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Abstract

This study investigates U.S. churches' response to the SARS-CoV-2 pandemic by looking at their public Facebook posts. For religious organizations, in-person gatherings are at the heart of their activities. Yet religious in-person gatherings have been identified as some of the early hot spots of the pandemic, but there has also been controversy over the legitimacy of public restrictions on such gatherings. Our sample contains information on church characteristics and Facebook posts for nearly 4000 churches that posted at least once in 2020. The share of churches that offer an online church activity on a given Sunday more than doubled within two weeks at the beginning of the pandemic (the first half of March 2020) and stayed well above baseline levels. Online church activities are positively correlated with the local pandemic situation at the beginning, but uncorrelated with most state interventions. After the peak of the first wave (mid April), we observe a slight decrease in online activities. We investigate heterogeneity in the church responses and find that church size and worship style explain differences consistent with churches facing different demand and cost structures. Local political voting behavior, on the other hand, explains little of the variation. Descriptive analysis suggests that overall online activities, and the patterns of heterogeneity, remain unchanged through end-November 2020.

Keywords: Covid-19 pandemic, church, social media, Facebook

JEL codes: H75, I18, Z12

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1 Introduction

For religious organisations, in-person gatherings are at the heart of their activities. They are where members of the organisation interact, a platform for prayer and religious rituals, and exchange with the religious leaders. Unfortunately, religious in-person gatherings have been identified as some of the early hot spots of the novel coronavirus (SARS-CoV-2).[1] Religious gatherings usually take place indoors, with large groups, and often involve singing and close contact between the members. These points have been identified as key features that facilitate the spread of SARS-CoV-2.[2] At the same time, in-persons gatherings are the way in which members' commitment to fellow members and to the organisation is strengthened, in a way that often translates directly into revenues for the organisation. This obviously creates important conflicts of interest for such organisations - how have they responded?

We investigate the response of US Christian churches to the coronavirus pandemic and to the interventions imposed by the governments to limit the virus propagation. Specifically, we ask to what extent churches have responded to the pandemic by moving their gatherings online, and which types of churches have done so most. We use a data set of nearly 4000 Christian churches in the United States that have a public Facebook profile, and that are registered at usachurches.org. With the support of CrowdTangle, a Facebook-owned tool that tracks interactions on public content from Facebook pages and groups, we obtained all public Facebook posts of those churches from January 2020 to October 2020 (CrowdTangle Team [2020]).

To identify church online activities, we hand coded 1600 church posts and then use a random forest algorithm to predict the advertisement of an online church activity in a Sunday post for the rest of the sample. The prediction algorithm evaluates the type of the post (video, link, live stream, etc), as well as the post text. We then observe the extent to which the churches' online activities are correlated with state and county regulations and numbers of Covid-19 cases in the period between

[1] For example an annual prayer meeting at an evangelical megachurch in France https://www.washingtonpost.com/world/europe/how-a-prayer-meeting-at-a-french-megachurch-may-have-led-to-scores-of-coronavirus-deaths/2020/04/01/fe478ca0-7396-11ea-ad9b-254ec99993bc_story.html and a Muslim gathering in India https://www.washingtonpost.com/world/asia_pacific/india-coronavirus-tablighi-jamaat-delhi/2020/04/02/abdc5af0-7386-11ea-ad9b-254ec99993bc_story.html. See also James et al. [2020].

[2] World Health Organization [2020], July 2020 version.

January and June 2020. We verify the results using the share of churches that post at least one video on a given Sunday as another proxy for online activity. We investigate heterogeneity in the reaction according to the size and the worship style of the church, as well as voting behavior at the county level in the 2016 presidential election.

Stories of religious organisations that held in-person gatherings despite the coronavirus pandemic and despite governmental orders are easy to find in the media.[3] Indeed, many religious organisations and denominations were presented as responding irresponsibly to the crisis.[4] Yet stories of churches defying public health guidance are undeniably more newsworthy and perhaps more relevant for enforcement of public health measures, which suggests they may not be representative of the behavior of churches overall. The issue of in-person religious gatherings has again become central to the political debate on the legitimacy of public health measures, in the wake of the US Supreme Court decision on 25th November 2020 striking down restrictions on religious services imposed in New York by Governor Andrew M. Cuomo.[5] We try to provide a more objective measure of the response of US churches in moving their gatherings online, to the extent that is possible from the limited available data. This may help formulate public health policies that may be necessary due to the continuation of the pandemic, as well as to future crises arising from other types of infectious disease.

In a pandemic, it seems likely that individuals turn to figures of authority for guidance on how to behave. Those figures of authority may be in government or in other components of civil society, and may include church leaders. The role of other sources is likely to be particularly important where the message from government is either not clear or not trusted by the people. The United States is especially suitable for this study because it is a country with a federal structure as well as high level of religious participation. There are multiple sources of advice and authority for individuals to listen to even within the government, and they are likely to have given particular weight

[3] For example, https://www.bbc.com/news/world-us-canada-52232384, accessed 2020-09-18.

[4] Forexample, https://www.nytimes.com/2020/03/30/us/coronavirus-pastor-arrested-tampa-florida.html?auth=login-facebook, accessed 2020-06-18, and https://www.independent.co.uk/news/world/americas/kenneth-copeland-blow-coronavirus-pray-sermon-trump-televangelist-a9448561.html, accessed 2020-06-18.

[5] See "Splitting 5 to 4, Supreme Court Backs Religious Challenge to Cuomo's Virus Shutdown Order", *New York Times*, 26th November 2020, https://www.nytimes.com/2020/11/26/us/supreme-court-coronavirus-religion-new-york.html?action=click&module=Top%20Stories&pgtype=Homepage.

to decisions by churches on how to respond to the pandemic.

We find that the proportion of churches offering an online activity more than doubled between February and April 2020. While around 28 percent of churches in our sample already posted an online alternative in February, around another 16 percent of churches responded very quickly and already posted an online alternative in the weekend after the international travel ban (March 11) and another 16 percent the weekend after. We also find a positive association between positive Covid cases or Covid deaths on the county level and churches online activity, even when controlling for governmental regulations, in the introduction period, defined as between January 1 and April 15, 2020.

Looking at the period between April 15 and June 30, the relaxation period, we find that the proportion of churches offering an online alternative slowly goes down over time. Yet the decrease is not correlated with the number of Covid cases or deaths. There is a correlation with lifting governmental regulations, yet it becomes insignificant once a trend is included. We thus cannot distinguish a relationship between lifting restrictions and online activities from a general fatigue effect. In the end, though, the proportion does not go down to the baseline levels but stays at a much higher level than before. Furthermore, we confirm that this high level of online activity continues through to the end of October.

We do not expect that churches would all react in the same way. For example, large churches that already have a significant online presence might find the cost of moving their activities entirely online is smaller than for smaller churches. If true, this might apply not only to their direct costs of moving online , but also to their opportunity costs: small churches may rely on appeals to funds delivered in person to their physical congregations, whereas larger churches may have more sophisticated online fundraising skills. The demand that churches face according to their size and worship style might also be different. Larger churches may be more attractive to a different type of population. Also, a contemporary church event might be easier to broadcast online and might have a higher take-up than a traditional church service.

Investigating heterogeneity in the church responses, we find that mega and large churches were indeed very fast in their response. The share of mega churches offering an online alternative on Sunday was already high before the pandemic (around 50%) but still increased significantly after the first weekend (after the international travel ban came into place). Relatedly, 36% of churches who have a contemporary worship style already offered an online alternative before the pandemic and the proportion increased strongly in the first two weekends of the pandemic. Large and mega churches also do not seem to decrease their online offer in the relaxation period as much, suggesting a more permanent shift to a hybrid model.

Medium and small churches, which started from a lower baseline level, were slower to respond. Yet the proportion of medium and small churches offering an online activity on a Sunday in the week after the federal guidelines on the coronavirus were issued (March 16) increased by 20 - 26 percentage points. This implies that the number offering an online alternative also doubled within the first weeks of the pandemic. However, there is a stronger decreasing trend for small churches in the relaxation period, suggesting that some might go back to solely in-person gatherings. Similarly, churches with a traditional worship style started with a lower baseline proportion but more than doubled the share offering an online activity on Sundays. Yet their decrease is the strongest in the relaxation period.

The ruling of the Supreme Court in favor of religious gatherings seems likely to entrench a view of the behavior of churches in the pandemic as reflecting primarily ideological or political beliefs, and as motivated by the political convictions of their leaders rather than the well-being or safety of their members. Yet when we interact churches' responses with the share of Republican votes in the county at the 2016 Presidential election we find almost no effect. A slight dampening of the move online can be observed in states with religious exemptions to stay-home orders, which tend to lean Republican. However, controlling for the nature of the stay-home orders, churches in Republican counties show a slightly greater tendency to move online, and the two effects more or less offset each other. In short, if their is a political effect of Republican support on online activity it appears to operate through a political channel (the type of state-level health measures imposed) rather than a religious channel (the decisions of church leaders).

It is hardly surprising that churches should become a focus of attention in a pandemic. A now substantial literature has shown that religious activities can help individuals to deal with stress, uncertainty, and negative shocks. Recent studies show that people become more religious if they recently experienced an earthquake close by (Bentzen [2019]) and that church members in Ghana made less charitable donations when they were enrolled in a formal insurance policy (Auriol et al. [2020]).[6] This phenomenon is likely to be particularly important in societies lacking comprehensive mechanisms of insurance against various risks including health risks.

The coronavirus pandemic is therefore likely to change the demand for religion. Indeed, Bentzen [2020] describes how the pandemic lead to a global increase in the demand for prayers measured by an increase in relative Googles searches. A survey conducted by Pew Research Center survey at the end of March 2020 finds that 55% of U.S. adults state that they have prayed for an end of the pandemic (Pew Research Center [2020]). Yet among those who usually attend religious services at least once or twice a month, 59% scaled back on attendance of religious gatherings. The coronavirus pandemic thus combines a change in the cost of holding in-person gatherings (due to regulations but also due to the health risk for members) with a shift in the demand for religious activities.

This economic view of the activities of religious organizations - that they primarily act to supply services for which they perceive a demand on the part of their actual and potential members - contrasts with a more ideological or political view, according to which church leaders have a significant ability to persuade church members to adopt the leaders' narrowly political or more broadly ideological beliefs. In our heterogeneity analysis, we find no evidence that supply-driven ideological factors have played a substantial part in shaping the churches' responses. Size and worship style are important sources of heterogeneity, while political orientation is not. Of course, we cannot rule out that churches are using their persuasive power to advance political messages in ways that escape our analysis. But if the majority of churches were opposing public health measures on a large scale we would expect to see evidence of this in our data, and we do not.

[6] See also Chen [2010] and Ager and Ciccone [2016].

2 Covid-19 in the US: Cases and regulations

The first case of Covid-19 in the US was confirmed on 20 January 2020 and from the beginning of March cases began to increase exponentially (see figure 10 in the Appendix). On March 11, the federal government banned foreign travel, trying to avoid infected travellers from abroad spreading the virus in the US. Just a few days later, on Monday March 16, the federal government published guidelines that should be implemented to mitigate the spread of the virus. It urged citizens to stay at home if they were sick, lived with someone who was tested positive, or were in an at-risk group. It also encouraged working from home and avoiding gatherings of more than 10 people.[7]

At around the same time, state governments reacted to the increase of cases in their states. We use regulation data from Killeen et al. [2020] which summarizes and groups state and district orders. Public schools in all states were closed with state orders being released between March 15 and April 2. Restaurants and entertainment establishments were told to close at around the same time in all states (except South Dakota). Most states also banned gatherings of more than 500 people or of more than 50 people. The different state regulations were often released within the same week, yet there are some states that had a one or two-week time lag between the regulations, and some regulations were implemented at the county level. Between March 21 and April 6, most states issued a stay-at-home order. Some states defined religious organisations as essential businesses and/or allowed small religious gatherings, while others did not.

The number of daily deaths due to Covid-19 reached its peak in the middle of April 2020. Confirmed Covid-19 cases decreased slightly after April. They stayed at a high level also due to more extensive testing with the number of tests doubling between mid-May and the end of June. The number of positive Covid-19 cases increased again from the middle of June onward with an increase of death from July onward which was less pronounced than the surge observed in April. As a reaction to the decreasing number of deaths and hospitalization, states rolled back their stay-home orders between April 24 and June 15. Similarly, restaurants and entertainment establishments were allowed to reopen between April 24 and June 22. At the end of June, several states still had

[7] https://www.whitehouse.gov/wp-content/uploads/2020/03/03.16.20_coronavirus-guidance_8.5x11_315PM.pdf, accessed 2020-09-16.

restrictions on the number of people being allowed to gather in one place.

3 Church Data

3.1 Church characteristics and Facebook pages from usachurches.org

On May 29, 2020, we collected information on churches from the usachurches.org website. usachurches.org is an online platform offering information for people searching for a church in the United States. It contains relevant information regarding the main characteristics of churches, such as denominations, location, size and the programs and services they offer. The platform was first established in 2000 in Columbus, Ohio and expanded to other states in 2005. Any website user can register their church and indicate their information. This implies that any member of the church, not only the church leaders, can register their church. The information is then reviewed and approved by the platform.

The website contains rich information on 10,190 churches in nearly all states. Estimating the total number of churches in the US at 350,000[8], the registry includes around 3% of all US churches. However, the website does not report when the information was registered nor when it was last updated. Also, because the information can be registered by any church member, it might omit certain programs and services or miscalculate the size of their church. Self-registration also implies that more technology-friendly churches, as well as those that are publicly advertising their congregation as a place to join, are more likely to be in our data set. Potential selection bias should therefore be borne in mind in interpreting our results.

Importantly, the registry includes information about the social media presence of the church, as well as some characteristics of interest. First, the church size is defined according to the church's average weekly attendance. Small churches are defined as receiving up to 50 people, medium churches between 51 and 300 people; large churches correspond to between 301 and 2000 people, and mega-churches receive on average over 2000 people a week. According to these definitions,

[8]Estimate by the Hartfort institute: http://hirr.hartsem.edu/research/fastfacts/fast_facts.html#numcong.

