# Appendix

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# A Ethics and Implementation of Field Research in Mosul

Research in conflict-affected areas presents a number of potentially serious risks to participants, and researchers have a professional and moral responsibility to do no harm Wood (2006). Conflict-affected populations are particularly vulnerable for several reasons including possible recent exposure to violence, the risk of retraumatization, and unequal power dynamics between international researchers and local participants (Cronin-Furman and Lake, 2018). In order to minimize these risks, the study underwent a rigorous process of obtaining ethics approval from Anonymous University's Institutional Review Board (IRB)[89] and followed best practices for participant and researcher safety including a detailed informed consent process, frequent reminders of respondents' right to end the survey at any time, and strong data security protocols (Koehler et al., 2020). As an additional precaution, Figure 3 above plots respondents' sampling coordinates after adding random error terms of up to 100 meters in order to further protect the anonymity of respondents.

This study began with in-depth interviews with residents of Mosul conducted over the course of more than two years of field research starting in 2016. Anonymous University's Institutional Review Board (IRB) approved these interviews on June 24, 2015 (Portocol #Anonymous). One of the authors conducted all interviews in standard Arabic with occasional help from local research assistants in interpreting the Iraqi dialect. Table A-1 summarizes key demographic attributes of a subset of 30 interviews with residents of Mosul that informed the design of the survey questionnaire and our analysis of the quantitative data. All interviewees are identified by a number to protect their anonymity. As an additional precaution to ensure anonymity, we specify the month and year but not the day on which the interview was conducted. Interviews were conducted in Mosul as well as in other towns, cities, and IDP camps to which Moslawis fled during the battle.

Between 2018 and 2022, one of the authors spent more than two years in Iraq based in Erbil and Baghdad conducting academic research,[90] and working as a researcher and advisor for humanitarian organizations. This work included several more visits to Mosul and continuous engagement with Iraqi colleagues and interlocutors from Mosul.

The research team returned to Mosul in August 2023 to conduct follow-up interviews and observations of street and building density in seven of the same neighborhoods included in the 2018 survey: four randomly selected neighborhoods from the list of previously surveyed neighborhoods on the west side of the river (Farouk, Shiah, Amil, and Hay Al Mansur) and three on the east (Jazara, Mazari, Karamah), resulting in eight interviews. These interviews

[89] The Human Subjects Committee of Anonymous University's Institutional Review Board (IRB) approved this study on December 14, 2017 (Protocol #Anonymous).

[90] For several related follow-on studies that were covered by subsequent IRB protocols approved by anonymous universities.

were approved by Anonymous University's Institutional Review Board (IRB) on July 22, 2023 (Portocol #Anonymous). We randomly selected these locations from the list of 47 neighborhoods that comprised the sampling frame in the 2018 survey. Figure A-1 shows the approximate areas the team visited and Table A-2 details the demographics of interviewees.

Since the 2018 survey was conducted anonymously for the safety of respondents, we did not attempt to re-interview any of our original respondents, opting to interview a convenience sample of eight individuals we encountered while walking through the neighborhoods. We used a screening question to identify potential interviewees who were living in Mosul during the battle of Mosul, our inclusion criterion.

Table A-1: Pre-Survey Interviews with Residents of Mosul: 2017

| # | Approximate Age | Gender | Occupation | Interview Date | Interview Location |
|---|---|---|---|---|---|
| 1 | 40s | Male | School administrator | 4/2017 | Mosul |
| 2 | 40s | Female | School administrator | 4/2017 | Mosul |
| 3 | 40s | Male | School administrator | 4/2017 | Mosul |
| 4 | 50s | Male | Teacher | 4/2017 | Mosul |
| 5 | 20s | Male | Teacher | 4/2017 | Mosul |
| 6 | 30s | Male | Teacher | 4/2017 | Mosul |
| 7 | 40s | Female | Teacher | 4/2017 | Mosul |
| 8 | 30s | Female | Teacher | 4/2017 | Mosul |
| 9 | 40s | Female | Housewife | 4/2017 | Mosul |
| 10 | 60s | Male | Butcher | 4/2017 | Mosul |
| 11 | 30s | Male | Factory worker | 4/2017 | Mosul |
| 12 | 20s | Female | Student | 4/2017 | Mosul |
| 13 | 30s | Male | Municipal worker | 4/2017 | Mosul |
| 14 | 60s | Male | Doctor | 4/2017 | Mosul |
| 15 | 30s | Male | Hospital administrator | 4/2017 | Mosul |
| 16 | 30s | Male | Accountant | 4/2017 | Mosul |
| 17 | 40s | Male | Journalist | 4/2017 | Mosul |
| 18 | 20s | Female | Store clerk | 4/2017 | Mosul |
| 19 | 40s | Male | Butcher | 4/2017 | Mosul |
| 20 | 50s | Male | Tailor | 4/2017 | Mosul |
| 21 | 30s | Male | Car dealer | 4/2017 | Mosul |
| 22 | 30s | Male | Store clerk | 4/2017 | Mosul |
| 23 | 30s | Male | Store clerk | 4/2017 | Mosul |
| 24 | 30s | Male | Food services | 4/2017 | Mosul |
| 25 | 20s | Male | Food services | 4/2017 | Mosul |
| 26 | 30s | Male | Truck driver | 4/2017 | Mosul |
| 27 | 50s | Female | Housewife | 12/2017 | IDP camp, Makhmour |
| 28 | 30s | Female | Housewife | 12/2017 | IDP camp, Makhmour |
| 29 | 30s | Female | Housewife | 12/2017 | IDP camp, Makhmour |
| 30 | 40s | Male | Retired military | 12/2017 | IDP camp, Makhmour |

Figure A-1: Approximate Neighborhood Locations of August 2023 Fieldwork


Table A-2: Interviews with Residents of Mosul: August 2023

| # | Approximate Age | Gender | Occupation | Interview Date | Interview Location |
|---|---|---|---|---|---|
| 1 | 60s | Female | Shop Owner | 8/2023 | West Mosul |
| 2 | 50s | Male | Shop Owner | 8/2023 | West Mosul |
| 3 | 60s | Male | Shop Owner | 8/2023 | West Mosul |
| 4 | 30s | Male | Shop Owner | 8/2023 | West Mosul |
| 5 | 60s | Male | Retired Military | 8/2023 | West Mosul |
| 6 | 30s | Male | Shop Owner | 8/2023 | West Mosul |
| 7 | 60s | Male | Shop Owner | 8/2023 | East Mosul |
| 8 | 50s | Male | Retired Military | 8/2023 | East Mosul |

## A.1 Abridged Quotes from Qualitative Interviews

This section provides abridged excerpts from our final round of interviews conducted in August 2023 to provide more context for the brief quotations included in the article. We do not provide full transcripts because of the risk that we might unintentionally disclose identifying information, among other ethical and security concerns noted in the Final Report of the Working Group on Qualitative Transparency Deliberations (Jacobs et al., 2021: 179).

