

**TRENDS IN THE DIFFUSION  
OF MISINFORMATION ON  
SOCIAL MEDIA**

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# Trends in the Diffusion of Misinformation on Social Media

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## Abstract

We measure trends in the diffusion of misinformation on Facebook and Twitter between January 2015 and July 2018. We focus on stories from 570 sites that have been identified as producers of false stories. Interactions with these sites on both Facebook and Twitter rose steadily through the end of 2016. Interactions then fell sharply on Facebook while they continued to rise on Twitter, with the ratio of Facebook engagements to Twitter shares falling by approximately 60 percent. We see no similar pattern for other news, business, or culture sites, where interactions have been relatively stable over time and have followed similar trends on the two platforms both before and after the election.

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# 1 Introduction

Misinformation on social media has caused widespread alarm in recent years. A substantial number of U.S. adults were exposed to false news stories prior to the 2016 election, and post-election surveys suggest that many people who read such stories believed them to be true (Silverman and Singer-Vine 2016; Allcott and Gentzkow 2017; Guess et al. 2018). Many argue that false news stories played a major role in the 2016 election (for example, Olson 2016; Parkinson 2016; Read 2016; Gunther et al. 2018), and in the ongoing political divisions and crises that have followed it (for example, Spohr 2017; Azzimonti and Fernandes 2018; Tharoor 2018). Numerous efforts have been made to respond to the threat of false news stories, including educational and other initiatives by civil society organizations, hearings and legal action by regulators, and a range of algorithmic, design, and policy changes made by Facebook and other social media companies.

Evidence on whether these efforts have been effective—or how the scale of the misinformation problem is evolving more broadly—remains limited. A recent study argues that false stories remain a problem on Facebook even after changes to its news feed algorithm in early 2018 (Newswhip 2018). The study reports that the 26th and 38th most engaging stories on Facebook in the two months after the changes were from fake news websites. Many articles that have been rated as false by major fact-checking organizations have not been flagged in Facebook’s system, and two major fake news sites have seen little or no decline in Facebook engagements since early 2016 (Funke 2018). Facebook’s now-discontinued strategy of flagging inaccurate stories as “Disputed” can modestly lower the perceived accuracy of flagged headlines (Blair et al. 2017), though some research suggests that the presence of warnings can cause untagged false stories to be seen as more accurate (Pennycook and Rand 2017). Media commentators have argued that efforts to fight misinformation through fact-checking are “not working” (Levin 2017) and that misinformation overall is “becoming unstoppable” (Ghosh and Scott 2018).

In this paper, we present new evidence on the volume of misinformation circulated on social media from January 2015 to July 2018. We assemble a list of 570 sites identified as sources of false stories in a set of five previous studies and online lists. We refer to these collectively as *fake news sites*. We measure the volume of Facebook engagements and Twitter shares for all stories on these sites by month. As points of comparison, we also measure the same outcomes for stories on (i) a set of major news sites; (ii) a set of small news sites not identified as producing misinformation; and (iii) a set of sites covering business and culture topics.

The results show that interactions with the fake news sites in our database rose steadily on both Facebook and Twitter from early 2015 to the months just after the 2016 election. Interactions then declined by more than half on Facebook, while they continued to rise on Twitter. The ratio of Facebook engagements to Twitter shares was roughly steady at around 40:1 from the beginning of our period to late 2016, then fell to roughly 15:1 by the end of our sample period. In contrast,

interactions with major news sites, small news sites, and business and culture sites have all remained relatively stable over time, and have followed similar trends on Facebook and Twitter both before and after the 2016 election. While this evidence is far from definitive, we see it as consistent with the view that the overall magnitude of the misinformation problem may have declined, at least temporarily, and that efforts by Facebook following the 2016 election to limit the diffusion of misinformation may have had a meaningful impact

The results also show that the absolute level of interaction with misinformation remains high, and that Facebook continues to play a particularly important role in its diffusion. In the period around the election, fake news sites received almost as many Facebook engagements as the 38 major news sites in our sample. Even after the sharp drop following the election, Facebook engagements of fake news sites still average roughly 70 million per month.

Our evidence is subject to many important caveats and must be interpreted with caution. This is particularly true for the raw trends in interactions. While we have attempted to make our database of false stories as comprehensive as possible, it is likely far from complete, and many factors could generate selection biases that vary over time. The raw decline in Facebook engagements may partly reflect the under-sampling of sites that could have entered or gained popularity later in our sample period, as well as efforts by producers of misinformation to evade detection on Facebook by changing their domain names. It may also reflect changes over time in demand for highly partisan political content that would have existed absent efforts to fight misinformation, and could reverse in the future, for example in the run-up to future elections.

We see the comparison of Facebook engagements to Twitter shares as potentially more informative. If the design of these platforms and the behavior of their users were stable over time, we might expect sample selection biases or demand changes to have similar proportional effects, and thus leave the ratio of Facebook engagements to Twitter shares roughly unchanged. For example, we might expect producers changing domain names to evade detection to produce similar declines in our measured interactions on both platforms. The fact that Facebook engagements and Twitter shares follow similar trends prior to late 2016 and for the non-fake-news sites in our data, but diverge sharply for fake news sites following the election, suggests that some factor has slowed the relative diffusion of misinformation on Facebook. The suite of policy and algorithmic changes made by Facebook following the election seems like a plausible candidate.

However, even the relative comparison of the platforms is only suggestive. Both Facebook and Twitter have made changes to their platforms, and so at best this measure captures the relative effect of the former compared to the latter. Engagements on Facebook affect sharing on Twitter and vice versa. The selection of stories into our database could for various reasons differentially favor the kinds of stories likely to be shared on one platform or the other, and this selection could vary over time. Demand changes need not have the same proportional effect on the two platforms. Some of these factors would tend to attenuate changes in the Facebook-Twitter ratio, leading our

results to be conservative, but others could produce a spurious decrease over time.

In the appendix, we show that our qualitative results survive a set of robustness checks intended to partially address potential sample selection biases. These checks include: (i) focusing on sites identified as fake in multiple lists; (ii) excluding sites from each of our five lists in turn, (iii) looking at sites that were active in different periods; (iv) excluding potential outliers and looking at sites of different sizes; and (v) looking at sites with different likelihoods to publish misinformation.

## **2 Background**

Both Facebook and Twitter have taken steps to reduce the circulation of misinformation on their platforms. In the appendix, we list twelve such announcements by Facebook and five by Twitter since the 2016 election. Broadly, the platforms have taken three types of actions to limit misinformation. First, they have limited its supply, by blocking ads from pages that repeatedly share false stories and removing accounts that violate community standards. Second, they have introduced features such as “disputed” flags or “related articles” that provide corrective information related to a false story. Third, they have changed their algorithms to de-prioritize false stories in favor of news from trustworthy publications and posts from friends and family.

Legislators are also taking action. For example, Connecticut, New Mexico, Rhode Island, and Washington passed laws in 2017 encouraging media literacy and digital citizenship (Zubrzycki 2017). Executives from Facebook, Google, and Twitter have been asked to testify before various congressional committees about their efforts to combat misinformation (Shaban et al. 2017; Popken 2018). Although there has been no major national legislation, this testimony may have raised public awareness.

Finally, civil society organizations also play an important role. For example, the News Literacy Project provides non-partisan educational materials to help teachers educate students to evaluate the credibility of information; demand for its materials has grown substantially in the past few years (Strauss 2018). In 2017, the newly established News Integrity Initiative (NII) made ten grants totaling \$1.8 million to help build trust between newsrooms and the public, make newsrooms more diverse and inclusive, and make public conversations less polarized (Owen 2017).

## **3 Data**

We compile a list of sites producing false news stories by combining five previous lists: (i) a research project by Grinberg et al. (2018, 490 sites); (ii) PolitiFact’s article titled “PolitiFact’s guide to fake news websites and what they peddle” (Gillin 2017, 325 sites); (iii) three articles by BuzzFeed on fake news (Silverman 2016; Silverman et al. 2017a; Silverman et al. 2017b; 223 sites); (iv) a research project by Guess et al. (2018, 92 sites); and (v) FactCheck’s article titled “Websites

that post fake and satirical stories” (Schaedel 2017, 61 sites). Politifact and FactCheck are independent journalistic fact-checking websites, while BuzzFeed similarly applies journalistic standards to evaluating whether articles are true or false. The two lists from research projects originally derive from subsets of the other three, plus Snopes.com, another independent fact-checking site, and lists assembled by blogger Brayton (2016) and media studies scholar Zimdars (2016). The union of these five lists is our set of fake news sites.