32.7% of the churches are small, 49% are medium, 12.5% are large, and the remaining 5.8% are mega-churches. Additionally, 3.6% of churches declare that they have more than one worship site. Comparing these numbers to the results of the National Congregation Study (Chaves [2019]) there are proportionately fewer small churches in our data set than in the National Congregation Study where they make up 42.7%. We also have proportionately more megachurches present in our data set than on average in the US.[9]

Secondly, churches declare their denomination. The raw data contains 159 different denominations; we categorize them into 18 broader Christian denominations according to the definitions presented in the USA Churches Directory. 27% of the churches are either non-denominational or independent churches. The most important denominations in the sample are Baptist (22.7%), Pentecostal (15.8%), and Methodist (5.3%). Thirdly, the directory contains information on the worship style which is either contemporary, traditional, or a blend of the two.

Finally, churches can provide links to their social media profiles. 43.4% provide a link to their public Facebook profile, 20.6% indicate a Twitter profile, and 5.9% provide a YouTube link. As Facebook is the most widespread social media platform, we decide to focus on their online Facebook presence.

Table 3 in the Appendix shows the difference between churches that provide a public Facebook link and those that do not. Not surprisingly, in the sample that provides a Facebook link there are more large and mega churches and fewer small churches. More churches with a Facebook link describe themselves as having a contemporary worship style. The two samples are similar in their denominational structure, with more Methodist and slightly fewer Baptist churches providing a Facebook link. Finally, churches that provide a Facebook link also more often provide a YouTube or Twitter link.

[9]The definitions for medium and large churches are unfortunately not the same in the two data sets.

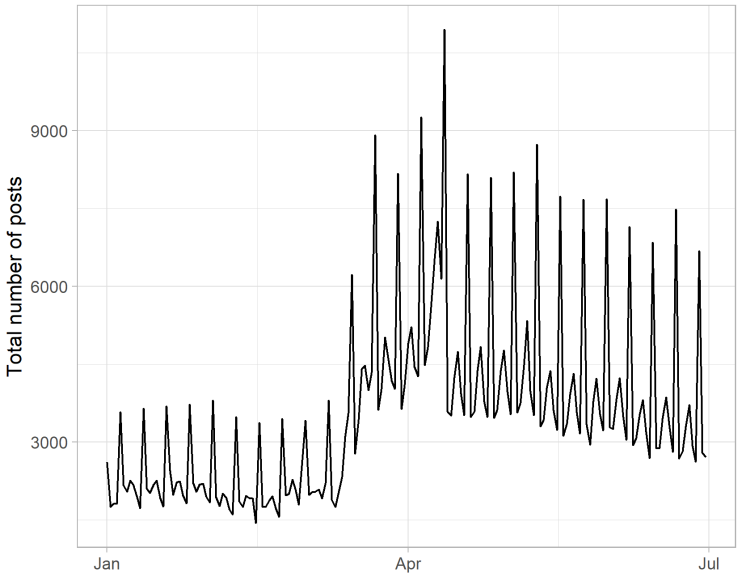
3.2 Public posts on Facebook

To study the churches' social media response to the coronavirus pandemic, we use Facebook as a proxy for online activity. Facebook is the social media platform that has the highest prevalence of the three in the church data set. Furthermore, Facebook still has one of the highest numbers of users in the US among all social media. According to the Pew Research Center (Perrin and Anderson [2019]), 69% say they have ever used the platform. Only usage of YouTube is higher, and this can be easily connected with Facebook. Among users, 74% visit Facebook at least once per day, which is much higher than usage of YouTube or Twitter. Furthermore, Facebook usage is more evenly distributed across most age and socio-economic categories, compared to most other social platforms. Finally, compared to social media such as WhatApp, information posted on public websites can be accessed and readily collected.

Nearly half (43%) of the 10,190 churches from the usachurches.org provide a link to a public Facebook page. Of those 91% were active on September 1st, 2020. To access the posts on Facebook, we partnered with CrowdTangle, a Facebook-owned tool that tracks interactions on public content from Facebook pages and groups.[10] We retrieved all posts that were posted by one of the churches in our data base, that were still online on July 1st, and that were posted between January 1st, 2020 and June 30th, 2020. The data set contains 644,752 posts of 3,897 churches that had made at least one publication in this period. The posts can be connected to the church characteristics via their Facebook Id. The information about the posts includes the date and time, the message (the text of the post, link text or picture text), the type of posts (different types of video, photo, link or just text "status"), the number of reactions, the number of comments and the number of shares.

[10] https://www.CrowdTangle.com/

Fig. 1. Total number of Facebook posts per day between January 1 and June 30, 2020



Note: Total number of posts made by public U.S. church profiles between January 2020 and June 30 2020 on Facebook. Facebook IDs were obtained from usachurch.org and Facebook posts by CrowdTangle.

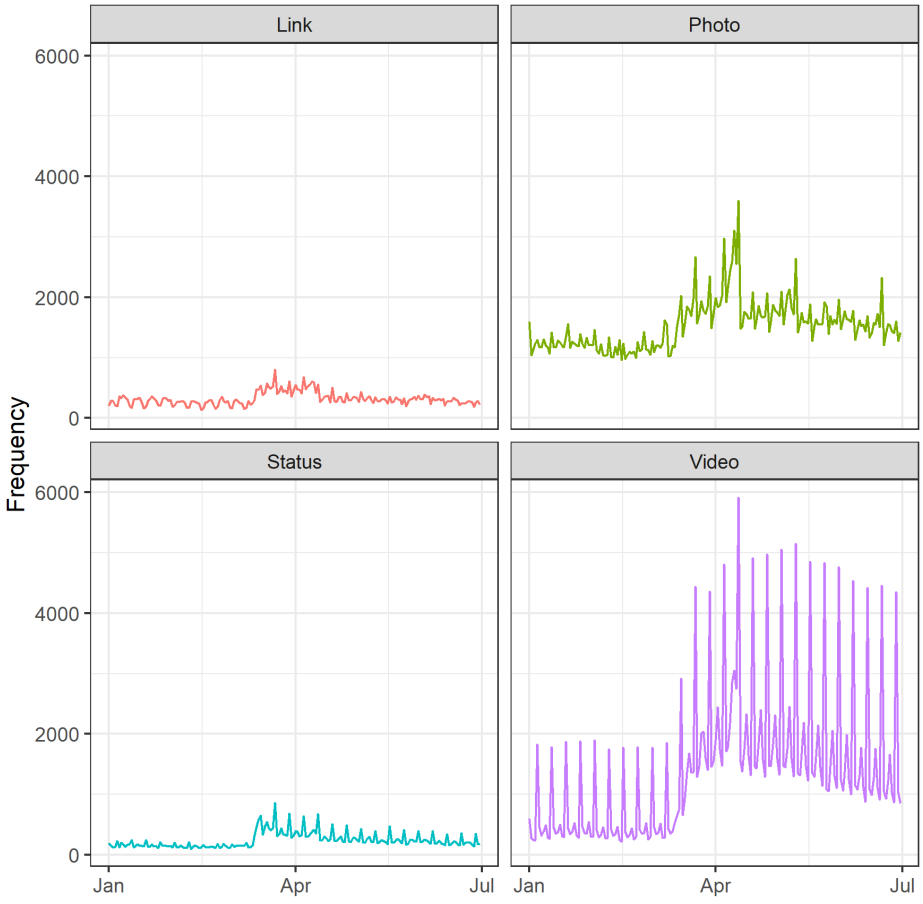
4 Empirical Strategy

4.1 Church posting behavior

Figure 1 illustrates the number of posts made by the churches in our data set from January to June 2020. We can see regular spikes in the number of posts. Zooming in on January in Figure 11 in the Appendix, we see that churches post most on Sunday, the day of worship. As we focus on the question whether churches moved their in-person gatherings online, we restrict our study to their posting behavior on Sundays. In particular, the same weekday pattern can be observed in Figure 2 for posts that contain a video (live videos, videos directly posted to Facebook or YouTube videos). Even before the pandemic, churches primarily posted videos on Sundays. On weekdays, they are more likely to post a photo. Links and statuses are not as common.

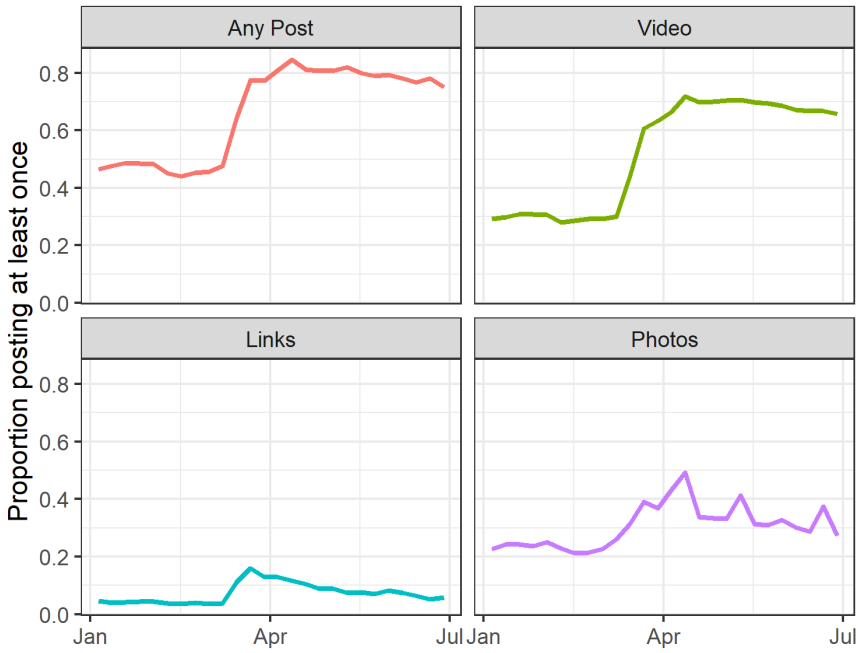
Even before the coronavirus pandemic (defined as before March 2020), 47% of churches in our sample posted on a given Sunday, as illustrated in Figure 3. Also, 30% posted at least one video on a given Sunday before the pandemic and 4% a link. Overall in April, at the height of the pandemic, 82% of churches posted on a given Sunday, 81% if Easter Sunday is excluded. 70% of churches

Fig. 2. Total number of Facebook posts per day between January 1 and June 30, 2020 by type of post



Note: Number of posts made by public U.S. church profiles between January 2020 and June 30 2020 on Facebook by type of post. Video includes live videos (including scheduled and completed live videos), native videos (video files posted directly to Facebook) and YouTube videos. Status describes posts that only contain text. Facebook IDs were obtained from usachurch.org and Facebook posts by CrowdTangle.

Fig. 3. Proportion of churches that post at least once on Sunday between January 1 and June 30, 2020 overall and by type of post



Note: Proportion of U.S. churches posting at least once on Sunday between January 2020 and June 30 2020 on Facebook overall and by type of post. Video includes live videos (including scheduled and completed live videos), native videos (video files posted directly to Facebook) and YouTube videos. Status describes posts that only contain text. Facebook IDs were obtained from usachurch.org and Facebook posts by CrowdTangle.

posted at least one video (69% excluding Easter Sunday) and 11% a link (10.7% excluding Easter Sunday). Therefore, nearly twice as many churches posted on a given Sunday in April than did before March 2020. The proportion of churches posting a video more than doubled, as did the number of links.

4.2 Proxying online gatherings

The first proxy for making online worship attendance possible is whether churches post a video. Videos include videos posted directly to Facebook, embedded YouTube videos, and live videos (including completed or scheduled). Table 4 shows 9 randomly selected Sunday posts with a message that are marked as video and 9 that are not. Most video posts seem to be connected to Sunday worship, yet there are some which are not directly related to Sunday worship (in this case a pastor

offering health advice). Some posts that are not marked as videos are connected to Sunday online service. For example, one post clearly announces a live Facebook video. In this case, we still record this church as posting at least one video on this Sunday because the follow-up post would be captured. Yet we do not capture whether churches announce an online service on Facebook but then stream the video via a different platform without linking it through Facebook. This would be the case, for example, if churches stream the video directly to their website or via WhatsApp.

In order to improve the online activity proxy we hand-coded 1600 posts[11] and identified those describing a "church activity that was clearly online" using the message text and the post type. Church activities include Sunday services, but also smaller group activities. 49% of all posts are related to a church activity in our training sample, and 74% of Sunday posts. 7% of all posts refer to a social event, 6% give information about the church, and 25% are defined are purely "motivational" (an inspiring quote or psalm). The rest is either unclear (5%), are congratulatory posts (celebrating for example the anniversary of the church - around 2%), talk about a charitable activity (3%) or include some political message (less than 1%). 4% of posts after March 01 2020 have a clear reference to Covid.

We use the hand-coded posts as the training sample for a random forest algorithm predicting online church activities.[12] As predictors, we use the type of the post and the 200 most commonly used words in the post texts. Figure 12 summarizes the most frequently used words churches use, both overall and on Sundays. The text analysis excludes stop words such as 'and' or 'or', as well as words that only consist of a number.[13] Figure 13 summarizes the most frequent words before March 2020 and after March 2020. We can see that "https" (also captured in the post type), "live", "online" and "watch" either improve in the ranking or enter the top 20 most frequent words.

The random forest prediction algorithm reaches an average 15% error rate.[14] Figure 14 in the

[11] We randomly selected 100 posts for each month from January to September 2020, as well as for March and April 2019. To this we added a random selection of 500 posts drawn from January to September 2020.

[12] We use the randomForest R package with 500 trees. The number of predictors used at each node minimizes the out-of-bag error rate.

[13] Covid-19 is therefore not excluded but if the message includes for example 'John 1:33', then only 'John' is counted as a word.

