Beyond the News Feed: Heterogeneous Impacts of Social Media on Protest Participation in the 2011 Egyptian Revolution

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Abstract

Evidence suggests political behavior continues to evolve as innovative technology finds its way into the political arena. While many media and qualitative research sources have asserted a strong role for social media platforms in enabling the Egyptian uprisings of 2011, skeptics have pointed out a relative scarcity of quantitative evidence to support that hypothesis. We revisit survey data from protesters in and around Tahrir Square in January 2011, building on the methodology of Tufekci & Wilson (2012). Using matching techniques, we find that while mostly traditional media sources influenced participation in protests prior to January 2011, new social media played a significant role in the decisions of protesters to participate in the first day of protests, even after controlling for additional variables like membership in civil society organizations and participation in previous protests. We address concerns about sampling methodology by applying similar analysis to a nationally representative survey conducted in 2011, and find evidence that social media had little effect on participation in the first day of protests on a national level, but played a significant role in influencing protest intensity over time, suggesting a time lag from Cairo to other regions or heterogeneous impact across the population.

1 Context

With the rapid growth of internet access, cell phone use and social media platforms for political mobilization, many scholars have sought to understand the relationship

between these new forms of media and political behavior. While protest movements in other countries have also used social media to a significant extent, few cases have attracted as much media and scholarly attention as the uprisings in Tunisia and Egypt in early 2011. While it is clear that social media was used by some protesters and influenced coverage of the protests, there is no definitive consensus on the depth or extent of the impact of new media on protest participation or other outcomes of interest. (Brym et al., 2014)

Other scholars have offered extensive analysis of the long-term effects of digital media, broadly defined, on democratization in the Middle East through cross-national comparisons (Howard and Hussain, 2011, Howard and Hussain, 2013), analysis within specific countries (Khamis and Vaughn, 2011), and qualitative analysis of interviews with protest leaders (Wilson and Dunn, 2011). In addition, there have been many efforts to assess the structural and contextual factors that affected the timing and effect of the protests, in addition to questions of media use (Goldstone, 2011, Norris, 2012).

We focus our attention on the specific claim that access to social media increased participation in protest movements in Egypt in 2011, with implications for the broader questions raised above. This claim is contested (Joseph, 2011), and characterized by a debate between camps of "cyber-enthusiasts" and "cyber-skeptics" (Wolfsfeld et al., 2013), or "digital-evangelists" and "techno-realists" (Comunello and Anzera, 2012). Terminology aside, the supporters of this claim argue that social media platforms provide new opportunities for empowerment and mobilization, especially in non-democratic societies or among marginalized groups (Shirky 2008, 2011, Gladwell and Shirky, 2011, Brym et al., 2014). Skeptics have suggested a list of alternative explanations which include structural and political factors far outweighing any impact of media forms, the growth of satellite television and programs such as Al-Jazeera, internet activism displacing participation in physical protest, or social media actually serving as surveillance technologies for repressive regimes. (He and Warren 2011, Morozov 2011).

We follow the line of empirical analysis established by previous scholars, most notably Tufekci and Wilson (2012) and Berman and Nugent (2014). Tufekci and Wilson analyze a survey of protesters in and around Tahrir Square conducted in February of 2011, and report logistic regression models in which several media sources – including print, blogs, Facebook and Twitter – are associated with increased odds of participation in protests. Berman and Nugent assess this evidence in light of another dataset, the Arab Democracy Barometer II survey, which is a nationally representative survey conducted in June of 2011. They note the substantial demographic differences between the protest sample and the national sample, and offer an alternative model for social

media's impact on protest behavior, in which online networks operate in parallel fashion to traditional networks like professional, civic or religious organizations. Using a finite mixture model, Berman and Nugent provide evidence that when evaluated as a stand-alone network, social media platforms are only responsible for mobilizing a subset of the population.