**Interview 1**

> "This area [West Mosul] was IS's last stronghold because it has narrow alleys and the houses are close together and there were basements where they could hide from the airplanes, and the tanks could not enter. That's why there was so much destruction here, because it was so confusing to the army. They didn't know who was IS or civilians and that's why they were bombing everywhere ... "

**Interview 2**

> "They were randomly bombing, there were no IS fighters here... We did not expect the bombings because there were no IS headquarters or fighters near our house. I kept thinking: Why was our house bombed if they [the Coalition] had informants on the ground? ... There were no IS fighters nearby. ... They claimed they were professionals, they had drones, they said they knew where the [IS] headquarters were, where the fighters were, where the civilians were. But they didn't know anything."

**Interview 3**

> "The Federal Police were the ones who were harming us and bombing us. But the Golden Division were the ones who were helping us ... My husband has Parkinsons disease and he fell while we were trying to flee. A Golden Division soldier picked us up with his own car and took us all the way to the hospital ... The Golden Division was much better [than the Federal Police] ... they [the CTS] very mixed in terms of ethnicity. The Federal Police were mostly Shia Muslims. The Federal Police were looting and stealing a lot from civilians and they were watching other people stealing and doing nothing ... They [the Coalition] were capable of minimizing the damage but they did not. They destroyed the whole minaret [referring to a historic mosque] for just a few IS fighters."

**Interview 4**

"They [the CTS] ... caused very little damage because they used snipers and ... some of the same techniques as IS, moving through holes between houses, which allowed them to liberate neighborhoods from the ground not using airstrikes ... There was no looting in this neighborhood because the Golden Division was here, but I did hear about looting in other neighborhoods ... The streets were wider in the east side, so IS could not easily fight back and resist. It was easier for the Iraqi forces to liberate the east first because it was so open. But in West Mosul, the narrow streets and alleys are not wide enough for tanks and Humvees to enter ... The Army made a big mistake by leading them to their own rather then leading them toward the desert. They led them to Old City [in West Mosul] and everyone complains about this. They could have led them to the desert with much less damage."

**Interview 5**

"The east was open, which made it easy to liberate because the roads were wide enough for tanks and Humvees. In the west, the streets were very narrow and even if they [the Iraqi forces and vehicles] could enter through streets, IS was throwing grenades from the rooftops so it was not easy for them to move."

**Interview 6**

"I believe the targeting was random. They didn't know who was IS and who was a civilian because IS was hiding among civilians ... The Golden Division was better trained and more effective. Both forces were professional [Golden Division and Federal Police] but there are always bad apples in every force, and there were more bad apples in the Federal Police ... Because the Iraqi forces were from Iraq, they were more careful with civilians than the U.S. If I were called up to fight to liberate Syria or Jordan, I would be less passionate and less careful with civilians than if I were fighting to defend my own people in my own country [Iraq]. The Federal Police were mostly Shia from the south of Iraq. The people of Mosul did not know them and did not trust them. The Golden Division, on the other hand, knew how we were living, they knew that this was our land, and they knew our people."

**Interview 7**

> "They were getting information from informants on the ground so they could track targets that were moving, but I don't understand why they destroyed hospitals ... The Golden Division were very good...The Old City [in West Mosul] is like Old Italy with very narrow streets. It would have been very difficult to start the battle in the west because all of the houses are connected to each other from the Old City all the way to the stadium and hospital. The streets are very tight and there would have been many causalities. That's why they started in the east, because they had better visuals and wider streets and could more effectively start the fight ... No it wasn't worth it [the defeat of IS was not worth the collateral damage it caused]. They destroyed the infrastructure, the schools, the hospitals, government institutions, and services just to kill a few thousand IS fighters ... It was not worth all of this damage. Most importantly, you cannot replace a human soul. There were way too many causalities and many more in the west than in the east. Too many houses collapsed on civilians, and there are still bones in the rubble."

**Interview 8**

> "I served in the military [previously, before 2003] and I think the airstrikes were too much ... It was kind of wild, frankly. IS fighters were concentrated on that side of the city [West Mosul]. The American air strikes were too wild. They said they wanted to save the civilians, but they caused too many causalities. All that force was not needed ... they used too much force, of which only 10 percent was needed to defeat IS and the remainder was all excessive ... Of course it would have been better to let IS escape into the desert."

# B Household Survey Methodology & Implementation

## B.1 Random Sampling Procedure

The random sample was drawn from 47 primary sampling units (PSUs) based on census blocks that were randomly selected from a list of all 209 census blocks in Mosul. These blocks have names corresponding to different neighborhoods. Enumerators conducted 30 interviews within each PSU.[91] Within each PSU, the sampling team randomly selected streets,

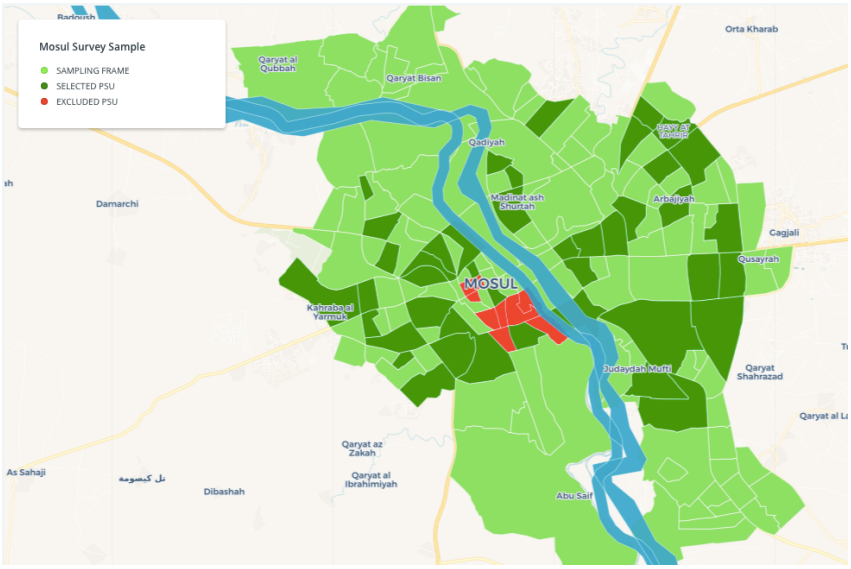
[91] It was not feasible to implement truly random sampling using probability proportional to size due to conflict-related changes in demography that make accurate estimates of the true populations of the PSUs

within which enumerators selected households using a random-walk procedure. Enumerators counted the number of houses on each street and divided by seven to determine the interval of houses skipped between interviews. The tablets were programmed with a Kish grid (Kish, 1949) that randomly selected a respondent from the pool of adult household members.