[14] 8% for wrong zeros and 27% for wrong 1.

Appendix illustrates the most important predictors for the random forest prediction. Not surprisingly, the type of the post is the most informative characteristic. However, we can also see expected keywords such as "online", "live", but also "facebook", "join" and "youtube". We use the prediction algorithm to predict online church activity for the whole sample. In 93% of the posts, the random forest based online indicator and the indicator for posting at least one video give the same result. In 3% of the cases, the algorithm predicts an online activity but there is no video posted, and in 4% of the cases a video is posted, but the algorithm does not predict the post as an online activity. Figure 4 illustrates the time trends in the two online activity proxies. Though the trend before the pandemics are quite similar, there seem to be some differences during the pandemic and afterwards.

In what follows we use the predicted online measure as our variable of interest, as we suggest that it is an improvement over the "naive" proxy that only uses the fact of posting a video. We report in the Appendix some robustness tests using the share of churches posting a video on a given Sunday.[15]

4.3 Intervention data, Introduction and Relaxation Period

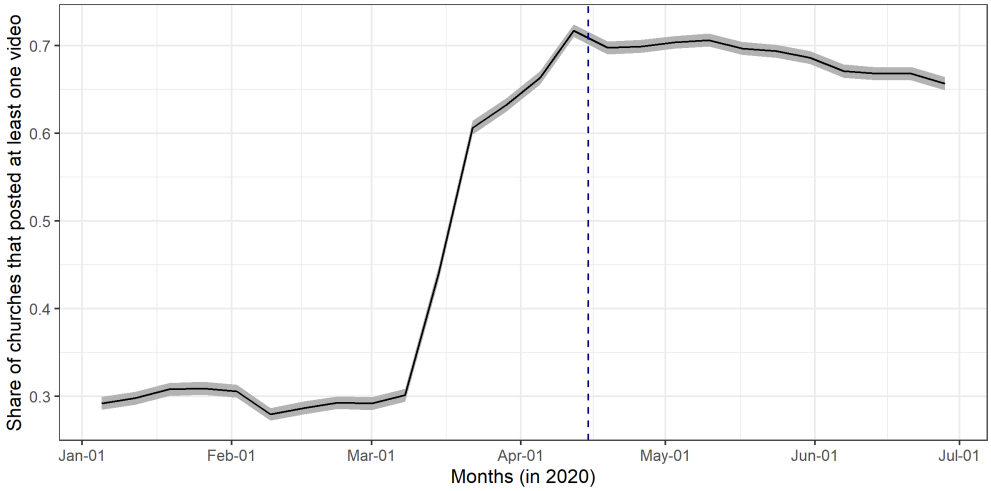
To estimate the churches' responses to governmental regulations, we use the county-level information about government intervention collected by Killeen et al. [2020]. We supplement the intervention database with information about religious exemptions to the stay home order. First, we define states that either define religious organisations as essential businesses and allow individuals to go there, or who allow small gatherings for religious purpose while they implemented their stay home order as having an religious exemption. States that do neither of those in their executive orders are defined as not having a religious exemption. Second, we use the definition used by the Pew Research Center that differentiates between 4 categories: religious gatherings forbidden, limited to 10 people or less, limited in other ways, or exempt from the stay home order.

We also use county level information on the number of confirmed positive cases, deaths and

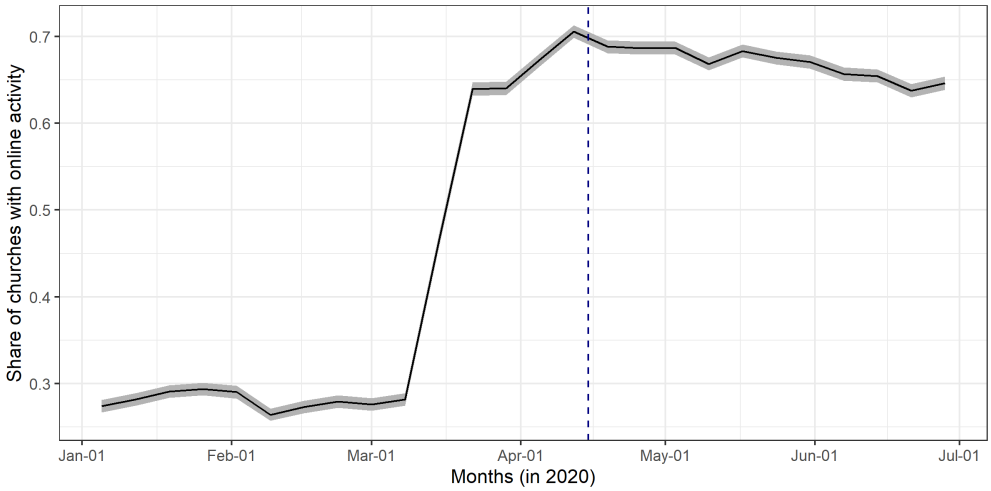
[15] In the multivariate analysis we find that coefficients on regressors of interest under the first proxy are generally smaller and somewhat less statistically significant than their counterpart coefficients under the second. This suggests the presence of attenuation bias due to measurement error, and that the first proxy might suffer more from measurement error than the second.

Fig. 4. Churches' online behavior over time

(a) At least one video post on a Sunday



(b) At least one post predicted as online activity on a Sunday



Note: Share of churches with a predicted online church activity on a Sunday from January to June 2020. Public Facebook posts obtained via CrowdTangle, Facebook IDs from usachurches.org. The dashed line separates the introduction and relaxation periods. Shaded area indicates the standard deviation.

hospitalizations from Killeen et al. [2020], based on numbers released by the Johns Hopkins University. We merge this information with the panel set of Facebook posts and the church characteristics using the FIPS code of the church address. For the heterogeneity analysis, we use information of county-level voting in the 2016 presidential election from Kirkegaard [2016], based on data from the New York Times[16].

We distinguish two different time periods: the introduction period and the relaxation period. The introduction period is defined from January 1 to April 15 and covers the time when federal guidelines were issued and states issued regulations. The relaxation period is defined as the time after April 15 until the end of June. It covers the time span where stay home orders were lifted, restaurant and entertainment establishments were allowed to reopen and some states allowed gatherings of more than 50 or 500 people. We choose to look at the two periods separately as we expect that introducing or lifting a governmental restriction would have different effects. The boundary between the two time periods is illustrated by the dashed line in figure 4.

As the state interventions are highly correlated among each other (given that we use weekly and not daily information), we merge the following measures: First, gatherings forbidden indicates if gatherings are limited to at least less than 500 people. Second, a restaurant and entertainment establishments closed indicator that equals one if both restaurant and entertainment establishments are order to closed, and 0.5 if only one category of both is ordered to close.

4.4 Empirical Specification

We regress our predicted online indicator on publicly available information about the severity of the coronavirus pandemic. For this we use the number of confirmed Covid-19 cases and deaths. Though both of the measures underestimate the true spread of the virus, particularly in the first quarter of the year, they are pieces of information available to the churches. We also use federal, state and district interventions as regressors. These include dummy variables for the periods after the travel ban, after the federal guidelines were issued, after public schools closed, and during state or district interventions and stay-at-home orders.

[16] https://www.nytimes.com/elections/2016/results/president

$$church\_activity_{itc} = \alpha.interventions_{tc} + \beta.Covid_{tc} + X_t + \gamma_i + \epsilon_{itc} \quad (1)$$

This regression is described in Equation 1: Church activity of church i at Sunday t in county c is regressed on the interventions in place in county c on Sunday t, and the Covid-cases in district c in the week before Sunday t. We also add controls X which include a dummy for Easter Sunday and a linear week in one specification for the relaxation period. Finally, we always use church fixed Effects (γ_i). Standard errors are clustered at the state level.

None of the coefficients should be interpreted in a causal way. Covid-19 cases are potentially correlated with religious demand factors in many ways: population density and economic activity, education and trust in science. Religious demand then shapes the religious supply that churches are offering and is correlated with political opinion. Simultaneously, religious activity can have an effect on Covid-19 cases. Finally, religious organisations that want to stay open and continue to gather in person might lobby against strict regulations at the state or county level and so influence the intervention variable.

5 Results

5.1 Average Effects

Table 1 displays the churches' online activities on Sundays in the introduction period, defined as lasting from January 01 to April 15, 2020, in relation to Covid-19 cases, deaths and regulations. In odd numbered columns we use reported infections as a measure of the spread of the pandemic by county, while in even numbered columns we use reported deaths. Results are qualitatively similar with some differences in points of detail. The same regression using the fact of posting a video on Sunday as proxy for online activity is shown in table 5 in the Appendix.

Online activity is positively correlated with the numbers of confirmed Covid cases and Covid deaths in previous weeks. To get an idea of the magnitude of the correlation, a 20% rise in infec-

tions or deaths is associated with a one percentage point increase in online presence (compared to an average of around 30% in February). The coefficients are smaller but still significantly positive when we control for governmental interventions (column 3 to 8).

Online activity increased dramatically on the Sunday after international travel was banned (by between 16 and 18 percentage points) and again after the Federal guidelines were issued (by between 16 and 18 percentage points according to specification). Apart from this, there is little sign of an impact from statewide public health orders, except for a negative effect of stay-home orders (which were typically implemented some time after the Federal orders) in column 3.

Table 1: Effect of Covid-19 and interventions on churches posting behavior on Sundays: Introduction Period (before April 15)

	Dependent variable: Predicted Online Church Activity on Sunday							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Infections previous week (county)	0.047***		0.021***		0.022***		0.022***	
	(0.002)		(0.008)		(0.008)		(0.007)	
Log deaths previous week (county)		0.052***		0.019*		0.019*		0.020*
		(0.002)		(0.011)		(0.011)		(0.011)
After International Travel Ban (March 11)			0.156***	0.178***	0.157***	0.179***	0.156***	0.178***
			(0.013)	(0.009)	(0.013)	(0.009)	(0.013)	(0.010)
After Federal guidelines issued (March 16)			0.160***	0.181***	0.161***	0.182***	0.158***	0.179***
			(0.027)	(0.026)	(0.027)	(0.026)	(0.027)	(0.025)
After Public Schools Closed			−0.009	−0.015	−0.008	−0.014	−0.006	−0.012
			(0.014)	(0.012)	(0.014)	(0.012)	(0.015)	(0.012)
Gatherings forbidden			−0.011	0.003	−0.012	0.002	−0.011	0.003
			(0.014)	(0.013)	(0.015)	(0.014)	(0.014)	(0.013)
Restaurants/Entertainment closed			−0.015	0.007	−0.017	0.006	−0.016	0.006
			(0.029)	(0.026)	(0.029)	(0.026)	(0.028)	(0.025)
During Stay Home Order			−0.044**	−0.039				
			(0.019)	(0.024)				
Stay Home: with religious exemption					−0.054**	−0.045		
					(0.022)	(0.027)		
Stay Home: without religious exemption					−0.024	−0.028		
					(0.018)	(0.022)		
Stay home: Rel. gatherings prohibited							−0.047*	−0.050
							(0.025)	(0.030)
Stay home: Exempt from limits							−0.065***	−0.058*
							(0.023)	(0.029)
Stay home: Limited to 10							−0.016	−0.010
							(0.021)	(0.022)
Stay home: Limited otherwise							0.007	−0.003
							(0.048)	(0.041)
Average in February (Sunday)	0.277	0.277	0.277	0.277	0.277	0.277	0.277	0.277
Number of churches	3893	3893	3893	3893	3893	3893	3893	3893
Observations	58,395	58,395	58,395	58,395	58,395	58,395	58,395	58,395
Adjusted R^2	0.570	0.530	0.594	0.590	0.594	0.590	0.594	0.590

Note: *p<0.1; **p<0.05; ***p<0.01. Includes church fixed effects and an Easter Sunday dummy. Standards error clustered on state level. Includes Sundays between 2020-01-01 and 2020-04-15. Columns 4 and 5: Religious exemptions according to own categorization. Columns 7 and 8: Categorization from Pew Research Center. Number of states (clusters): 51

Though the negative coefficient of the stay-home order may be a statistical fluke, we explore the matter further in columns 5 to 8 by differentiating between different types of stay-home orders according to whether or not there were exemptions for religious organisations. In columns 5 and 6, we use our own categorization, which differentiates between orders that did and did not have an exemption for a religious gatherings. In column 7 and 8, we use a categorization from the Pew research institute, which differentiates between prohibiting religious gatherings, exempting them from any limit, or limiting them to 10 persons, or limiting otherwise[17]. When we control for the number of infections in the previous week (columns 5 and 7), there is a substantially and significantly negative coefficient on states with complete exemption of religious gatherings from limits. Controlling for the number of deaths, the coefficient becomes insignificant when using our own categorization (column 6) and is only significant at 10% for the Pew categorization (column 8). We cautiously interpret this as being likely due to a relaxation of their previously increased online presence in states where the stay-home orders allowed this.

Table 2 displays the results for the relaxation period, defined as lasting from April 15 to June 30, 2020.[18] There is not much evidence of any responsiveness to reports of deaths or infections in the county, suggesting that such reports may have played a part in the initial phase in bringing home to churches the seriousness of the pandemic, but once the pandemic was established such reports made little difference. Although public health orders are positively correlated with online church activity in columns 3, 5 and 7, once we control for a time trend that effect disappears. This suggests that a general effect of fatigue with the restrictions may have been at work, rather the restrictions *per se*.

Overall, it is possible to be impressed by the speed with which many churches moved activities online once the pandemic began, while also noting that there remained a substantial share of churches that did not have any perceptible online activity even at the height of the first wave of the pandemic. It should be kept in mind however, that other church behavior such as offering online activities on other platforms or offering drive though prayers, is not captured in these results.

[17] More than 10 persons, but still limited.

[18] And table 6 shows the results using posting a video as dependent variable.