In the following sections, we build upon this literature by extending the logistic regression model of protesters in Tahrir Square to address questions about the impact of participation of civil society groups, the size of the effect of social media use, and whether participants in the January 25th protests differed substantially from participants in previous protests. Then, we assess the degree to which these findings can be replicated in the nationally representative Arab Democracy Barometer II survey.

2 Tahrir Data Set

We begin by examining the data used by Tufekci & Wilson (2012) to assess social media's impact on protest participation. This data comes from a survey of Egyptian protesters living in Cairo who participated in the Tahrir Square protests. It was conducted from February 24th, 2011 to February 27th, 2011, about one month after the beginning of the uprising. Due to the strained political environment, survey researchers used "a snowball sampling approach in which participants were recruited through referrals," rather than approached by researchers on the street (Tufekci & Wilson, 2012).

The survey yielded 1,050 valid responses, however it was determined that assessing the representativeness of the sample is infeasible due to "the conditions and the lack of reliable information about the population of Cairo" (Tufekci & Wilson, 2012). But survey researchers did determine that the sample approximately matches the demographics of the people who partook in the protests. We will proceed under these assumptions, however we consider methods to address this potentially unrepresentative sample in a following section.

The questionnaire gathers an extensive amount of information about each individual, however the variables of most importance for our analysis are date of first participation, previous protest participation, membership in a civil society group, gender, age, education measured on a scale from 1 (no formal education) to 7 (postgraduate), Internet access at home or on the phone, and the usage of various types of media such as satellite television, print, Facebook, Twitter, blogs, email, text messages etc. (Tufekci & Wilson, 2012).[1]

[1]It is important to note that we obtained the data from a publicly available source and there are notice-

While previous analysis of this data has covered a broad range of outcomes, including the specific sources where participants heard about protests or the media used to document the experience, we focus our analysis only on the effects of media on protest participation. Protest participation is divided into participation on the first day of the protests, defined as participating on January 25th, 2011, and previous protest participation, defined as taking part in any protests prior to that date. Previous authors used logistic regression models to estimate the effects of certain media controlling for age, gender, education, and Internet access.

They find that gender, blogs, print, satellite television, and Twitter are significant predictors of whether or not a protester participated on the first day of the protests. In our replication of their analysis we find that gender is not a significant predictor, while both Facebook and Twitter are significant at the .05 level. The main finding is that regardless of which results are used, a new form of social media, i.e. Facebook or Twitter, is a significant and positive predictor of participation during the first day of protests among eventual protesters. The second analysis of protest participation considers the effect of media on participating in a previous protest. They find that age, blogs, Facebook, print, and Twitter are significant predictors of previous protest participation. Our replication finds very similar results, except Twitter is no longer significant. We confirm that regardless of which results are considered, a new form of social media is a significant and positive predictor. We define Facebook and Twitter as "new forms" of social media because the rise of popularity of these platforms in Egypt began in 2009 according to Google Trends. This suggests that these types of social media would not have been widely used in protests prior to this time. For the remainder of the paper, we will refer to these new social media simply as social media.

We extend the previous analysis by including previous participation in protests and civil society dichotomous variables as predictors of whether or not a protester protested on the first day of protests. Since previous scholars have determined that involvement with civil society groups is a significant predictor of involvement in political activities (Berman & Nugent, 2014), we also posit that previous participation is a vital determinant as to whether or not an individual will be active in future protests. Including this term in the regression also allows us to account for some of the variation

able discrepancies between the publicly available data and the data described in previous analyses. Most noticeably, the publicly available data have 1,048 observations, 805 males, and 242 females compared to the 1,050 observations, 792 males, and 258 females described by Tufekci & Wilson. We foresaw this potential problem as there is a note published with the data explaining these inconsistencies. Despite the variations, we were able to successfully replicate the results of Tufekci & Wilson with only slight deviations in the significance of relevant social media variables (Twitter and Facebook). We will specify any variations in the social media variables when we outline the relevant findings of Tufekci & Wilson in the following section.

that would be induced if there are unobserved characteristics of individuals that are more inclined to protest than others, including intrinsic characteristics or particular experiences. As a result, our regression of participation during the first day of protests can provide predicted values for first-time versus experienced protesters, who could potentially be distinct groups.