PolitiFact and FactCheck work directly with Facebook to evaluate the veracity of stories flagged by Facebook users as potentially false. Thus, these lists comprise fake news sites that Facebook is likely to be aware are fake. As a result, our results may be weighted toward diffusion of *misinformation that Facebook is aware of*, and may not fully capture trends in *misinformation that Facebook is not aware of*. It is difficult to assess how large this latter group might be. Our list almost certainly includes the most important providers of false stories, as Facebook users can flag any and all questionable articles for review. On the other hand, the list might exclude a large tail of small sites producing false stories.

Combining these five lists yields a total of 673 unique sites. We have data for 570 of them. We report in the appendix the names and original lists of 50 largest sites in terms of total Facebook engagements plus Twitter shares during the sample period. In our robustness checks, we consider alternative rules for selecting the set of sites.

Our sets of comparison sites are defined based on category-level web traffic rankings from Alexa.<sup>1</sup> Alexa measures web traffic using its global traffic panel, a sample of millions of Internet users who have installed browser extensions allowing their browsing data to be recorded, plus data from websites that use Alexa to measure their traffic. It then ranks sites based on a combined measure of unique visitors and pageviews. We define major news sites to be the top 100 sites in Alexa’s News category. We define small news sites to be the sites ranked 401-500 in the News category. We define business and culture sites to be the top 50 sites in each of the Arts, Business, Health, Recreation, and Sports categories. For each of these groups, we omit from our sample government websites, databases, sites that do not mainly produce news or similar content, international sites whose audiences are primarily outside the U.S., and sites that are included in our list of fake news sites. Our final sample includes 38 major news sites, 78 small news sites, and 54 business and culture sites.

We gather monthly Facebook engagements and Twitter shares of all articles published on these sites from January 2015 to July 2018 from BuzzSumo ([www.buzzsumo.com](http://www.buzzsumo.com)). BuzzSumo is a commercial content database that tracks the volume of user interactions with internet content on Facebook, Twitter, and other social media platforms, using data available from the platforms’ application programming interfaces (APIs). We use BuzzSumo’s data on total Facebook engagements and total Twitter shares by originating website and month. Facebook engagements are defined

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<sup>1</sup>© 2018, Alexa Internet ([www.alexa.com](http://www.alexa.com))

as the sum of shares, comments, and reactions such as "likes." We have data for 570 out of 673 fake news sites in our list and all sites in the comparison groups. We sum the monthly Facebook engagements and Twitter shares of articles from all sites in each category and then average by quarter.

## 4 Results

Figure 1 shows trends in the number of Facebook engagements and Twitter shares of stories from each category of site. Interactions for major news sites, small news sites, and business and culture sites have remained relatively stable during the past two years, and follow similar trends on Facebook and Twitter. Both platforms show a modest upward trend for major news and small news sites, and a modest downward trend for business and culture sites. In contrast, interactions with fake news have changed more dramatically over time, and these changes are very different on the two platforms. Fake news interactions increased steadily on both platforms from the beginning of 2015 up to the 2016 election. Following the election, however, Facebook engagements fell sharply (declining by more than 50 percent), while shares on Twitter continued to increase.

Figure 2 shows our main result: trends in the ratio of Facebook engagements to Twitter shares. The ratios have been relatively stable for major news, small news, and business and culture sites. For fake news sites, however, the ratio has declined sharply, from around 45:1 during the election to around 15:1 two years later.

While these results suggest that the circulation of fake news on Facebook has declined in both absolute and relative terms, it is important to emphasize that the absolute quantity of fake news interactions on both platforms remains large, and that Facebook in particular has played an outsized role in its diffusion. Figure 1 shows that Facebook engagements fell from a peak of roughly 200 million per month at the end of 2016 to roughly 70 million per month at the end of our sample period. As a point of comparison, the 38 major news sites in the top left panel—including the New York Times, Wall Street Journal, CNN, Fox News, etc.—typically garner about 200-250 million Facebook engagements per month. On Twitter, fake news shares have been in the 4-6 million per month range since the end of 2016, compared to roughly 20 million per month for the major news sites.

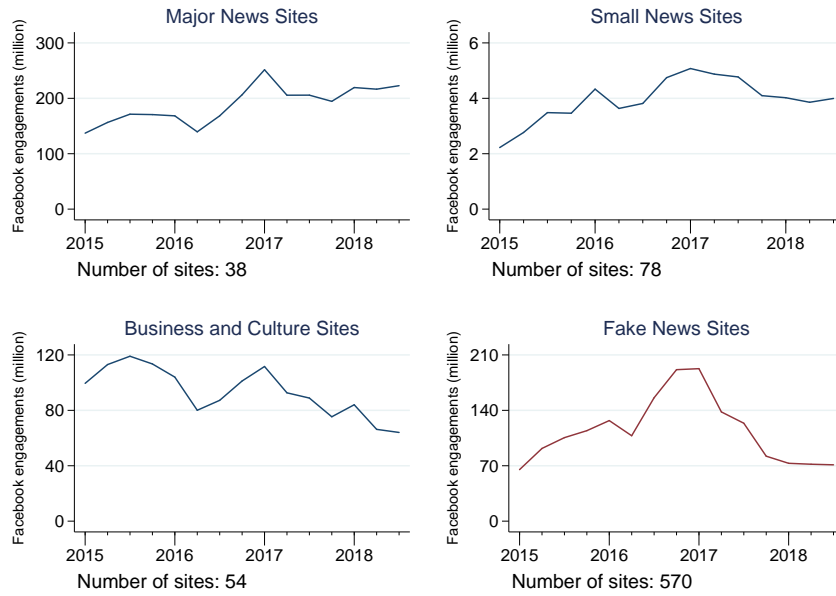
We report a number of robustness checks in the appendix designed to address concerns about selection into our sample of sites. First, we restrict to sites that are identified as fake news sites by at least two or three of our original five lists, which leaves 116 and 19 sites, respectively. Second, given that people might disagree with any one particular study's list of fake news sites, we run five additional analyses, each excluding fake news sites identified exclusively by one of our five lists. Third, we focus on sites that started active operations after November 2016, sites that were still in active operation as of July 2018, and sites that were in active operation from August 2015

to July 2018, which leaves 226, 215, and 82 sites respectively. (Active operation is defined to be a global traffic rank reported by Alexa of at least one million.) Fourth, we exclude the five largest sites in terms of total interactions to ensure the trend is not driven solely by outliers. We also look at sites in the first decile and sites in the bottom nine deciles separately to see if the trend holds for both large sites and small sites. Fifth, Grinberg et al. (2018) provide three lists of sites classified by different likelihoods to publish misinformation. We look at each of these lists separately. Our main qualitative conclusions remain consistent across these checks, though the exact size and shape of the trends vary. Finally, we present an alternative comparison group: a small set of politically focused sites such as Politico and The Hill. These sites do see a decline in engagements on Facebook relative to Twitter, but it mainly occurred in late-2015.

