The Economic Effects of Facebook

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Abstract

Social media permeates many aspects of our lives, including how we connect with others, where we get our news and how we spend our time. Yet, we know little about the economic effects for users. In 2017, we ran a large field experiment with over 1,765 individuals to document the value of Facebook to users and its causal effect on news, well-being and daily activities. Participants reveal how much they value one week of Facebook usage and are then randomly assigned to a validated Facebook restriction or normal use. One week of Facebook is worth $67. Those who are off Facebook for one week reduce news consumption, are less likely to recognize politically-skewed news stories, report being less depressed and engage in healthier activities. These results are strongest for men. Our results further suggest that, after the restriction, Facebook's value increases, consistent with information loss or that using Facebook may be addictive.

JEL codes: C93, D91, D83, I31

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1 Introduction

Social media usage has increased dramatically over the past decade, and Facebook has dominated the market. Almost 2.2 billion individuals worldwide have an active Facebook account, and nearly 1.4 billion log on daily (Facebook, 2017) for an average of 50 minutes per day (Facebook, 2016). Facebook not only provides means to connect with friends and build social networks and capital (Bailey et al., 2018; Mayer and Puller, 2008; Shirley Cramer, 2017), but it is also exposes users to a vast amount of information and news. Despite the potential influence of Facebook on an individual's behavior via information and content provision, there is surprisingly little known about its direct and comprehensive effects on news exposure and awareness, subjective well-being and day-to-day activities.

Facebook's platform has several characteristics that lend well to investigating its effects on an individual's exposure to news content as well as its impact on well-being. The platform consolidates information from many sources, making it an important and compelling place to go on the internet to keep up with news. People tap into Facebook for local, national and international news. Indeed, roughly two-thirds of Americans get at least some of their news from social media sources (Pew Research Center, 2017). While there is a concern that news transmitted through social media could be fake or skewed and affect political outcomes (Allcott and Gentzkow, 2017), these type of platforms could also serve to uncover corruption (Enikolopov et al., 2016). As individuals rely more on social media and news aggregators as a primary source of information, segregation may increase (Gentzkow and Shapiro, 2011) and voting behavior can be affected (DellaVigna and Kaplan, 2007; Bond et al., 2012; Martin and Yurukoglu, 2017). The consequences of this in terms of news awareness and biases - highlighted by political investigations regarding Facebook's involvement in the 2016 U.S. Presidential Election - are largely unknown.

More broadly, there is little consensus on Facebook's impact on well-being, especially in the context of daily behaviors and activities. Facebook is often used to connect with friends

and family, organize events and share information and photos (Laroche et al., 2012; De Vries et al., 2012; Ashley and Tuten, 2015; Lee and Ma, 2012; Bailey et al., 2017). Being able to seamlessly keep in touch with others might improve mood and happiness, but it might also induce negative emotions and habits from social comparison (Tromholt, 2016; Deters and Mehl, 2013). How Facebook directly affects well-being and mood in general and the correlation with daily activities is unclear.

Facebook's platform is provided for free to users and paid for by advertising, so the monetary value to users, as reflected in a market price, is untested. The platform facilitates building social networks and seamless access to relevant information. Usage rates, both in frequency and intensity, suggest this provides benefits to users. While the economic impact of Facebook on advertising has been estimated, the benefits to users and impact on behavior have been given more limited study.[1] Knowing the value of Facebook would inform an understanding of welfare effects and provide a monetary measure of the importance of Facebook to users.

We ran a field experiment in the Spring of 2017 with a randomized, and validated, Facebook restriction to investigate how Facebook may affect daily activities and news exposure and quantify how much users value access. In total, 1,769 individuals from a large U.S. university participated in the study. Using an incentive-compatible procedure (Becker et al., 1964), we asked participants how much they would need to be paid to not use Facebook for one week. Qualified participants were then randomly assigned to either a one-week Facebook restriction group or a control group that faced no restriction.

Our design has several important and unique features worth noting. First, we can exploit the rich data collected on the distribution of Facebook's value to check for possible selection effects in our results. Second, we enforced and validated the restriction by logging participants off Facebook and verified treatment compliance using an unobtrusive online monitoring procedure throughout the week. Our procedure was undetectable to the parti-

[1]It is estimated that the impact of Facebook through advertising is $77.6 billion in the U.S. (Deloitte, 2015). Evidence on the value of Facebook is given in Brynjolfsson et al. (2018).

cipant and did not involve direct contact which could potentially impact behavior. Finally, participants completed two surveys, the first prior to random assignment and a second survey one week later. These surveys were designed to provide a comprehensive view of behavior and measure the short-term effects of Facebook on news awareness and consumption, well-being, daily time allocation and daily activities.

We have several key results. First, our study reveals that one week of Facebook is worth about $67 to users, with a median value of $40. This value is in line with other studies (Brynjolfsson et al., 2018; Corrigan et al., 2018; Allcott et al., 2019; Sunstein, 2018; Herzog, 2018) and represents a significant portion of a typical university student's weekly budget and expenses (roughly 30% according to Flood et al. (2017)).[2] Individuals place a nontrivial value on Facebook usage, and the value increases 19.6% after not being able to use it for one week. This is consistent with addiction or the compounding loss of information, however, we note this is only suggestive as we are underpowered to detect a statistically significant effect.

Second, our data document that Facebook is an important source of news exposure. Individuals restricted from Facebook are less aware of politically-skewed sources, and this is stronger for men than women. Consistent with this result, the Facebook restriction reduces news consumption and participants do not substitute towards other news sources or social media platforms when being off Facebook for a short period of time. There is no effect on news awareness from mainstream sources. The causal estimates show that Facebook is an important conduit for news from non-mainstream outlets, and this echoes the findings of Allcott and Gentzkow (2017) who show that social media is correlated with the distribution of "fake news." Our results provide additional evidence that Facebook plays an important role in the acquisition of information by affecting what news is available to consume and thus an individual's ability to assess its veracity.

[2]We note that the BDM mechanism used in our study, and in other studies using the BDM or other mechanisms, involve hassle costs and some complexity that may affect values. Our participants face a one in two chance of experiencing a Facebook restriction, and this may reduce bias in value estimates when using elicitation mechanisms coupled with implementation uncertainty.

Third, our findings contribute to the literature that focuses on Facebook's effect on happiness and well-being. Early studies found mostly positive effects of social media on subjective well-being, perhaps through enhanced engagement, in cross-sectional studies (Ellison et al., 2007; Valenzuela et al., 2009; Gonzales and Hancock, 2011; Kim and Lee, 2011) and laboratory experiments (Sagioglou and Greitemeyer, 2014; Vogel et al., 2015; Verduyn et al., 2015). More recent studies have found mixed results using panel data (Shakya and Christakis, 2017) and Facebook use limitations (Tromholt, 2016).[3] Cross-sectional evidence on the effect of Facebook on depression is mixed. Feinstein et al. (2013) finds depressive feelings are driven by negative outcomes from social comparison, but other studies find no relationship between Facebook and depression (Steers et al., 2014; Jelenchick et al., 2013; Tandoc et al., 2015). We contribute to this literature by using a randomized and verified Facebook restriction and show no significant effect of using Facebook on overall life satisfaction. However, we do find a large short-term reduction in feelings of depression when restricted from Facebook, especially for men.

Finally, we build on existing research by studying the effect of Facebook on behaviors largely found to be correlated with mood. We find suggestive evidence that individuals restricted from using Facebook engage in healthier activities. While our design does not allows us to recover the underlying mechanism, this finding is consistent with research in psychology (Salovey et al., 2000; Ostir et al., 2000; Fredrickson and Joiner, 2002; Blake et al., 2009; Kettunen et al., 2015; Newman et al., 2014; Sonnentag, 2001) that better mood is positively correlated with engagement in healthier behaviors.

Overall, the effects our study finds on news awareness, news consumption, feelings of depression and daily activities show that Facebook has significant effects on important aspects of life not directly related to building and supporting social networks. Furthermore, almost two years after our experiment, Allcott et al. (2019) find similar results for news awareness and subjective well-being for a different population, which supports our findings. The effects

[3]Tromholt (2016) uses a one-week, self-enforced Facebook restriction and finds a positive effect on overall life satisfaction.

of Facebook are far reaching, and our results provide a more comprehensive documentation of these impacts on daily life. Users seem to understand this and place a substantial value on the experience that Facebook provides.

The paper is organized as follows. Section 2 describes the study design and implementation. Section 3 reports results on the value of Facebook to users and the effect of the Facebook restriction on news awareness, subjective well-being and activities. Section 4 continues with robustness checks on our main findings. Section 5 concludes.

2 Study Design

A direct approach to analyze the causal effects of Facebook on daily life would be to take the population of Facebook users, randomly restrict usage for some and not others and then examine behavior across the restricted and not restricted groups. This is difficult to achieve, however, absent a random event that blocks some comparable users from accessing Facebook for period of time and not others and then identifying those users to examine behavior. As an alternative, we adopt an approach where we recruit volunteers and then randomize a Facebook restriction among them.[4] While feasible to implement, a challenge is the representativeness of the generated sample. Simply asking for volunteers willing to give up Facebook would likely result in a sample of low-value individuals. To address this issue, we collect additional information from our volunteers that allows us to account for this type of selection. Rather than merely asking for volunteers, we elicit an individual's value of Facebook for one week and then use the distribution of stated values to test if selection affects the results.

Our study occurs in three major phases, as outlined in Figure 1. In Phase 1, we elicit an individual's value of using Facebook for one week and recruit qualified participants into the Facebook restriction. In Phase 2, we administer a pre-treatment survey and then randomly assign participants into two groups – a group that experiences one week without Facebook

[4]The study is registered in the AEA Registry (AEARCTR-0003952)

and a group with no restriction. In Phase 3, participants return to complete a second survey and collect payments. In a surprise, we also re-elicit an individual's value of Facebook for one week. We ran this intervention between April and May 2017.

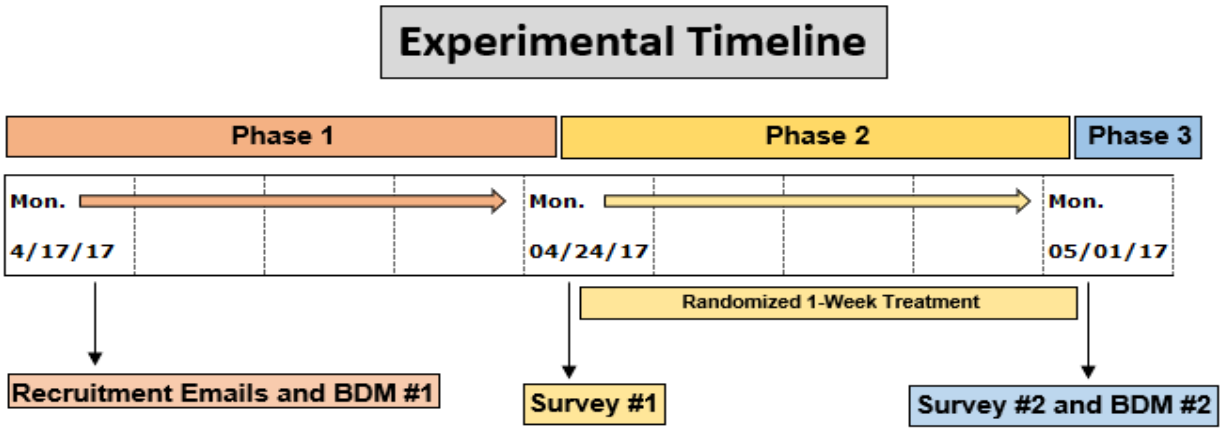


Figure 1: Timeline of Study Phases

2.1 Phase 1 - Recruitment and value of Facebook

We sent an invitation email to recruit participants. The email contained a short description of the study and a link to an online survey that asked basic demographic information, determined if the participant had a Facebook account (95% did) and elicited the participant's value for not using Facebook for one week.[5]

An individual's value of Facebook is revealed with the Becker-DeGroot-Marschak (BDM) mechanism (Becker et al., 1964) and determines eligibility for participation in subsequent phases of the study. The participant is asked to submit her value of one week of Facebook usage. A random counter offer is drawn and shown to the participant. If the participant's value is less than the counter offer, then the participant is eligible for the next phases of the study and would be paid the counter offer upon study completion. If the participant's value is higher than the random offer, then she is not eligible to participate in any of the subsequent phases of the study and does not receive payment. Several examples of how

[5]The email text and online survey questions are in the Appendix, Sections A.1 & A.2.

the procedure works are included in the instructions to make sure that participants understand the procedure prior to submitting a value.[6] The examples explicitly highlight that participants should optimally reveal their true value. To assure that reported values are not biased upwards, we follow the suggestion of Bohm et al. (1997) and Mazar et al. (2014) and leave the upper limit of the random offer unclear because that increases the validity of the BDM mechanism. This is implemented by informing participants that the minimum counter offer is $5 and the maximum is "our most reasonable estimate of the value of the time spent on Facebook."[7]

All eligible participants were invited by email to attend the next phase (Phase 2) on Monday of the following week.[8] The email explained that the next phase involves completing a comprehensive survey and being randomly assigned to log off Facebook for one week. In addition, the participants were informed that they would need to come back a second time (one week later) to complete another survey and receive cash payments of the counter offer they received. The time and location of the session is indicated in the email, and participants confirm their attendance.