We also use coarsened exact matching to attempt to minimize bias from treatment assignment and address concerns about the lack of randomization found in observational data (Iacus, King, & Porro, 2011). In doing this, we define the treatment as using a new form of social media (Facebook, Twitter, or both), the outcome as first day participation, and match on all other covariates. We only stratify on age, as it was the only continuous variable used in our analysis. Both treatment and control observations without matches are trimmed, allowing us to estimate the feasible sample average treatment effect on the treated (FSATT). Imbalance tests prove the resulting matched dataset shows much improved balance both in terms of difference in means for all covariates and multivariate imbalance.

We proceed by using logistic regression and including the treatment variable, all covariates, and weights obtained from matching with replacement to estimate the FSATT of social media on participating during the first day of protests. The social media treatment is still found to be a positive and significant predictor of attending the protests on the first day even after correcting for potential bias using matching and controlling for previous participation and activism in civil society. These results are comparable to the results found by Tufekci & Wilson, however their estimate shows a slightly stronger effect for new social media.

Figure 1: First differences in Expected Values of Participation in the First Day of Protests

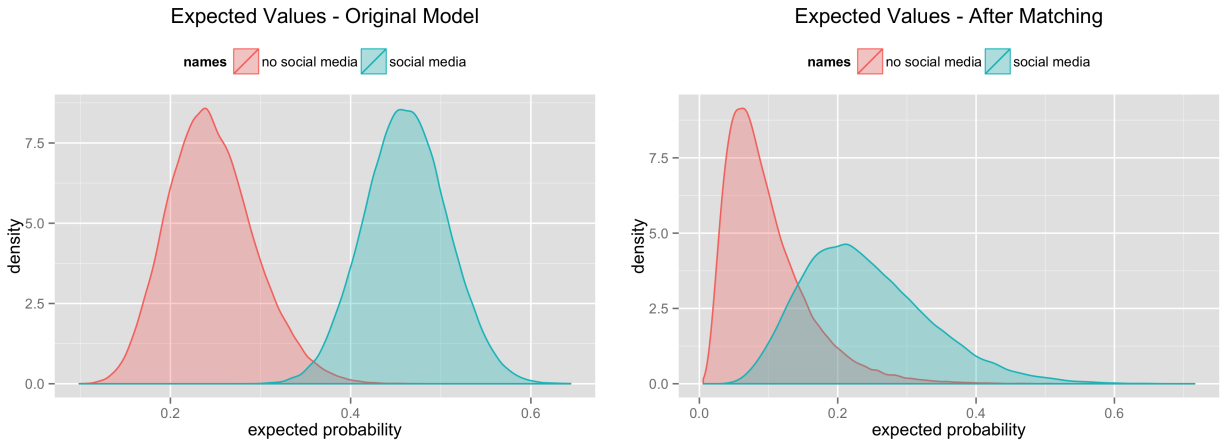

Figure 1 shows the expected probability of participating in the first day of protests

for protesters who use social media and those who do not use social media with all other variables held at their median. The density curve from the Tufekci & Wilson replication is on the left, and ours with the matched data is on the right. The original model finds an expected difference in probability of participating during the first day of protests among social media users and non-social media users is 21.57%, while our estimates find the expected difference in the probability between the two groups is 14.33%, which is a 50% decrease compared to previous findings. While it may be case that the original, less balanced data leads to an overestimation of the effect of social media, Figure 1 clearly shows that protesters who used social media had a higher probability of attending the protests on the first day. For the analysis of protesters who previously attended protests, we make a new matched dataset using the same method as above, except previous protest participation is now defined as the outcome variable. Again, imbalance tests prove that this new matched data is significantly more balanced than the original data. Using logistic regression and including new weights from the second round of matching, we estimate the FSATT of social media on previously participating in protests. The social media treatment is found to *not* have a significant effect on whether or not a protester attended a protest prior to January 25th, 2011 after correcting for potential bias using matching, and controlling for activism. We find that civil society activism is a significant predictor of previously attending protests, along with traditional media sources such as text messages and blogs. This reverses the findings of Tufekci & Wilson, in which Facebook and Twitter have a significant effect among protesters in determining their participation in previous protests.