## B.2 Map of the Sampling Frame

Figure A-2 shows the sampling frame of 209 Primary Sampling Units (PSUs) in light green and the 47 randomly selected PSUs in dark green. Eight PSUs in West Mosul were excluded from the sampling frame (marked in red) because these areas experienced severe collateral damage during the recent military operation and were largely uninhabited. To the extent these neighborhoods experienced the highest "doseage" of our bundled treatment, we anticipate that exlcuding these neighborhoods biases our estimates towards zero.

Figure A-2: Map of the Sampling Frame




## B.3 Enumerator Training and Gender Protocol

We worked with a respected Iraqi survey firm, the Independent Institute for Administration and Civil Society Studies (IIACSS), to train a team of 10 Iraqi enumerators from Mosul who

impossible. For this reason, we assigned a consistent number of interviews to each PSU.

then conducted the door-to-door survey with tablets. One author conducted the training in Arabic and supervised translation of the questionnaire and eventual data in both directions (English to Arabic and Arabic to English). Given that many Iraqis have religious and cultural preferences for gender segregation, the team included male and female enumerators in order to accommodate any respondents who requested to be interviewed by someone of the same gender. Enumerators walked door-to-door individually, if a female or male respondent requested to be interviewed by an enumerator of the same gender, the opposite-gender enumerator called a colleague to conduct the interview.

## B.4 Response Rate and Quality Control

As noted in the article, Mosul's current population is almost entirely Sunni Arab due to massive out-migration by other religious and ethnic groups who were persecuted by IS. Through the filter questions that were designed to limit the sample to Sunni Arab Iraqis who were living in Mosul in June 2014, only 4 people were excluded for not being Iraqi, 4 were excluded for not being Sunni Arab, and 9 were excluded because they were not living in Mosul in June 2014. The refusal rate was 15%. After piloting the survey, the research team agreed that the survey should take at least 25 minutes to complete, to ensure that all questions were read thoroughly and slowly. Six surveys were dropped from the final dataset because they were completed in less than 25 minutes.

## B.5 Wording of Survey Instruments

Table A-3 presents the survey instrument wording for all control variables included in the analysis. The replication package contains a codebook for all variables.

Table A-3: Codebook of Control Variables

| Variable | Survey Question | Outcome Space |
|---|---|---|
| Pre-IS household income | Which of these statements comes closest to describing your household income mmediately before Daesh captured Mosul? | Our household income... (1) does not cover our expenses and we face significant difficulties in meeting our needs (2) does not cover our expenses and we face some difficulties in meeting our needs (3) cover our expenses without notable difficulties (4) cover our expenses well and we are able to save |
| Reported harm during IS rule (pre-battle) | Did your household, as a whole, experience house damage, house confiscation, household injury, or household death during the time that Daesh was in control of Mosul? | (0) No (1) Yes |
| Experienced various grievances with the Iraqi government (pre-IS) | 4 variables: During the years 2006- 2014... (1) Did you ever feel disrespected or insulted by an Iraqi police officer? (2) Were you ever arrested? (3) Did you ever feel that you were discriminated against ... for being Sunni? (4) Did you ever participate in a demonstration or protest directed at the Iraqi government? | (0) No (1) Yes |
| Paid taxes to IS | 3 variables: During the first six months of Daesh rule, did Daesh collect any of the following types of taxes and fees from this household? (1) electricity fees (2) water fees (3) zakat | (0) No (1) Yes |

| | | |
|---|---|---|
| Voted in the 2014 parliamentary elections | Did you vote in the last parliamentary election in 2014? | (0) No (1) Yes |
| Support for Sharia law | Do you believe that Iraqi state law should be reformed to include more Sharia, less Sharia, or stay the same as it is now? | (1) More Sharia (2) Stay the same (3) Less Sharia |
| Attendance at Friday prayer | How often do you attend Friday prayer? | (1) Never (2) Rarely (3) Sometimes (4) Most of the time (5) Always |
| Preferences for IS governance | During the first six months of Daesh rule, did you believe that Daesh was doing a better job of governing Mosul than the Iraqi government did previously? | (0) No (1) Yes |
| Evaluation of IS corruption | During the first six months of Daesh rule, to what extent did you think that Daesh was corrupt? | (1) Not at all corrupt (2) Somewhat corrupt (3) Very corrupt |
| Fairness of IS taxation | How much do you agree or disagree with the following statement? "The taxes and fees collected by Daesh were fair in exchange for the services that Daesh was providing." | (1) Strongly Disagree (2) Somewhat Disagree (3) Somewhat Agree (4) Strongly Agree |
| Evaluation of Iraqi government corruption | In general, to what extent do you think that the current Iraqi government is corrupt? | (1) Not at all corrupt (2) Somewhat corrupt (3) Very corrupt |

# C Design & Identification

## C.1 Requirements for Causal Inference

Our empirical strategy rests on two assumptions: (1) exposure to the bundled treatment is exogenous and (2) that we are able to control for all systematic differences between East and West Mosul. We address potential violations of these two assumptions below.

To begin, it would threaten our identification if the East-to-West sequencing of operations was in fact correlated with civilian attitudes on either side of Mosul. In fact, our extensive field research and a review of secondary sources both strongly suggest that the sequencing of operations was primarily driven by plausibly exogenous factors. We are aware of no evidence that Iraqi or coalition military planners viewed East Mosul as a more favorable starting location due to any differences in civilian attitudes there.

The decision was primarily a consequence of the pre-battle location of armed forces. In preparation for the Battle of Mosul, the Iraqi Armed Forces worked in tandem with the Kurdish Peshmerga and the Popular Mobilization Forces (PMF), predominately Shia paramilitary force, to encircle the city. The PMF established control from the southwest, the Peshmerga from the north, and the Iraqi Armed Forces from the southeast. Rather than liberate the city simultaneously, a key decision was made to let the Iraqi Armed Forces liberate Mosul alone in two phases starting in the East Mosul. The decision was based on two consideration, both unrelated to civilian attitudes. First, the positioning of Kurdish Pershmerga forces north of Mosul allowed Iraqi forces to leverage existing Kurdish defenses and avoided the potential for friendly fire (Wasser et al., 2021). Second, Turkey explicitly requested for the Iraqi Armed Forces to liberate the city without assistance from the PMF and Peshmerga (Spencer and Geroux, 2021). Turkey was adamant, convinced that liberation of West Mosul by any other actor would lead to Shia or Kurdish control of of the politically important district of Telafar, which borders Mosul and Turkey (Anadolu Agency, 2016; Stansfield, 2016).

And what drove the various strategic and tactical shifts comprising bundled treatment itself? Here, too, the evidence supports a variety of plausibly exogenous factors. We have already discussed how changes in the composition of ground forces—from the elite multi-ethnic CTS in East Mosul to lesser-trained and predominately Shia Federal Police in West Mosul—were necessitated by the CTS's severe losses (Amnesty International, 2017). In addition, the shift from house-to-house ground fighting with support from relatively precise munitions to greater reliance on unguided "wide-impact-area" explosives was influenced by the urban terrain of West Mosul, particularly its denser buildings and narrower streets in comparison with East Mosul (Baudot, 2019: 18, 48), which one of our interviewees described as "like Old Italy."[92]

[92]The Appendix includes photographs of West and East Mosul street views taken during our field research.