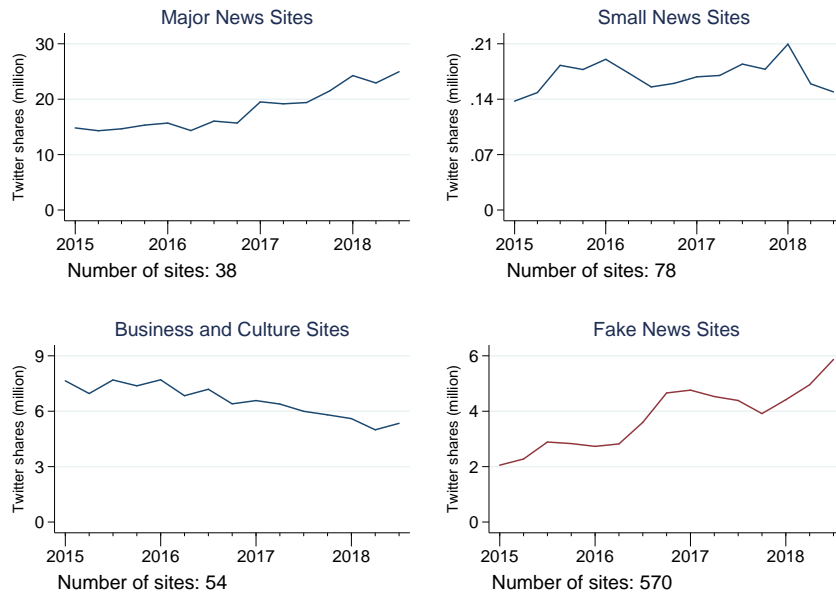


Figure 1: Engagement on Facebook and Twitter

*Panel A: Facebook Engagements*

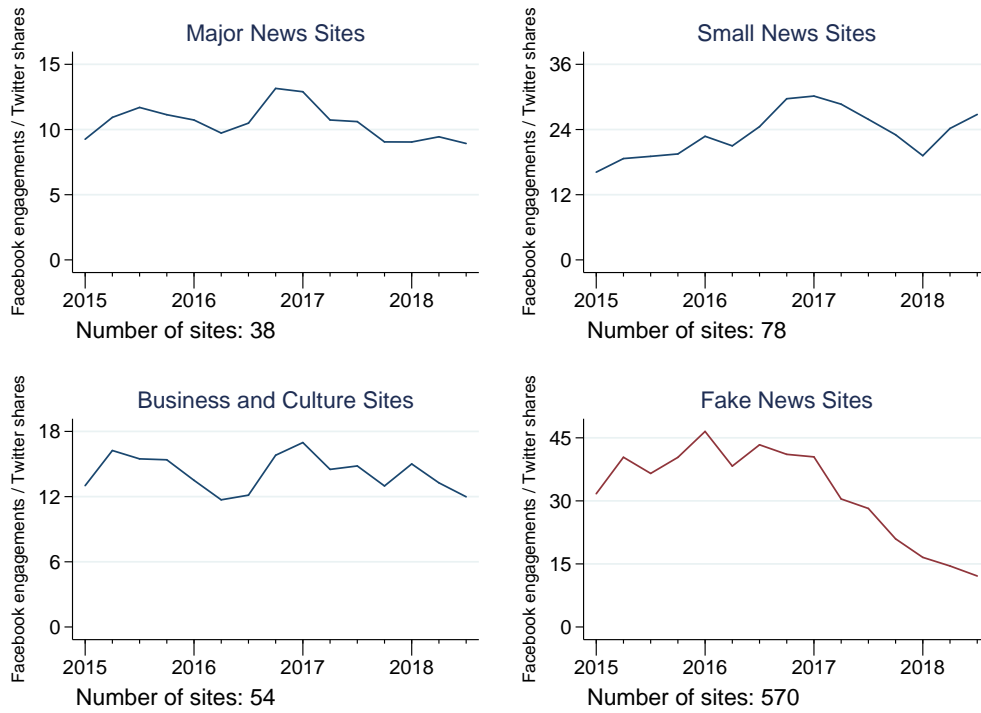


*Panel B: Twitter Shares*



*Notes:* This figure shows monthly Facebook engagements and Twitter shares of all articles published on sites in different categories averaged by quarter. Data comes from BuzzSumo. Major News Sites include 38 sites selected from the top 100 sites in Alexa’s News category. Small News Sites include 78 sites selected from the sites ranking 401-500 in the News category. Business and Culture Sites include 54 sites selected from the top 50 sites in each of the Arts, Business, Health, Recreation, and Sports categories. Fake News Sites include 570 sites assembled from five lists. The complete lists can be found in the appendix.

Figure 2: Relative Engagement on Facebook



*Notes:* This figure shows the ratio of monthly Facebook engagements over Twitter shares of all articles published on sites in different categories averaged by quarter. Data comes from BuzzSumo. Major News Sites include 38 sites selected from the top 100 sites in Alexa’s News category. Small News Sites include 78 sites selected from the sites ranking 401-500 in the News category. Business and Culture Sites include 54 sites selected from the top 50 sites in each of the Arts, Business, Health, Recreation, and Sports categories. Fake News Sites include 570 sites assembled from five lists. The complete lists can be found in the appendix.

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# Appendix

## I Actions Against Fake News

Appendix table 1 lists Facebook’s actions to reduce the diffusion of fake news since the 2016 U.S. election, while Appendix table 2 lists Twitter’s actions. All announcements are taken from the platforms’ official websites.<sup>1</sup>

## II Data

We combine five lists of fake news sites created by fact-checking organizations or research studies to form our sample of fake news sites. The union of these lists contains 673 unique sites. Among them, 103 have no data available from BuzzSumo. Thus, our final list includes 570 unique sites. Appendix table S3 presents the 50 largest sites in the list in terms of total Facebook engagements plus Twitter shares from January 2015 to July 2018.

We also collect three other categories of sites: major news sites, small news sites, and business and culture sites covering arts, business, health, recreation, and sports. Appendix table S4 presents these lists.

## III Robustness Checks

As discussed in the manuscript, a key concern is that our list of fake news sites may suffer from sample selection bias. To mitigate the concerns, we consider alternative sets of fake news sites as robustness checks.

### III.A Lists of Fake News Sites

Our five different lists each have different inclusion criteria for defining a fake news site, and one might disagree with a particular list’s approach. We thus carry out two sets of robustness checks. First, in Appendix figure 1, we focus on sites that are identified as fake news sites by at least two or three lists instead of one, leaving 116 and 19 sites, respectively. Second, Appendix figure 2 replicates the results using sites assembled from any four out of the five original lists. By doing this, we exclude sites that are only identified by one particular list. The downward trend in the ratio of Facebook engagements to Twitter shares since the beginning of 2017 is invariant to including only sites identified on multiple lists and to excluding any single list.

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<sup>1</sup>Facebook: <https://newsroom.fb.com/news/>; Twitter: [https://blog.twitter.com/official/en\\_us.html](https://blog.twitter.com/official/en_us.html).

### **III.B Time Coverage**

It is possible that the original lists of fake news sites primarily include sites that were popular on Facebook before the 2016 election, and this sample selection combined with the rapid entry and exit of small sites focused on fake stories could generate a spurious downward trend in both the absolute number of Facebook engagements of fake news and the ratio of Facebook engagements to Twitter shares. In Appendix figure 3, we look at sites that were active during different periods. In Panel A, B, and C, respectively, we focus on sites that started active operation after November 2016, sites that were still in active operation as of the end of the sample in July 2018, and sites that were in active operation from August 2015 to July 2018. (Active operation is defined to be a global traffic rank reported by Alexa of at least one million.) The downward trend in the ratio of Facebook engagements to Twitter shares since the beginning of 2017 remains consistent across these samples.

### **III.C Number of Interactions**

Interactions on social media vary substantially across sites in our list. A natural concern might be that the sums of Facebook engagements and Twitter shares could be driven by a small number of outliers. In Appendix figure 4 Panel A, we exclude five largest sites in terms of total Facebook engagements plus Twitter shares in our sample period. The trend survives the exclusion of potential outliers. In Panel B and C, we divide all sites into deciles and look at sites in the first decile and sites in the bottom nine deciles separately. The downward trend in the Facebook/Twitter ratio is observed for both large and small sites.

### **III.D Likelihood to Publish Misinformation**

Grinberg et al. (2018) provide three lists of sites which they deem to have different likelihoods to publish misinformation. “Black” domains are reported to publish entirely fabricated stories. The black list is constructed from pre-existing lists of fake news constructed by academic work and professional fact-checkers such as PolitiFact, FactCheck, and BuzzFeed. “Red” and “orange” domains are identified by Snopes as sources of fake news or questionable claims and classified by their levels of perceived likelihood to publish misinformation: stories from red domains have an “extremely high” likelihood of containing misinformation, and stories from orange domains a “high” likelihood. In Appendix figure 5, we look at these lists separately. There are some differences across these lists. The downward trend of Facebook engagements appears only for black and red domains but not for orange domains. The time when the Facebook/Twitter ratio started to fall is also different. For black domains, the ratio dropped sharply in mid-2016 and all of 2017. For red and orange domains, however, the decline primarily occurred in 2016. These patterns would be consistent with black and to a lesser extent red domains being the primary target of the changes Facebook made to its platform following the election.

### III.E Sites Focusing on Political News

Fake news is often political in nature, and it is possible that the Twitter user base is more consistently politically engaged than the (much larger) Facebook user base. If Facebook users' interest in political stories is cyclical, rising with major presidential elections and falling after, this could generate a drop in fake news diffusion on Facebook after the 2016 election that might not be mirrored on Twitter. Thus, the declining Facebook/Twitter ratio beginning in 2017 could be generated by changes in demand for fake news, not changes in supply or efforts by Facebook.