Figure 2: First differences in Expected Values of Participation in the Previous Protests

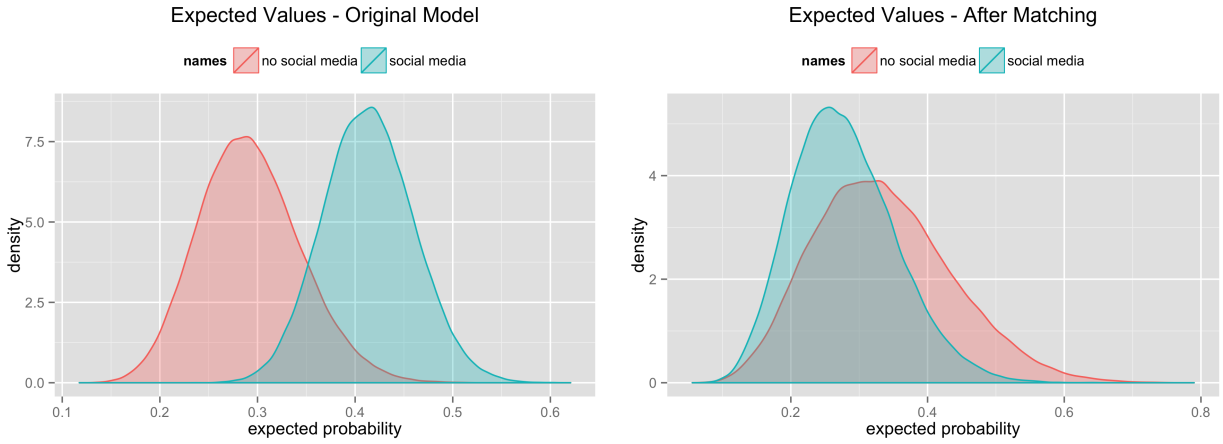

Figure 2 shows the expected probability of participating in previous protests for

protesters who use social media and those who do not use social media with all other variables held at their median. Again, the density curve from the Tufekci & Wilson replication is on the left, and ours from the second set of matched data is on the right. Their model finds an expected difference in probability of participating in previous protests among social media users and non-social media users is 12.17%, which is a positive and significant effect. We find the expected difference in probability between the two groups is -5.63%, though this is not a significant treatment effect when we consider the standard error of the estimate. We suggest that the significant effects found by Tufekci & Wilson might be explained by the civil society activism variable and bias from non-random treatment assignment, which is reduced in our estimate by the use of matching.

Evidence that social media significantly affected protesters' decisions to participate during the first day of protests on January 25th, 2011 but not in prior protests supports the hypothesis that the dramatic increases in internet access and social media usage have had significant ramifications for political mobilization. We have already provided evidence that the search trends for the terms "Facebook" and "Twitter" in Egypt started increasing in 2009 and then increased by multiple factors between 2009 and 2011[2], but we also find that Internet users in Egypt increased by 45%, 24%, and 29% in years 2009, 2010, and 2011, respectively[3]. This rapid increase in the popularity of social media platforms coupled with a continuously growing Internet user base suggests that social media like Facebook and Twitter only recently became a viable form of social media in Egypt.