Additionally, Tactical Directive 1 and other changes comprising the shift from "attrition" to "annihilation" were partially reactive to IS's evolving strategy[93] and influenced by lessons learned by Iraqi and Coalition commanders during the first phase of the battle (Awadi and Haus, 2017; Wasser et al., 2021: 83-84). Altogether, we do not find evidence that commanders were making decisions on the basis of any differences between East and West Mosul that are not captured in our controls.

Regarding our second assumption, we cannot definitively rule out the possibility of omitted variable bias, but we can test for balance across observable characteristics. Indeed, Table 1 above shows balance between East and West Mosul across several key individual covariates, and Table A-4 shows balance across an even more extensive list of individual- and neighborhood-level covariates. With the exception of self-reported slightly higher pre-IS household economic security in East Mosul, high preferences for Sharia law in East Mosul, and greater urban density in West Mosul—which we believe was itself one of the exogenous factors driving certain aspects of the bundled treatment—Tables 1 and A-4 show that our covariates are well balanced across East and West with no other statistically significant differences, and all covariates are only jointly marginally significant. Especially notable is that respondents in East and West Mosul report nearly identical levels of grievances with the Iraqi government prior to IS occupation in 2014; this suggests that differences in respondents' present attitudes toward Iraqi and Coalition armed forces are not merely reflecting pre-existing attitudes toward the Iraqi government that are unrelated to the battle of Mosul itself.

Overall, the balance in observables across East and West Mosul gives us confidence that our estimates are unlikely to be biased by unobservable or omitted variables and lends credibility to our identifying assumption (Altonji, Elder and Taber, 2005). In addition, to formally benchmark the degree our results may be influenced by omitted variables bias, in the below section we conduct sensitivity analysis. Results suggest that our analysis is reasonably robust to the possibility of omitted-variable bias.

Table A-4 shows that East Mosul had a higher density of population and residential units.

[93]By the time the battle moved to West Mosul, IS's posture was much more defensive and desperate. After losing East Mosul, IS entrenched itself in the dense Old City of West Mosul, using civilians as human shields and summarily executing those who tried to flee (El Deeb, 2019).

Table A-4: Balance on Covariates

| | East Mosul | West Mosul | Difference-in-Means (East Mosul - West Mosul) |
|---|---|---|---|
| Education: None | 0.151 | 0.173 | 0.022 |
| | (0.359) | (0.379) | |
| Education: Elementary | 0.393 | 0.418 | 0.025 |
| | (0.489) | (0.494) | |
| Education: Primary | 0.164 | 0.130 | -0.035 |
| | (0.371) | (0.336) | |
| Education: Secondary | 0.149 | 0.157 | 0.008 |
| | (0.357) | (0.364) | |
| Education: Mid-level Diploma | 0.048 | 0.047 | -0.001 |
| | (0.215) | (0.213) | |
| Education: Bachelor | 0.092 | 0.073 | -0.019 |
| | (0.289) | (0.260) | |
| Education: Masters | 0.002 | 0.002 | -0.000 |
| | (0.047) | (0.043) | |
| Age | 36.311 | 37.712 | 1.401 |
| | (13.906) | (14.432) | |
| Income: Significant Difficulties | 0.257 | 0.377 | 0.120*** |
| | (0.437) | (0.485) | |
| Income: Some Difficulties | 0.191 | 0.192 | 0.001 |
| | (0.393) | (0.394) | |
| Income: No Difficulties | 0.338 | 0.234 | -0.104*** |
| | (0.473) | (0.424) | |
| Income: Can Save | 0.215 | 0.197 | -0.017 |
| | (0.411) | (0.398) | |
| Primary Identity: Iraqi | 0.481 | 0.495 | 0.013 |
| | (0.500) | (0.500) | |
| Primary Identity: Mulsim | 0.394 | 0.398 | 0.004 |
| | (0.489) | (0.490) | |
| Voted In 2014 Elections | 0.686 | 0.700 | 0.014 |
| | (0.465) | (0.459) | |
| Prefers More Sharia Law | 0.607 | 0.541 | -0.066* |
| | (0.489) | (0.499) | |
| Prefers Less Sharia Law | 0.062 | 0.046 | -0.017 |
| | (0.242) | (0.209) | |
| Friday Prayer Attendance | 2.607 | 2.475 | -0.132 |
| | (1.649) | (1.665) | |
| Experienced Harm During IS Rule | 0.381 | 0.400 | 0.020 |
| | (0.486) | (0.490) | |
| Paid IS Electricity Fees | 0.353 | 0.416 | 0.063* |
| | (0.478) | (0.493) | |
| Paid IS Water Fees | 0.428 | 0.451 | 0.022 |
| | (0.495) | (0.498) | |
| Paid IS Zakat | 0.349 | 0.330 | -0.019 |
| | (0.477) | (0.471) | |
| Insulted by Iraqi Police | 0.235 | 0.267 | 0.032 |
| | (0.425) | (0.443) | |
| Arrested | 0.068 | 0.053 | -0.015 |
| | (0.252) | (0.224) | |
| Sunni Based Discrimination | 0.123 | 0.124 | 0.001 |
| | (0.329) | (0.330) | |
| Protest Participation | 0.035 | 0.020 | -0.015 |
| | (0.184) | (0.140) | |
| Population Density | 0.014 | 0.018 | 0.004*** |
| | (0.010) | (0.008) | |
| Road Density | 0.024 | 0.024 | -0.000 |
| | (0.005) | (0.005) | |
| Residenial Unit Density | 0.001 | 0.002 | 0.001*** |
| | (0.001) | (0.001) | |
| Observations | 603 | 668 | 1271 |

*Note*: * p <.10, ** p <.05, *** p <.01.

## C.2 Sensitivity Analysis

Our identification strategy relies on the strong assumption of conditional independence. The exposure to the bundled treatment, as defined by the two phases of the battle, is assumed

to be as-if random after conditioning on a rich set of observable. Omitted-variable bias is possible. Unobserved factors could drive selection into treatment and bias estimates. To alleviate this concern we conduct sensitive analysis. As an initial approach, presented in the manuscript, we calculate Osters bounds. In addition, we below conduct two additional approaches. Across all tests, results are reasonably robust to the concern of omitted variable bias.