2.2 Phase 2 - Pre-survey and Facebook restriction assignment

Participants were required to show up in person to complete a short survey that collects information on social media usage, news awareness, consumption behavior, time allocation, and subjective well being (Appendix Sections A.3 and A.4). The questions on social media usage included time spent, frequency of postings and emotions felt while using the platform.[9]

[6]Our procedures made clear to participants that they would be paid the random offer upon study completion to mitigate any uncertainty bias (Horowitz, 2006).

[7]For budgetary reasons and expected participation rates, the random counter offers were drawn with the following probabilities: (5, 15.14%; 7, 15.14%; 9, 11.14%; 10, 11.14%; 12, 11.14%; 14, 11.14%; 16, 7.14%; 18, 6.14%; 20, 5.14%; 21, 5.14%; 24, 0.64%; 25, 0.64%; 28, 0.14%; 30, 0.14%). The expected offer is $11.58.

[8]Those who are ineligible for subsequent phases are not contacted.

[9]Participants complete the survey in Phase 2, prior to random assignment to the Facebook restriction, and in Phase 3. One might be concerned that changes in outcomes are due to experimenter demand effects. First, participants are not aware they will complete the same survey questions a second time. Second, we find effects for some, but not most, of the outcomes, thus alleviating concerns of such an effect. Finally, in a later study with a similar design, Allcott et al. (2019) find similar results to ours while explicitly testing for demand effects.

To capture news awareness, we tapped into a variety of news sources. In the week prior to the survey, we collected headlines from the front page of the eleven most popular newspapers as ranked by the Pew Research Center, including The New York Times, Washington Post, USA Today, Wall Street Journal, LA Times, New York Daily News, New York Post, Boston Globe, San Francisco Chronicle, The Chicago Tribune and The British Daily Mail. We used Breitbart as the source of skewed news.[10] There were no extraordinary news events during this period, like a mass shooting or major natural disaster, that might bias news knowledge. The participant is shown six headlines randomly chosen from the pool of mainstream sources and one randomly chosen from the skewed source and asked to identify if the event occurred or not. From the six mainstream sources, two headlines are changed slightly so as to make the headline false. All other headlines did appear on the front page of a newspaper or on Breitbart.[11]

Daily behavior is measured by presenting participants with a series of statements (e.g. "I save more money than I normally do", etc.) and asking them to identify on a scale of 1-5 whether they agree/disagree with the statement. Time allocation is measured with estimates for average time spent doing a variety of activities, such as working and exercising. Finally, our subjective well-being questions are constructed following the OECD Guidelines used to characterize the affective state of the respondent (OECD Better Life Initiative, 2013). These questions ask participants to respond on a 0-10 scale how frequently they feel a certain emotion (e.g. depression, happiness, etc.).

Upon completion of the survey, participants were randomly assigned to either a one-week Facebook restriction or no restriction based on the last digit of the participant's university-assigned ID number.[12] All participants complied with their assigned treatment and associated protocols.

[10]We chose Breitbart given that its internet traffic as of March 2017 surpassed other major skewed news sources and was similar in magnitude to that of mainstream news sources such as The Washington Post according to data from alexa.com

[11]See the questionnaire in Appendix A.3

[12]The university randomly generates the last four digits of a student's ID number.

The no restriction group is dismissed and asked to return the following Monday (one week later) to complete another survey and receive payment. The restriction group is required to log off of Facebook, and all its associated features, including Messenger, for one week. To validate compliance with the restriction, we created a Facebook account for the study and had treated participants become friends with our study account. As friends, we can monitor all access to their account through the "Last Active" feature in Facebook Messenger. This feature automatically updates as soon as someone logs on to Facebook, thus we can validate if a participant complies or not with the restriction. A participant could go invisible, block or un-friend our Facebook account, but they would have to log in and we would observe this in our data. We saw no instances of this, and all participants complied with the restriction. After becoming friends with our Facebook account, participants logged off of all their active Facebook sessions on all their devices using Facebook's security settings. Finally, the restriction group was asked to return the following Monday (one week later) to complete another survey and receive payment.

2.3 Phase 3 - Post-survey and re-elicited value of Facebook

All participants returned one week later to complete another survey and receive payment. The survey is identical to the one given in Phase 2 and allows us to see how key indicators – social media use, news awareness and subjective well-being – have changed over the previous week.[13] After completing the survey, participants were instructed to go to a separate room for payment.

In the separate room, before receiving payment, we again elicited each participant's value for one week of Facebook usage. Up to this point, participants did not know they would again be asked their value of Facebook. This procedure gives us an unbiased measure of the change in Facebook's valuation following the restriction. We use the same BDM mechanism procedures as in Phase 1.[14] Afterwards, all participants receive a cash payment based on

[13]We updated the news pool to reflect headlines from the previous week.

[14]Participants are asked to write down their valuation and informed that their payment today is unaffected

the counter offer from Phase 1 before leaving the session.

2.4 Implementation

Participants were recruited via email from a random sample of the undergraduate population at Texas A&M University during the Spring semester of 2017. Overall, 1,929 individuals initiated the Phase 1 online survey and 1,769 completed it, thus producing the distribution of stated values used to estimate the value of Facebook and to test if selection affects results. When we compare the characteristics of the individuals who responded to the survey with the entire undergraduate population (based on year in school, home state and declared major), we find that our survey respondents are representative. Of those individuals who completed the Phase 1 survey, 562 were eligible for Phase 2 of the study, and eligibility does not depend on covariates.[15] Also, we find no evidence that participants who ended up being eligible or ineligible based on the randomly-drawn counter offer are different.[16]

All eligible participants were invited to Phase 2 of the study, and this session was held on main campus where participants came to complete the survey and be randomized into the Facebook restriction.[17] For the Phase 2 sessions, 167 participants showed up and completed the survey. Appendix Table A.5.1 shows the comparison between those who were eligible and showed up and those who did not. The only meaningful differences are that those who did not show up had a slightly lower value for Facebook and counteroffer. We test the robustness of our results to design-induced selection in Section 4.1 by re-weighting the sample.

by their response. Eligible participants from this second BDM go through the same process as in Phase 2, return for a third and final survey in one week, and are paid their counteroffers from the second BDM. We do not include this third survey in our estimates.

[15]Eligibility for Phase 2 means that the submitted value was less than a randomly-selected counter-offer of no more than $30. This is by the design of the elicitation mechanism – so all those with submitted values higher than $30 were ineligible. Descriptive statistics for these groups are in Appendix Table A.5.1. In Section 4.1 of the paper, we test the robustness of the results to this design-induced selection.

[16]When we compare participants who submitted values less than or equal to $30, so they could have been eligible to participate in Phase 2, there is no significant difference by age or gender between those who ended up being eligible or ineligible based on the counteroffer. See Appendix Table A.5.1

[17]Participants were aware of this procedure prior to submitting their value of Facebook in the Phase 1 online survey. Holding this session on main campus minimizes travel costs that might have affected valuations for Facebook.

Among the participants who completed the Phase 2 survey, fifty-four percent (n=90) were randomly assigned to the no restriction control group, and 46% (n=77) were assigned to the Facebook restriction treatment group. Comparing covariates of the control and treatment groups, we find there are significantly more women in the control group (71%) compared to the treatment group (57%), but otherwise, the two groups are balanced.[18] To address covariate differences by treatment assignment, our analysis controls for individual fixed effects so that treatment effects are identified through differences in changes in behavior before and after the one-week Facebook restriction across the treatment and control groups.

After one week of treatment, 90% (n=151) of the participants from Phase 2 returned to complete the Phase 3 survey. There is no significant difference in covariates between the participants who returned for Phase 3 and those who did not, and attrition is not correlated with treatment status. Our monitoring process validates compliance with the restriction.[19] Those in the treatment group reduced their use of Facebook by 1.7 hours per day. Given a baseline Facebook usage of 1.9 hours per day, this illustrates that the treatment group complied with the restriction.

All sessions were completed in April-May 2017. Time to complete the Phase 1 online survey was approximately five minutes, and each subsequent in-person survey took about 10-15 minutes. Average payment to participants was $16.79 (s.d. $5.22) at the completion of Phase 3.

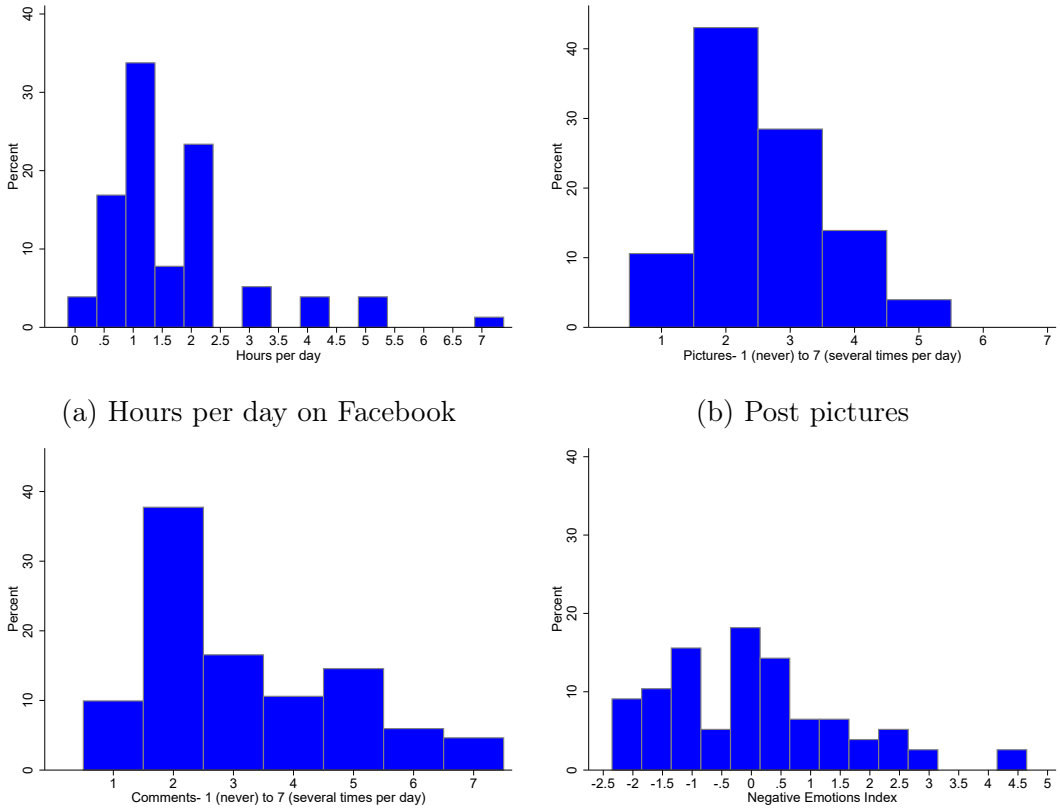
3 Results

3.1 Description of the sample

In the baseline survey (Phase 2), participants report spending a mean of 1.9 hours per day on Facebook, including reading news feeds and news content (Figure 2, panel a). This is consistent with other surveys with college students that report an average of 2.6 hours

[18] Appendix Table A.5.2 shows the balance of covariates across the treatment and control groups.

[19] Participants did not interact with the study account in any way.



(a) Hours per day on Facebook

(b) Post pictures

(c) Post comments

(d) Negative Emotions Index

Notes: This figure presents descriptive statistics on Facebook usage. The x-axis in panels (b) and (c) represents: 1 never, 2 rarely, 3 1-2 times per month, 4 once a week, 5 2-4 times per week, 6 once a day, 7 several times per day.

Figure 2: Time Spent on Facebook and Facebook Usage

spent on Facebook per day (EMarketeer, 2015), yet higher than the national average of 50 minutes per day (Neilsen Company, 2016). Engagement on Facebook is measured by how often participants post pictures and comment. This activity was rated on a scale of 1 (never) to 7 (several times per day). About 52% never or rarely post pictures, 28% once or twice a month and the remainder post once a week or more (Figure 2, panel b). In terms of posting comments, 48% never or rarely comment, 18% once or twice a month and the remainder post once a week or more (Figure 2, panel c).

Other social media platforms are also used. On a daily basis, participants report spending close to two hours on Facebook, Snapchat and YouTube, over one hour on Instagram, less

than one hour on Twitter, and very little on Tumblr and Vimeo.[20] This is consistent with the number of friends and followers reported across platforms. On average, there are more friends and followers on Facebook (641) and Instagram (452) than on Tumblr (87) and Twitter (182).

Information is also collected on where participants get their news and time spent acquiring news. Roughly, 15-30 minutes a day is spent reading or watching news, and most news is obtained from digital sources (e.g. online news, social media) as opposed to traditional outlets (e.g. cable tv, paper news, radio).[21] Participants reported their preferred news sources, and we rank each source's political bias on a scale of 1 (Left) to 5 (Right).[22] The average preferred news source has a political bias of 2.8 - slightly left of Center.