We expect that individuals who participated in protests that occurred prior to this period of increased social media popularity lacked access to a platform with similar characteristics to Facebook or Twitter that they could use to organize and communicate protests. Those who protested during this growing period of social media popularity and Internet usage are expected to have had Internet access and to have been aware that social media is a valuable vehicle for communicating about political news. As a result, it is not surprising that greater knowledge of these platforms will increase usage. For these reasons, it seems reasonable that that social media would be a significant predictor for first day participation on January 25th, 2011, but not for previous protest participation.

Once again, we emphasize that these results are based on a survey of protesters selected using a snowball sampling method in Cairo, and that the demographics of this sample are not nationally or locally representative. To assess whether these results are

[2]Google Trends, www.google.com/trends

[3]"Egypt Internet Users." *Internet Live Stats.* internetlivestats.com, 2015. Web. 29 Apr. 2015

replicable in the broader population, we turn to a nationally representative data.

3 Arab Barometer

3.1 Effects on First Day Protest Participation

While the data from Tahrir Square provides us with a rare and valuable snapshot of information about the behavior and characteristics of protesters, the non-random selection process for interviews prevents us from extrapolating conclusions beyond the population under study. Fortunately the Arab Democracy Barometer (ADB) Wave II survey captured a nationally representative data sample in Egypt in June and July of 2011, including metrics of social media usage and participation in political protest. By conducting the same analysis on this dataset as we applied to the Tahrir data, we can assess whether there is evidence for the role of social media in protest behavior on a broader scale.

The ADB provides a national probability sample among adults 18 and older, using stratification and clustering techniques to provide sample balance across governorates, urban and rural areas, and regions with high proportions of Christians. Interviews were conducted face-to-face in Arabic and were distributed proportional to population size, with a total sample size of 1,219. The data include information on a broad range of political and social questions, as well as demographic attributes and measures of media access and use.

To approximate the procedure used on the protestor data, we employ a logistic regression model on the full nationally representative data set, with a few modifications. The ADB does not include data on access to phones, text messages or previous protest history, and does not distinguish between internet access at home or on a mobile device. As before, we include a binary variable that represents involvement with civil society organizations, and also add a variable representing whether the survey was conducted in an urban or rural area, to account for the fact that all of the previous data were collected in Cairo.

The results of the model suggest that social media did not substantially affect participation in the first day of protests at a national level – only involvement in civil society organizations and demographic characteristics had statistically significant coefficients. This supports the hypothesis that social media was not a significant factor in predicting protest behavior outside of the specific set of individuals surveyed in Tahrir Square, especially given that a few variables from that data set (telephone use, text message use and previous protest history) were not available in this data set.

Figure 3 shows density plots of expected probability of protest participation, based on 100,000 simulations from the logistic regression model. We see that the expected probabilities for a median respondent who also uses social media is not substantially different than the overall median, which is very low. By contrast, the density plot for individuals who have median demographic characteristics and are involved with civil society differs from the median plot, even if the resulting probability is still fairly low. This would seem to support the claim in Berman and Nugent that civil society was the main driver of protest behavior in the population as a whole. Finally, the plot of expected values for individuals with the same characteristics as the median Tahrir Square protester is far to the right, reflecting the substantial differences between that sample and the rest of the population.[4]

