Managing Insurgency Online Appendix

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1 Estimation Notation and Assumptions

$(\widehat{Coalition\,Attacks})_{i,t}$ denotes the observed number of significant activities (SIGACT) committed against coalition forces in a given governorate (i) and month (t). $(\widehat{Local\,Killings})_{i,t}$ denotes the number of local killings in a governorate-month. These variables include attacks that are not committed by AQI.

$(Coalition\,Attacks)_{i,t}$ and $(Local\,Killings)_{i,t}$ denote the number of attacks on coalition forces and local killings committed by AQI in a governorate-month.

$(Coalition\,Attacks)^*_{i,t}$ and $(Local\,Killings)^*_{i,t}$ denote AQI's leadership's preferred levels of Coalition Attacks and Local Killings in a governorate-month. These levels are driven by the circumstances on the ground.

$(\widehat{Local\,Killings})_{i,t}$ consists of $(Not\,subversion)_{i,t}$ and $(Subversion)_{i,t}$. $(Not\,subversion)_{i,t}$ denotes the number of Local Killings conducted by AQI in a governorate-month that the leadership would like to occur. $(Subversion)_{i,t}$ denotes the number of Local Killings conducted by AQI in governorate-month that the leadership would consider subversion. Because subversion took the form of Local Killings within AQI, I assume all instances of subversion are local killings beyond the level of local killings that the leadership prefers. Formally, $(Local\,kill)^*_{i,t} = (Not\,subversion)_{i,t}$, and $(Local\,kill)_{i,t} = (Not\,subversion)_{i,t} + (Subversion)_{i,t}$.

I assign each of these terms a shorthand version, summarized in the table below.

Notation Used		
Variables	**Shorthand**	**Description**
$\widehat{Coalition\,Attacks)}_{i,t}$, $(\widehat{Local\,Killings})_{i,t}$	$\widehat{CA}_{i,t}$, $\widehat{LK}_{i,t}$	Observed violent incidents
$(Coalition\,Attacks)_{i,t}$, $(Local\,Killings)_{i,t}$	$CA_{i,t}$, $LK_{i,t}$	Incidents committed by AQI
$(Coalition\,Attacks)^*_{i,t}$, $(Local\,Killings)^*_{i,t}$	$CA^*_{i,t}$, $LK^*_{i,t}$	AQI leadership's preferred incident levels
$(Subversion)_{i,t,}$, $(Not\,Subversion)_{i,t}$	$S_{i,t}$, $NS_{i,t}$	AQI's levels of local killings that would be considered subversion (or not).

Referring back to the estimation model, for β_1 to identify the causal shift in AQI's proportion of subversion, the estimation relies on three assumptions. Throughout these assumptions, I let Z_t denote the Zarqawi indicator and X denote a control variables (as defined in the body of the paper).

First, I assume members of AQI subvert at the expense of attacking coalition forces at a 1-to-1 trade-off.

Assumption 1: *I assume*

$$
\begin{aligned}
(Not\,Subversion)_{i,t} &= (Not\,subversion)^*_{i,t} && (1)\\
(Coalition\,Attack)_{i,t} &= (Coalition\,Attack)^*_{i,t} - \chi(Subversion)_{i,t}, && (2)
\end{aligned}
$$

with $\chi = 1$.

This assumption, that conducting one additional local killing comes at the expense of one attack against coalition forces may mis-estimate the true trade-off. Because attacking coalition forces is likely riskier and harder than attacking civilians, it might be expected that one less attack against coalition forces would lead to more violence against local actors. If this is the case, the estimation below understates the true value of subversion that occurred.

Using the one-to-one trade-off, it is useful to define the "operational constraint."

Definition: *$K_{i,t} \in \{0, 1, 2, ..., \bar{K}\}$ defines an operational constraint. In month t and governorate i, AQI is only able to conduct a finite number of attacks, or*

$$K_{i,t} = (Not\, subversion)_{i,t} + (Subversion)_{i,t} + (Coalition\, Attack)_{i,t}. \quad (3)$$

Note that the one-to-one trade-off also implies that $K_{i,t} = (Coalition\, Attack)^{*}_{i,t} + (Not\, subversion)^{*}_{i,t}$.

Second, I assume the Zarqawi targeting did not change the underlying "appropriate" ratio of violence that AQI leadership would want committed.

Assumption 2: *I assume*

$$\mathbb{E}\left[\frac{NS^{*}_{i,t}}{NS^{*}_{i,t} + CA^{*}_{i,t}} \mid Z_t = 1,\, X\right] = \mathbb{E}\left[\frac{NS^{*}_{i,t}}{NS^{*}_{i,t} + CA^{*}_{i,t}} \mid Z_t = 0,\, X\right] = \bar{\rho}_i \quad (4)$$

To accommodate Assumption 2, I restrict analysis to a time frame that includes the Zarqawi targeting but would likely not experience a major, sample wide shift in AQI's preferred levels of violence. For this reason, months before the Samarra Mosque bombing in February 2006, which escalated the sectarian civil war between Sunni and Shia populations in Iraq, are excluded. Similarly, months including and following the outbreak of the Anbar Awakening and coalition troop surge are excluded.