In Table A-5, we present sensitivity analysis from Cinelli and Hazlett (2019). This has become the recent standard for bench-marking omitted variable bias. Table A-5 reports our estimated treatment effects and standard error from Table 3 Column (4), and then reports a number of diagnostics. The Partial $R^2$ of the treatment with the outcome, $R^2_{Y\sim D|\mathbf{X}}$, indicates that a confounding variable (or set of variables), orthogonal to our matrix of controls, that explains 100% of the residual variance of the outcome, would need to explain at least 1.4% of the residual variance of the treatment to fully account for the observed estimated effect. The robustness values $RV_{q=1}$ reports that an unobserved confounders (orthogonal to the covariates) would have to explain more than 11.2% of the residual variance of both the treatment and the outcome (a partial $r^2$ of .112) to bring the point estimate to 0 (a bias of 100% of the original estimate). A similar, yet more difficult test, $RV_{q=1,\alpha=0.05}$, estimates that an unobserved confounder would have to a partial $r^2$ of .052 to bring the estimate to a range where it is no longer "statistically different" from zero.

Table A-5: Minimal Reporting on Sensitivity to Unobserved Confounders

Outcome: *Percieved Military LEgitimacy*

| Treatment: | Est. | S.E. | t-value | $R^2_{Y\sim D\|\mathbf{X}}$ | $RV_{q=1}$ | $RV_{q=1,\alpha=0.05}$ |
|---|---|---|---|---|---|---|
| *treated* | -0.168 | 0.047 | -3.606 | 1.4% | 11.2% | 5.2% |
| df = 929 | *Bound (1x $gov_grievances_unni$)* : $R^2_{Y\sim Z\|\mathbf{X},D}$ = *0.9%*, $R^2_{D\sim Z\|\mathbf{X}}$ = *0%* | | | | | |

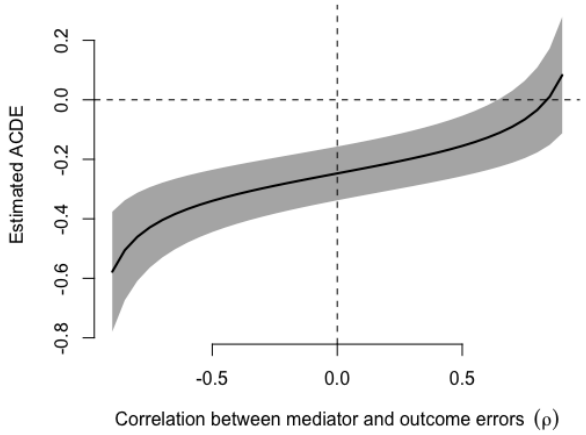
In Table A-6 we then benchmark this effect to a known, measured confounder in our control matrix. Pre-treatment grievances with the Iraqi government – proxied with an variable indicating a respondent was discriminated against because on their Sunni identity – as a plausible confounder between our treatment indicator and military legitimacy. A confounder that has the same strength as pre-treatment grievances can explain at most 0.9% of the residual variation of the outcome and treatment. This is well below the robustness value, showing that our estimates are robust to omitted variable bias. If an omitted variable was 1, 5, our 10 times as strong as government grievances our estimated coefficient would be -.167, -0.166, and -0.164 respectively, remaining negative and statistically significant.

Table A-6: Adjusted Treatment Estimates To Unobserved Confounding

| Bound | Label | R2dz.x | R2yz.dx | Adjusted Estimate | Adjusted Se | Adjusted T | Adjusted Lower CI | Adjusted Upper CI |
|---|---|---|---|---|---|---|---|---|
| 1x | gov_grievances | 0e+00 | 0.0091 | -0.1677 | 0.0464 | -3.6119 | -0.2588 | -0.0766 |
| 5x | gov_grievances | 0e+00 | 0.0454 | -0.1660 | 0.0456 | -3.6429 | -0.2554 | -0.0766 |
| 10x | gov_grievances | 1e-04 | 0.0908 | -0.1639 | 0.0445 | -3.6852 | -0.2512 | -0.0766 |

An additional assessment of sensitivity is warranted unique to the results presented in Table 4. Sequential g-estimation requires the assumption of sequential unconfoundedness, there should be no unmeasured covariates which effect the mediator (harm) and the outcome (military legitimacy). We probe this assumption in Figure A-3, using the approach from Acharya, Blackwell and Sen (2016). A substantial positive, residual correlation is required for there to be a non-significant ACDE. Harm and perceptions of military legitimacy are likely to negatively correlated indicating that the ACDE may be larger than the original estimate.

Figure A-3: Sensitivity Analysis of the ACDE




## C.3 Design Validation: Comparing Battle Experiences

In Table A-7 we confirm that respondents in West Mosul experienced higher levels of harm and less professionalism by the Iraqi Armed Forces.

Table A-7: Validation Test: The Effect of the Treatment on Experiences of Harm

| | **Reported House Damage** | **Reported Death of Injury** | **Detected House Damage** | **Reported Looting** |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Treated (West Mosul) | 0.137*** | 0.077** | 0.148** | 0.128*** |
| | (0.047) | (0.034) | (0.056) | (0.030) |
| Observations | 975 | 975 | 975 | 975 |
| Unconditional Mean | .731 | .305 | .118 | .247 |
| PARAMETERS | | | | |
| Basic Demographic Controls | ✓ | ✓ | ✓ | ✓ |
| Additional Individual Controls | ✓ | ✓ | ✓ | ✓ |
| Neighborhood Controls | ✓ | ✓ | ✓ | ✓ |

*Note*: * p <.10, ** p <.05, *** p <.01. HC1 robust, neighborhood-clustered standard errors. Demographic controls are: gender, education level, age, pre-IS household income, and primary identity. Additional individual-level controls are: reported harm during IS rule (pre-battle), experienced various grievances with the Iraqi government (pre-IS), voted in the 2014 parliamentary elections, and paid taxes to IS. Neighborhood controls are: residential unit density, population density, and street density.

## C.4 Additional Survey Evidence on Variation of Harm and Tactics

Table A-8: Causes of Battle-Related Death

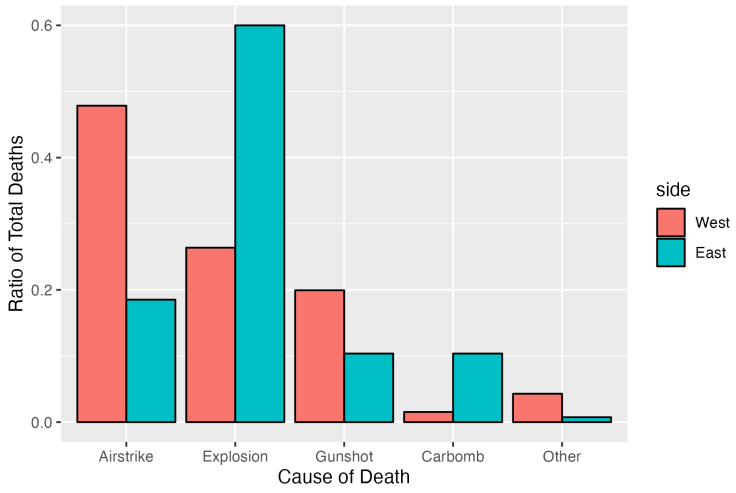
| | East Mosul | West Mosul | Difference-in-Means (East Mosul - West Mosul) |
|---|---|---|---|
| Death from Conflict: Any | 0.028 | 0.124 | 0.095*** |
| | (0.166) | (0.329) | |
| Death from Conflict: Airstrike | 0.005 | 0.059 | 0.054*** |
| | (0.072) | (0.236) | |
| Death from Conflict: Explosion | 0.017 | 0.033 | 0.016*** |
| | (0.129) | (0.178) | |
| Death from Conflict: Gunshot | 0.003 | 0.025 | 0.022*** |
| | (0.054) | (0.155) | |
| Death from Conflict: Carbomb | 0.003 | 0.002 | -0.001 |
| | (0.054) | (0.044) | |
| Death from Conflict: Other | 0.000 | 0.005 | 0.005*** |
| | (0.014) | (0.073) | |
| Observations | 4781 | 2637 | 7418 |

*Note*: * p <.10, ** p <.05, *** p <.01.