Figure 3: Expected Values of Protest Participation Probability by Subgroup

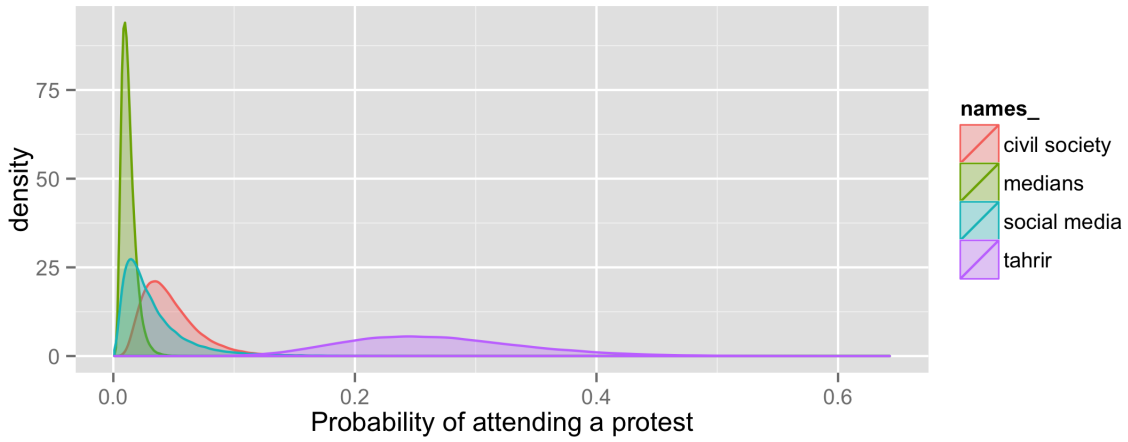

Table 1 shows the result of simulations from the logistic regression model for individuals with various demographic and media usage characteristics. The median respondent to the survey is expected to have only a 1.26% probability of attending the first day of protests, and the additional probability gained if we assume social media usage is only 2%. This is substantially lower than 14.33%, the first difference estimate calculated from the protestor sample. An active member of civil society with all other variables at the population median is only expected to have a 4.76% probability of participating in protest, which is a statistically significant difference but small in practice. However, if we use the demographic and media characteristics of the median protestor from the previous data set, we see that there is a 26.63% probability of protesting. This underscores the fact that the protester sample had vastly different

[4]See Appendix for median values from each sample.

demographic and media characteristics than the broader Egyptian population, which produced meaningful differences in expected protest probability.

Table 1: Simulated expected values of protest attendance

	Median respondent	Median + Social Media	Median + Civil Society	Tahrir Square Median
Probability of attending a protest	0.0126	0.0330	0.0476	0.2663
Difference from median	-	0.02	0.035	0.2538

Next, we attempt to account for bias in the assignment of our treatment variable, social media, by employing the same matching procedure as applied to the previous dataset. Data were matched exactly on all characteristics except for age, which was matched within strata. This procedure produced 38 control and 49 treated variables with significantly improved balance over the original data set. Regressing participation in the first day of protests on all of the above covariates produced an estimated average treatment effect on the treated which is not statistically distinguishable from zero – the 95% confidence interval ranges from -.11 to .07. This result provides additional evidence that social media was not a significant factor in protest participation in the broader population, even when attempting to account for some of the bias created by non-random treatment assignment. Combined with the result from the logistic regression above, this would seem to indicate that the effect identified in the protestor sample almost entirely due to the selection bias of the sampling procedure, and cannot be extended to a broader population.

3.2 Effects on Protest Intensity

However, the Barometer also collected data on protest intensity, measured by whether or not respondents participated in 6 key dates of mass mobilization: January 25, January 28, February 2, February 4, February 6 and February 11. To assess the relationship between social media and protest intensity, we employed a 6-trial binomial count model, which employs the same systematic component as the logistic regression function to estimate the probability of protest participation for each individual based on demographic and media characteristics.

This model found that social media had a statistically significant effect on protest intensity, along with variables like involvement in civil society, access to blogs, print media and demographic characteristics. Figure 4 shows the density plots of simulations conducted using the same subset of characteristics as employed above. Median survey respondents continued to have extremely low expected values for protest attendance, but we see that much of the density plot for a median respondent with social media

is farther right in the graph. Involvement in civil society groups has a larger effect on protest intensity, as before. Finally, the density of the expected values for protest attendance for individuals in the Tahrir Square protestor survey has no substantial overlap with the other plots.