Third, I assume the observed local killing proportion is the sum of AQI's local killing proportion and random noise with a governorate-specific fixed conditional expectation.

Assumption 3: *I assume the observed violence relates to the level of violence conducted by*

AQI by

$$\frac{\widehat{LK}_{i,t}}{\widehat{CA}_{i,t} + \widehat{LK}_{i,t}} = \frac{LK_{i,t}}{CA_{i,t} + LK_{i,t}} + \psi_{i,t}, \tag{5}$$

where, for each governorate i, $\mathbb{E}\left[\psi_{i,t} \,|\, Z = 0,\, X\right] = \mathbb{E}\left[\psi_{i,t} \,|\, Z = 1,\, X\right] = \bar{\psi}_i$.

Becuase AQI was a major actor in the Iraqi insurgency, it follows that AQI's activity would play a significant role in determining the violence that occurred. Assumption 3 follows this by formalizing that the observed violence follows from AQI's violence, subject to some random noise.

2 Identifying the Shift in Subversion

I define the expected value of the β_1 coefficient as

$$\mathbb{E}\left[\beta_1 \,|\, Z,\, X\right] = \mathbb{E}\left[\frac{\widehat{LK}_{i,t}}{\widehat{CA}_{i,t} + \widehat{LK}_{i,t}} \,|\, Z_t = 1,\, X\right] - \mathbb{E}\left[\frac{\widehat{LK}_{i,t}}{\widehat{CA}_{i,t} + \widehat{LK}_{i,t}} \,|\, Z_t = 0,\, X\right].$$

By Assumption 3,

$$\mathbb{E}\left[\beta_1 \,|\, Z,\, X\right] = \left[\frac{LK_{i,t}}{CA_{i,t} + LK_{i,t}} + \psi_{i,t} \,|\, Z_t = 1,\, X\right] - \mathbb{E}\left[\frac{LK_{i,t}}{CA_{i,t} + LK_{i,t}} + \psi_{i,t} \,|\, Z_t = 0,\, X\right],$$

$$= \mathbb{E}\left[\frac{LK_{i,t}}{CA_{i,t} + LK_{i,t}} \,|\, Z_t = 1,\, X\right] - \mathbb{E}\left[\frac{LK_{i,t}}{CA_{i,t} + LK_{i,t}} \,|\, Z_t = 0,\, X\right].$$

By Assumption 1,

$$\begin{aligned}\mathbb{E}\left[\beta_1 \,|\, Z,\, X\right] =& \mathbb{E}\left[\frac{NS_{i,t}+S_{i,t}}{NS_{i,t}+S_{i,t}+CA_{i,t}-\chi * S_{i,t}} \,|\, Z_t=1,\, X\right] - \\ & - \mathbb{E}\left[\frac{NS_{i,t}+S_{i,t}}{NS_{i,t}+S_{i,t}+CA_{i,t}-\chi * S_{i,t}} \,|\, Z_t=0,\, X\right],\end{aligned}$$

$$=\mathbb{E}\left[\frac{NS_{i,t}+S_{i,t}}{NS_{i,t}+CA_{i,t}} \,|\, Z_t=1,\, X\right] - \mathbb{E}\left[\frac{NS_{i,t}+S_{i,t}}{NS_{i,t}+CA_{i,t}} \,|\, Z_t=0,\, X\right].$$

By Assumption 2,

$$\mathbb{E}\left[\beta_1 \,|\, Z,\, X\right] =\mathbb{E}\left[\frac{S_{i,t}}{NS_{i,t}+CA_{i,t}} \,|\, Z_t=1,\, X\right] - \mathbb{E}\left[\frac{S_{i,t}}{NS_{i,t}+CA_{i,t}} \,|\, Z_t=0,\, X\right].$$

By the defintion of K,

$$\mathbb{E}\left[\beta_1 \,|\, Z,\, X\right] =\mathbb{E}\left[\frac{S_{i,t}}{K_{i,t}} \,|\, Z_t=1,\, X\right] - \mathbb{E}\left[\frac{S_{i,t}}{K_{i,t}} \,|\, Z_t=0,\, X\right].$$

I let the subscript "pre-Zarqawi" denote values before the Zarqawi targeting and let "post-Zarqawi" denote values after the Zarqawi targeting. β_1 can be re-written

$$\mathbb{E}\left[\beta_1 \,|\, Z,\, X\right] =\mathbb{E}\left[\frac{S_{i,post-Zarqawi}}{K_{i,t}} \,|\, X\right] - \mathbb{E}\left[\frac{Subversion_{i,pre-Zarqawi}}{K_{i,t}} \,|\, X\right].$$