Table A-8 conducts a difference in means test of Lafta, Al-Nuaimi and Burnham (2018)'s household survey outcomes covering 7,559 residents of Mosul after the conclusion of the battle. Lafta, Al-Nuaimi and Burnham (2018) ask respondents if they experienced any

death or injury in their household due to the conflict and the cause of the death or injury. Consistent with our analysis, West Mosul residents experiences a higher level of civilian harm in comparison to East Mosul. To explore, variation in the sources of harm, Figure A-4 subsets the data to the households who reported death in the household (326 individuals died in West Mosul compared to 135 in East Mosul) and then plots the percentage of deaths attributed to a given source. Figure A-4shows that a larger proportion of deaths in West Mosul (compared to East Mosul) were due airstrikes or gunshots, while a higher proportion of deaths in East Mosul were attribute to explosions.

Figure A-4: Death Causes




# D Robustness & Additional Results

## D.1 Directly Controlling for Harm

Our theory predicts that the shift in tactics, strategy, and goals during the Battle of Mosul should have a negative effect on military legitimacy. This effect should persist even after conditioning on experiences of harm. To estimate this direct effect of our treatment, our preferred specification de-mediates harm through sequential-g estimation. As an alternative approach, we estimate Equation 2 in Table A-9, a reduced from regression which simply includes the mediator, reported and detected civilian harm, as a control variable. While this estimation strategy may be susceptible to intermediate variable bias, results from this approach are generally consistent with our preferred specification (Table 4).

$$\text{Military Legitimacy}_{ij} = \alpha + \beta \text{West}_j + \theta \text{Collateral Damage}_{ij} + \mathbf{X}_i'\Gamma + \mathbf{N}_j'\Pi + \epsilon_{ij}. \quad (2)$$

Table A-9: Military Legitimacy Between East & West Mosul Directly Controlling for Harm

| | **Perceived Military Legitimacy** | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| Treated (West Mosul) | -0.167*** | -0.147*** | -0.154*** |
| | (0.048) | (0.046) | (0.047) |
| Reported HH Injury or Death | -0.019 | | -0.016 |
| | (0.052) | | (0.052) |
| Detected House Damage | | -0.137*** | -0.143*** |
| | | (0.044) | (0.048) |
| Reported House Damage | | | 0.070 |
| | | | (0.057) |
| Observations | 959 | 959 | 959 |
| Unconditional Mean | 3.636 | 3.636 | 3.636 |
| Oster's $\delta$ | 12.072 | 12.348 | 12.446 |
| PARAMETERS | | | |
| Basic Demographic Controls | ✓ | ✓ | ✓ |
| Additional Individual Controls | ✓ | ✓ | ✓ |
| Neighborhood Controls | ✓ | ✓ | ✓ |

*Note*: *** p<0.01, ** p<0.05, * p<0.1; HC1 robust, neighborhood-clustered standard errors. Demographic controls are: gender, education level, age, pre-IS household income, and primary identity. Additional individual-level controls are: reported harm during IS rule (pre-battle), experienced various grievances with the Iraqi government (pre-IS), voted in the 2014 parliamentary elections, and paid taxes to IS. Neighborhood controls are: residential unit density, population density, and street density.

## D.2 Interactions & Marginal Effects

An *additional* implication of our theory is that harm may have differential effects on military legitimacy, depending on the context in which harms occurs. This extension predicts that the marginal effect of being harmed should be greater in West Mosul than in East Mosul. To probe this extension, we estimate the following equation, and present results in Table A-10.

$$\begin{aligned}\text{Military Legitimacy}_{ij} = \alpha + \beta\text{West}_j + \beta\text{Collateral Damage}_{ij} \\ + \theta\text{West X Collateral Damage}_{ij} + \mathbf{X}_i'\Gamma + \mathbf{N}_j'\Pi + \epsilon_{ij}.\end{aligned} \tag{3}$$

To be clear, our identification does not claim to identify the direct effects of harm. Because harm is potentially endogenous, these results should be interpreted with caution. Regardless, the fully interacted model provides evidence for our primary argument and suggestive support for the extension. The marginal effect of the treatment is negative, regardless whether a respondent was harmed or not. Additionally, the marginal effect of harm is negative for individuals who experienced the battle in West Mosul compared to those exposed to the battle for the East.

Table A-10: Interactive Effects of the Treatment and Harm

| | **Perceived Military Legitimacy** | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| Treated (West Mosul) | -0.008 | -0.118* | -0.138*** |
| | (0.087) | (0.058) | (0.046) |
| Reported House Damage | 0.168*** | | |
| | (0.055) | | |
| Treated (West Mosul) X Reported House Damage | -0.233** | | |
| | (0.089) | | |
| Reported HH Injury or Death | | 0.086 | |
| | | (0.062) | |
| Treated (West Mosul) X Reported HH Injury or Death | | -0.172* | |
| | | (0.092) | |
| Detected House Damage | | | -0.092 |
| | | | (0.166) |
| Treated (West Mosul) X Detected House Damage | | | -0.093 |
| | | | (0.164) |
| Observations | 959 | 959 | 959 |
| Unconditional Mean | 3.636 | 3.636 | 3.636 |
| PARAMETERS | | | |
| Basic Demographic Controls | ✓ | ✓ | ✓ |
| Additional Individual Controls | ✓ | ✓ | ✓ |
| Neighborhood Controls | ✓ | ✓ | ✓ |

*Note*: *** p<0.01, ** p<0.05, * p<0.1; HC1 robust, neighborhood-clustered standard errors. Demographics controls are: gender, education level, age, pre-IS household income, and identity. Additional individual level controls are: reported harm during IS rule (pre-battle), grievances with the Iraqi government (pre-IS), vote participation in the 2014 parliamentary elections, and having paid taxes to IS. Neighborhood controls are: residential unit density, population density, and street density.

## D.3 Additional Regressions

The tables below shows the results of endogenous regressions, where we regress perceived military legitimacy directly on reports of looting and harm. Table A-11 examines the effect of whether a respondent observed looting by Iraqi military in their neighborhoods, and Table A-12 the effect of detected harm.