Table 2: Effect of Covid-19 and interventions on churches posting behavior on Sundays: Relaxation Period (after April 15)

	Dependent variable: Predicted Online Church Activity on Sunday							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Infections previous week (county)	−0.004		−0.002	0.0002	−0.002	0.0003	−0.002	−0.0004
	(0.003)		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Log deaths previous week (county)		0.001						
		(0.002)						
Gatherings forbidden			0.026**	0.016	0.026**	0.017	0.025**	0.015
			(0.010)	(0.010)	(0.010)	(0.010)	(0.011)	(0.010)
Restaurants/Entertainment closed			0.012	−0.001	0.013*	−0.0002	0.012	−0.001
			(0.008)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
During Stay Home Order			0.017**	−0.002				
			(0.007)	(0.007)				
Stay Home: with religious exemption					0.019**	−0.0001		
					(0.008)	(0.008)		
Stay Home: without religious exemption					0.010	−0.006		
					(0.009)	(0.010)		
Stay home: Rel. gatherings prohibited							0.028***	0.011
							(0.010)	(0.011)
Stay home: Exempt from limits							0.018*	−0.001
							(0.009)	(0.009)
Stay home: Limited to 10							0.005	−0.013
							(0.010)	(0.010)
Stay home: Limited otherwise							0.033*	0.012
							(0.017)	(0.017)
Linear week trend				−0.005***		−0.005***		−0.005***
				(0.001)		(0.001)		(0.001)
Average in April (Sunday)	0.688	0.688	0.688	0.688	0.688	0.688	0.688	0.688
Number of churches	3893	3893	3893	3893	3893	3893	3893	3893
Number of States (clusters)	51	51	51	51	51	51	51	51
Observations	42,823	42,823	42,823	42,823	42,823	42,823	42,823	42,823
Adjusted R^2	0.671	0.671	0.671	0.672	0.671	0.672	0.671	0.672

Note: *p<0.1; **p<0.05; ***p<0.01. Dependent variable: At least one post predicted to offer an online church activity on a given Sunday. Includes church fixed effects. Standards error clustered on state level. Includes Sundays between 2020-04-15 and 2020-06-30. Columns 4 and 5: Religious exemptions according to own categorization. Columns 7 and 8: Categorization from Pew Research Center.

5.2 Heterogeneity

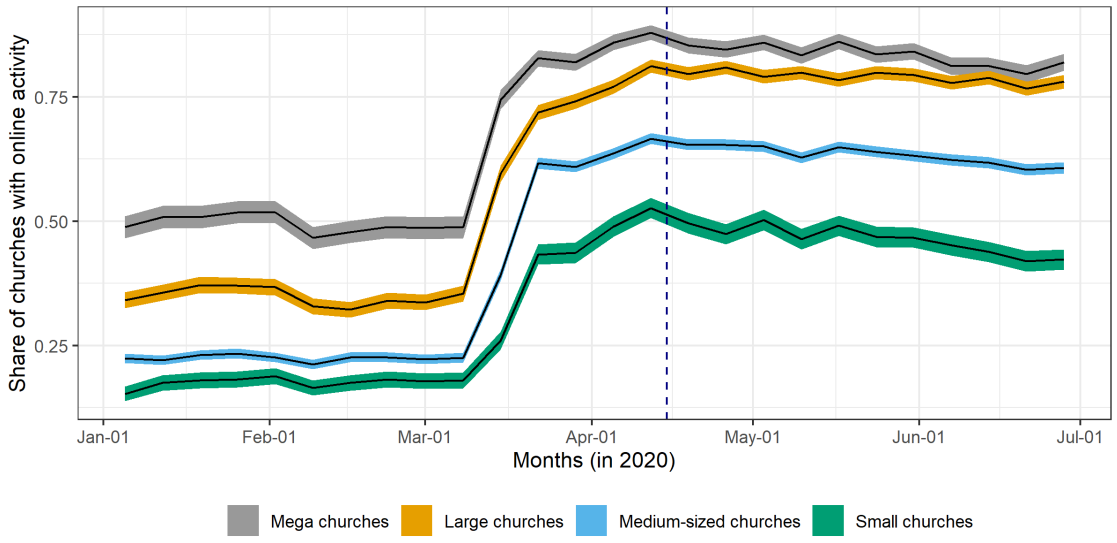
We now look at heterogeneity among churches in their response to the pandemic, concentrating in particular on the dimensions of church size, worship style and political environment. Figure 5 shows the evolution over time of online activity according to the size of the church. Unsurprisingly, size matters a lot. Already before the pandemic, half of megachurches were posting online activity on any given Sunday, and that proportion rose very rapidly to over 80%. More surprisingly, even medium and small churches, though beginning from lower levels, saw almost equally substantial rises in their online activity. In the relaxation period all sizes of church saw some decline in their online activity, though this was more marked among smaller churches.

A similar pattern can be seen comparing churches by worship style, illustrated in Figure 6. Those that report a contemporary worship style posted more prior to the pandemic and the more mainline churches that report a traditional worship style posting less. All types see a rapid and substantial increase, with a subsequent slight decline that is more marked among the traditional churches.

The comparison by political environment is interesting for what it does not show. Figure 7 compares churches in counties in the highest 40 percentile and the lowest percentile of Republican vote share in the 2016 presidential election. Given the strong political polarisation surrounding pandemic management, it might have been expected that churches in strongly Republican areas would respond less to the pandemic than those in strongly Democrat areas. The evolution of activity in these two types of county is almost identical. Indeed, even if the curves are slightly different at the beginning of the pandemic, they converge and are nearly identical from May onward. Of course this is a pure description of average activity, and it may be that more detailed analysis may reveal more traces of polarisation. But if polarisation had been as deep as many media commentators appeared to suggest we would have expected to see a difference in the development of these averages, and we do not.

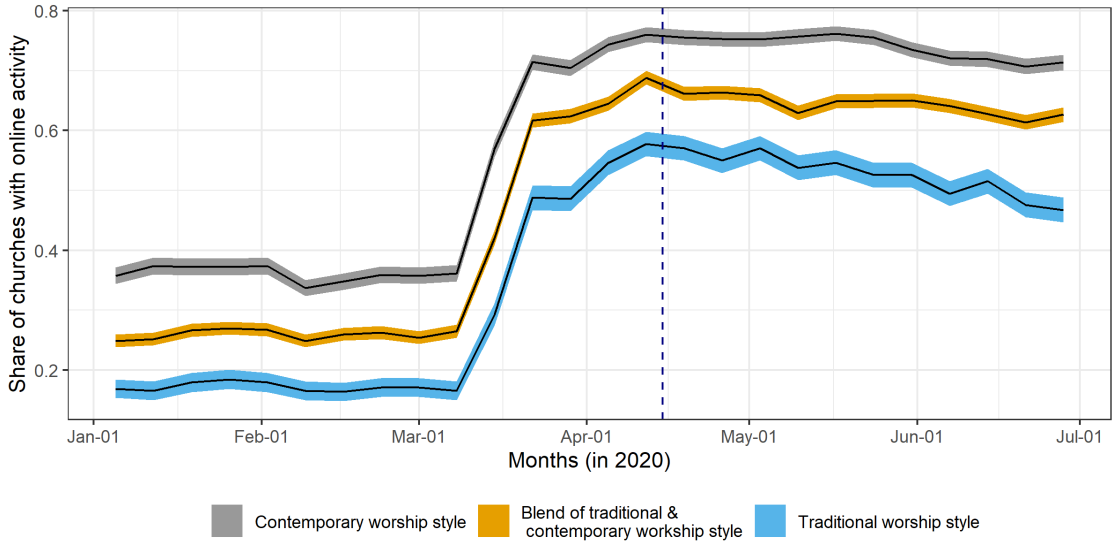
The multivariate regression analysis in the Appendix tends to corroborate these findings and

Fig. 5. Churches' online activity over time by church size.



Note: Share of churches with a predicted online church activity on a Sunday from January to June 2020 according to church size. Public Facebook posts obtained via CrowdTangle, Facebook IDs from usachurches.org. The dashed line separates the introduction and relaxation periods. Shaded areas indicate the standard deviation. Small churches are defined as receiving up to 50 people on a regular Sunday, medium churches between 51 and 300, large churches between 301 and 500 and mega churches over 2000. Size characterization from usachurches.org.

Fig. 6. Churches' online activity over time by church worship style.



Note: Share of churches with a predicted online church activity on a Sunday from January to June 2020 according to church worship style. Public Facebook posts obtained via CrowdTangle, Facebook IDs from usachurches.org. The dashed line separates the introduction and relaxation periods. Shaded areas indicate the standard deviation. Worship style characterization from usachurches.org.

adds some points of detail. However, it should be noted that in our regressions we always use church fixed effects and control for public health measures, so that the coefficients cannot be interpreted in exactly the same way as the lines in the Figures, which show raw averages by category. Table 7 confirms that Mega and large churches both had higher average postings prior to the pandemic and reacted faster (after March 11th) than medium and small churches. Nevertheless, the latter responded almost as fast, with a strong response to the Federal guidelines on the 16th of March. There is an interesting difference between these two groups in association with the closure of public schools, which has a positive impact on online activity in the larger churches and a negative impact on activity in smaller churches. This makes sense since smaller churches probably rely on volunteers to manage online activity, and these volunteers may have been constrained by childcare responsibilities. Finally, the correlation between the report of infections in the county in the previous week and small churches' online behavior is insignificant.

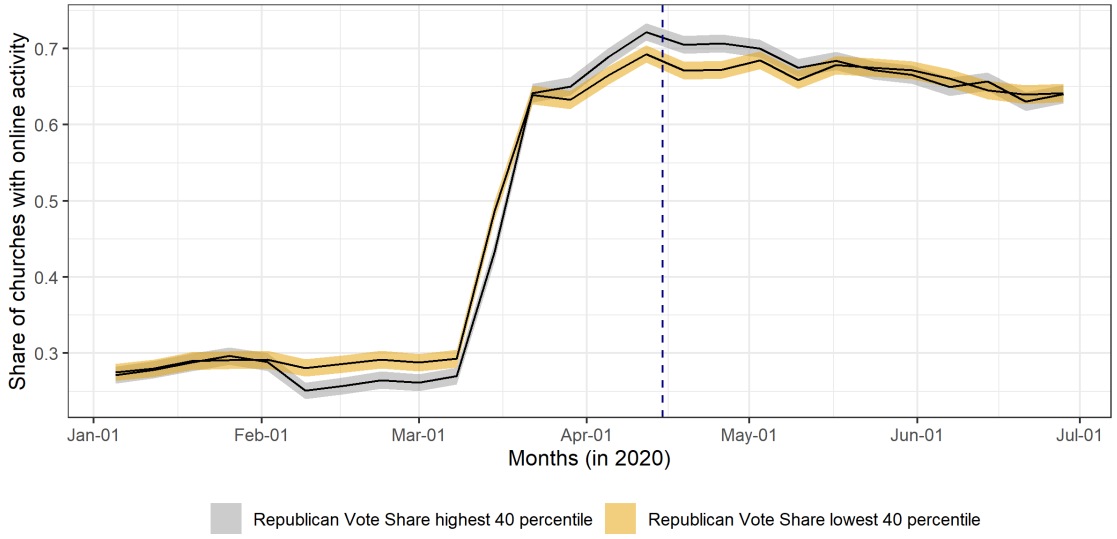
Table 8, for the relaxation period, shows little impact of public health measures, but a negative

week trend reflecting probably a fatigue effect, that seems faster for smaller churches. Table 9 confirms the impression of Figure 6 with respect to differences of worship style during the introduction period, and Table 10 shows, as for size, no major effect of public health measures, only a generalized negative weekly trend.

Finally, Tables 11 and 12 confirm that there is no tendency for churches in strongly Republican counties to respond less to public health measures. If anything there are slightly positive coefficients on the interaction of Republican vote share with certain of the announced measures. However, as Table 12 shows, there is a strong negative coefficient on the presence of a religious exemption in a stay home order. There may well be a tendency for churches in strongly Republican counties to be located in states that have religious exemptions, and those religious exemptions seem to be very clearly associated with lower online activity. But given the nature of the stay-home order, churches in strongly Republican counties do seem to have posted more online. This might indicate that such orders were perceived as more legitimate in Republican counties - though at this stage that remains a conjecture.

Overall, though, the absence of any visible negative association of a county's Republican vote share on the level of online activity remains striking in the light of the expectations generated by widespread press reports of political polarisation in churches' response to the pandemic.

Fig. 7. Churches' online activity over time by previous political voting behavior on the county level.



Note: Share of churches with a predicted online church activity on a Sunday from January to June 2020, according to if the county the church is located in is within the top of bottom 40 percentile of the vote share for the Republican party in the 2016 presidential elections. Public Facebook posts obtained via CrowdTangle, Facebook IDs from usachurches.org. The dashed line separates the introduction and relaxation periods. Shaded areas indicate the standard deviation.

5.3 Developments through end-November 2020

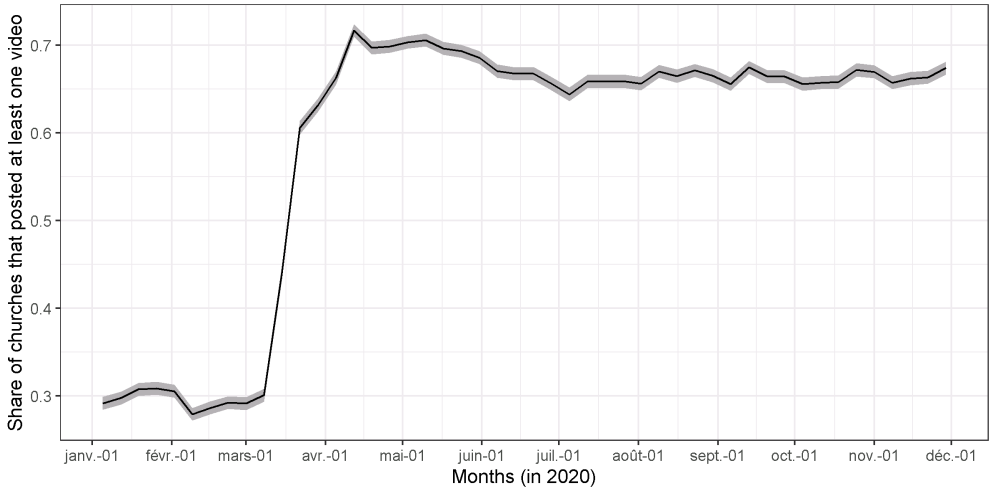
In this section we show the equivalents of Figures 4 through 7 on Facebook data until the end of November 2020. Though we do not perform multivariate analysis for the larger sample (since updated information about public health measures is not yet available), it is nevertheless possible to note a number of salient features. First, as we can see from Figure 8, after an initial dip in the relaxation period from the middle of April until the end of June, average online activity levels off and shows no tendency to decline further. This may reflect the fact (shown in Figure 10 in the Appendix), that confirmed cases and deaths from Covid-19 rose in July and August 2020 in the United States. This contrasts with the European Union where they fell to low levels until they caught up with and overtook US levels by November 2020. Even if churches relaxed their vigilance after the April peak, they may quickly have realized the pandemic was not under control.