We further asked a variety of subjective wellbeing questions. On a scale of 0 (Never) to 10 (Very/Always), participants are generally satisfied with life (mean of 7.2) and responded with a mean of 3.4 to feelings of depression. These results are in line with the OECD's Better Life Initiative Survey for 2017 which reports an average overall life satisfaction score of 7.3.

Participants were asked to rate on a scale of 1 (never) to 6 (all the time) how often they felt certain negative emotions while using Facebook, such as envy/jealousy, loneliness, misery and annoyance. To generate a general measure of experiencing negative emotions while on Facebook, we take these four measures and combine them into a factor index that ranges from -2.35 to 4.37 using principal component analysis. A higher index indicates a participant feels more negative emotions (see Figure 2, panel d), and there is large variation in this index.[23]

[20] Appendix Table A.5.3.

[21] Appendix Table A.5.3. While we cannot say what proportion of news participants get from Facebook, 81% report opening up Facebook every day or several times a day to check their news feed.

[22] We use the rankings on www.allsides.com. If a participant lists a news outlet that is not reported on allsides.com, we treat their preferred news outlet as missing. The top five first choice sources are CNN (28.1%), FOX (12.6%), BBC (8.3%), NYT (4.7%), and ESPN (4.7%). Breitbart was not listed as a first choice, however, news from this source could appear on a Facebook news feed.

[23] Appendix Figure A.5.1 shows the distribution of these emotions separately.

3.2 Value of Facebook

Participant responses to the BDM lottery show that one week of Facebook usage is valued at $24.84 on average ([23.02, 26.65] 95% confidence interval), and the median value is $15 ([12.70, 17.30] 95% confidence interval).[24] We evaluate how sensitive the mean is to outliers by trimming the distribution at $200, $100 and $50. With each cut, the mean BDM value changes to $22, $21 and $18, respectively. The median BDM value remains fixed at $15 with each cut of the distribution.[25] There is no bunching at $5 which indicates that participants did not try to manipulate the BDM mechanism to be eligible for the next stage of the study.

Our experiment introduces a lottery in which an individual has a 50% chance of being restricted from Facebook. Given that the restriction is experienced half of the time, stated values could be dampened and the BDM would then produce an underestimate of Facebook's value. If we assume that stated valuations are half of the truth, then under risk neutrality, the mean value of Facebook would be $50 per week (median=$30) and $200 per month (median=$120). If individuals are risk averse and we assume a CRRA utility function with a risk aversion parameter within a reasonable range (0.1-0.3), then the mean value of Facebook would be $67 per week (median=$40) and $267 per month (median=$160). Throughout the remainder of the paper, we report values adjusted for risk aversion. However, results are qualitatively the same if we use the unadjusted reported values from the BDM mechanism. Figure 3 shows the distribution of the risk-adjusted values.[26] While our design does not separately consider hassle costs, other studies find similar values to ours, suggesting that hassle costs are minimal. Brynjolfsson et al. (2018) and Corrigan et al. (2018) find lower

[24] We calculate the confidence intervals using bootstrap with 1000 replications.

[25] Our design also explored the willingness to pay (WTP) - willingness to accept (WTA) gap in the BDM mechanism (see Knetsch et al. (2001), Plott and Zeiler (2005), Horowitz (2006), and Brynjolfsson et al. (2018) for a discussion of this phenomenon). Half of the participants were asked the value in terms of selling participation in the study (WTA), "How much money would you need to be given to stop using Facebook for a week?" and half were asked in terms of purchasing participation (WTP), "What is the value of your weekly time on Facebook?" We find no significant difference in the reported value of Facebook from either solicitation method or by covariates across groups, so we pool the data in our analysis.

[26] The distribution is trimmed at $540 because of a few outliers in the data – the maximum value is $2,153. We use the nontrimmed, full sample in our analysis.

weekly median values ($3.92 and $15 respectively), and Allcott et al. (2019) find median monthly values ($100-$180) similar to ours.[27]

According to the Pew Research Center (2016), women are 8 percentage points more likely to use Facebook than men. Hence, we might expect to see differences in the value of Facebook across genders, however, we do not find a statistically significant difference. On average, one week of Facebook is worth $69.35 for men (median=$43.07) and $65.18 for women (median=$40.38). We also test for difference in the distributions of the value by gender and find no significant difference.[28]

There is a positive correlation between the value of Facebook and age in our data. For those aged 21 years or younger, one week of Facebook is worth $62.95 (median=$40.38), while for those older than 21 years, Facebook is worth $78.37 (median=$53.84). This could reflect differences in income or that younger participants are more likely to use other social media. Indeed, those 21 years and younger spend more time on Twitter and Snapchat and have more Instagram followers.[29]

The value of Facebook changes across user types, with those who are more active reporting higher values. Facebook is worth 20% more for participants who use it for more than one hour a day and for those who post at least once per month. There is a positive, but not significant, correlation between the value of Facebook and having a large number of friends on Facebook, however, there is a positive and significant correlation between the value and having a large number of friends on other social media platforms. Those with a large number

[27]There are differences across studies. Brynjolfsson et al. (2018) use an online sample, one out of every 200 participants are randomized into the Facebook restriction, and respondents who do not use Facebook are not screened out for their weekly estimate. Corrigan et al. (2018) use a series of second-price auctions with different samples and compensation schemes. Allcott et al. (2019) also use a BDM mechanism but with an online sample.

[28]Women are typically found to be more risk averse than men. The risk-adjusted values of Facebook that we use assume that men and women have the same level of risk aversion. Women would need to be 37% more risk-averse than men for the difference to be significant at the 10% level, 41% more risk-averse than men for the difference to be significant at the 5% level, and 48% more risk-averse than men for the difference to be significant at the 1% level.

[29]We did not ask questions on income but asked the zip code of where the participant lived at age 15. Using income data from this zip code, we find no significant difference in mean income for younger participants compared to older.

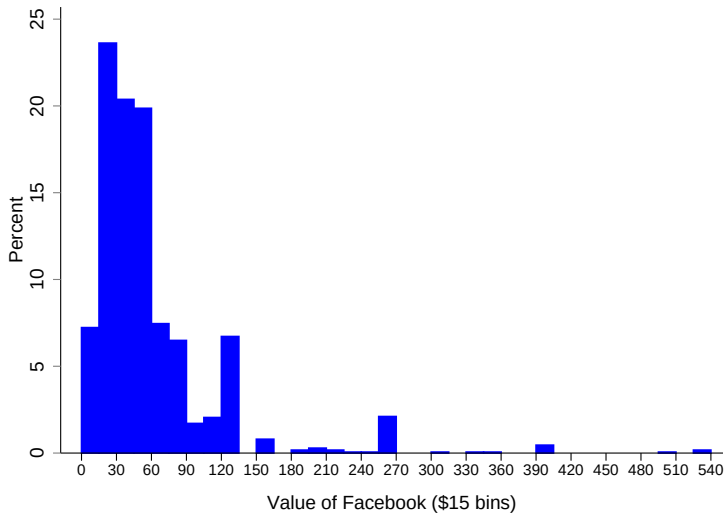


Figure 3: Distribution of the Value of Facebook (trimmed at $540)

of friends on other social media also have a lot of friends on Facebook, so this likely reflects the larger value that active Facebook users place on using the platform. There is a negative correlation between feeling depressed or experiencing negative emotions while on Facebook and the value of Facebook, but these correlations are not significant.[30]

To put some perspective on the magnitude of the stated values of Facebook in our sample, we compare its value with college students' mean income and some common expenses. The weekly average income of a college student is $224.28 (Flood et al., 2017), so a week of Facebook usage is worth 30% of income.[31] In addition, university students spend roughly $14 in clothing, $14 in personal care and $11.50 in technology (devices, plans and subscriptions) per week. Facebook is worth more than each of these and more than the average weekly expenditure of $20 on coffee (Tuttle, 2012). Facebook has a large value for our participants relative to their income and other purchases.

[30] Appendix Table A.5.4 presents the Pearson correlation coefficients between the value of Facebook and several measures that characterize Facebook users.

[31] In-state tuition at Texas A&M is $11,200 per year, or $350 per week, implying that participants value Facebook as much as 19% of the weekly cost of studying at the university. According to the College Board, the average university student in the U.S. spends $225 per week ($10,800 per year) on room and board. Facebook is then worth 30% of these expenses.

3.3 Effects of the Facebook Restriction

We explore the effect of not using Facebook for one week on five outcomes: social media usage, news consumption, news awareness, subjective well-being, daily activities and the value of Facebook. Throughout the paper, indices are constructed using the procedure of Anderson (2008). We demean each variable using the mean of the control group in Phase 2 and convert it into an effect size by dividing it by the standard deviation of the control group in Phase 2. The index is the weighted average of the transformed outcomes, where the weights are derived from the inverse of the covariance matrix of the transformed outcomes. A key advantage of our design is that we can verify that participants assigned to the Facebook restriction remained logged off without having to directly contact participants with reminders and possibly affect their behavior. Our compliance rate is 95%, and throughout the paper we report intent-to-treat effects.[32]

To examine the effects of Facebook on behavior, we exploit the fact that we ask the same questions in the pre and post-treatment surveys (administered in Phase 2 and Phase 3) and estimate the change in the outcome of interest and control for individual fixed effects. This approach identifies treatment effects based on changes in individual behavior and controls for any unbalancedness that might exist in covariates across the treatment and control groups. By relying on within-individual variation to identify effects, the only difference across individuals is random assignment to treatment and control.

Specifically, we estimate the following equation:

$$y_{it} = \beta_0 + \beta_1 PostSurvey_t + \beta_2 PostSurvey_t \cdot Treatment_i + \alpha_i + \varepsilon_{it} \quad (1)$$

where $PostSurvey_t$ is a dummy variable for the survey given in Phase 3 after the one-

[32] All but three treated participants stayed off of Facebook for the entire week. The three who did log back into Facebook did so only once for less than an hour to communicate for a student organization via the organization's Facebook account. All three participants contacted the research team prior to logging in to inform us why they were logging back on. These participants are included in our intent-to-treat analysis. Instrumental variable estimates are 5% larger and slightly less precise.

week Facebook restriction and $Treatment_i$ indicates if individual i is randomly assigned to the Facebook restriction group. β_2 is our coefficient of interest. Individual fixed effects are included and thus control for treatment assignment and fixed individual covariates. Standard errors are clustered at the individual level. We estimate equation (1) for the full sample and explore heterogeneous effects by gender and different classifications of Facebook users.

In addition to testing differences in means, we test whether Facebook usage has an effect on the distribution of outcomes. We test for equality of the distributions, as well as first and second order stochastic dominance.[33]

Our analysis tests for effects on a large number of outcomes. To make sure that our results are not due to chance, we adjust the p-values to account for multiple comparisons and report these as our main findings.[34] We apply the procedure defined by Benjamini and Hochberg (1995) and Benjamini et al. (2006).[35]

3.3.1 News Awareness

According to Gottfried and Shearer (2016), 64% of social media users access news from just one site, and on Facebook, 66% of users report getting at least some news while using the platform (Pew Research Center, 2016). This suggests that Facebook might play an important role in the distribution of news. If this is true, we should expect that logging individuals off Facebook for a week decreases awareness of current events. We use the news headlines quiz described in Section 2.2 to define three indicators that measure the effect of

[33]It would be important to test for effects at different quantiles, but we do not have enough power to estimate meaningful comparisons at the tails of the distribution. To test for distribution equality, let $F_{(1)}$ be the distribution of outcome y_{it} for the treated group and $F_{(0)}$ be the distribution of the control group. According to Abadie (2002), we define $F_{(1)}$ first order stochastic dominates $F_{(0)}$ if $\int_0^x dF_{(1)}(y) \leq \int_0^x dF_{(0)}(y)\ \forall x \geq 0$ and $F_{(1)}$ second order stochastic dominates $F_{(0)}$ if $\int_0^x \left(\int_0^z dF_{(1)}(y) \right) dz \leq \int_0^x \left(\int_0^z dF_{(0)}(y) \right) dz\ \forall x \geq 0$

[34]Doing this involves a trade off between a Type I error and the power of the test (Anderson, 2008). We control for the false discovery rate to adjust our p-values and achieve a balance between these two factors.

[35]For reference, both the unadjusted and adjusted p-values are reported in Table A.5.6. All of our results remain statistically significant at the 5% level or less, with the exception of the probability of answering "Don't Know" for skewed news, the healthy activities index and the change in the value of Facebook. We also do a more robust adjustment controlling for the family-wise error rate. When we use the free step-down method described by Anderson (2008), only the effects on Facebook use, news access through social media, news consumption and the correct answer of skewed news are statistically significant at conventional levels.

Facebook usage on news awareness: the proportion of news headlines participants correctly recognized as having occurred, the proportion they got wrong and the proportion for which they were uncertain (i.e. they answered "I don't know"). We calculate these measures for the questions from mainstream sources (six questions) and for the skewed news source.