If this explanation is true, one would also expect to see a decline in the diffusion of articles from major political websites on Facebook, but not on Twitter. To test this, Appendix figure 6 presents Facebook engagements, Twitter shares, and their ratio for a list of ten (non-fake) political sites of five types: (i) sites mostly focusing on political news (Politico and The Hill); (ii) major parties and politicians (donaldjtrump.com, hillaryclinton.com, democrats.org, and gop.com); (iii) think tanks (Brookings and AEI); (iv) CSPAN; and (v) a mainstream political blog (Real Clear Politics). There is a decline in the Facebook/Twitter ratio for these sites, but it mainly occurred in late-2015, well before the election.



Appendix Table 1: Facebook’s Actions to Fight Against Fake News

Date	Actions
Dec 15, 2016	Announced four updates to address hoaxes and fake news: make reporting easier for users; flag stories as “Disputed” with fact-checking organizations and warn people before they share; incorporate signals of misleading articles into rankings; and disrupt financial incentives for spammers. <sup>2</sup>
Apr 6, 2017	Described three areas where it is working to fight the spread of false news: disrupt economic incentives; build new products to curb the spread of false news; and help people make more informed decisions. <sup>3</sup>
Apr 25, 2017	Tested “Related Articles”, an improved feature that presents users a cluster of additional articles on the same topic when they come across popular links, including potential fake news articles, to provide people easier access to additional information, including articles by third-party fact checkers. <sup>4</sup>
Aug 8, 2017	Announced it would address cloaking so people see more authentic posts. <sup>5</sup>
Aug 28, 2017	Announced it would block ads from pages that repeatedly share false news. <sup>6</sup>
Dec 20, 2017	Announced two changes to fight against false news: replace “Disputed” flags with “Related Articles” to give people more context; and start an initiative to better understand how people decide whether information is accurate. <sup>7</sup>
Jan 11, 2018	Prioritized posts from friends and family over public content. <sup>8</sup>
Jan 19, 2018	Prioritized news from publications rated as trustworthy by the community. <sup>9</sup>
Jan 29, 2018	Prioritized news relevant to people’s local community. <sup>10</sup>
May 23, 2018	Described three parts of their strategies to stop misinformation: remove accounts and content that violate community standards or ad policies; reduce the distribution of false news and inauthentic content; and inform people by giving them more context on the posts they see. <sup>11</sup>
June 14, 2018	Detailed how its fact-checking program works. <sup>12</sup>
June 21, 2018	Announced five updates to fight false news: expand fact-checking programs to new countries; test fact-checking on photos and videos; use new techniques in fact-checking including identifying duplicates and using “Claim Review”; take action against repeat offenders; and improve measurement and transparency by partnering with academics. <sup>13</sup>

- 2.Addressing Hoaxes and Fake News.
- 3.Working to Stop Misinformation and False News.
- 4.New Test With Related Articles.
- 5.Addressing Cloaking So People See More Authentic Posts.
- 6.Blocking Ads From Pages that Repeatedly Share False News.
- 7.Replacing Disputed Flags With Related Articles.
- 8.Bringing People Closer Together.
- 9.Helping Ensure News on Facebook Is From Trusted Sources.
- 10.More Local News on Facebook.
- 11.Hard Questions: What’s Facebook’s Strategy for Stopping False News?
- 12.Hard Questions: How Is Facebook’s Fact-Checking Program Working?
- 13.Increasing Our Efforts to Fight False News.

Appendix Table 2: Twitter’s Actions to Fight Against Fake News

<b>Date</b>	<b>Actions</b>
June 14, 2017	Described the phenomenon of fake news and bots and the approaches it used, including surfacing the highest quality and most relevant content and context first, expanding the team and resources, building new tools and processes, and detecting spammy behaviors at source. <sup>14</sup>
June 29, 2017	(Not officially announced) Tested a feature that would let users flag tweets that contain misleading, false, or harmful information. <sup>15</sup>
Sept 28, 2017	Shared information on its knowledge about how malicious bots and misinformation networks on Twitter may have been used in the 2016 U.S. Presidential elections and its work to fight both malicious bots and misinformation. <sup>16</sup>
Oct 24, 2017	Announced steps to dramatically increase the transparency for all ads. <sup>17</sup>
July 11, 2018	Announced it removed fake accounts. <sup>18</sup>

14.Our Approach to Bots & Misinformation.

15.Twitter is looking for ways to let users flag fake news, offensive content.

16.Update: Russian Interference in 2016 US Election, Bots, & Misinformation.

17.New Transparency For Ads on Twitter.

18.Confidence in follower counts.

Appendix Table 3: 50 Largest Fake News Sites

Site	Source							Created	Still	Last
	G-B	G-R	G-O	PF	BF	GNR	FC	Post-Election	Active	Long
indiatimes.com	0	0	0	1	0	0	0	0	1	1
dailywire.com	0	0	1	0	0	1	0	0	1	0
ijr.com	0	0	0	0	0	1	0	0	1	0
dailycaller.com	0	0	1	0	0	0	0	0	1	1
occupydemocrats.com	1	0	0	0	0	0	0	1	1	0
express.co.uk	0	0	1	0	0	0	0	0	1	1
redstatewatcher.com	1	0	0	0	0	1	0	0	1	0
thepoliticalinsider.com	0	0	0	1	0	0	0	0	1	1
thefederalistpapers.org	0	0	1	0	0	0	0	0	1	1
truthfeed.com	0	1	0	0	0	1	0	0	1	0
bipartisanreport.com	0	1	0	0	0	1	0	0	1	0
rightwingnews.com	0	0	1	0	0	0	0	0	1	1
qpolitical.com	0	0	1	0	0	0	0	0	0	0
madworldnews.com	1	0	0	1	0	0	0	0	1	1
yournewswire.com	1	0	0	1	1	0	1	0	1	1
uschronicle.com	0	0	1	0	0	0	0	0	1	0
louderwithcrowder.com	0	1	0	0	0	0	0	0	1	1
jewsnews.co.il	0	0	0	1	0	0	0	0	1	1
100percentfedup.com	0	1	0	0	0	0	0	0	1	1
angrypatriotmovement.com	1	0	0	1	0	1	0	0	1	0
anohq.com	0	1	0	0	0	0	0	0	1	1
inquisitr.com	0	0	1	0	0	0	0	0	1	1
yesimright.com	1	0	0	0	0	1	0	0	0	0
worldtruth.tv	0	1	0	1	0	0	0	0	1	1
collective-evolution.com	0	1	0	0	0	0	0	0	1	1
ilovemyfreedom.org	1	0	0	0	0	1	0	0	1	0
tribunist.com	0	0	1	0	0	0	0	0	1	0
clashdaily.com	1	0	0	1	0	0	0	0	1	1
naturalnews.com	0	1	0	0	0	0	0	0	1	1
joeforamerica.com	0	0	1	0	0	0	0	0	1	1
conservativedailyreport.com	1	0	0	1	0	1	0	0	1	0
worldnewsdailyreport.com	1	0	0	1	1	0	0	0	1	1
trueactivist.com	0	0	1	0	0	0	0	0	1	1
americasfreedomfighters.com	0	1	0	0	0	0	0	0	1	1

Site	Source							Created	Still	Last
	G-B	G-R	G-O	PF	BF	GNR	FC	Post-Election	Active	Long
conservative101.com	0	0	0	1	0	0	0	0	1	0
usanewsflash.com	1	0	0	1	0	1	0	0	0	0
babylonbee.com	0	0	0	1	0	0	0	0	1	0
firstpost.com	0	0	0	1	0	0	0	0	1	1
zerohedge.com	0	0	1	0	0	0	0	0	1	1
teaparty.org	0	0	0	1	0	0	0	0	1	1
palmerreport.com	0	0	1	0	0	0	0	1	1	0
judicialwatch.org	0	1	0	0	0	0	0	0	1	1
disclose.tv	1	0	0	1	0	0	0	0	1	1
conservativepost.com	0	1	0	0	0	0	0	0	1	1
thegatewaypundit.com	0	1	0	1	0	0	0	0	1	1
infowars.com	0	1	0	0	0	0	0	0	1	1
dailysnark.com	0	0	0	1	0	0	0	0	1	1
postcard.news	0	0	0	1	0	0	0	0	1	0
higherperspectives.com	0	0	0	1	0	0	0	0	1	0
tmn.today	0	0	1	0	0	1	0	0	1	0
...										
<b>Total</b>	<b>382</b>	<b>61</b>	<b>47</b>	<b>325</b>	<b>223</b>	<b>92</b>	<b>61</b>	<b>308</b>	<b>287</b>	<b>82</b>

*Notes:* This table lists 50 largest fake news sites in terms of total Facebook engagements plus Twitter shares from January 2015 to June 2018. The complete list can be found [here](#). Column 2-8 lists the fake news sites identified by five sources described above, where a value of 1 indicates the site appears in the corresponding source and 0 not. **G-B**, **G-R**, and **G-O** represent the black domains, red domains, and orange domains in Grinberg et al. (2018). **PF** represents PolitiFact. **BF** represents BuzzFeed. **GNR** represents Guess et al. (2018). **FC** represents FactCheck. The last three columns list sites that started active operation after the election in November 2016, sites that were in active operation in July 2018, and sites that were in active operation during the whole sample period from August 2015 to July 2018. A site is defined as being in active operation if it is tracked by Alexa with a global rank higher than one million in terms of total traffic.