However, it is also notable that online activity shows no further increase. All the response of church online activity to the pandemic seems to have happened within the first month of the pandemic. One might have expected a significant proportion of churches to develop an online presence gradually over the following months, but there is no sign of this in our data. Yet it should be noted that the constant levels of online activities could hide some churches stopping while new churches offer online activities as the pandemic becomes more important in different parts of the country.

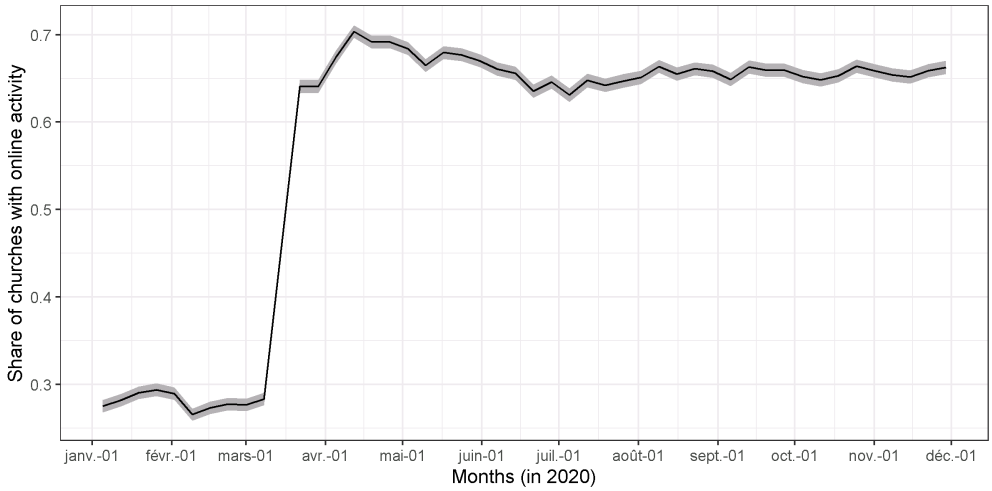
Next, Figure 9 shows that heterogeneity by both church size and worship style remained more or less constant until the end of November (panels (a) and (b)). Most interestingly of all, panel (c) shows that activity of churches in strongly Republican and strongly Democrat areas show no tendency to diverge through to mid-October, even though the period covered the run-up to a very partisan election with an unprecedentedly high voter turnout. There is a slight divergence during November though the gap is small. This corroborates our impression, reported above in our discussion of the content of Facebook posts, that churches overwhelmingly use their posts to advertise their services and to provide inspirational content for members rather than to communicate politically partisan messages.

Fig. 8. Churches' online activities until November 2020

(a) At least one video post on a Sunday



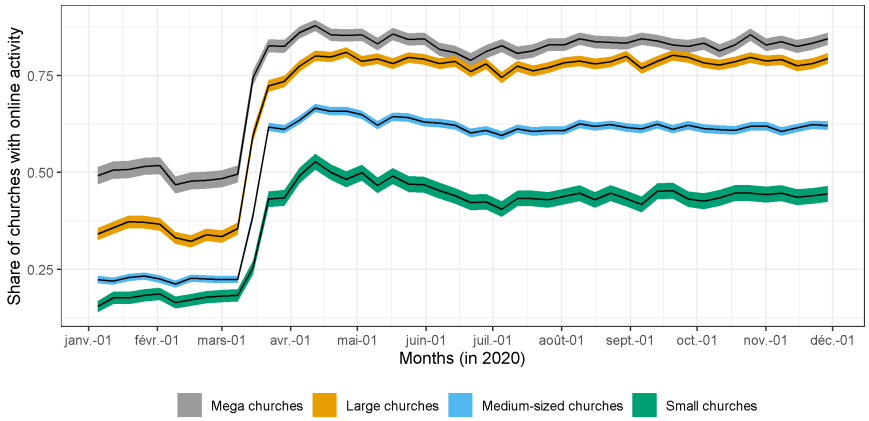
(b) At least one post predicted as online church activity on a Sunday



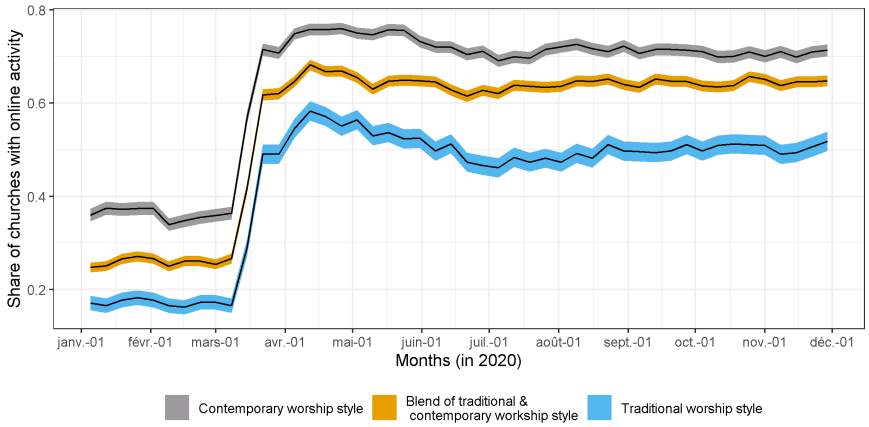
Note: Share of churches with a predicted online church activity on a Sunday from January to end-November 2020. Public Facebook posts obtained via CrowdTangle, Facebook IDs from usachurches.org. The dashed line separates the introduction and relaxation periods. Shaded area indicates the standard deviation.

Fig. 9. Churches' online activities until November 2020

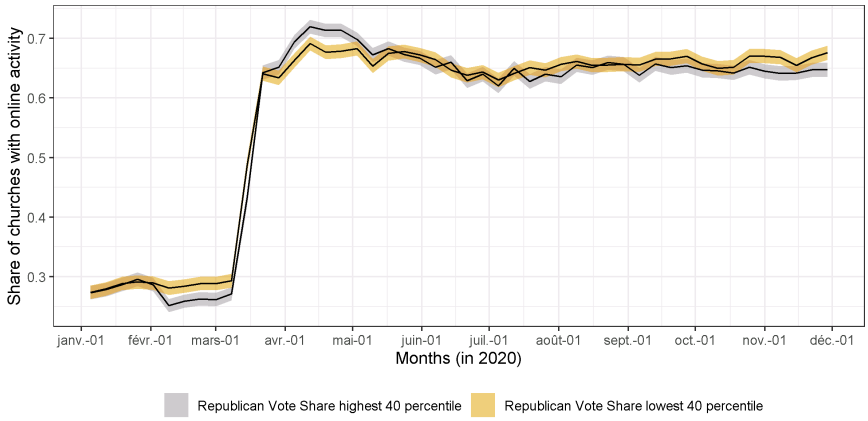
(a) Heterogeneity in Church Size



(b) Heterogeneity in Worship Style



(c) Heterogeneity in Voting Behavior



Note: Share of churches with a predicted online church activity on a Sunday from January to end-November 2020 according to (a) church size, (b) worship style, and (c) whether the county in which the church is located lies within the top or bottom 40 percentile of the vote share for the Republican party in the 2016 presidential elections. Public Facebook posts obtained via CrowdTangle, Facebook IDs, size, worship style and location from usachurches.org, from usachurches.org. Shaded areas indicate the standard deviation.

6 Conclusion

In this paper we have examine the way in which US churches responded in their online behavior to the unexpected challenge of the Covid-19 pandemic. We draw a contrast between two broad models of churches' operations. Under the economic model, churches respond to the demand of their members for ritual and communitarian activities, as well as for some other services that may be bundled with these. For such churches, the pandemic represents both a shock to demand and a shock to supply. The shock to demand comes in the form of an unexpected increase in demand for online services. Larger churches can typically meet this demand at a lower marginal cost, and the increase might be different according to the service style. The supply shock takes the form of an increase in the cost of in-person religious gatherings which again might be different according to the average number of people attending. We find that US churches with Facebook pages responded rapidly to these two shocks, with two-third of churches showing evidence of online activity each Sunday from the middle of April compared to less than one-third prior to the beginning of March. Consistent with the economic model, churches of all sizes and worship styles responded, but larger churches and those with more contemporary worship styles had higher levels of online activity throughout the period than smaller and more traditional churches.

An alternative model of churches' operations, in which they use their ideological influence over the beliefs of church members to reinforce partisan political divides and resist public health measures that would diminish their revenues, is one that we cannot rule out but for which we find no evidence in our data. Churches in strongly Republican and churches in strongly Democrat counties display very similar behavior. Religious exemptions from stay-home orders are indeed associated with lower levels of online activity, but such exemptions are the result of political decisions at the state level. Conditional on exemptions there is no evidence that political factors influence church responses.

Our sample is drawn from Christian churches that already have a significant online presence through at least a Facebook page. We decided to focus on Christian churches to compare religious organisations that are part of the Christian majority. There might be very different dynamics for

religious organisations that are of a minority religion. Furthermore, this more technology-friendly sample may overestimate the increase in online activities in the general church population. It would be of interest to analyse the creation of new public church Facebook pages during the pandemic, which so far escapes our analysis. This omission also leaves open the possibility that selection bias, as well as the choice to analyse Facebook posts, may have hidden from us evidence of a more ideological role for churches' behavior. This remains an important avenue for future research. Yet in view of the politically charged nature of controversies during the pandemic it is useful to draw attention to the apparently bipartisan nature of churches' general responses to the pandemic.

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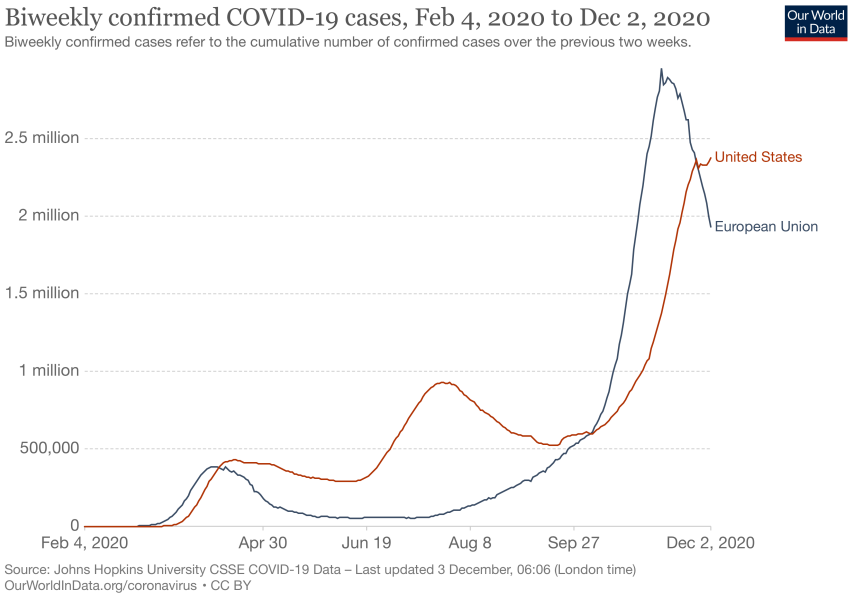
7 Appendix

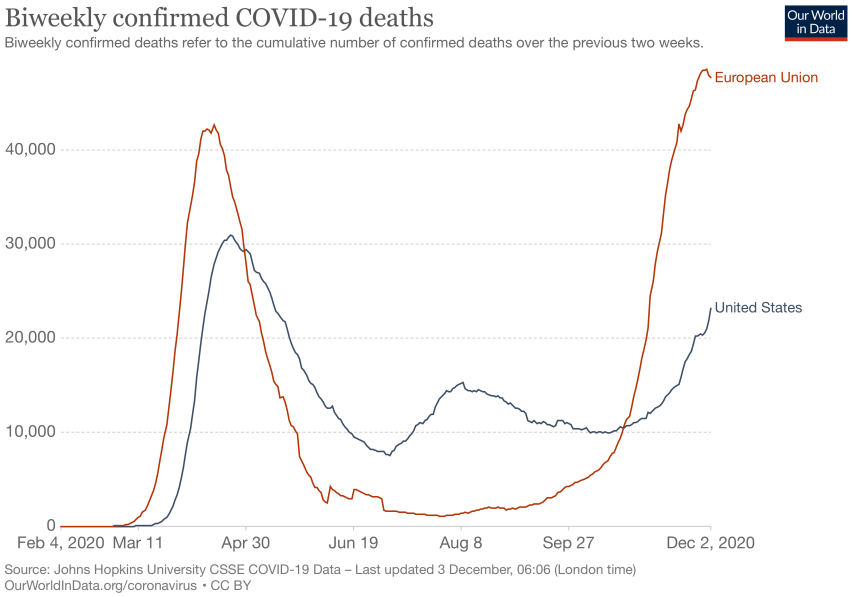
7.1 Additional Figures

Fig. 10. The evolution of confirmed cases and deaths from Covid-19 in the United States and the European Union from February to December 2020.