Figure 4 shows the effect of the Facebook restriction on these three measures for mainstream and skewed sources. There is no significant effect of the restriction on news awareness for headlines from mainstream sources.[36] However, there is significant uncertainty of the veracity of headlines from skewed news. Those who experienced a week off of Facebook are 22.1 percentage points more likely to be uncertain about whether or not a politically-skewed news headline is true or not. And, they are 15.6 percentage points less likely to answer correctly if the event actually occurred.[37]

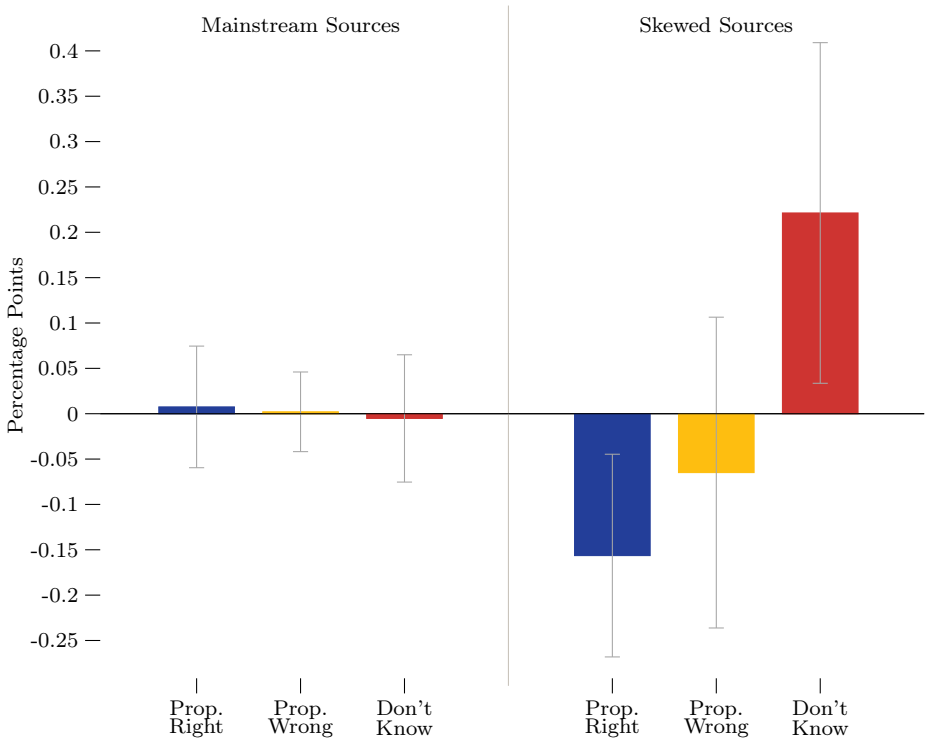
3.3.2 Potential Mechanisms for the Reduction in News Awareness

The reduction in news awareness should be correlated with an overall decrease in access and consumption of news. We analyze how being logged off Facebook for a week affects the frequency with which individuals access different news media and whether consumption of different types of news changes. Participants reported their answers for news consumption and types of news using a Likert scale ranging from "not at all" (1) to "all the time" (7). Following the procedure described in Section 3.3, we aggregate access to "traditional" news media (i.e. radio, newspapers, television and Internet sites) in one index (Traditional Media) and access to social media and news feeds into a second index (Social Media). We use the two indices to measure changes in access to news media.

The left panel in Figure 5 presents the effect of the Facebook restriction on access frequency to news media. On average, access to news through social media decreases by 0.66

[36] We tested whether the Facebook restriction had different effects for true headlines and the false headlines we created (by changing a few words) in the news quiz. For both types of headlines, the point estimates are similar to the main results and statistically insignificant.

[37] Gender differences do emerge. While both men and women are less likely to be aware of the veracity of skewed news when off of Facebook, the effect is much stronger for men than women. This suggest that men, more than women, are exposed to politically skewed news when on Facebook.

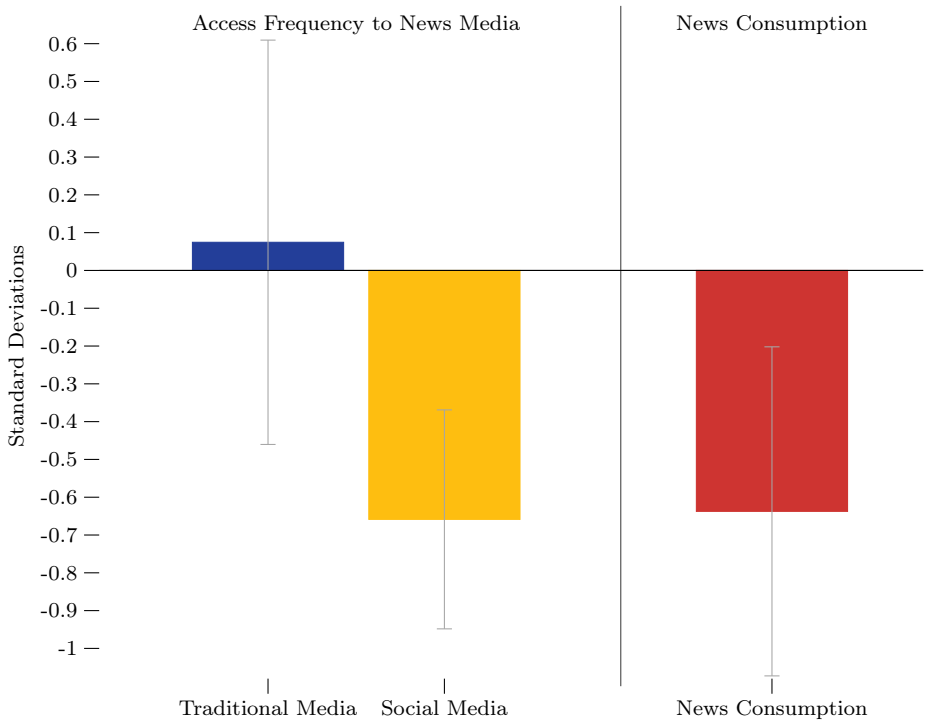


Notes: This figure presents the intent to treat effects of the Facebook restriction on news awareness. Prop. Right corresponds to the proportion of questions answered correctly on the news headlines quiz, Prop. Wrong corresponds to the proportions of questions answered incorrectly and Don't Know corresponds to the proportion of questions answered "I don't know". Estimates control for individual fixed effects. Each estimate corresponds to the change in the proportions of answers in each category. The figure displays the 95% confidence interval.

Figure 4: Effects on News Awareness

standard deviations (significant at the 5% level), while there is no statistically significant change in access to "traditional" news media. These results are consistent with the fact that participants in the restriction group reduced their Facebook usage to zero but they do not substitute by increasing use of traditional media.[38] We also find that the distribution of the social media index for the restriction group first order stochastic dominates the distribution of the non-restricted group. This indicates that access to news through social media decreases not only at the mean, but throughout the distribution (see Appendix Table A.5.5).

[38]Our research design restricted usage of Facebook for those in the treatment group, but participants were not restricted in their usage of other social media platforms. We validate that those in the treatment group did reduce their use of Facebook – by 1.7 hours per day. Given a baseline Facebook usage of 1.9 hours per day, this illustrates that the treatment group did comply with the restriction. While the treatment group refrained from using Facebook, we find that they did not increase their usage of other social media (e.g. Instagram, Snapchat, Tumblr, Twitter). This is consistent with studies finding low cross-platform usage for social media and a significant cost to switch to alternatives for one week (Pew Research Center, 2016). Only one-third of Facebook users are active on other social media platforms, yet about 90% of users of other platforms are active on Facebook (Pew Research Center, 2016).



Notes: This figure presents the intent to treat effects of the Facebook restriction on access to two types of news media. Traditional media is an index that measures access to "traditional" news media (i.e. radio, newspapers, television and Internet sites). Social media is an index that measures access to news through social media and news feeds. Estimates control for individual fixed effects. Each estimate corresponds to the change in access frequency of a type of media. The figure displays the 95% confidence interval.

Figure 5: Effects on News Media Access

We find no distribution differences for access to "traditional" media. These results indicate that Facebook is an important source of news for our participants, and in the short term, they do not substitute with other news sources.

The right panel in Figure 5 presents the effect of the Facebook restriction on news consumption. We asked how frequently the participants read political, business, sports, international, culture, science, local and weather news, and we aggregate these measures into an index (News Consumption) to capture overall news consumption. On average, participants in the Facebook restriction group significantly decrease their consumption of news by 0.64 standard deviations with respect to the baseline (p-value < 0.05), and this effect is consistent across all news types. The reduction in consumption of news decreases not only at the mean but also across the entire distribution (see Appendix Table A.5.5.

In summary, these results indicate that Facebook is an important conduit for news aware-

ness, specifically from skewed sources, for college students. News consumption decreases and there is no evidence of substitution to other news sources. In the next section we study the effects of Facebook on subjective well-being.

3.3.3 Subjective Well-being

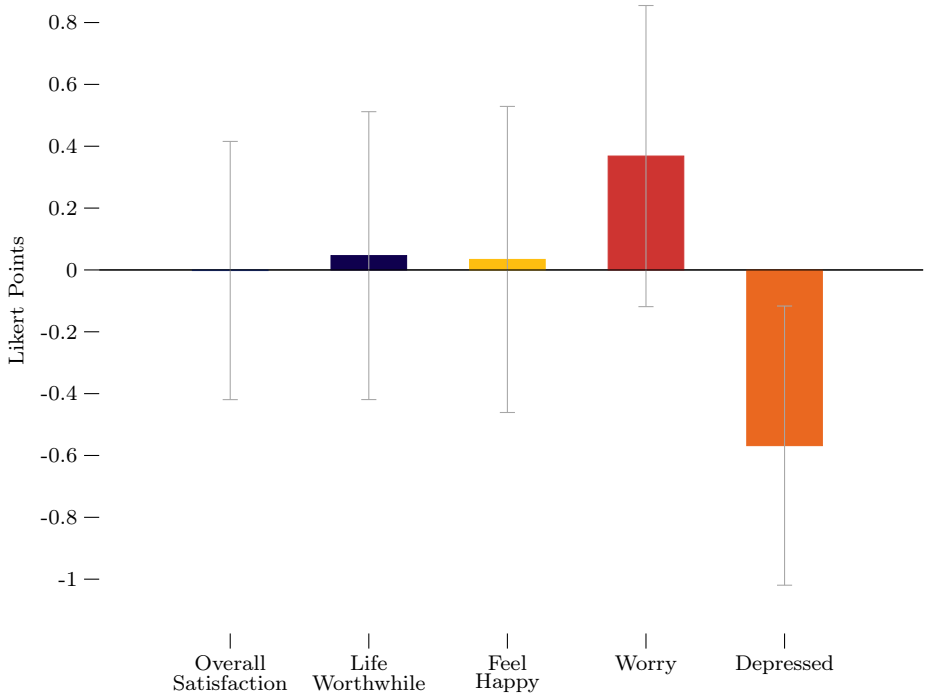
Previous studies have found mixed results on the effects of Facebook on happiness and well-being. We build on previous research by applying a validated Facebook restriction that does not interfere with participants during treatment, and by including a series of questions on daily habits and activities potentially correlated with well-being (Salovey et al., 2000; Ostir et al., 2000; Fredrickson and Joiner, 2002; Blake et al., 2009; Kettunen et al., 2015; Newman et al., 2014; Sonnentag, 2001).

We asked participants five subjective well-being questions (taken from the OECD Better Life Initiative) using a Likert scale (from 0-10). The questions assess overall life satisfaction, how worthwhile life is, happiness, level of worry, and depression.[39] Figure 6 presents the effects of the Facebook restriction on these measures. Estimates for overall life satisfaction, life is worthwhile, happiness and worry are small and statistically insignificant.[40] However, being off of Facebook does significantly reduce depression by 17% (0.57 points on the Likert scale). This result is consistent with findings from the social psychology literature using cross-sectional data that shows Facebook increases feelings of depression (Steers et al., 2014 and Feinstein et al., 2013).[41] We do not find evidence of distribution shifts (see Appendix

[39]The questions are: (i) Overall, how satisfied are you with life as a whole? (ii) Overall, to what extent do you feel that things you do in your life are worthwhile? (iii) How happy are you? (iv) How often do you worry? and (v) How often do you feel depressed? An alternative approach could have been to use the Day Reconstruction Method (Kahneman et al., 2004 and Kahneman and Krueger, 2006), however, to keep the survey short, we opted for the five OECD questions.

[40]Our results on life satisfaction are smaller than Tromholt (2016) who finds a significant effect of 0.26 standard deviations. The study's Danish sample is older (average age of 34 years) compared to our U.S. sample (average age of 20 years), and participants were contacted daily by the researcher team to follow their assigned treatment status.

[41]Subjective well-being measures can be sensitive to temporary events (e.g. the weather, long lines at a coffee shop, meeting somebody) (Krueger and Schkade, 2008), nonetheless, because our participants are randomly assigned to treatment, random shocks should be evenly distributed and our panel estimation allows us to directly control for events that affect both groups uniformly across time.



Notes: This figure presents the intent to treat effects of the Facebook restriction on five different measures of subjective well-being. Estimates control for individual fixed effects. The figure displays the 95% confidence interval.