Appendix Table 4: Lists of Sites in Each Category

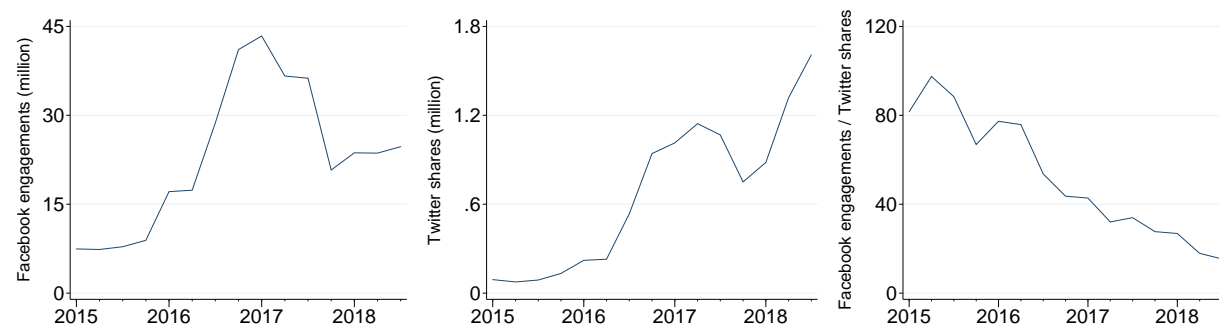
Category	Site		
<i>Major News Sites</i>	cnn.com	nytimes.com	theguardian.com
	washingtonpost.com	foxnews.com	huffingtonpost.com
	usatoday.com	wsj.com	cnbc.com
	reuters.com	time.com	nypost.com
	usnews.com	cbsnews.com	chron.com
	thehill.com	nbcnews.com	theatlantic.com
	latimes.com	abcnews.go.com	thedailybeast.com
	sfgate.com	newsweek.com	chicagotribune.com
	economist.com	theroot.com	voanews.com
	nj.com	miamiherald.com	mercurynews.com
	bostonglobe.com	seattletimes.com	oregonlive.com
	washingtontimes.com	azcentral.com	ajc.com
	philly.com	sacbee.com	
<i>Small News Sites</i>	asptimes.com	bakersfield.com	bendbulletin.com
	bnd.com	broadcastingcable.com	charlestoncitypaper.com
	chicagomaroon.com	collegian.psu.edu	columbian.com
	dailynebraskan.com	dailynexus.com	dailynorthwestern.com
	dailypress.com	dailyprogress.com	dailytexanonline.com
	dailytrojan.com	dcourier.com	delcotimes.com
	durangoherald.com	fair.org	fredericksburg.com
	globegazette.com	greenvilleonline.com	greenwichtime.com
	havasunews.com	hcn.org	heraldnet.com
	heraldsun.com	heraldtimesonline.com	ibj.com
	independent.com	islandpacket.com	jou.ufl.edu
	journalism.org	journalismjobs.com	journaltimes.com
	kitv.com	knoxnews.com	lacrossetribune.com
	leadertelegram.com	macon.com	myrtlebeachonline.com
	naplesnews.com	nashvillescene.com	news.cornell.edu
	news.usc.edu	newseum.org	news-journalonline.com
	news-leader.com	newstimes.com	nwfdailynews.com
	pjstar.com	presstelegram.com	rapidcityjournal.com
	readingeagle.com	redandblack.com	rgj.com
	sacurrent.com	santacruzsentinel.com	santafenewmexican.com
	sgvtribune.com	signalscv.com	siouxcityjournal.com
	standard.net	stanforddaily.com	steynonline.com
	studlife.com	tallahassee.com	theday.com
	theeagle.com	theledger.com	timesleader.com

Category	Site		
<i>Small News Sites</i>	ubm.com	vcstar.com	wacotrib.com
	wfcourier.com	wvgazetteemail.com	yakimaherald.com
<i>Arts</i>	imdb.com	ign.com	rottentomatoes.com
	ultimate-guitar.com	npr.org	vice.com
	tmz.com	pitchfork.com	wired.com
<i>Business</i>	forbes.com	shutterstock.com	businessinsider.com
	finance.yahoo.com	bloomberg.com	eventbrite.com
	fortune.com	adweek.com	
<i>Health</i>	webmd.com	psychologytoday.com	who.int
	apa.org	bmj.com	mercola.com
	menshealth.com	self.com	nejm.org
<i>Recreation</i>	9gag.com	jalopnik.com	timeout.com
	lonelyplanet.com	caranddriver.com	hollywoodreporter.com
	nationalgeographic.com	rd.com	topix.com
<i>Sports</i>	espn.com	cricbuzz.com	nba.com
	espnricinfo.com	sports.yahoo.com	bleacherreport.com
	nhl.com	cbssports.com	nfl.com
	iplt20.com	skysports.com	deadspin.com
	nbcsports.com	wwe.com	si.com
	sbnation.com	formula1.com	rivals.com
	foxsports.com		

*Notes:* This table lists sites in the comparison groups. *Major News Sites* include 38 sites selected from the top 100 sites in Alexa’s News category. *Small News Sites* include 78 sites selected from the sites ranking 401-500 in the News category. *Business and Culture Sites* include 54 sites selected from the top 50 sites in each of the Arts, Business, Health, Recreation, and Sports categories. For each group, we omit from our sample government websites, databases, sites that do not mainly produce news or similar content, international sites whose audiences are primarily outside the U.S., and sites that are included in our list of fake news sites.

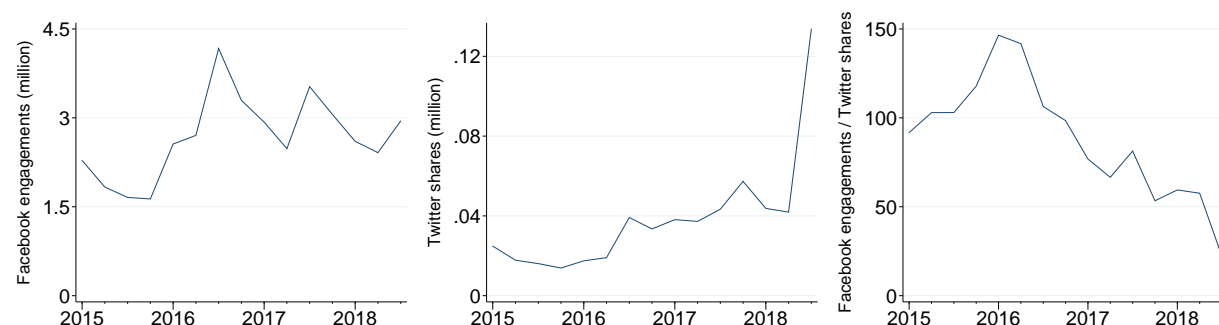
Appendix Figure 1: Robustness Checks of Fake News Sites - Multiple Lists