Figure 4: Expected Values of Protest Attendance Counts by Subgroup

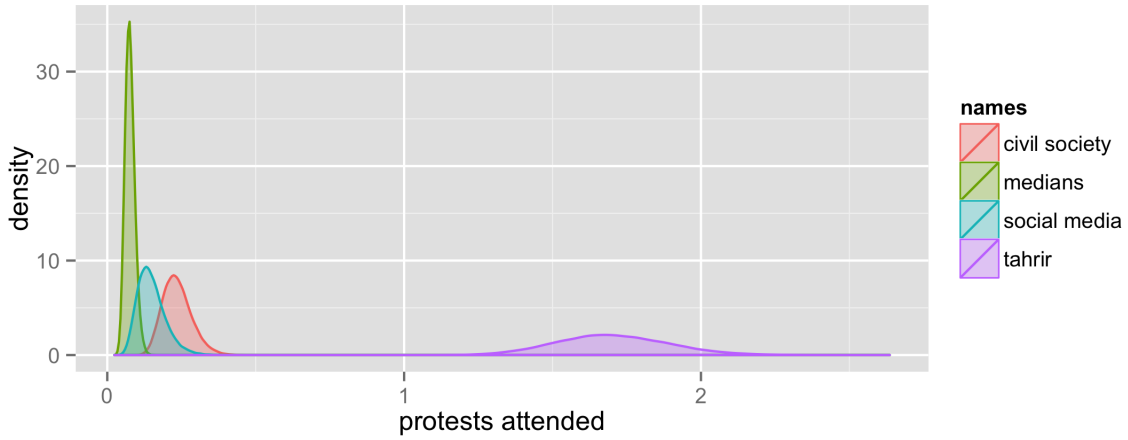

Table 2 provides additional information about the expected values simulated from the binomial count model. The first row shows the expected number of protests attended across all simulations, and the second indicates the number of simulated outcomes in which the expected value was above 1. There are substantial differences between the expected number of protests for median respondents and the values obtained by changing only the social media and civil society variables. However, none of these three respondent profiles had any simulations in which the expected value was greater than 1. By contrast, the expected values for an individual with the same demographic and media characteristics as the median protester in Tahrir Square are much larger, reflecting both the demographic differences between the two samples and the magnitude of the coefficients on those variables in this model. Every simulation of the expected number of protests for an individual with the same demographics as the Tahrir Square protesters is greater than 1, and the overall average is 1.70. Put another way, we would expect that all individuals with the demographic characteristics of the Tahrir Square protesters would participate in at least one protest during the time period of interest.

These results complicate the previous results in the literature, and in the logistic regression and matching estimation above, which generally conclude that nearly all of the measured effect of social media was due to selection bias and sampling procedure.

Table 2: Simulated expected values of protest attendance

	Median respondent	Median + Social Media	Median + Civil Society	Tahrir Square Median
Expected number of protests attended	0.0765	0.1487	0.2359	1.7021
% Predicted to Attend >= 1 Protest	0%	0%	0%	100%

Instead, this data suggests that there is substantial heterogeneity in the effect of social media on protest behavior, which may not be captured by average treatment effects on participation in a single protest alone, but do manifest in measurements of protest intensity.

One interpretation is that while social media played a role in sparking protests in Cairo, where the first set of survey data was collected, it did not affect results at a national scale until later protests. Under this scenario, protesters in other parts of the country could have observed the methods employed in Cairo and duplicated them in other contexts, or protesters in Cairo could have improved their methods to reach a broader set of people. Alternatively, social media could amplify the effects of other covariates in increasing protest intensity, encouraging someone to protest who would otherwise be on the margin, or increasing the probability that they protest again. In another case, the effect of social media could be amplified by having many peers who are also members of social media platforms, in which case we would need to account for variable treatment effects depending on network density and spillover effects.

4 Concluding Remarks

With the analyses above, we attempt to extend the literature on the relationship between social media and political protest in the uprisings of early 2011 in Egypt, and address questions raised by scholars about the attribution of previously detected effects of social media. To address concerns about missing variables and treatment assignment, we included a civil society involvement variable and employed matching techniques to reduce potential treatment assignment bias in previous estimations. Our findings suggest that social media had different effects for different portions of the population within our sample, with first-time protesters experiencing increased probability of protest and individuals with previous protest experience relatively unaffected.