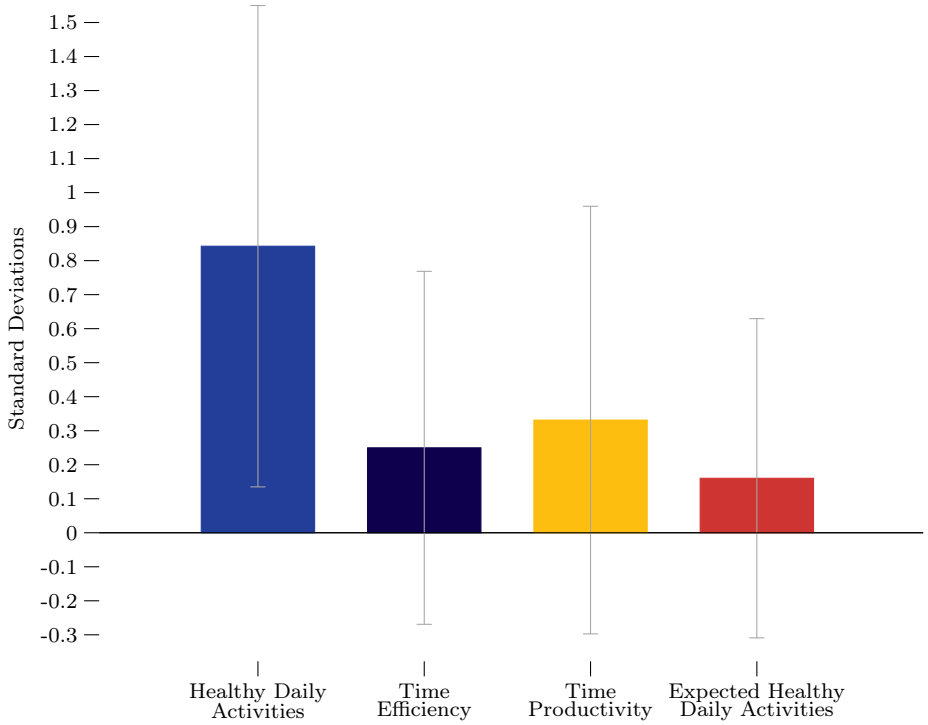
Figure 6: Effects on Subjective Wellbeing

Table A.5.5).

Our results suggest that using Facebook induces feelings of depression. While this could plausibly decrease an individual's well-being, our estimates reject significant changes in well-being. Evidence of a negative correlation between happiness and depression is weak (Rezaee et al., 2016), hence, a significant decrease in depression is not inconsistent with no change in well-being.

The reduction in feelings of depression from being logged off of Facebook could be driven by changes in behavior. To shed light on how people respond to losing Facebook access, we asked participants to report on a variety of activities the week prior to completing the pre and post-treatment surveys (Phases 2 and 3). Healthy behavior was measured by asking whether participants ate out less than usual, did less impulse buying, saved more money, ate healthier and exercised more.[42] We also asked what they expected their behavior would be

[42]There is evidence that eating out is associated with excessive calorie intake (Urban et al., 2016), a less



Notes: This figure presents the intent to treat effects of the Facebook restriction on four index measures of activities and time use. Healthy Daily Activities indexes engagement in "healthier" consumption/savings practices in the past week. Time Efficiency measures efficient time use. Time Productivity measure productive time use. Expected Healthy Daily Activities indexes the expected engagement in "healthier" consumption/savings practices the following week. Estimates control for individual fixed effects. The figure displays the 95% confidence interval.

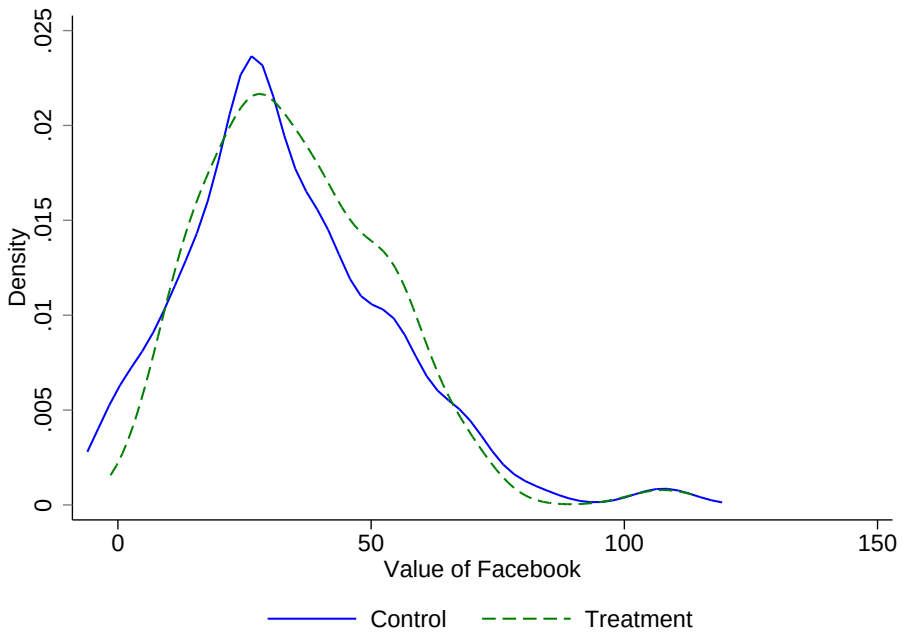
Figure 7: Effects on Activities and Time Use

the following week. Productive time use was measured by asking whether they spent more time studying, had time to relax and be with friends, and partied a lot. Time efficiency was measured by whether they wasted less time, achieved more than usual, were not late for class, were able to meet deadlines, were able to prevent distractions, discontinued wasteful activities, and procrastinated less.[43] Again, we use the procedure in Section 3.3 to aggregate these four categories of questions into four indices: healthy daily activities, time efficiency, time productivity and expected healthy daily activities.

Figure 7 reports the effects of the one week Facebook restriction on these four measures.

healthy diet (Wolfson and Bleich, 2015), increased hypertension (Seow et al., 2015) and a higher exposure to phthalates (Varshavsky et al., 2018), which have been linked to asthma, breast cancer, type 2 diabetes and fertility issues. Diet is correlated with an individual's mental health (O'Neil et al., 2014).

[43]Participants were asked on a scale 1-5 to what extent they agreed with a particular statement, where 1: Strongly Agree, 5: Strongly Disagree. We adjust the coding so a higher value indicates a "healthier" response.



Notes: This figure compares the distribution of the value of Facebook after a one-week Facebook restriction for the participants who attended both Phase 2 and Phase 3.

Figure 8: Distribution of the Value of Facebook after Treatment

Overall, we find suggestive evidence that people behave in a healthier manner. Healthy daily activities increase by 0.86 standard deviations with respect to the baseline p-value=0.057). We find positive, but not statistically significant changes for the other indices. There are no significant effects on the distributions (see Appendix Table A.5.5).

In summary, a one-week Facebook restriction decreased feelings of depression and increased engagement in healthier activities. While we are not able to pinpoint the exact mechanism, these results suggest that Facebook can negatively affect components of daily life that go beyond any existing benefits of social media.

3.3.4 Change in the Value of Facebook

Being off Facebook for one week decreases news awareness and consumption, improves well-being by decreasing feelings of depression and promotes healthier behavior. If participants internalize these changes, we would expect a change in individuals' value of Face-

book. Figure 8 shows the distribution of values for the restricted and unrestricted groups for those who completed the pre and post-surveys (Phases 2 and 3). Experiencing a week-long Facebook restriction increases the value of Facebook by 19.6% from $30.13 to $36.04, however, this effect should be interpreted cautiously given that we are not powered to detect significant results.[44] We find no significant distributional treatment effects (see Appendix Table A.5.5).

There are several potential explanations for this increase in value. First, the reduction in access to news may simply not be compensated by a better mood and healthier activities. Individuals would then need a higher payment to be willing to be off of Facebook for another week. Second, the increase in value is consistent with withdrawal effects of an addictive good.[45] If being on Facebook creates addiction, then the week-long restriction should increase the desire to be back on Facebook. This would also explain the rise in value of Facebook. Third, Facebook further affects other dimensions of daily life that were not captured in our study. For instance, we do not measure the effects of losing access to Facebook's messenger service. These aspects along with their interactions may be utility increasing, which could explain the increase in value for an additional week off of Facebook.[46]

4 Robustness Checks

4.1 Sample Selection

Our approach of recruiting volunteers to log off Facebook may induce selection by over-sampling low-value participants. To address this, we use the distribution of the stated BDM value of Facebook to re-weight the sample using the inverse probability of being eligible

[44]The adjusted p-value is 0.125. Our sample size allows us to detect effects up to 0.182 percentage points at the 5% level with a power of 80%.

[45]A key characteristic of an addictive good is that its consumption exhibits "adjacent complementarity" (Becker and Murphy, 1988, and Gruber and Köszegi, 2001), which means that past consumption increases the marginal utility of present consumption.

[46]Appendix Figure A.5.2 shows that while the level of depression in the treatment group has decreased relative to control group, there is no evidence that suggests that treated participants are internalizing this benefit by lowering their value for Facebook.

to participate in Phase 2 conditional on the stated value. Table 1 presents these results. Columns 1 and 2 show that the results pertaining to news awareness and news consumption remain and are robust to sample selection. The point estimates are robust to re-weighting the sample, although the weighted estimates are less precise, suggesting incremental power issues due to re-weighting. The point estimate of the effect on depression decreases from 0.57 (17% of baseline) to 0.39 (11% of baseline) Likert points and loses statistical significance. The same happens to the effect on daily activities. The point estimate decreases from 0.84 (17% of baseline) to 0.69 (11% of baseline) standard deviations.

This analysis suggests that the results on news consumption and awareness are robust to sample selection and representative of the broader population of college students. Conversely, the results on depression and daily activities speak to the population of college students who report having a BDM value of Facebook up to $30 per week (84.4% of the student population who uses Facebook).

Table 1: Weighting Adjustments

	Full Sample		Men		Women	
	Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted
Facebook Use	-1.73***	-1.88***	-1.27***	-1.34***	-2.09***	-2.22***
News Media Index - Traditional Media	0.07	-0.05	0.47	0.77	-0.17	-0.48
News Media Index - Social Media	-0.66***	-0.61***	-0.81***	-0.68*	-0.53*	-0.55
News Consumption Index	-0.64**	-0.59	-1.01**	-0.59	-0.46	-0.62
Probability Right Answer - Mainstream News	0.01	0.04	-0.09	-0.03	0.03	0.05
Probability Wrong Answer - Mainstream News	0.002	0.005	-0.02	-0.04	0.02	0.02
Probability Not Sure Answer - Mainstream News	-0.01	-0.04	0.10	0.06	-0.05	-0.07
Probability Right Answer - Skewed News	-0.16**	-0.14	-0.32**	-0.33	-0.09	-0.09
Probability Wrong Answer - Skewed News	-0.06	-0.03	-0.27*	-0.22	0.06	0.06
Probability Not Sure Answer - Skewed News	0.22*	0.17	0.59***	0.55**	0.03	0.03
Overall Satisfaction	-0.002	-0.02	0.12	0.21	-0.07	-0.10
Life is Worthwhile	0.05	-0.12	0.51	0.80**	-0.17	-0.42
Feel Happy	0.03	0.16	0.05	0.21	0.06	0.23
Worry	0.37	0.48	0.42	0.28	0.37	0.57
Depressed	-0.57**	-0.39	-0.82**	-0.90**	-0.44	-0.24
Healthy Daily Activities Index	0.84*	0.69	1.47**	1.16*	0.52	0.67
Productive Time Index	0.25	0.04	0.40	0.10	0.19	0.12
Efficient Time Index	0.33	-0.13	0.41	0.12	0.31	-0.18
Expected Healthy Daily Activities Consumption Index	0.16	0.22	0.28	0.12	0.14	0.32
Value of Facebook	0.20*	0.19	-0.16	0.10	0.33*	0.19

* $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$

This table compares the main results with the weight-adjusted estimates. We use the inverse probability of being eligible as weights. All the p-values are adjusted for multiple comparisons.

4.2 Gender differences

There is evidence to suggest that men and women use Facebook for different purposes and with different frequencies. According to the Pew Research Center (2018) report, more women (74%) use Facebook than men (62%). Women are more likely to use it daily (69%) than men (54%) (Statista, 2018), and they post more comments and pictures and send more messages (Muscanell and Guadagno, 2012). This is also evident in our sample.[47] These differences in Facebook usage may imply heterogeneous responses to the Facebook restriction.

Splitting our sample by gender, Table 1 shows that for men one week off Facebook decreases feelings of depression by 0.82 Likert points, which increases to 0.90 after re-weighting. Both are statistically significant at the 5% level. There are no significant effects for women. While the point estimate of the effect on healthy daily activities decreases from 0.84 to 0.69 standard deviations in the full sample, losing statistical significance, the effect remains large and significant at the 10% level for men. Both the weighted and unweighted results show that the group, in this case men, that is less depressed also engages in healthier activities, confirming the influence of Facebook on other aspects of daily life. This is also consistent with findings that men are more likely to feel depressed due to negative social comparisons (Steers et al., 2014).