*Panel A: Sites Identified by At Least Two Lists*



Number of sites: 116

*Panel B: Sites Identified by At Least Three Lists*

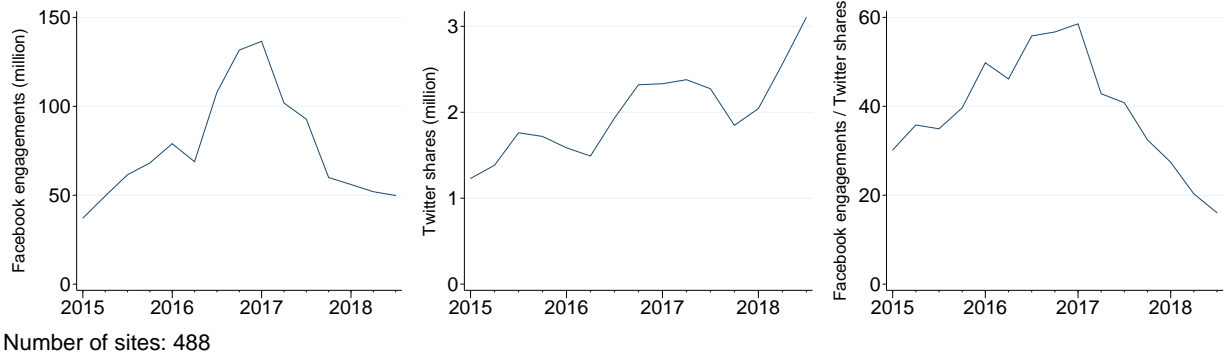


Number of sites: 19

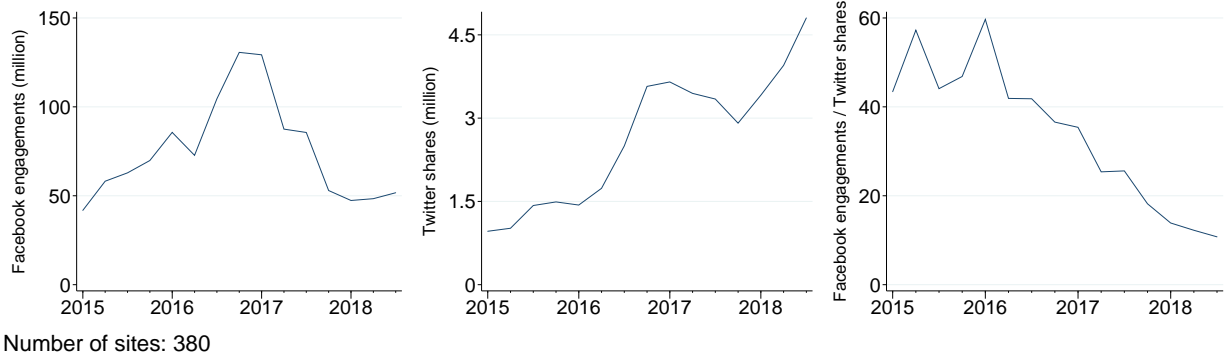
*Notes:* This figure plots robustness checks for the sample of fake news sites by looking at sites only identified by multiple lists. Each panel plots monthly Facebook engagements, Twitter shares, and the ratio of Facebook engagements over Twitter shares averaged by quarter. Panel A includes sites identified by at least two lists out of five. Panel B includes sites identified by at least three lists. Grinberg et al.'s (2018) provide three types of domains. The black domains derive from lists that we already use (with the exception of nine sites, as PolitiFact and FactCheck updated their lists at some point). We avoid double-counting black domains when we count the number of lists that identify a fake news site.

Appendix Figure 2: Robustness Checks of Fake News Sites - Excluding Lists

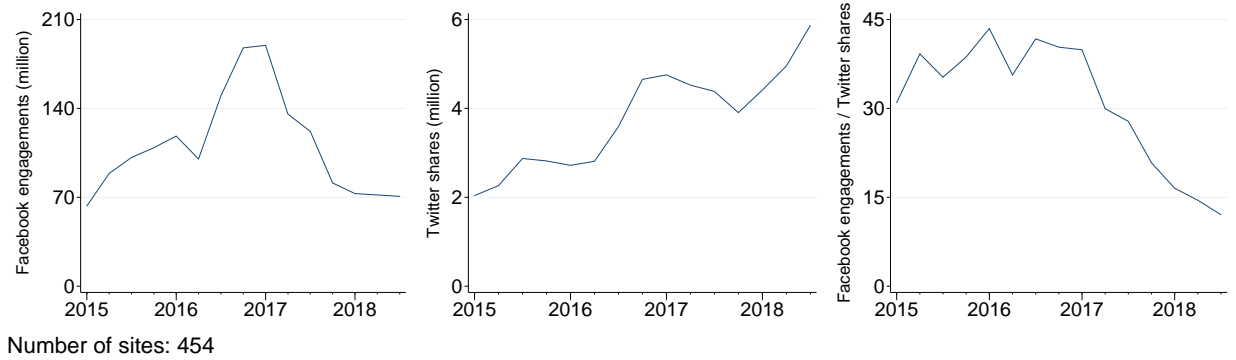
*Panel A: Excluding Sites Only Identified by Grinberg et al. (2018)*



*Panel B: Excluding Sites Only Identified by PolitiFact*



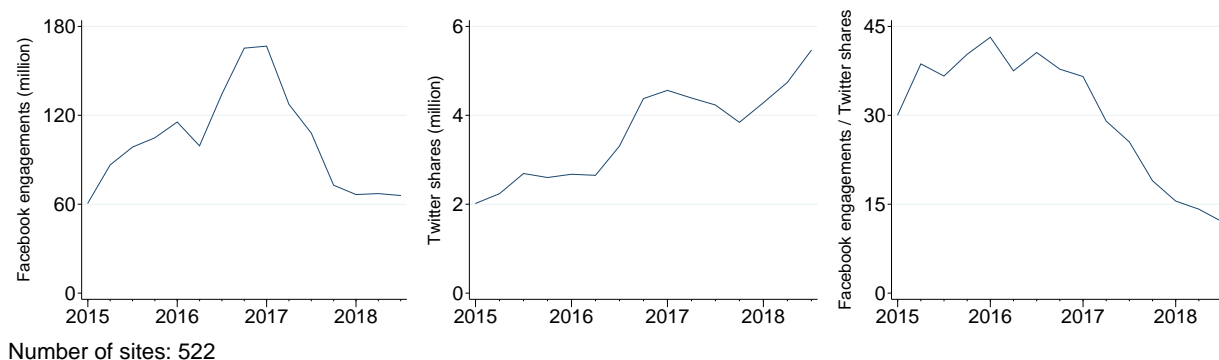
*Panel C: Excluding Sites Only Identified by BuzzFeed*



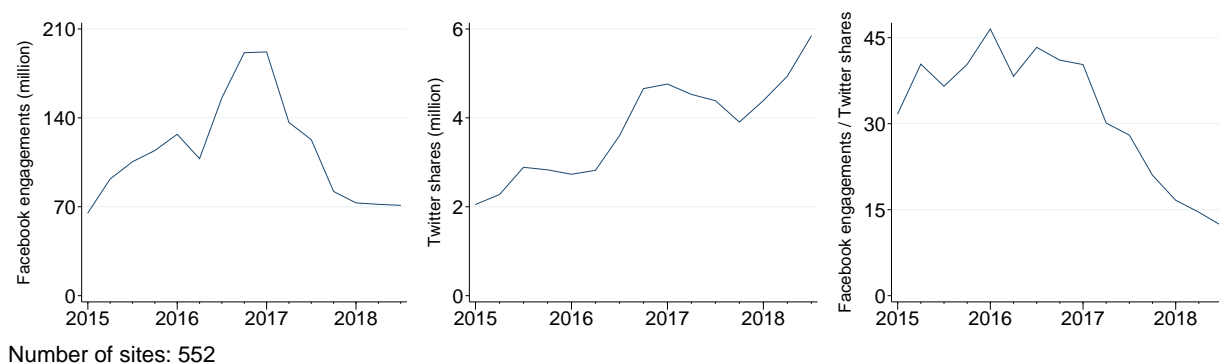


Appendix Figure 2: Robustness Checks of Fake News Sites - Excluding Lists (*continued*)