(a)

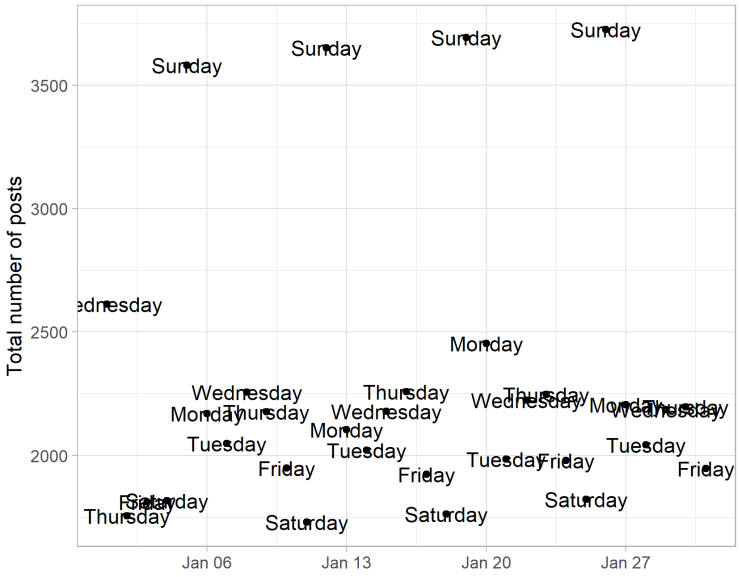


(b)



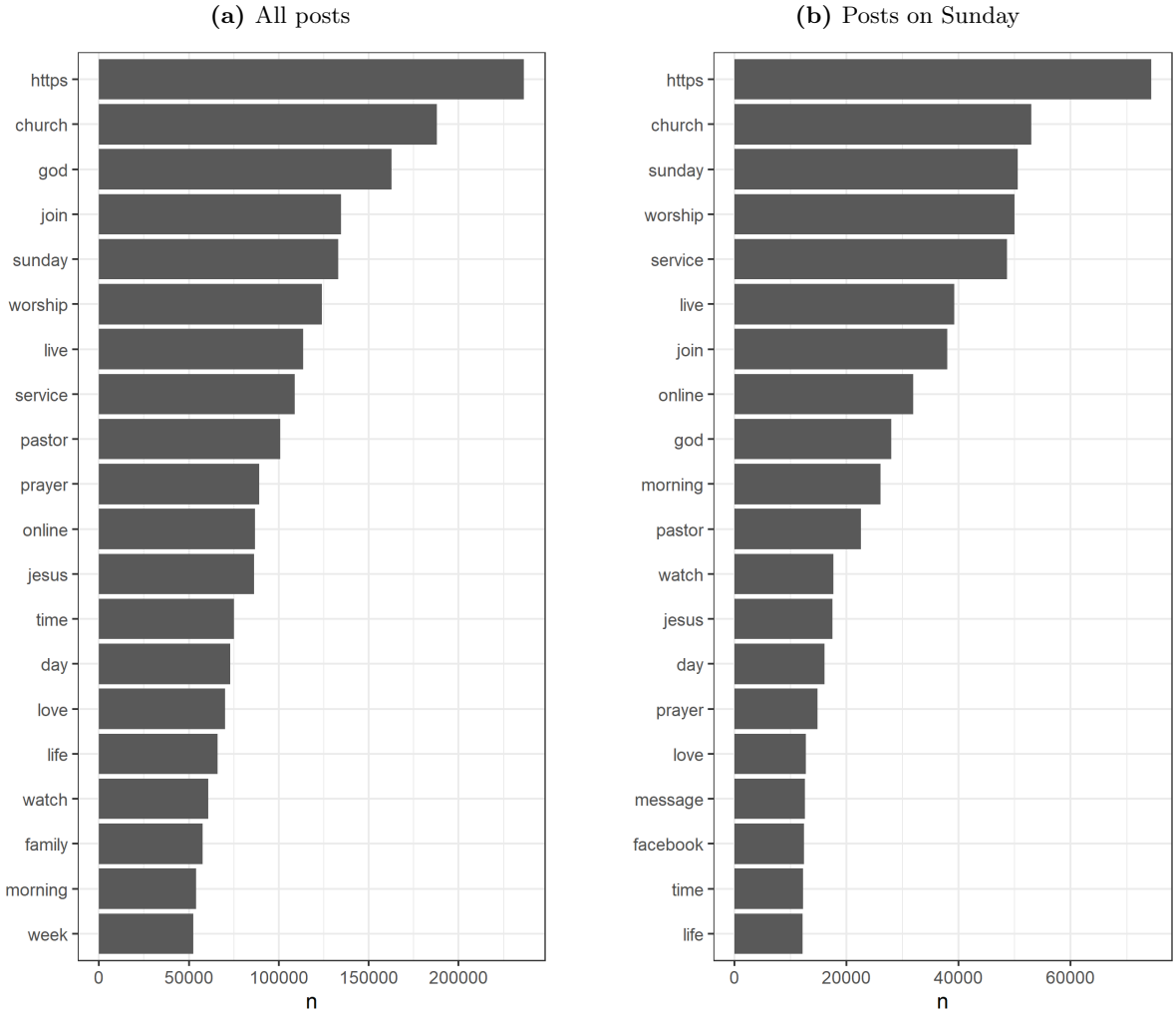
Source: Our World in Data

Fig. 11. Total number of Facebook posts per day in January 2020 with information about the weekday



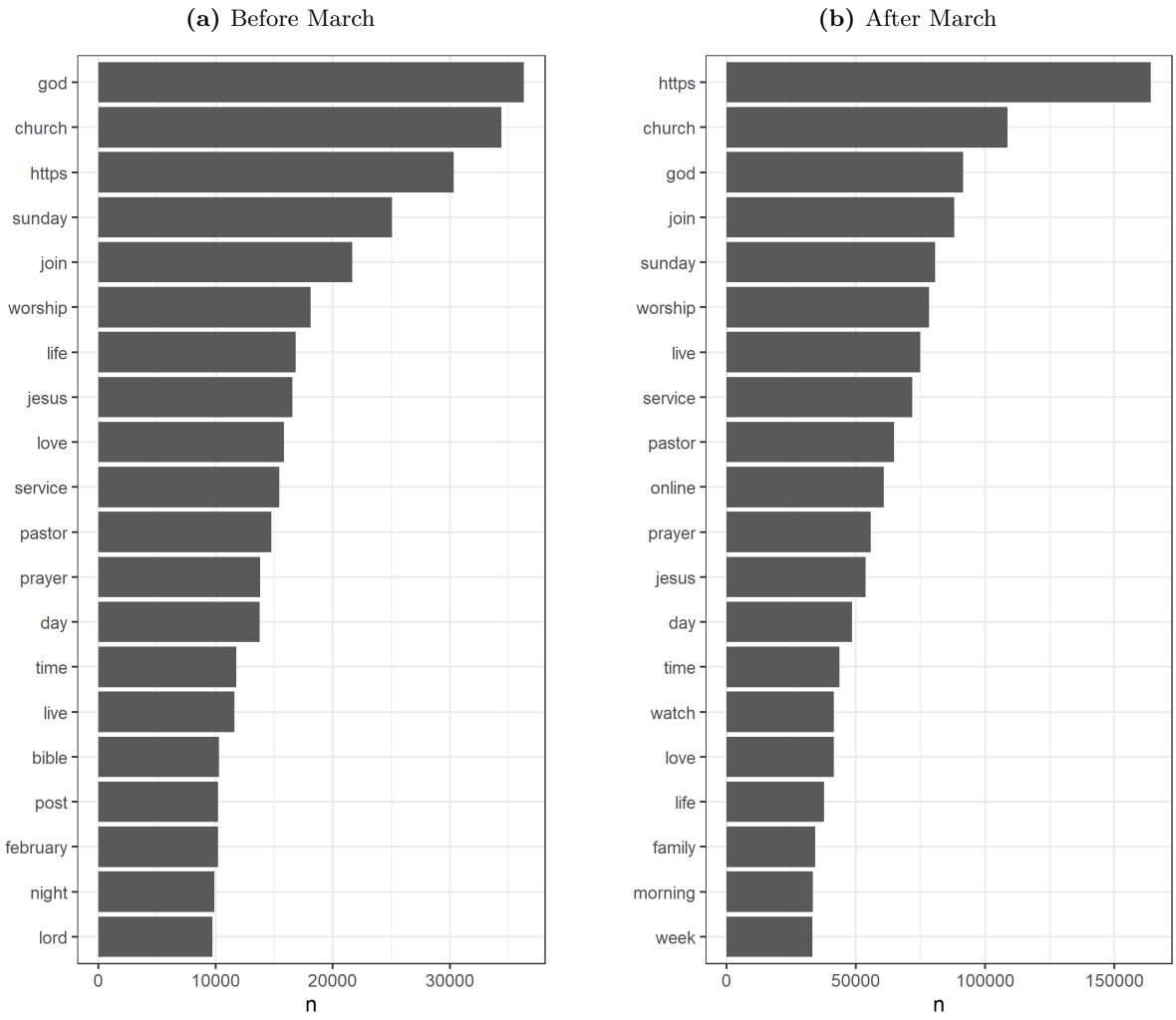
Note: Number of posts made by public U.S. church profiles in January 2020. The weekday is added to each day. Facebook IDs were obtained from usachurch.org and Facebook posts by CrowdTangle.

Fig. 12. 20 most common words in church posts overall and on Sunday



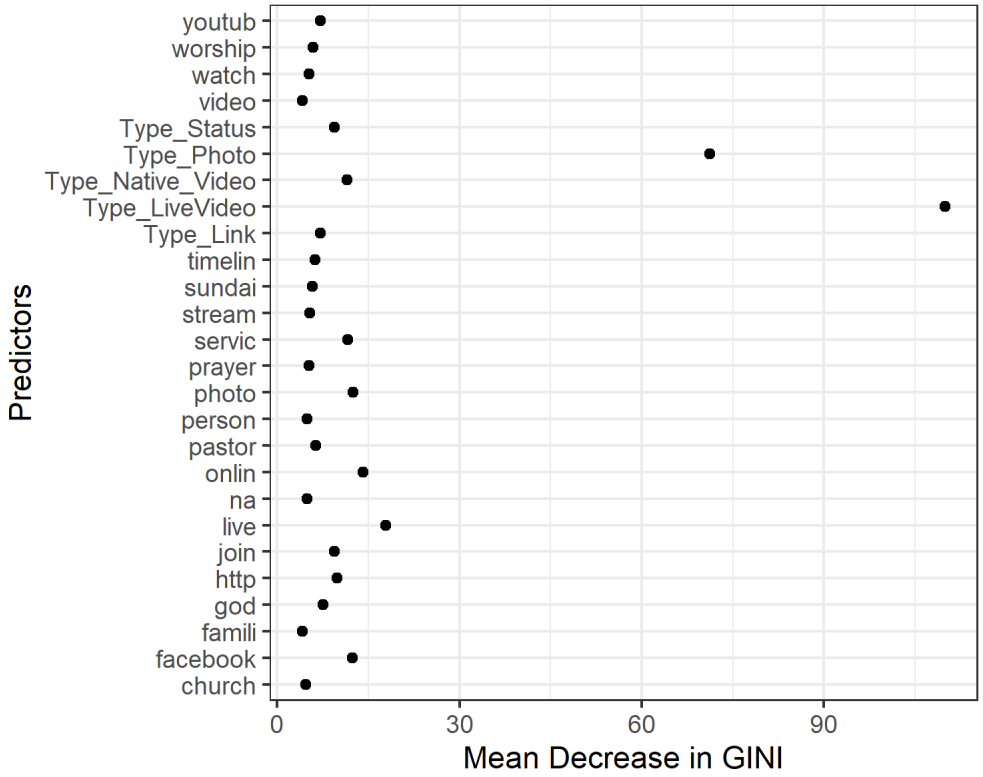
Note: Displays the 20 most common words in the messages of posts including all days (panel a) and on Sundays (panel b) made by churches from January to June 2020. Stop words and numbers are excluded. Posts are obtained from Facebook public profiles via CrowdTangle. Facebook IDs obtained via usachurches.org

Fig. 13. 20 most common words in church posts before and after March 2020



Note: Displays the 20 most common words in the messages of posts including all days made by churches before March 2020 (panel a) and after March 2020 (panel b). Stop words and numbers are excluded. Posts are obtained from Facebook public profiles via CrowdTangle. Facebook IDs obtained via usachurches.org

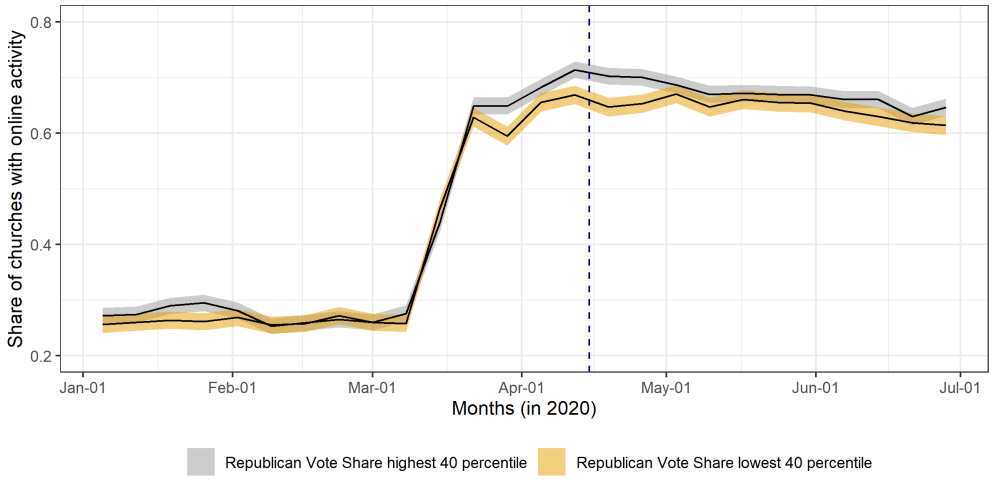
Fig. 14. Most important predictors for online activity