Our finding on the reduction in awareness of skewed news is supported by the behavior of men. They are significantly less likely to be certain about the veracity of skewed news both in the weighted and unweighted samples, and women are unaffected. Women reduce their consumption of news via social media, as do men, but are otherwise not significantly affected by the Facebook restriction.

There is an increase in the value of Facebook after the restriction. This is driven by women. They significantly increase their value by 33%, which decreases to 19% after re-weighting.

[47] In our sample, about 43% of women post comments on Facebook at least once a week, compared to 21% of men. Also, 23% of women post pictures at least once a week compared to 8% of men.

5 Conclusions

Social media and Facebook have become entities of global proportions. However, we know little about their economic value to users, the effects on daily activities, consumption behavior and news awareness. Using a randomized, and validated, Facebook restriction in a large field experiment, we provide an estimate of an individual's value of Facebook. One week on Facebook is worth about $67 for our participants – a relatively large value considering that it represents 30% of average weekly income. We also examine the direct effect of being logged off Facebook for one week on five outcomes: social media usage, news awareness, news consumption, subjective well-being, activities and the value of Facebook.

While individuals facing a Facebook restriction did refrain from using Facebook, they did not increase their usage of other social media. This is consistent with studies that find low usage across social media platforms and suggests that there is a significant switching cost between platforms.

In addition to not using other social media, participants did not look for news from other sources, even when the substitution cost for accessing news from other sources is low (i.e. turning on the television or radio or typing the web address of a news site instead of Facebook). Overall, awareness of mainstream news was not affected, but being off of Facebook resulted in more uncertainty about whether news from politically-skewed sources was fake or not. Those who experienced a week without Facebook were 22.1 percentage points more likely to be uncertain about a skewed news headline, and men's news awareness was most affected. These results imply that Facebook is an important source of news and may especially be a source of skewed news for men.

Our study has further implications. News aggregators that remove biases from news sources would better inform and educate the general public and could weaken the influence of skewed news. Facebook features (i.e. Instant Article, Trending News, etc.) suggest the company desired to serve as a news aggregation platform. However, recently Facebook

eliminated these features out of concerns of propagating fake or skewed news, which goes in line with our finding on news consumption and awareness. While a news aggregator has the potential to provide an unbiased perspective of news and events (Mullainathan and Shleifer, 2005), our findings suggest that Facebook, as currently constructed, may not be well suited for this purpose.

Our results suggest that using Facebook induces feelings of depression, which plausibly decreases an individual's well-being. This effect is particularly pronounced for men, for active Facebook users and for those who experience negative emotions while on Facebook. Contrary to other studies (Tromholt, 2016; Valenzuela et al., 2009; Deters and Mehl, 2013), we find no effect with respect to reported overall life satisfaction. The reduction in depression we find from being off of Facebook might be explained by two mechanisms. First, being off Facebook could encourage individuals to engage in more positive, healthy activities, such as exercising and eating out less often, which could explain the improvement in mood. Second, Facebook itself might be a channel for decreasing subjective well-being, and changes in activities and consumption patterns could be a result of feeling better. Untangling the direction of causality would be an important area for future research.

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A Appendix - Not intended for publication

A.1 Phase 1 Recruitment Email:

Howdy "Student's Name",

Did you know that the average person spends about 50 minutes a day on Facebook? Over an individual's lifetime, this will amount to 5 or more years.

To date, the impact of this usage is unclear. Texas A&M's Department of Economics is seeking current TAMU students who are Facebook users to participate in a research study. You are receiving this email because you are on A&M's email list. Our team is examining the effects of Facebook on everyday life, and we are looking for students to help us out.

If you have an active Facebook account, you may be eligible to participate in this paid research study. In an unusual turn of events, we are asking **you** to tell us how much money you would need to be paid to stay off Facebook for a week. Please note that if selected for this study, staying off Facebook for one week will be a part of the protocol.

Participation in this study involves:

- Cash payouts based on an auction
- Coming to the Evans Library on main campus to complete two surveys
- The potential to be without Facebook for a week

If you are interested in participating in this study, please click the link below for more information.
Take the survey

If you have any questions or would like more information about this study, please contact the research team by email at rpetrie@tamu.edu.

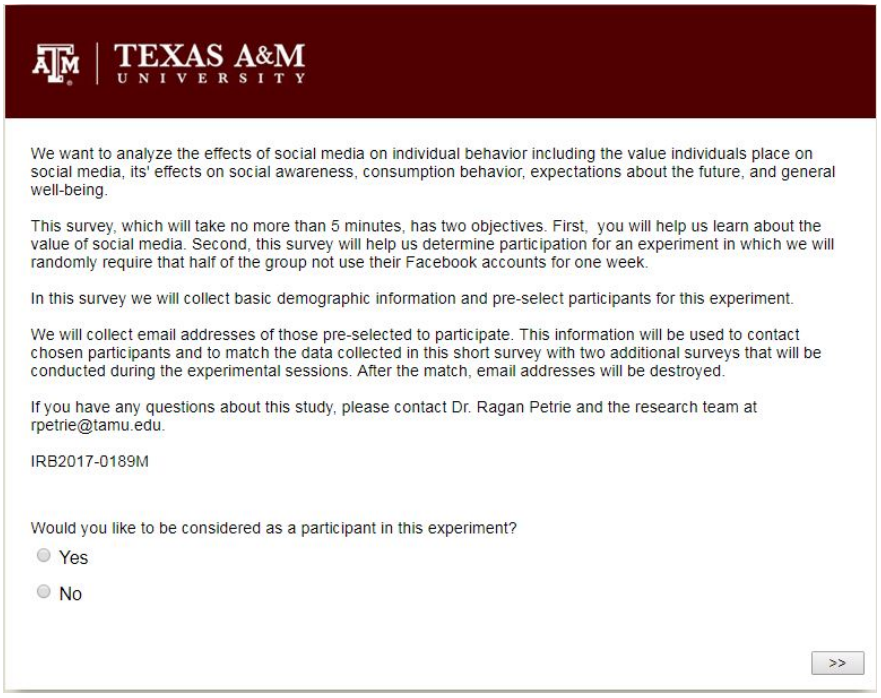
Thank you,

Prof. Ragan Petrie
TAMU Department of Economics
3035 Allen Building, College Station, TX 77845

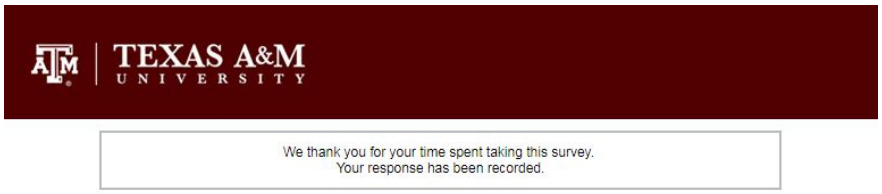
Study Title: The Behavioral Effects of Social Media
IRB2017-0189M

Follow the link to opt out of future emails:
Click here to unsubscribe

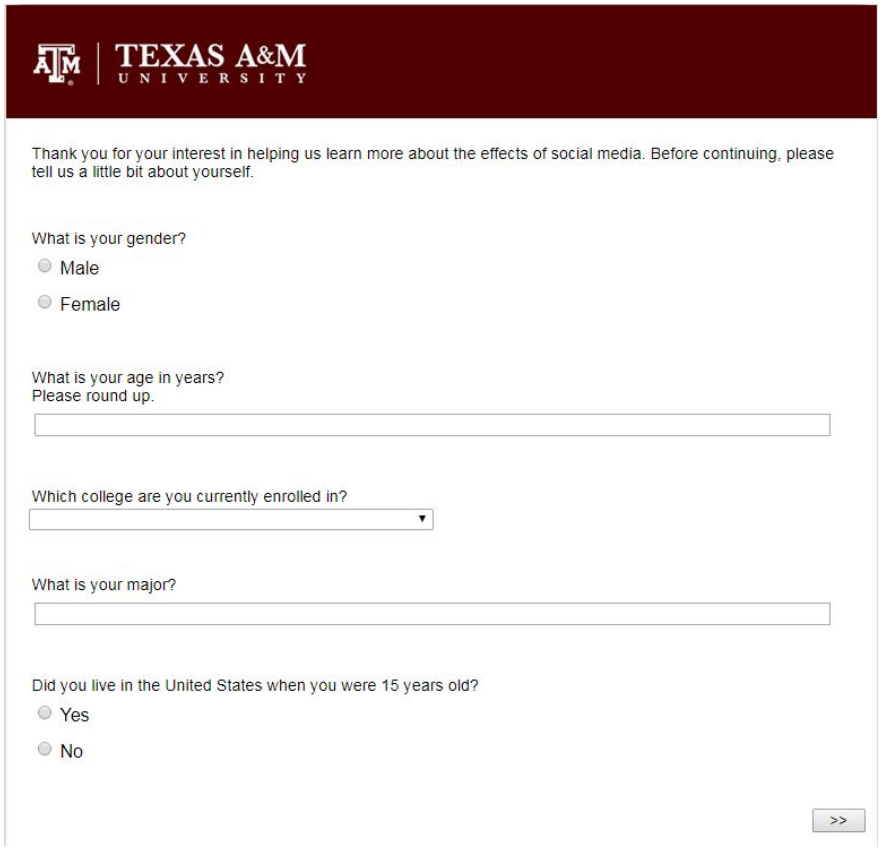
A.2 Phase 1 Survey:



If no, the next screen shows



If yes, the next screen shows


TEXAS A&M UNIVERSITY
Thank you for your interest in helping us learn more about the effects of social media. Before continuing, please tell us a little bit about yourself.
What is your gender?
Male
Female
What is your age in years?
Please round up.
Which college are you currently enrolled in?
What is your major?
Did you live in the United States when you were 15 years old?
Yes
No
>>


TEXAS A&M UNIVERSITY
What was the zip code of your address when you were 15 years old?
>>


TEXAS A&M UNIVERSITY
What country did you live in when you were 15 years old?
>>

TEXAS A&M UNIVERSITY

Do you have an active Facebook account?

- Yes
- No

>>

TEXAS A&M UNIVERSITY

Let's play a game!

Please think carefully about your value of the time you spend on Facebook over a week. You will be asked to enter this value later.

Afterwards, we will present a counter-offer! This counter-offer will be randomly drawn from an interval of $5 to a maximum that is our most reasonable estimate of Facebook's value over a week.

If our counter-offer is greater than or equal to your valuation YOU WILL BE CONSIDERED TO PARTICIPATE IN THE EXPERIMENT. We will randomly select the final participants from this group. FINAL PARTICIPANTS will be paid the value of our random counter-offer.

If our counter-offer is lower than your valuation we will not be able to compensate you fairly. YOU WILL NOT BE CONSIDERED TO PARTICIPATE IN THE EXPERIMENT.

The next screen provides examples.

>>

TEXAS A&M UNIVERSITY

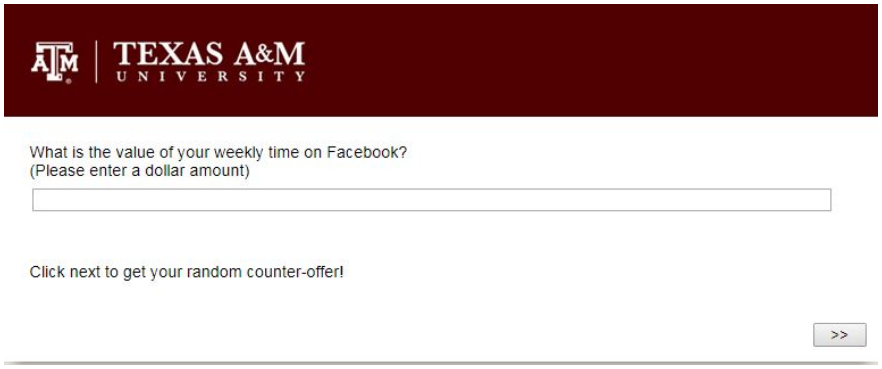
Please read the following examples of this game:

1) Mary values her weekly time on Facebook at $20. She enters this value in the following screen and clicks next. Then she receives our random counter-offer of $15. Since our counter-offer is lower than her valuation, she will not be considered to participate.

2) John values his weekly time on Facebook at $8. He enters this value in the following screen and clicks next. Then he receives our random counter-offer of $10. Since our counter-offer is higher than his valuation, he will be considered as a potential participant. If John is selected to participate he will be paid $10, the value of our counter-offer, at the end of the experiment.