*Panel D: Excluding Sites Only Identified by Guess et al. (2018)*



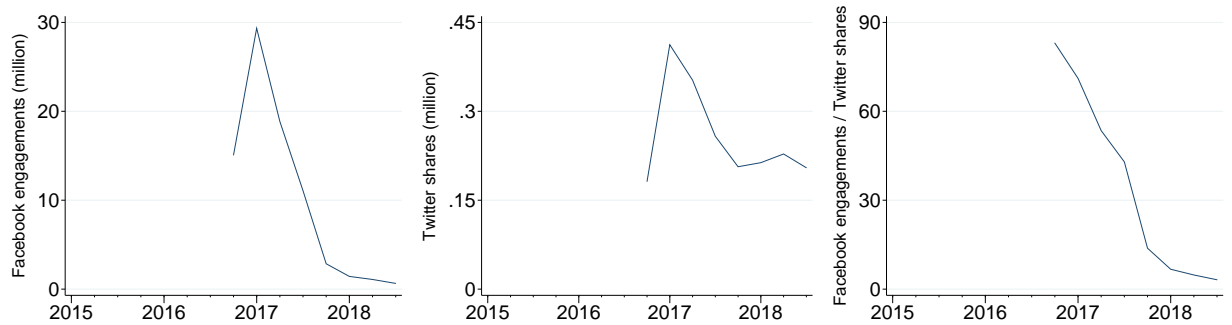
*Panel E: Excluding Sites Only Identified by FactCheck*



*Notes:* This figure plots robustness checks for the sample of fake news sites by excluding sites only identified by a particular list. Each panel plots monthly Facebook engagements, Twitter shares, and the ratio of Facebook engagements over Twitter shares averaged by quarter. Panel A excludes sites only identified by Grinberg et al. (2018). Panel B excludes sites only identified by PolitiFact. Panel C excludes sites only identified by BuzzFeed. Panel D excludes sites only identified by Guess et al. (2018). Panel E excludes sites only identified by FactCheck.

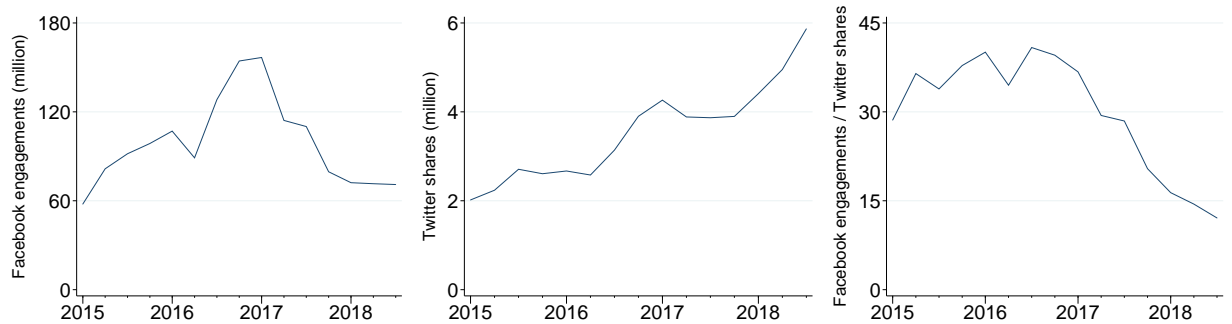
Appendix Figure 3: Robustness Checks of Fake News Sites - Time Coverage

*Panel A: Sites that Started Active Operation after November 2016*



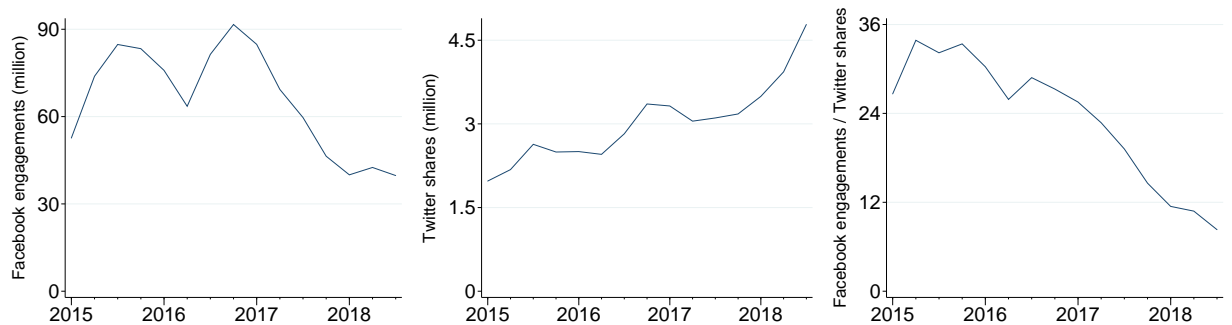
Number of sites: 226

*Panel B: Sites that were in Active Operation in July 2018*



Number of sites: 215

*Panel C: Sites that were in Active Operation during August 2015 to July 2018*

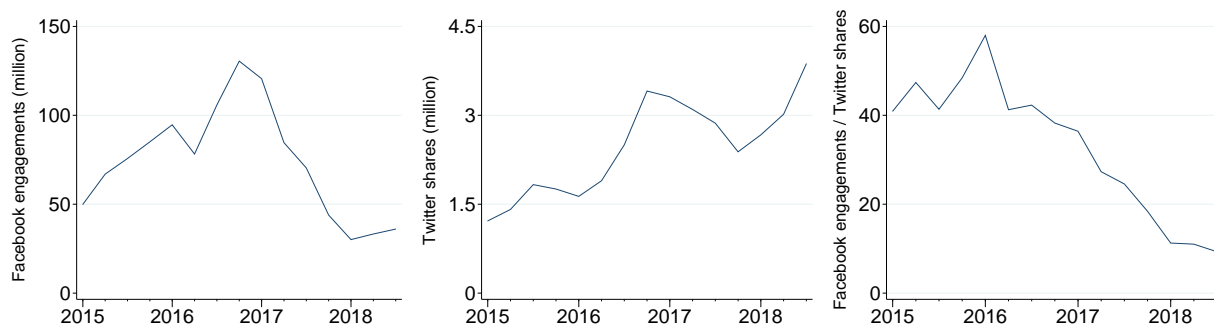


Number of sites: 82

*Notes:* This figure plots robustness checks for the sample of fake news sites by looking at sites active in different period. Each panel plots monthly Facebook engagements, Twitter shares, and the ratio of Facebook engagements over Twitter shares averaged by quarter. Panel A includes sites that started active operation after the election in November 2016. Panel B includes sites that were still in active operation in July 2018. Panel C includes sites that were in active operation during August 2015 to July 2018. A site is defined as being in active operation if it is tracked by Alexa with a global rank higher than one million in terms of total traffic.

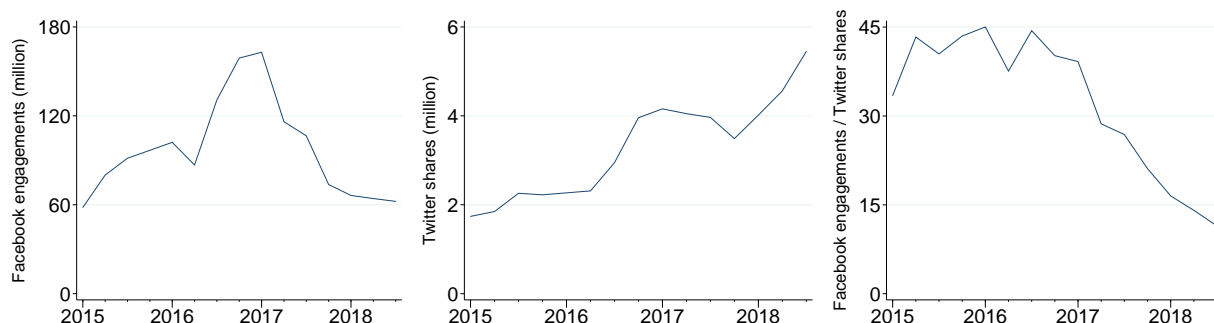
Appendix Figure 4: Robustness Checks of Fake News Sites - Number of Interactions