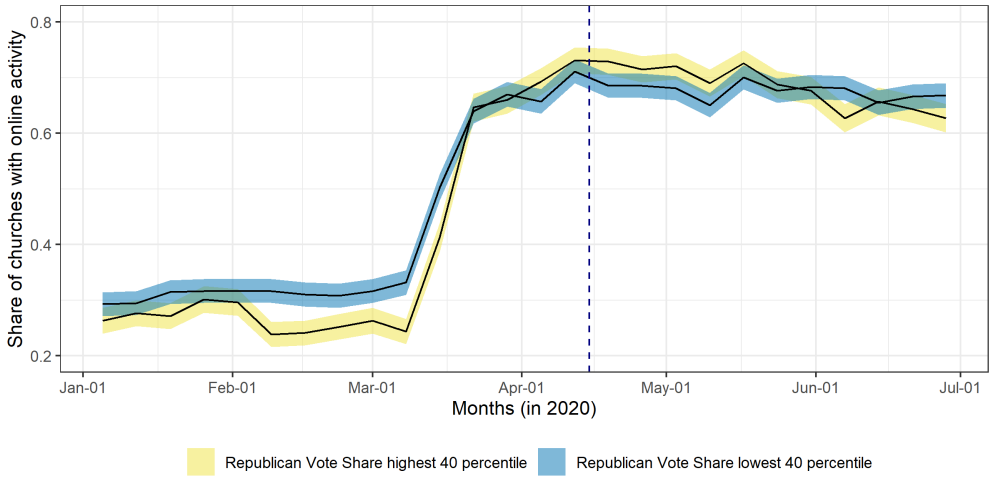
Note: Illustrates the "importance" of each predictor in the online forest prediction algorithm that identifies online church activities, measured as the mean decrease in the GINI. Based on a training set of 1600 hand coded public Facebook posts. Predictors included the word stem of the 200 most used words and the post type.

Fig. 15. Church online Sunday activity according to the Republican vote share in 2016 on the county level separately for states that eventually had a stay home order with and without a religious exemption

(a) States that issued a stay home order with an exemption for religious gatherings



(b) States that issued a stay home order without an exemption for religious gatherings



Note: Share of churches with a predicted online church activity on a Sunday according to if the county the church is located within the top or bottom 40 percentile of Republican vote shares in the 2016 presidential elections. Panel (a) includes only states that issued a stay home order with an exemption for religious gatherings, panel (b) includes only states that issued a stay home order without an exemption.

7.2 Additional Tables

Table 3: Comparing churches with and without Facebook Link Provided on usachurches.org

Variable	Without Facebook Link	With Facebook Link	Difference	P-Value
Church Size: Small	0.440	0.180	0.260	0.000
Church Size: Medium	0.490	0.490	-0.005	0.609
Church Size: Large	0.060	0.210	-0.150	0.000
Church Size: Mega	0.010	0.120	-0.104	0.000
Denomination: Baptist	0.230	0.220	0.019	0.024
Denomination: Catholic	0.010	0.010	0.002	0.377
Denomination: Lutheran	0.030	0.030	-0.006	0.068
Denomination: Methodist	0.040	0.070	-0.024	0.000
Denomination: Pentecostal	0.170	0.140	0.030	0.000
Denomination: Non-denominational or Independent	0.270	0.280	-0.005	0.542
Traditional worship style	0.260	0.150	0.108	0.000
Blend of traditional and and contemporary worship style	0.500	0.430	0.067	0.000
Contemporary worship style	0.200	0.310	-0.113	0.000
Twitter Provided	0.030	0.430	-0.399	0.000
YouTube provided	0.010	0.120	-0.113	0.000
N	5763	4427		

Note: Information from usachurches.org, accessed in May 2020, according to if the church information included a Facebook link or not. P-values from a two-sided t-test comparing the means. Small churches are defined as receiving up to 50 people on a regular Sunday, medium churches between 51 and 300, large churches between 301 and 500 and mega churches over 2000. Broad denomination according to the entry's own definition and church name. Worship style could be selected between traditional, contemporary, blend of contemporary and traditional, and other.

Table 4: Examples of posts with text defined as with and without at video

Posts with Video	**Posts without Video**
Sunday is here! Watch live at 9:30 and 11:00 AM.	Psalm 139 1-6 God knows you 7-12 God is close to you 13-18 God made you 19-24 God protects you
Welcome to our Sunday Service Live Streaming - April 19, 2020 Ptr. Jose Butao Message: " SEASONS OF PRAYER." #worshipjesusfellowship	What an awesome way to start a new year. 8 baptisms.
On Father's Day, Worship with your family. Watch Valley Baptist.	*YouTubeLink*
Pastor Danny launches us into Day 1 of 21 Days of Prayer and Fasting with a devotional message on Romans 5! Let us know how God is speaking to you through Romans 5 today!	Join us tomorrow online or in person!!! Service begins at 10:45 AM. There will be NO Children's Church or Nursery, children will remain with their parents. Hope to see you there!!
Attend Church right from your living room! Join us live right now as Pastor Josh Surratt shares how we can become Unshakable, even in scary and uncertain times. teachers.	Today, our #pandemicprayer is to pray for the parents
During the welcome today, Pastor Matt shared with us some steps that we are taking to stay healthy, as well as a change in how we are going to take communion starting next week. Check it out below!	Its a beautiful day to worship! Join us this morning as we gather together, virtually! WAYS TO WATCH: FACEBOOK LIVE (9:30am) *church website* (9:30am & 11am) FBCA Mobile APP (9:30am & 11am)
Live Event	$Emoji$ There is no fear in love. But perfect love drives out fear, because fear has to do with punishment. The one who fears is not made perfect in love. 1 John 4:18 $Emoji$
Sunday Livestream	JOIN US for our Sunday afternoon online services, 2PM, 4PM & 6PM, where Pastor Corey will be chatting LIVE at 2PM, Pastor Yolie at 4PM and Pastor Tammy at 6PM. Each will be offering prayer and encouragement right here on Facebook LIVE! Don't forget to tag a friend or SHARE this post! See you soon!
Sunday Service: 31 May 20: Sunday Morning Worship	If you are making disciples, who are not making disciples, then you are not making disciples

Note: Randomly selected public posts with a message defined as with and without a video. Posts obtained via CrowdTangle. Facbooks ID from usachurches.org

7.2.1 Posting at least one video on a given Sunday as dependent variable

Table 5: Effect of Covid-19 and interventions on churches posting behavior on Sundays: Introduction Period (before April 15)

	Dependent variable: Posted at least one video on Sunday							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Infections previous week (county)	0.041***		0.016**		0.016**		0.016**	
	(0.002)		(0.006)		(0.006)		(0.006)	
Log deaths previous week (county)		0.047***		0.014*		0.014*		0.015*
		(0.003)		(0.008)		(0.008)		(0.008)
After International Travel Ban (March 11)			0.122***	0.139***	0.123***	0.139***	0.122***	0.138***
			(0.011)	(0.008)	(0.011)	(0.009)	(0.011)	(0.009)
After Federal guidelines issued (March 16)			0.165***	0.181***	0.166***	0.181***	0.163***	0.178***
			(0.026)	(0.025)	(0.026)	(0.025)	(0.026)	(0.024)
After Public Schools Closed			−0.019	−0.023	−0.017	−0.022	−0.016	−0.020
			(0.019)	(0.016)	(0.019)	(0.016)	(0.020)	(0.017)
Gatherings forbidden			0.005	0.015	0.003	0.014	0.004	0.015
			(0.014)	(0.012)	(0.014)	(0.013)	(0.014)	(0.012)
Restaurants/Entertainment closed			−0.009	0.007	−0.010	0.006	−0.009	0.007
			(0.026)	(0.024)	(0.026)	(0.024)	(0.025)	(0.023)
During Stay Home Order			−0.014	−0.010				
			(0.017)	(0.020)				
Stay Home: with religious exemption					−0.023	−0.017		
					(0.019)	(0.022)		
Stay Home: without religious exemption					0.006	0.003		
					(0.019)	(0.020)		
Stay home: Rel. gatherings prohibited							−0.012	−0.015
							(0.027)	(0.028)
Stay home: Exempt from limits							−0.033	−0.027
							(0.021)	(0.024)
Stay home: Limited to 10							0.009	0.013
							(0.020)	(0.020)
Stay home: Limited otherwise							0.017	0.010
							(0.049)	(0.042)
Average in February (Sunday)	0.291	0.291	0.291	0.291	0.291	0.291	0.291	0.291
Number of churches	3893	3893	3893	3893	3893	3893	3893	3893
Observations	58,395	58,395	58,395	58,395	58,395	58,395	58,395	58,395
Adjusted R^2	0.564	0.533	0.586	0.583	0.586	0.583	0.586	0.584

Note: *p<0.1; **p<0.05; ***p<0.01. Dependent variable: At least one post includes a video (YouTube video, live video, scheduled and completed, native video) on a given Sunday. Includes church fixed effects and an Easter Sunday dummy. Standards error clustered on state level. Includes Sundays between 2020-01-01 and 2020-04-15. Columns 4 and 5: Religious exemptions according to own categorization. Columns 7 and 8: Categorization from Pew Research Center. Number of states (clusters): 51.

Table 6: Effect of Covid-19 and interventions on churches posting behavior on Sundays: Relaxation Period (after April 15)

	Dependent variable: Posted at least one video on Sunday							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Infections previous week (county)	−0.004		−0.002	−0.0004	−0.002	−0.0002	−0.003	−0.001
	(0.003)		(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)
Log deaths previous week (county)		0.003**						
		(0.002)						
Gatherings forbidden			0.022**	0.012	0.022**	0.013	0.020**	0.010
			(0.010)	(0.010)	(0.010)	(0.009)	(0.009)	(0.009)
Restaurants/Entertainment closed			0.011	−0.002	0.012*	−0.001	0.012	−0.002
			(0.007)	(0.006)	(0.007)	(0.006)	(0.007)	(0.006)
During Stay Home Order			0.014*	−0.005				
			(0.007)	(0.007)				
Stay Home: with religious exemption					0.017**	−0.003		
					(0.008)	(0.006)		
Stay Home: without religious exemption					0.008	−0.008		
					(0.010)	(0.011)		
Stay home: Rel. gatherings prohibited							0.030**	0.012
							(0.014)	(0.015)
Stay home: Exempt from limits							0.014	−0.005
							(0.011)	(0.008)
Stay home: Limited to 10							0.008	−0.011*
							(0.007)	(0.006)
Stay home: Limited otherwise							0.010	−0.011
							(0.012)	(0.012)
Linear week trend				−0.005***		−0.005***		−0.005***
				(0.001)		(0.001)		(0.001)
Average in April (Sunday)	0.694	0.694	0.694	0.694	0.694	0.694	0.694	0.694
Number of churches	3888	3888	3888	3888	3888	3888	3888	3888
Number of States (clusters)	50	50	50	50	50	50	50	50
Observations	42,823	42,823	42,823	42,823	42,823	42,823	42,823	42,823
Adjusted R^2	0.706	0.706	0.707	0.707	0.707	0.707	0.707	0.707

Note: *p<0.1; **p<0.05; ***p<0.01. Dependent variable: At least one post includes a video (YouTube video, live video, scheduled and completed, native video) on a given Sunday. Includes church fixed effects. Standards error clustered on state level. Includes Sundays between 2020-04-15 and 2020-06-30. Columns 4 and 5: Religious exemptions according to own categorization. Columns 7 and 8: Categorization from Pew Research Center.

7.2.2 Heterogeneity Analysis

Table 7: Effect of Covid-19 and interventions on churches posting behavior on Sundays according to size of the church: Introduction Period (before April 15)

	Dependent variable: Predicted Online Church Activity on Sunday			
	Mega churches	Large churches	Medium churches	Small churches
	(1)	(2)	(3)	(4)
Log Infections previous week (county)	0.027***	0.023***	0.022**	0.009
	(0.005)	(0.007)	(0.009)	(0.007)
After International Travel Ban (March 11)	0.194***	0.223***	0.147***	0.058***
	(0.022)	(0.021)	(0.016)	(0.019)
After Federal guidelines issued (March 16)	0.022	0.035	0.262***	0.177***
	(0.058)	(0.047)	(0.038)	(0.063)
After Public Schools Closed	0.069**	0.086***	−0.072***	−0.058
	(0.032)	(0.021)	(0.027)	(0.064)
Gatherings forbidden	0.027	−0.002	−0.024	−0.002
	(0.034)	(0.028)	(0.017)	(0.027)
Restaurants/Entertainment closed	−0.094	−0.039	−0.008	0.054
	(0.060)	(0.052)	(0.034)	(0.035)
During Stay Home Order	−0.054**	−0.051**	−0.052**	−0.003
	(0.025)	(0.023)	(0.026)	(0.026)
Average in February (Sunday)	0.488	0.34	0.223	0.177
Number of churches	504	888	1912	589
Number of States (clusters)	43	50	51	48
Observations	7,560	13,320	28,680	8,835
Adjusted R^2	0.574	0.589	0.569	0.582

Note: *p<0.1; **p<0.05; ***p<0.01. Dependent variable: At least one post predicted to offer an online church activity on a given Sunday. Includes church fixed effects and an Easter Sunday dummy. Standards error clustered on state level. Includes Sundays between 2020-01-01 and 2020-04-15. Small churches are defined as receiving up to 50 people on a regular Sunday (column 4), medium churches between 51 and 300 (column 3), large churches between 301 and 500 (column 2) and mega churches over 2000 (column 1).

