓
Clustered SE	✓
Weight	✓
R^2	0.16
Adj. R^2	0.14
Num. obs.	1938
RMSE	0.10
N Clusters	30

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\cdot}p < 0.1$

Positive values reflect greater support for immigration and more favorable perceptions of immigrants. The PCA includes general and specific immigration attitudes, as well as variables related to perceptions of crime rates and personal knowledge about immigration

I. Twitter Trends

See Fig. 13.

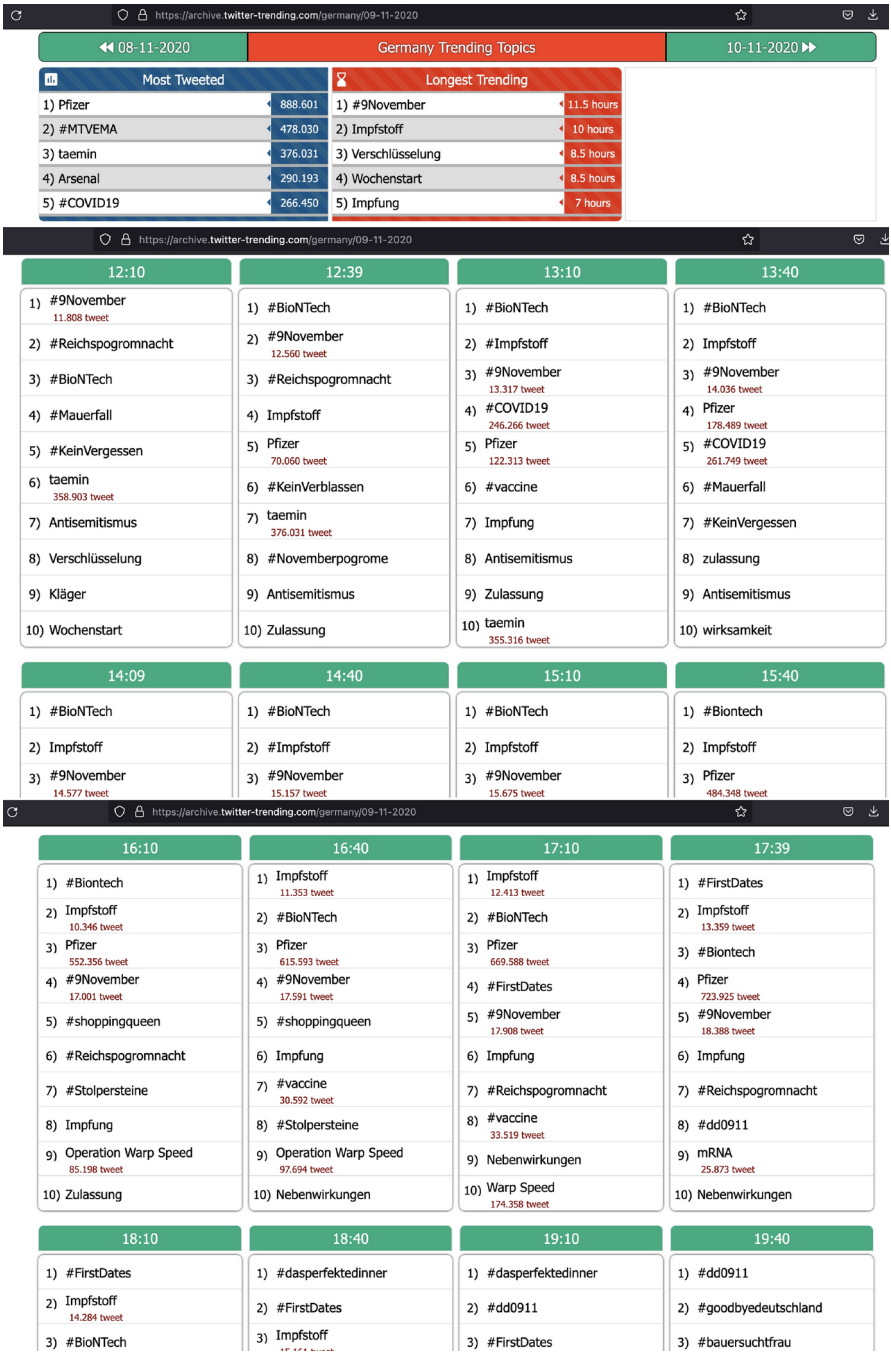


Fig. 13 Twitter Trends in Germany on the day of vaccine success announcement, 9 November 2020. Impfstoff = Vaccine, Impfung = Vaccination

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