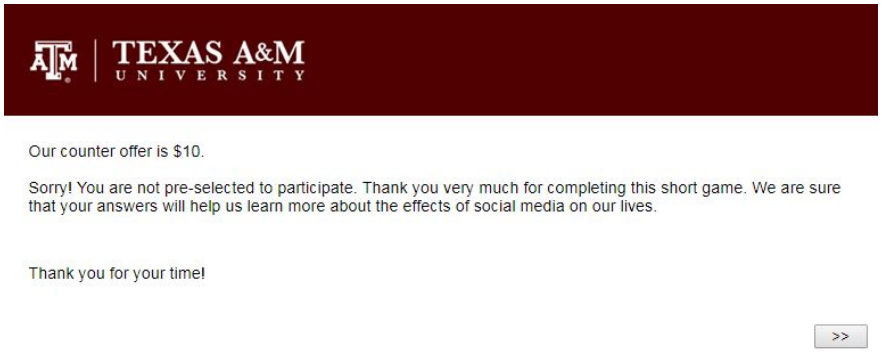
Click next to continue.

>>



†The screen above represents the WTP setting. Half of the subjects received this wording while the other half were asked "How much money would you need to be given to stop using Facebook for a week?", which reflects the WTA setting.

For the case where the counter offer is less than the valuation:



A.3 News Quiz

News Quiz in phase 2 (before treatment)

A1	Read the following list of events. Did these events happen in the previous week?			
		Definitely happened	I do not know	Definitely did not happened
A11	Serena Williams, the best women's tennis player, is expecting her first child and will not play again until next year.	❑	❑	❑
A12	Thousands of people gathered in the rain Saturday on the soggy grounds of the Washington Monument to turn Earth Day into an homage to science.	❑	❑	❑
A13	Facebook killer, Steve Stephens, was arrested in Ohio.	❑	❑	❑
A14	Vice President Mike Pence visited the demilitarized zone as the U.S. kept its options open on North Korea.	❑	❑	❑
A15	Stanford University, said that it would permit the conservative author Ann Coulter to speak on campus in early May, just one day after it canceled her appearance.	❑	❑	❑
A16	MSNBC analyst calls for ISIS to bomb Trump property.	❑	❑	❑
A17	General Motors has become the latest multinational company to pull out of Venezuela after it says government authorities illegally seized its plant there.	❑	❑	❑

News Quiz in phase 3 (after treatment)

A1	Read the following list of events. Did these events happen in the previous week?			
		Definitely happened	I do not know	Definitely did not happened
A11	Bulls bow out of playoffs with blowout loss to Celtics in Game 6.	❑	❑	❑
A12	Federal agencies take actions to implement President Trump's order to strip fund from municipal governments that refuse to cooperate fully with immigration agents.	❑	❑	❑
A13	Obama begins new phase of public life with Chicago visit.	❑	❑	❑
A14	Tens of thousands of people protested the president's rollback of rules protecting the environment.	❑	❑	❑
A15	President Trump has instructed his advisers to keep the corporate tax rate close to 30 percent.	❑	❑	❑
A16	In France's most consequential election in recent history, voters on Sunday chose Emmanuel Macron and Marine Le Pen to go to a runoff to determine the next president.	❑	❑	❑
A17	Trump wants to send astronauts to Mars during his presidency.	❑	❑	❑

A.4 Survey Questionnaire

Date: May 1, 2017 Time: ☐☐ : ☐☐ PM

UIN	Please enter your TAMU UIN:	☐☐☐☐☐☐☐☐☐	Please enter your TAMU Email:

N1 How much time did you spend reading or watching the news per day last week?

- ❑ Less than 15 min
- ❑ More than 15 minutes but less than 30 minutes
- ❑ More than 30 minutes but less than 1 hours
- ❑ More than 1 hour but less than 2 hours
- ❑ More than 2 hours

N2 Please indicate how frequently you used the following types of news media last week. Please answer on a scale of 1 to 7, where 7 is a type of media that you used frequently, and 1 is a type of media you used infrequently.

		◄ Not at all						All of the time ►
		1	2	3	4	5	6	7
N21	Cable TV	❑	❑	❑	❑	❑	❑	❑
N22	Paper news	❑	❑	❑	❑	❑	❑	❑
N23	Radio	❑	❑	❑	❑	❑	❑	❑
N24	Online news	❑	❑	❑	❑	❑	❑	❑
N25	Social media	❑	❑	❑	❑	❑	❑	❑
N26	News feed	❑	❑	❑	❑	❑	❑	❑
N27	Other 1: _____	❑	❑	❑	❑	❑	❑	❑
N28	Other 2: _____	❑	❑	❑	❑	❑	❑	❑

N3 Please indicate how frequently you used the following methods to obtain news last week. Please answer on a scale of 1 to 7, where 7 is a method you used frequently, and 1 is a method you used infrequently.

		◄ Not at all						All of the time ►
		1	2	3	4	5	6	7
N31	Watch	❑	❑	❑	❑	❑	❑	❑
N32	Read	❑	❑	❑	❑	❑	❑	❑
N33	Listen	❑	❑	❑	❑	❑	❑	❑

N4 List the top 3 news outlets/sources you got your news from last week.

1st Choice: _____ 2nd Choice: _____ 3rd Choice: _____

N5 What type of news did you frequently read, watch or listen to last week? Please answer on a scale of 1 to 7, where 7 is a type you used frequently, and 1 is a type you used infrequently.

		◄ Not at all						All of the time ►
		1	2	3	4	5	6	7
N51	Political	❑	❑	❑	❑	❑	❑	❑
N52	Sports	❑	❑	❑	❑	❑	❑	❑
N53	Business	❑	❑	❑	❑	❑	❑	❑
N54	International	❑	❑	❑	❑	❑	❑	❑
N55	Local news	❑	❑	❑	❑	❑	❑	❑
N56	Culture	❑	❑	❑	❑	❑	❑	❑
N57	Science	❑	❑	❑	❑	❑	❑	❑
N58	Weather	❑	❑	❑	❑	❑	❑	❑

N6 For the following sources, indicate how frequently you used each last week. Please answer on a scale of 1 to 7 where 7 is a source you used frequently, and 1 is a source you used infrequently.

		◄ Not at all						All of the time ►
		1	2	3	4	5	6	7
N61	Battalion	❑	❑	❑	❑	❑	❑	❑
N62	KBTX	❑	❑	❑	❑	❑	❑	❑
N63	MSC website	❑	❑	❑	❑	❑	❑	❑
N64	Local radio	❑	❑	❑	❑	❑	❑	❑
N65	Local newspaper	❑	❑	❑	❑	❑	❑	❑
N66	National newspaper	❑	❑	❑	❑	❑	❑	❑
N67	Online news	❑	❑	❑	❑	❑	❑	❑
N68	Online social network	❑	❑	❑	❑	❑	❑	❑
N69	Friends	❑	❑	❑	❑	❑	❑	❑

M1	Last week, how much time did you spend <u>each day</u> doing the following activities?				
M11	Sitting in a library on campus	_____ Hours	M17	Attending class	_____ Hours
M12	Studying	_____ Hours	M18	Sleeping (average number of hours per night)	_____ Hours
M13	Working for pay	_____ Hours	M19	Attending a party or social event (fill in for time you spent in total last week)	_____ Hours
M14	Exercising	_____ Hours	M110	At what time do you typically go to bed?	☐☐ : ☐☐ ❑ AM / ❑ PM
M15	Hanging out with friends	_____ Hours	M111	At what time do you typically wake up?	☐☐ : ☐☐ ❑ AM / ❑ PM
M16	Reading news	_____ Hours			
M2	Last week, how much time did you spend <u>each day</u> on the following types of social media?				
M21	Facebook	_____ Hours	M27	Vimeo	_____ Hours
M22	Instagram	_____ Hours	M28	YouTube	_____ Hours
M23	Twitter	_____ Hours	M29	Other 1: _____	_____ Hours
M24	Tumblr	_____ Hours	M210	Other2 : _____	_____ Hours
M25	Snapchat	_____ Hours			
M3	How many friends do you have on Facebook? (Feel free to open your FB account to check)				
M4	How many followers do you have on Instagram?				
M5	How many followers do you have on Tumblr?				
M6	How many followers do you have on Twitter?				

F1	How often do you do the following on Facebook?						
		Never	Rarely	1-2 times per month	Once a week	2-4 times per week	Once a day	Several times per day
F11	Open up FB to check your news feed	❑	❑	❑	❑	❑	❑	❑
F12	Read news feed content	❑	❑	❑	❑	❑	❑	❑
F13	Post pictures	❑	❑	❑	❑	❑	❑	❑
F14	Post comments	❑	❑	❑	❑	❑	❑	❑

F4	When you are on Facebook, how often do you feel the following?						
		Never	Rarely	Sometimes	Frequently	Often	All the time
F41	Envy/jealousy	❑	❑	❑	❑	❑	❑
F42	Happiness	❑	❑	❑	❑	❑	❑
F43	Misery	❑	❑	❑	❑	❑	❑
F44	Satisfaction	❑	❑	❑	❑	❑	❑
F45	Connected with friends	❑	❑	❑	❑	❑	❑
F46	Up to date on my friends' activities	❑	❑	❑	❑	❑	❑
F47	Lonely	❑	❑	❑	❑	❑	❑
F48	Annoyed	❑	❑	❑	❑	❑	❑
F49	Inspired	❑	❑	❑	❑	❑	❑

Please think about what you did <u>last week</u> as you answer the following questions.

C1	(1-Strongly agree, 2-Agree, 3-Neither agree nor disagree, 4-Disagree, 5-Strongly disagree)					
		1	2	3	4	5
C11	I ate out less than I normally do	❑	❑	❑	❑	❑
C12	I did less impulse buying than usual	❑	❑	❑	❑	❑
C13	I saved more money than I usually do	❑	❑	❑	❑	❑
C14	I ate healthier than usual	❑	❑	❑	❑	❑
C15	I exercised more than usual	❑	❑	❑	❑	❑
C2	(1-Strongly agree, 2-Agree, 3-Neither agree nor disagree, 4-Disagree, 5-Strongly disagree)					
		1	2	3	4	5
C21	I wasted less time than I normally do	❑	❑	❑	❑	❑
C22	I achieved more than I normally do	❑	❑	❑	❑	❑
C23	I spent more time studying and doing school related work	❑	❑	❑	❑	❑
C24	I was not late for classes, meetings or work	❑	❑	❑	❑	❑
C25	I was able to meet deadlines without rushing at the last minute.	❑	❑	❑	❑	❑
C26	I was able to prevent distractions from achieving high priority tasks.	❑	❑	❑	❑	❑
C27	I discontinued any wasteful or unprofitable activities or routines.	❑	❑	❑	❑	❑
C28	I had time to relax and be with friends	❑	❑	❑	❑	❑
C29	I procrastinated less than I normally do	❑	❑	❑	❑	❑
C210	I partied a lot	❑	❑	❑	❑	❑

Please think about what you are going to do <u>this coming week</u> as you answer the following questions.

C3	(1-Strongly agree, 2-Agree, 3-Neither agree nor disagree, 4-Disagree, 5-Strongly disagree)					
		1	2	3	4	5
C33	I expect to spend less on eating out and hanging out with friends	❑	❑	❑	❑	❑
C34	I expect to save more money	❑	❑	❑	❑	❑
C35	I will cut down on my impulse buying	❑	❑	❑	❑	❑
C36	I will spend more time studying	❑	❑	❑	❑	❑
C37	I will eat more healthy food	❑	❑	❑	❑	❑
C38	I will exercise more than I normally do	❑	❑	❑	❑	❑

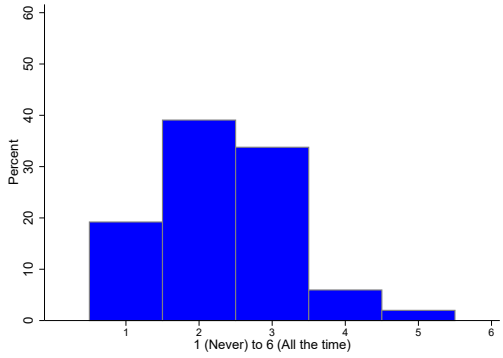
S1	**Overall, how satisfied are you with life as a whole?**										
	◄ Not at all satisfied										**Completely satisfied ►**
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
S2	**Overall, to what extent do you feel the things you do in your life are worthwhile?**										
	◄ Not at all worthwhile										**Very worthwhile ►**
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
S3	**How happy are you?**										
	◄Very unhappy										**Very happy ►**
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
S4	**How often do you worry?**										
	◄ Never										**All of the time ►**
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
S5	**How often do you feel depressed?**										
	◄ Never										**All of the time ►**
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑

D1	**What is your race?**		
	❑ **White** ❑ **Black/ African American** ❑ **American Indian/ Alaskan Native**	❑ **Asian** ❑ **Native Hawaiian/ Other Pacific Islander** ❑ **Other: _____**	
D2	**What is your ethnicity?**	❑ **Hispanic/ Latino**	❑ **Not Hispanic/ Latino**

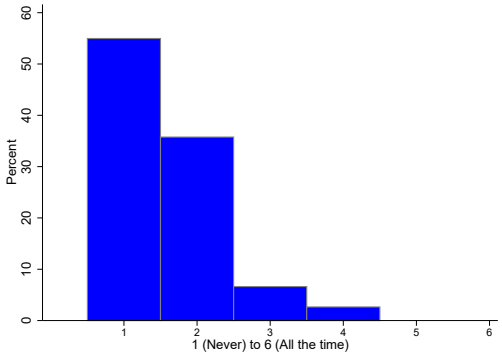
O1	**Is there anything else you would like to tell the research team?**