Table 8: Effect of Covid-19 and interventions on churches posting behavior on Sundays according to size of the church: Relaxation Period (after April 15)

	Dependent variable: Predicted Online Church Activity on Sunday							
	Mega churches	Mega churches	Large churches	Large churches	Medium churches	Medium churches	Small churches	Small churches
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Infections previous week (county)	0.007	0.011	−0.008	−0.006	−0.004	−0.002	0.005	0.007
	(0.007)	(0.008)	(0.005)	(0.005)	(0.004)	(0.004)	(0.006)	(0.006)
Gatherings forbidden	0.022	0.011	0.034**	0.027*	0.030**	0.021*	0.0003	−0.016
	(0.021)	(0.022)	(0.015)	(0.015)	(0.012)	(0.012)	(0.023)	(0.023)
Restaurants/Entertainment closed	−0.004	−0.016	−0.012	−0.021	0.019*	0.007	0.034**	0.012
	(0.014)	(0.014)	(0.012)	(0.013)	(0.010)	(0.010)	(0.017)	(0.016)
During Stay Home Order	0.046***	0.031*	0.009	−0.004	0.012	−0.007	0.023*	−0.006
	(0.016)	(0.017)	(0.008)	(0.011)	(0.008)	(0.009)	(0.013)	(0.018)
Linear week trend		−0.004**		−0.003*		−0.005***		−0.008**
		(0.002)		(0.002)		(0.001)		(0.003)
Average in April (Sunday)	0.859	0.859	0.797	0.797	0.652	0.652	0.496	0.496
Number of churches	504	504	888	888	1912	1912	589	589
Number of States (clusters)	43	43	50	50	51	51	48	48
Observations	5,544	5,544	9,768	9,768	21,032	21,032	6,479	6,479
Adjusted R^2	0.594	0.595	0.594	0.594	0.657	0.658	0.709	0.710

Note: *p<0.1; **p<0.05; ***p<0.01. Dependent variable: At least one post predicted to offer an online church activity on a given Sunday. Includes church fixed effects and an Easter Sunday dummy. Standards error clustered on state level. Includes Sundays between 2020-04-15 and 2020-06-30. Small churches are defined as receiving up to 50 people on a regular Sunday, medium churches between 51 and 300, large churches between 301 and 500 and mega churches over 2000.

Table 9: Effect of Covid-19 and interventions on churches posting behavior on Sundays according to worship style of the church: Introduction Period (before April 15)

	Dependent variable: Predicted Online Church Activity on Sunday		
	Contemporary worship style	Traditional worship style	Blend of the 2 worship styles
	(1)	(2)	(3)
Log Infections previous week (county)	0.025***	0.011	0.019**
	(0.006)	(0.009)	(0.009)
After International Travel Ban (March 11)	0.179***	0.109***	0.128***
	(0.016)	(0.023)	(0.019)
After Federal guidelines issued (March 16)	0.155***	0.309***	0.132***
	(0.044)	(0.041)	(0.035)
After Public Schools Closed	−0.061**	−0.080***	0.030
	(0.029)	(0.025)	(0.019)
Gatherings forbidden	−0.013	−0.001	−0.001
	(0.019)	(0.029)	(0.020)
Restaurants/Entertainment closed	−0.017	−0.048	0.003
	(0.043)	(0.042)	(0.037)
During Stay Home Order	−0.020	−0.028	−0.056**
	(0.019)	(0.029)	(0.026)
Average in February (Sunday)	0.355	0.17	0.26
Number of churches	1222	580	1655
Number of States (clusters)	50	47	51
Observations	18,330	8,700	24,825
R^2	0.621	0.593	0.620
Adjusted R^2	0.594	0.563	0.593

Note: *p<0.1; **p<0.05; ***p<0.01. Dependent variable: At least one post predicted to offer an online church activity on a given Sunday. Includes church fixed effects and an Easter Sunday dummy. Standards error clustered on state level. Includes Sundays between 2020-01-01 and 2020-04-15. Worship style could be selected between traditional, contemporary, blend of contemporary and traditional, and other.

Table 10: Effect of Covid-19 and interventions on churches posting behavior on Sundays according to worship style of the church: Relaxation Period (after April 15)

	Dependent variable: Predicted Online Church Activity on Sunday					
	Contemporary worship style	Contemporary worship style	Traditional worship style	Traditional worship style	Blend of the 2 worship styles	Blend of the 2 worship styles
	(1)	(2)	(3)	(4)	(5)	(6)
Log Infections previous week (county)	−0.001	0.001	−0.009	−0.004	−0.001	0.001
	(0.004)	(0.005)	(0.007)	(0.006)	(0.004)	(0.004)
Gatherings forbidden	0.021	0.012	0.046	0.024	0.025	0.016
	(0.020)	(0.021)	(0.031)	(0.029)	(0.021)	(0.020)
Restaurants/Entertainment closed	0.009	−0.002	0.029*	−0.003	0.011	0.0003
	(0.011)	(0.012)	(0.016)	(0.016)	(0.012)	(0.011)
During Stay Home Order	0.029***	0.013	0.021*	−0.024	0.010	−0.006
	(0.009)	(0.010)	(0.012)	(0.015)	(0.011)	(0.011)
Linear week trend		−0.004***		−0.011***		−0.004***
		(0.001)		(0.002)		(0.001)
Average in April (Sunday)	0.753	0.753	0.561	0.561	0.665	0.665
Number of churches	1222	1222	580	580	1655	1655
Number of States (clusters)	50	50	47	47	51	51
Observations	13,442	13,442	6,380	6,380	18,205	18,205
R^2	0.660	0.660	0.717	0.719	0.719	0.719
Adjusted R^2	0.626	0.626	0.688	0.691	0.691	0.691

Note: *p<0.1; **p<0.05; ***p<0.01. Dependent variable: At least one post predicted to offer an online church activity on a given Sunday. Includes church fixed effects. Standards error clustered on state level. Includes Sundays between 2020-04-15 and 2020-06-30. Worship style could be selected between traditional, contemporary, blend of contemporary and traditional, and other.

Table 11: Effect of Covid-19 and interventions on churches posting behavior on Sundays interacted with the Republic vote share in 2016 (county level): Introduction Period (before April 15)

	Dependent variable: Predicted Online Church Activity on Sunday			
	(1)	(2)	(3)	(4)
Log Infections previous week (county)	0.054^{***}		0.027^{***}	
	(0.002)		(0.006)	
Log deaths previous week (county)		0.063^{***}		0.027^{***}
		(0.003)		(0.009)
After International Travel Ban (March 11)			-0.041^{***}	-0.044^{*}
			(0.015)	(0.023)
After Federal guidelines issued (March 16)			-0.022^{*}	-0.002
			(0.013)	(0.013)
After Public Schools Closed			-0.014	0.008
			(0.023)	(0.026)
Gatherings forbidden			0.141^{***}	0.174^{***}
			(0.024)	(0.028)
Restaurants/Entertainment closed			0.151^{***}	0.181^{***}
			(0.012)	(0.008)
During Stay Home Order			-0.009	-0.016
			(0.014)	(0.012)
Log Infections previous week* Percent Republic Votes 2016	0.001^{***}		-0.0002	
	(0.0001)		(0.0002)	
Log deaths previous week* Percent Republic Votes 2016		0.0005^{***}		0.00005
		(0.0002)		(0.0004)
After International Travel Ban* Percent Republic Votes 2016			0.001	0.002^{*}
			(0.001)	(0.001)
After Federal guidelines issued * Percent Republic Votes 2016			0.002^{*}	0.001
			(0.001)	(0.001)
After Public Schools Closed* Percent Republic Votes 2016			0.001	0.0003
			(0.001)	(0.002)
Gatherings forbidden* Percent Republic Votes 2016			0.002	0.002
			(0.001)	(0.002)
Restaurants/Entertainment closed* Percent Republic Votes 2016			-0.0004	-0.002^{***}
			(0.001)	(0.001)
During Stay Home Order* Percent Republic Votes 2016			-0.0002	-0.0001
			(0.001)	(0.001)
Average in February (Sunday)	0.277	0.277	0.277	0.277
Number of churches	3888	3888	3888	3888
Number of States (clusters)	50	50	50	50
Observations	58,320	58,320	58,320	58,320
R^2	0.603	0.564	0.625	0.619
Adjusted R^2	0.575	0.533	0.598	0.592

Note: *p<0.1; **p<0.05; ***p<0.01

Note: *p<0.1; **p<0.05; ***p<0.01. Dependent variable: At least one post predicted to offer an online church activity on a given Sunday. Includes church fixed effects and an Easter Sunday dummy. Standards error clustered on state level. Percent Republican Votes 2016 measures the difference between the votes cast for the Republican party in the 2016 presidential elections on the county level and the national average. The uninteracted coefficients are thus interpreted as the relationship at the mean, the interaction as one percentage point increase in the vote share compared to the average. The Includes Sundays between 2020-01-01 and 2020-04-15.

Table 12: Effect of Covid-19 and interventions on churches posting behavior on Sundays interacted with the Republic vote share in 2016 (county level): Introduction Period (before April 15)

	Dependent variable: Predicted Online Church Activity on Sunday			
	(1)	(2)	(3)	(4)
Log Infections previous week (county)	0.028^{***}		0.028^{***}	
	(0.006)		(0.005)	
Log deaths previous week (county)		0.029^{***}		0.030^{***}
		(0.009)		(0.009)
Stay Home: with religious exemption	-0.057^{***}	-0.057^{**}		
	(0.016)	(0.025)		
Stay Home: no religious exemption	-0.010	-0.021		
	(0.018)	(0.022)		
Stay home: Rel. gatherings prohibited			-0.004	-0.023
			(0.023)	(0.024)
Stay home: Exempt from limits			-0.073^{***}	-0.077^{***}
			(0.017)	(0.027)
Stay home: Limited to 10			-0.009	-0.008
			(0.017)	(0.020)
Stay home: Limited otherwise			0.014	-0.003
			(0.046)	(0.043)
Log Infections previous week* % Republic Votes 2016	-0.0001		-0.0002	
	(0.0001)		(0.0001)	
Log deaths previous week* % Republic Votes 2016		0.0001		-0.00003
		(0.0004)		(0.0003)
Stay Home: with religious exemption* % Republic Votes 2016	0.001^{**}	0.002^{*}		
	(0.001)	(0.001)		
Stay Home: no religious exemption* % Republic Votes 2016	0.001	0.002		
	(0.001)	(0.002)		
Stay home: Rel. gatherings prohibited* % Republic Votes 2016			0.004^{**}	0.006^{**}
			(0.002)	(0.003)
Stay home: Exempt from limits* % Republic Votes 2016			0.002^{**}	0.003^{**}
			(0.001)	(0.001)
Stay home: Limited to 10* % Republic Votes 2016			0.001	0.001
			(0.001)	(0.001)
Stay home: Limited otherwise* % Republic Votes 2016			-0.001	-0.001
			(0.002)	(0.002)
State Intervention Indicators:	Yes	Yes	Yes	Yes
Average in February (Sunday)	0.277	0.277	0.277	0.277
Number of churches	3888	3888	3888	3888
Number of States (clusters)	50	50	50	50
Observations	58,320	58,320	58,320	58,320
Adjusted R^2	0.598	0.592	0.598	0.593

Note: *p<0.1; **p<0.05; ***p<0.01. Dependent variable: At least one post predicted to offer an online church activity on a given Sunday. Includes church fixed effects and an Easter Sunday dummy. Standards error clustered on state level. Percent Republican Votes 2016 measures the difference between the votes cast for the Republican party in the 2016 presidential elections on the county level and the national average. The uninteracted coefficients are thus interpreted as the relationship at the mean, the interaction as one percentage point increase in the vote share compared to the average. The Includes Sundays between 2020-01-01 and 2020-04-15. Columns 1 and 2: Religious exemptions according to own categorization. Columns 3 and 4: Categorization from Pew Research Center.

Table 13: Effect of Covid-19 and interventions on churches posting behavior on Sundays interacted with the Republic vote share in 2016 (county level): Relaxation Period (after April 15)

	Dependent variable: Predicted Online Church Activity on Sunday			
	(1)	(2)	(3)	(4)
Log infections previous week (county)	−0.004		−0.002	0.001
	(0.003)		(0.003)	(0.002)
Log deaths previous week (county)		0.001		
		(0.002)		
Gatherings forbidden			0.017**	−0.002
			(0.007)	(0.007)
Restaurants/Entertainment closed			0.026**	0.016
			(0.011)	(0.011)
During Stay Home Order			0.010	−0.003
			(0.007)	(0.006)
Linear week trend				−0.005***
				(0.001)
Log infections previous week* Percent Republic Votes 2016	0.00000		0.0001	0.0002
	(0.0002)		(0.0002)	(0.0002)
Log deaths previous week* Percent Republic Votes 2016		−0.0001		
		(0.0001)		
Gatherings forbidden* Percent Republic Votes 2016			0.0003	−0.00001
			(0.0004)	(0.0005)
Restaurants/Entertainment closed* Percent Republic Votes 2016			−0.0003	−0.001
			(0.001)	(0.0005)
During Stay Home Order* Percent Republic Votes 2016			0.001*	0.0004
			(0.0004)	(0.0004)
Linear week trend* Percent Republic Votes 2016				−0.0001
				(0.0001)
Average in April (Sunday)	0.688	0.688	0.688	0.688
Number of churches	3888	3888	3888	3888
Number of States (clusters)	50	50	50	50
Observations	42,768	42,768	42,768	42,768
Adjusted R^2	0.671	0.671	0.672	0.672

Note: *p<0.1; **p<0.05; ***p<0.01. Dependent variable: At least one post predicted to offer an online church activity on a given Sunday. Includes church fixed effects. Standards error clustered on state level. Percent Republican Votes 2016 measures the difference between the votes cast for the Republican party in the 2016 presidential elections on the county level and the national average. The uninteracted coefficients are thus interpreted as the relationship at the mean, the interaction as one percentage point increase in the vote share compared to the average. The Includes Sundays between 2020-04-15 and 2020-06-30.