*Panel A: Excluding Top Five Fake News Sites*



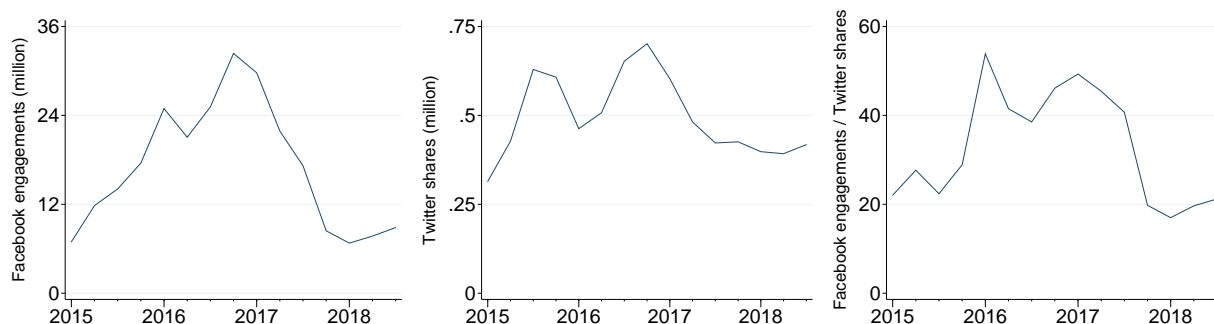
Number of sites: 565

*Panel B: The First Decile of Fake News Sites*



Number of sites: 57

*Panel C: The Bottom Nine Deciles of Fake News Sites*

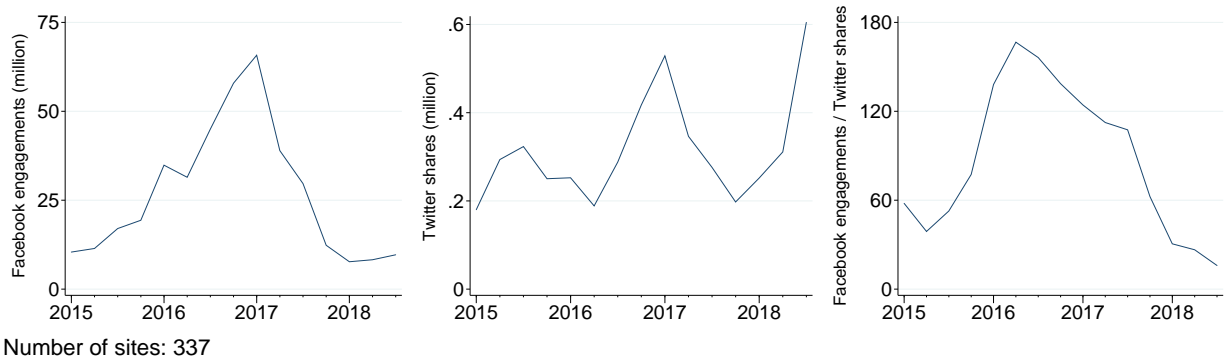


Number of sites: 513

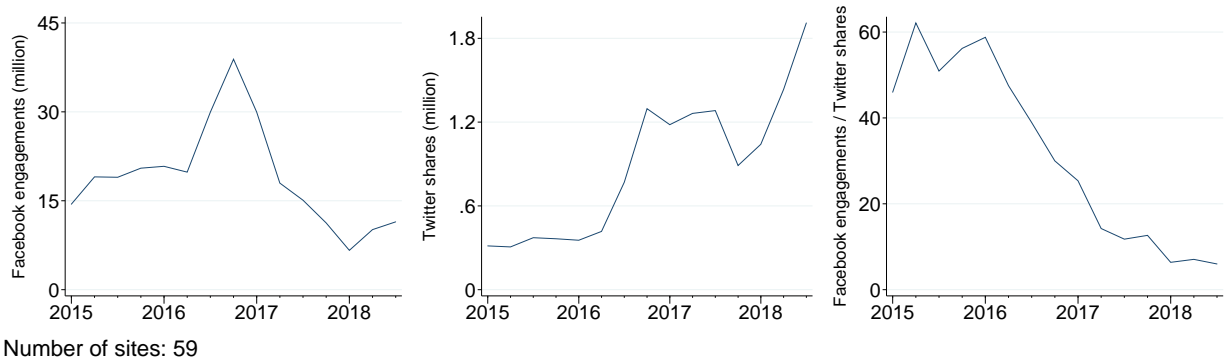
*Notes:* This figure plots robustness checks for the sample of fake news sites by excluding the largest sites and looking at sites of different sizes. Each panel plots monthly Facebook engagements, Twitter shares, and the ratio of Facebook engagements over Twitter shares averaged by quarter. Panel A excludes five largest sites in terms of total Facebook engagements plus Twitter shares from January 2015 to July 2018. Panel B includes sites in the first decile. Panel C includes sites in the bottom nine deciles, i.e., excludes sites in the first decile. The deciles are also defined in terms of total Facebook engagements plus Twitter shares during the sample period.

Appendix Figure 5: Robustness Checks of Fake News Sites - Likelihood to Publish Misinformation

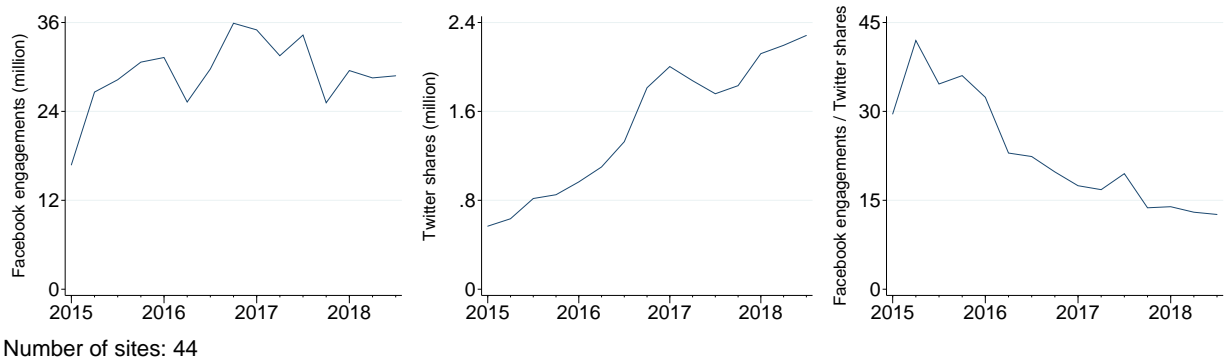
*Panel A: Black Domains*



*Panel B: Red Domains*

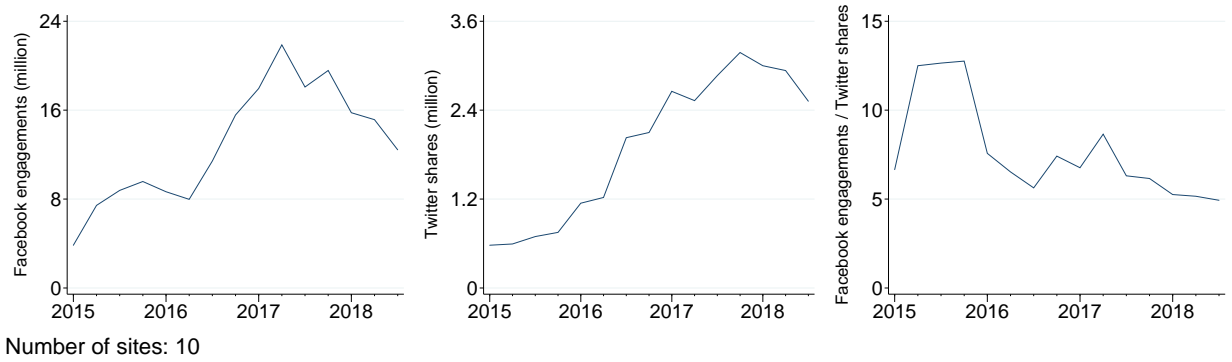


*Panel C: Orange Domains*



*Notes:* This figure plots robustness checks for three lists of fake news sites in Grinberg et al. (2018) separately, classified by their likelihoods to publish misinformation. Each panel plots monthly Facebook engagements, Twitter shares, and the ratio of Facebook engagements over Twitter shares averaged by quarter. The black domains were reported to have published entirely fabricated stories, taken from pre-existing lists of fake news constructed by the fact-checking and journalistic outlets Politifact, FactCheck, and BuzzFeed, as well as domains used in other academic work. The red and orange domains are identified by Snopes as sources of fake news or questionable claims and classified by the authors by their levels of perceived likelihood to publish misinformation: stories from red domains have an extremely high likelihood of containing misinformation, and stories from orange domains a high likelihood.

Appendix Figure 6: Robustness Checks of Sites Focusing on Political News



*Notes:* This figure plots monthly Facebook engagements, Twitter shares, and the ratio of Facebook engagements over Twitter shares averaged by quarter of sites mostly focusing on political news. The sites include politico.com, thehill.com, brookings.edu, aei.org, c-span.org, realclearpolitics.com, donaldjtrump.com, hillaryclinton.com, democrats.org, and gop.com.