A.5 Additional Results

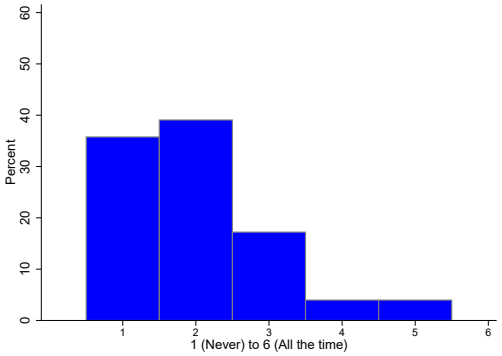
Figure A.5.1: Facebook Negative Emotions



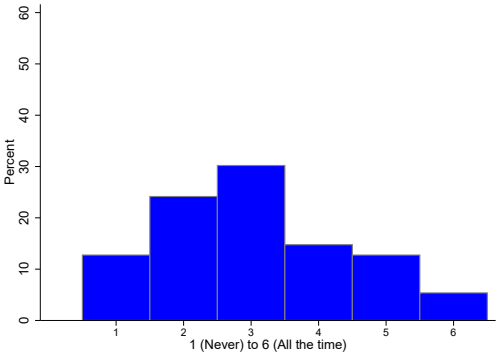
(a) Envy/Jealousy



(b) Misery



(c) Lonely



(d) Annoyed

Figure A.5.2: Change in Reported Depression and Change in the Value of Facebook between Phase 2 survey and Phase 3 survey

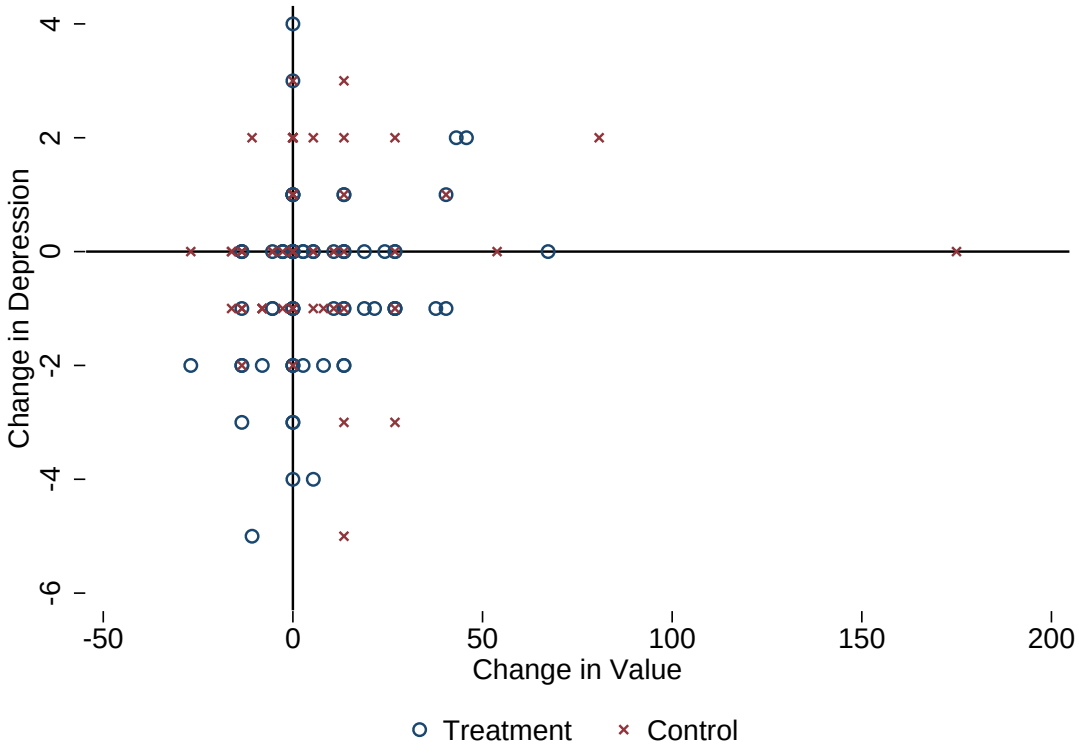


Table A.5.1: Descriptive Statistics by Survey Phases

	Ineligible	Eligible	P-value	Eligible (Show)	Eligible (No-Show)	P-value
Value of Facebook	85.35	27.11	0.000	28.97	26.33	0.025
	(119.88)	(12.72)		(12.98)	(12.55)	
Offer	15.04	10.16	0.000	16.90	14.26	0.000
	(5.19)	(4.46)		(5.14)	(5.01)	
Woman	0.60	0.59	0.720	0.65	0.57	0.089
	(0.49)	(0.49)		(0.48)	(0.50)	
Age	20.77	20.55	0.009	20.59	20.53	0.693
	(1.65)	(1.68)		(1.99)	(1.53)	
Income ($)	67,204	71,761	0.109	69,509	72,286	0.512
	(55,192)	(68,778)		(63,207)	(71,032)	
N	1,207	562		167	395	

This table presents the means for eligible and ineligible participants from the Phase 1 survey and for the eligible participants that showed up to complete the Phase 2 survey and those that were eligible but did not show up for phase 2. The p-values represents the difference of means for each group. Standard deviations are in parentheses.

Table A.5.2: Facebook Restriction - Balance of Covariates

	Treatment	Control	P-value
Value of Facebook	28.42	29.43	0.618
	(11.27)	(14.33)	
Woman	0.57	0.711	0.060
	(0.50)	(0.46)	
Age	20.69	20.51	0.569
	(2.41)	(1.56)	
Income($)	67,900	75,986	0.482
	(55,988)	(68,904)	
N	77	90	

The first two columns present the means of different observables characteristics for the Facebook restriction treatment group and the no restriction control group. Columns 3 presents the p-values of the difference of means between these groups. Standard deviations are in parentheses.

Table A.5.3: Phase 2 Survey - Summary Statistics

	Mean	Median	Std. Dev.
Daily Time Reading or Watching News (1-5)[1]	2.15	2	1.19
Frequency of Use (1-7)[2]			
Cable TV	1.93	1	1.49
Paper News	1.31	1	0.67
Radio	2.46	2	1.66
Online News	4.55	5	1.73
Social Media	5.60	6	1.56
News Feed	4.14	4	1.99
Political Nature of Preferred News (1-5)[3]	2.81	3	0.97
Daily Social Media Usage (hours)[4]			
Facebook	1.87	1	2.21
Instagram	1.28	1	1.60
Twitter	0.86	0	2.06
Tumblr	0.35	0	1.57
Snapchat	1.95	1	3.02
Vimeo	0.03	0	0.16
YouTube	1.85	1	2.65
Social Media Friends and Followers (number)[5]			
Facebook	640.99	538	442.04
Instagram	452.36	350	511.77
Tumblr	87.32	0	571.74
Twitter	182.12	0	333.80
Subjective Well-Being (0-10)[6]			
Satisfied with life	7.15	8	1.92
Things in life are worthwhile	7.37	8	1.88
How happy are you	7.17	8	2.12
How often do you worry	6.79	7	2.33
How often do you feel depressed	3.40	3	2.63

Notes: [1]Responses to the question "How much time did you spend reading or watching the news per day last week?" Response options: 1) Less than 15 min, 2) More than 15 minutes but less than 30 minutes, 3) More than 30 minutes but less than 1 hour, 4) More than 1 hour but less than 2 hours, and 5) More than 2 hours. N=167 obs. [2]Responses to the question "Please indicate how frequently you used the following types of news media last week." Scale was from 1 to 7 where 1 indicates "Not at all" and 7 indicates "All of the time." N=167 obs. [3]List top news outlets/sources from the previous week. We categorized each 1st choice as either being 1) Left, 2) Left-Center, 3) Center, 4) Right-Center, or 5) Right based on www.allsides.com. N=57 obs. [4]Time spent each say on various social media platforms. [5]How many friends and followers on various social media platforms. [6]Subjective well-being questions, with 0 indicating "never and" 10 "very/always."

Table A.5.4: Correlations between the Value of Facebook and User's Characteristics

	Value of Facebook	High Time	High Engage	Depressed	High Negative	High Friends in Facebook	High Friends in other Social Media
Value of Facebook	1.00						
High Time	0.23***	1.00					
High Engage	0.20**	0.32***	1.00				
Depressed	-0.11	0.23***	0.05	1.00			
High Negative	-0.06	0.17**	0.09	0.32***	1.00		
High Friends on Facebook	0.06	0.10	0.21***	-0.02	0.01	1.00	
High Friends on other Social Media	0.17**	0.18**	0.38***	-0.10	0.01	0.42***	1.00

* $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$

This table presents the Pearson correlation coefficients between the stated value of Facebook and characteristics of its users based on Phase 2 survey responses. High Time refers to individuals who on average use Facebook for more than one hour per day; High Engage refers to individuals who post pictures and comments on Facebook at least once or twice per month; Depressed refers to individuals who reported feeling depressed above the reported median value; High Negative refers to individuals who are above the median of the factor index that combines measures of feeling envy, misery, lonely and annoyed while on Facebook; High Friends in Facebook refers to individuals who have more than 564 friends in Facebook (median number of friends); and High Friends in other Social Media refers to individuals who have more than 529 friends in Facebook (median number of friends in other social media).

Table A.5.5: Distribution Shift Tests

	Equality	FSD C-T	SSD C-T	FSD T-C	SSD T-C
Facebook Use	0.00***	0.00***	0.00***	0.93	1.00
News Media Index -Traditional Media	0.41	0.22	0.10*	0.60	0.57
News Media Index -Social Media	0.00***	0.00***	0.00***	0.94	1.00
News Consumption Index	0.07*	0.04**	0.00***	0.95	0.75
Probability Right Answer - Mainstream News	0.37	0.77	0.80	0.18	0.23
Probability Wrong Answer - Mainstream News	0.61	0.70	0.55	0.33	0.34
Probability Not Sure Answer - Mainstream News	0.55	0.29	0.21	0.58	0.51
Probability Right Answer - Skewed News	0.01***	0.01***	0.01***	0.54	0.99
Probability Wrong Answer - Skewed News	0.46	0.50	0.75	0.23	0.23
Probability Not Sure Answer - Skewed News	0.37	0.51	0.81	0.19	0.19
Overall Satisfaction	0.25	0.11	0.20	0.58	0.76
Life is Worthwhile	0.28	0.14	0.09*	0.62	0.79
Feel Happy	0.17	0.09*	0.11	0.93	0.82
Worry	0.21	0.90	0.79	0.10*	0.11
Feel Depressed	0.32	0.16	0.22	0.91	0.98
Consumption Index	0.03**	0.97	0.89	0.01**	0.00***
Productive Time Index	0.10	0.97	0.90	0.05*	0.02**
Efficient Time Index	0.10*	0.98	0.90	0.05*	0.01***
Expected Consumption Index	0.07*	0.79	0.63	0.03**	0.01***
Value of Facebook	0.47	0.70	0.99	0.25	0.14

* $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$

This table presents the bootstrap p-values of Kolmogorov-Smirnov statistics that test for equality of distributions, first order stochastic dominance and second order stochastic dominance between treatment and control after a one week Facebook restriction. In column 1 the null hypothesis is that the distributions are the same, in column 2 the null hypothesis is that the treatment group first order stochastic dominates the control group, in column 3 the null hypothesis is that the treatment group second order stochastic dominates the control group, in column 4 the null hypothesis is that the control group first order stochastic dominates the treatment group, and in column 5 the null hypothesis is that the control group first order stochastic dominates the treatment group. First order stochastic dominance and second order stochastic dominance are defined as in Abadie (2002).

Table A.5.6: Adjustments for Multiple Comparisons

	Unadjusted P-value	FDR Adjusted P-value
Facebook Use	0.000***	0.000***
News Media Index - Traditional Media	0.785	1.000
News Media Index - Social Media	0.000***	0.000***
News Consumption Index	0.004***	0.027**
Probability Right Answer - Mainstream News	0.826	1.000
Probability Wrong Answer - Mainstream News	0.926	1.000
Probability Not Sure Answer - Mainstream News	0.885	1.000
Probability Right Answer - Skewed News	0.006***	0.030**
Probability Wrong Answer - Skewed News	0.458	0.723
Probability Not Sure Answer - Skewed News	0.022**	0.052*
Overall Satisfaction	0.993	1.000
Life is Worthwhile	0.845	1.000
Feel Happy	0.893	1.000
Worry	0.139	0.228
Depressed	0.014**	0.048**
Consumption Index	0.020**	0.057*
Productive Time Index	0.302	0.499
Efficient Time Index	0.346	0.530
Expected Consumption Index	0.504	0.743
Value of Facebook	0.068*	0.125

* $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$

This table shows how the significance of the main results changes when we control for multiple comparisons. The table present the unadjusted p-values of our main estimates (Column 1) and their corresponding values adjusted for multiple comparisons (Column 2). We apply a false discovery rate control as described in Anderson (2008).