Table A-11: The Effect of Looting on Military Legitimacy

| | **Perceived Military Legitimacy** | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Looting | -0.355*** | -0.356*** | -0.338*** | -0.330*** |
| | (0.062) | (0.059) | (0.062) | (0.064) |
| Observations | 993 | 990 | 972 | 968 |
| Unconditional Mean | 3.632 | 3.633 | 3.635 | 3.633 |
| PARAMETERS | | | | |
| Basic Demographic Controls | | ✓ | ✓ | ✓ |
| Additional Individual Controls | | | ✓ | ✓ |
| Neighborhood Controls | | | | ✓ |

*Note*: *** p<0.01, ** p<0.05, * p<0.1; HC1 robust, neighborhood-clustered standard errors. Demographic controls are: gender, education level, age, pre-IS household income, and primary identity. Additional individual-level controls are: reported harm during IS rule (pre-battle), experienced various grievances with the Iraqi government (pre-IS), voted in the 2014 parliamentary elections, and paid taxes to IS. Neighborhood controls are: residential unit density, population density, and street density.

Table A-12: The Effect of Detected Harm on Military Legitimacy

| | **Perceived Military Legitimacy** | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Detected House Damage | -0.178*** | -0.167*** | -0.183*** | -0.166*** |
| | (0.044) | (0.051) | (0.050) | (0.048) |
| Observations | 993 | 990 | 972 | 968 |
| Unconditional Mean | 3.632 | 3.633 | 3.635 | 3.633 |
| PARAMETERS | | | | |
| Basic Demographic Controls | | ✓ | ✓ | ✓ |
| Additional Individual Controls | | | ✓ | ✓ |
| Neighborhood Controls | | | | ✓ |

*Note*: *** p<0.01, ** p<0.05, * p<0.1; HC1 robust, neighborhood-clustered standard errors. Demographic controls are: gender, education level, age, pre-IS household income, and primary identity. Additional individual-level controls are: reported harm during IS rule (pre-battle), experienced various grievances with the Iraqi government (pre-IS), voted in the 2014 parliamentary elections, and paid taxes to IS. Neighborhood controls are: residential unit density, population density, and street density.

## D.4 Disaggregated Results by Actor

In the survey we ask respondents about the perceived military legitimacy of all counter-insurgent actors participating in the Battle of Mosul. Our primary outcome averages across members of the Iraqi Armed Forces – the CTS, Army, and Police. In the primary analysis, we focus on the collective perception of actors because of tractability and because perceptions of the CTS, Army, and Police are all highly correlated. Table A-5 presents the correlation between the survey questions.

Below we analyze the perception of military legitimacy separately for each armed actor. Our treatment does not have a statistically significant effect on perceptions of the United States, a finding that is consistent with our theory because U.S. forces were primarily involved in air operations; they were not visibly involved in ground operations where civilians would have been able to directly observe and form judgments about just conduct and just cause.Additionally, the effect on legitimacy is largest for the federal police followed by the army, and then finally the CTS. This pattern is consistent with our qualitative and secondary-source evidence establishing that the CTS are widely perceived as the most professional and the federal police as the least professional of the actors involved in the battle.

Figure A-5: Correlation Matrix:
Perceived Military Legitimacy By Individual Actor

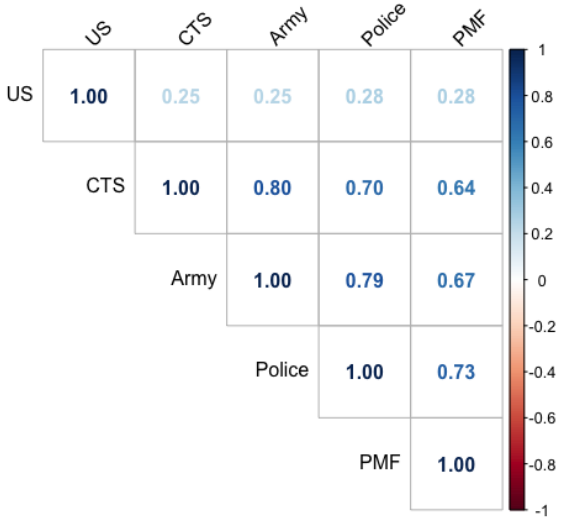



Table A-13: Military Legitimacy of Individual Actors Between East & West Mosul

| | **Perceived Military Legitimacy** | | | | |
|---|---|---|---|---|---|
| | **US** | **CTS** | **Army** | **Police** | **PMF** |
| | (1) | (2) | (3) | (4) | (5) |
| Treated (West Mosul) | -0.130 | -0.124** | -0.185*** | -0.196*** | -0.108** |
| | (0.093) | (0.047) | (0.051) | (0.059) | (0.049) |
| Observations | 954 | 961 | 959 | 961 | 958 |
| Unconditional Mean | 2.017 | 2.017 | 2.017 | 2.017 | 2.017 |
| Oster's $\delta$ | 28.092 | 16.759 | 12.121 | 13.065 | 55.982 |
| PARAMETERS | | | | | |
| Basic Demographic Controls | ✓ | ✓ | ✓ | ✓ | ✓ |
| Additional Individual Controls | ✓ | ✓ | ✓ | ✓ | ✓ |
| Neighborhood Controls | ✓ | ✓ | ✓ | ✓ | ✓ |

*Note*: *** p<0.01, ** p<0.05, * p<0.1; HC1 robust, neighborhood-clustered standard errors. Demographic controls are: gender, education level, age, pre-IS household income, and primary identity. Additional individual-level controls are: reported harm during IS rule (pre-battle), experienced various grievances with the Iraqi government (pre-IS), voted in the 2014 parliamentary elections, and paid taxes to IS. Neighborhood controls are: residential unit density, population density, and street density.

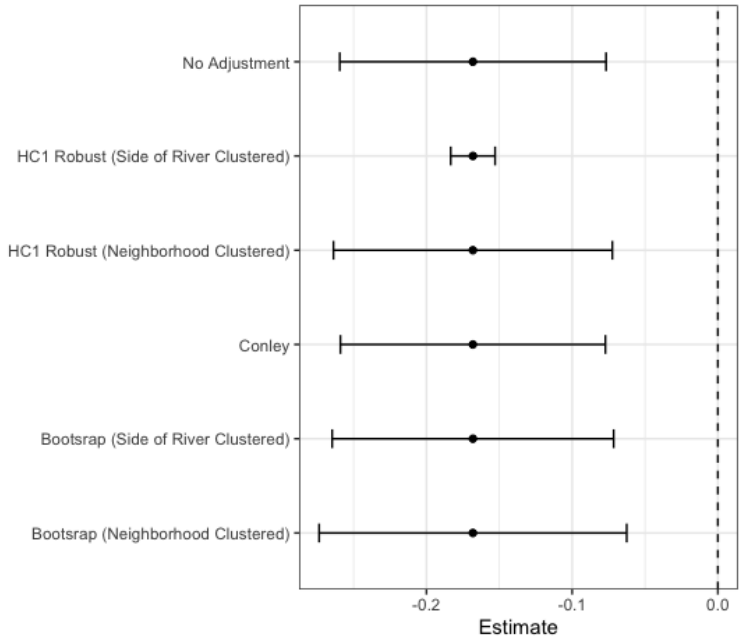
## D.5 Alternative Standard Errors

In this section, we employ alternative calculations for the standard errors of our estimates. Our primary specification estimates HC1 robust, standard errors. Errors are clustered at the neighborhood level, the primary sampling unit of our survey. Respondents within a neighborhood are exposed to similar battle conditions, and thus errors should be correlated within the neighborhood.