To assess the relevance of within-sample findings for the broader population, we applied the same analytic procedure to a nationally representative sample, and found no evidence to support claims that social media played a substantial role in participation in the first day of protests. However, we do find evidence that social media played a role in determining protest intensity over the course of the uprisings, another indication

that social media may have heterogeneous effects across the population.

These findings raise additional questions about the nature of the relationship between social media and protest participation, rather than providing conclusive evidence resolving the theoretical debate. There are a number of hypotheses that could explain the conflicts between analysis of first-time and experienced protesters, and between participation in the first day of protests and protest intensity over time, but testing them would require additional data.

As always, there could be omitted variables that play a particularly strong role in affecting protest behavior, such as personality characteristics or ideology, which are correlated with social media use but are the true causal factors. In addition, there could be interactions between social media use and particular political positions, or certain demographic groups, that explain the variation in effect across models. It may be the case that access to social media is not the best metric for the effect of the platform, and that we should be examining variables like frequency of use, length of membership, network density, audience size, or proximity to influential users instead.

Finally, new data sets or different model specifications may provide additional insight into this relationship. Rather than a single snapshot of protest behavior and social media access in a survey, a longitudinal approach with text analysis might reveal a complex relationship between social media use and participation in political action. Similarly, relaxing the assumptions in both logistic and binomial count models might provide additional insight, either by accounting for the effects of peer behavior in a network or by allowing protest probability to vary over time as individuals gain education, protest experience or shift involvement between various forms of civil society organizations.

While our findings are limited in some respects to the context of the Egyptian uprisings of 2011, we suggest that similar methods could be employed to assess empirical evidence regarding social media in other contexts, especially since randomized or blocked experiments do not seem feasible for this area of research.

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6 Appendix

Medians by Survey		
	ADB Wave II	Tahrir Data Set
age	37	26
gender	Male	Male
education	4	6
internet	0	1
print	0	1
tv	1	1
blogs	0	0
social	0	1
activism	0	1
urban	0	1

First Day Logistic Regression Table			
	Coefficient	Standard Error	P-value
constant	0.518	4.687	0.912
social	1.186	0.542	0.029
previously	-0.256	0.961	0.790
age	0.052	0.055	0.339
gender	-0.677	0.809	0.403
education	-0.258	0.479	0.590
activism	0.612	0.786	0.436
internet at home	-0.899	0.813	0.268
internet on phone	0.193	0.645	0.765
blogs	1.582	1.065	0.137
email	-1.166	0.675	0.084
phone calls	-0.810	2.078	0.700
print	-0.071	0.601	0.906
tv	-0.260	1.990	0.896
text message	0.912	0.868	0.2936

Previous Participation Logistic Regression Table			
	Coefficient	Standard Error	P-value
constant	-0.919	3.364	0.785
social	-0.262	0.407	0.520
age	-0.012	0.047	0.800
gender	-1.056	0.648	0.103
education	0.417	0.400	0.298
activism	1.408	0.524	0.007
internet at home	1.346	0.968	0.164
internet on phone	-0.590	0.436	0.176
blogs	2.062	1.161	0.076
email	-0.100	0.582	0.863
phone calls	-4.127	1.443	0.004
print	0.837	0.580	0.149
tv	-1.053	2.006	0.600
text message	2.750	1.206	0.023

Protest Intensity Binomial Count Model Table			
	Coefficient	Standard Error	P-value
constant	-3.39	0.382	0
age	-0.03	0.006	0
gender	0.882	0.176	0
education	0.031	0.05	0.268
internet	-0.007	0.238	0.488
print	0.457	0.181	0.006
tv	-0.871	0.264	0
blogs	1.008	0.324	0.001
social	0.649	0.234	0.003
activism	1.149	0.169	0
urban	0.792	0.165	0