Conventional practice is to cluster standard errors at the level of treatment to adjust for hierarchical correlation of the errors. Our bundled treatment is assigned by a respondent's location in regard to the side of the river. Since there are only two sides of the river (two treatment clusters), this complicates standard approaches for clustering standard errors.

In Figure A-6 we probe the robustness of our primary specification from Table 4 Column 4, by displaying alternative corrections for geographically correlated errors. Below we visualize our estimate and associated confidence intervals from various approach. The first rows applies no correction. The second row clusters standard errors by sides of the river. The third row displays standard errors clustered by the neighborhood. The fourth row employs Conley standard errors which account for spatial auto-correlation of data points based on exact locations. Row 5 and 6 mirror rows 2 and 3 but standard errors are calculated non-parametrically through bootstrapping. Results are robust to all specifications.

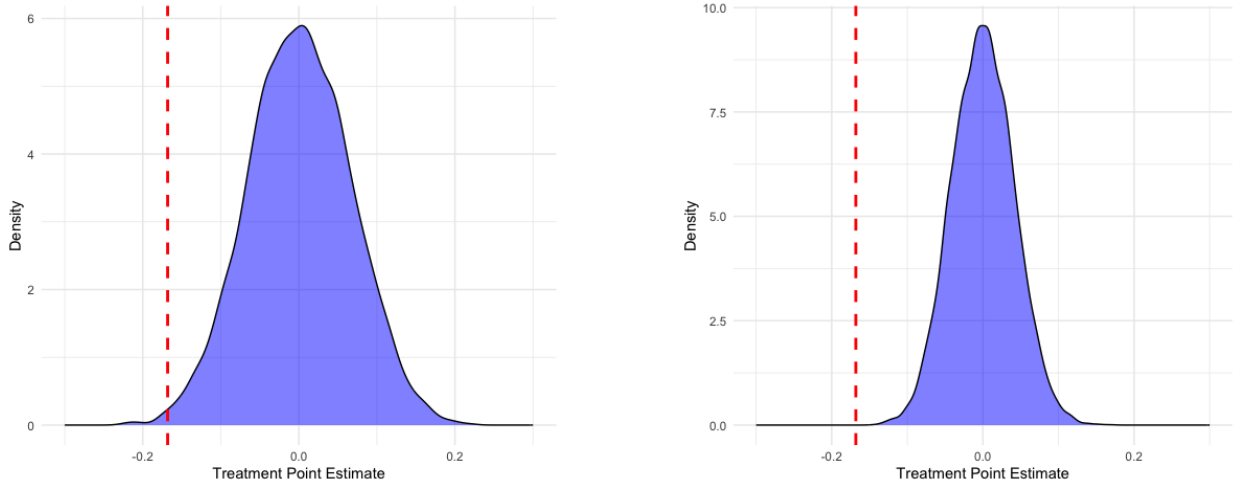
Figure A-6: Robustness to Standard Error Specifications




Additionally, we conduct randomized inference. If a respondent were randomly assigned to living on a side of the river, and thus randomly exposed to the treatment conditions

specific to the different phases of the battle, would it be likely that our estimated results could have occurred by chance? To investigate the robustness of our result to randomized inference, we simulate 10,000 possible permutations of the treatment assignment and estimate our primary specification. Figure A-7 plots the 10,000 simulated coefficients from randomizing the treatment assignment. Panel (A) randomize the treatment assignment at the respondent level and panel (B) cluster randomizes at the neighborhood level. In either case, it is extremely improbable that our results could have occurred by chance. When randomizing at the neighborhood, only 45 of 10,000 estimated coefficients were larger than our estimated effect, resulting in a one-sided p-value of 0.0045 and two-sided p-value of 0.009.

Figure A-7: Randomization Inference




(a) Complete Randomization

(b) Neighborhood Cluster Randomization

## D.6 Size of Buffers

In Table A-14 we expand the size of the buffer to detect harm in a larger vicinity. We replicate our result from Column (4) of Table 4, but we measure satellite-detected within a variety of distances (between 10, 50, 100, and 500 meters) from the respondent's home. In other words, here we attempt to control for damage to a respondent's immediate neighborhood but not necessarily to the respondent's own home. That our results are robust to a variety of radii further suggests that differences in perceived military legitimacy between East and West Mosul are not merely driven by differences in levels of collateral damage alone.

Table A-14: Military Legitimacy Between East & West Mosul Controlling for Various Buffers of Detected Harm

| | **Perceived Military Legitimacy** | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Treated (West Mosul) | -0.152*** | -0.131*** | -0.122*** | -0.132*** |
| | (0.046) | (0.046) | (0.045) | (0.046) |
| Observations | 951 | 951 | 951 | 951 |
| Unconditional Mean | 3.633 | 3.633 | 3.633 | 3.633 |
| PARAMETERS | | | | |
| Basic Demographic Controls | ✓ | ✓ | ✓ | ✓ |
| Additional Individual Controls | ✓ | ✓ | ✓ | ✓ |
| Neighborhood Controls | ✓ | ✓ | ✓ | ✓ |
| Intermediate Controls | ✓ | ✓ | ✓ | ✓ |
| Reported House Damage | ✓ | ✓ | ✓ | ✓ |
| Reported HH Death or Injury | ✓ | ✓ | ✓ | ✓ |
| Detected House Damage (10m) | ✓ | | | |
| Detected House Damage (50m) | | ✓ | | |
| Detected House Damage (100m) | | | ✓ | |
| Detected House Damage (500m) | | | | ✓ |

*Note*: *** p<0.01, ** p<0.05, * p<0.1; Demographics controls are: gender, education level, age, and pre-IS household income. Additional individual level controls are: reported harm during IS rule (pre-battle), experienced various grievances with the Iraqi government (pre-IS), voted in the 2014 parliamentary elections, and paid taxes to IS. Neighborhood controls are: residential unit density, population density, and street density. Intermediate Controls are: primary identity, support for Sharia law, attendance at Friday prayer, preferences for IS governance, evaluation of IS corruption, fairness of IS taxation, and evaluation of Iraqi government corruption.