3 Calculating the Lower-Bound on Incidents of Subversion

How did the Zarqawi targeting affect the actual number of incidents of subversion? Using the definition of β_1 as defined above, it is possible to calculate a lower bound on the number of local killings that can be attributed to Zarqawi's removal.

$$minimize \quad [S_{i,post-Zarqawi} - S_{i,pre-Zarqawi}]$$

Such that:

$$\beta_1 \quad = \quad \frac{S_{i,post-Zarqawi}}{K_{i,post-Zarqawi}} - \frac{S_{i,pre-Zarqawi}}{K_{i,pre-Zarqawi}}$$

Substituting the condition on β_1 into the minimization generates

$$minimize \left[K_{i,post-Zarqawi} * \beta_1 + \frac{K_{i,post-Zarqawi} * S_{i,pre-Zarqawi}}{K_{i,pre-Zarqawi}} - S_{i,pre-Zarqawi} \right]$$

I assume $K_{i,post-Zarqawi} > K_{i,pre-Zarqawi}$ or that AQI's capacity grew after the Zarqawi targeting because local killings and incidents against Coalitions forces were both increasing after Zarqawi's death. Therefore, to minimize the difference, I assume the level of subversion pre-Zarqawi is fixed at 0.[1]

To assign a value to $K_{i,post-Zarqawi}$, I make assumptions on the share of violence committed by AQI relative to the other insurgent groups. While there is no way to know this exact figure, I identify a conservative estimate. Based on details given in Pincus (2006), I assume AQI accounted for roughly 5% of the insurgent population in Iraq, which is the lowest estimate I could find. Notably, this estimate is lower than others; for example, the US military claimed that in 2007 AQI was responsible for 15% of the violence in Iraq (Tilghman, 2007). If this latter estimate was correct, what I report below is an underestimation of the true number of local killings. I also assume that members of AQI were no more productive in committing violence than members of other insurgent groups. Together, this implies that

[1] In all likelihood this was not the case, as some statements by AQI in 2004 suggest agents were stealing and looting (CTC, 2004). If there was some subversion occurring before the Zarqawi targeting, this would imply the true impact of the Zarqawi targeting was larger.

AQI accounted for 5% of the violence committed in governorates where it operated, which gave the group a per-month "operational constraint" of 298 Coalition Attacks and Local Killings each month across governorates where AQI operated. Then, using the regression estimates and formula above, I find the targeting of Abu Zarqawi caused an increase of 79 Local Killings in the three months following the Zarqawi targeting. If instead AQI's members were more productive than other insurgent groups, this figure would increase. For example, if AQI conducted twice the level of violence as comparably sized insurgent groups, then as a lower bound, the Zarqawi targeting caused an increase in 151 incidents of sectarian violence. Finally, if AQI conducted three times the level of violence as comparably sized insurgent groups, the Zarqawi targeting caused to an increase in 217 incidents of sectarian violence.

4 Zarqawi Targeting Robustness Checks

4.1 Full Estimation Results

Table 6 repeats the full estimation reported in the body of the paper, but includes all estimation coefficients. "F.d. In Civcas" are the first-differenced levels of insurgent-caused civilian casualties, as taken from the Iraq Body Count data. "L.f.d In Civcas" are the lagged $(t-1)$ first-differenced levels of insurgent caused civilian casualities. "F.d. Co Civcas" and "L.f.d. Co Civcas" are first-differenced and lagged-first-differenced levels of coalition caused civilian casualties. "F.d. CERP" and "L.f.d. CERP" denoted first-differenced and lagged-first-differenced levels of CERP spending.

Table 1: Zarqawi Targeting and Changes in the Local Killing Proportion (Feb-Aug 2006)

	(1) OLS	(2) OLS	(3) OLS	(4) F.Logit	(5) ME F.Logit	(6) Boot
Zarqawi	0.0846**	0.0884**	0.0891**	0.581***	0.113***	0.0891***
	(0.0256)	(0.0266)	(0.0287)	(0.168)	(0.0326)	(0.0269)
F.d. In Civcas			0.000172	0.0000555	0.0000106	0.000172
			(0.000379)	(0.00257)	(0.000490)	(0.000688)
L.f.d. In Civcas			0.000346	-0.000871	-0.000166	0.000346
			(0.000525)	(0.00484)	(0.000922)	(0.000723)
F.d. Co Civcas			0.000640	0.00446	0.000851	0.000640
			(0.000689)	(0.00384)	(0.000732)	(0.00220)
L.f.d. Co Civcas			-0.000331	-0.00227	-0.000433	-0.000331
			(0.000918)	(0.00443)	(0.000845)	(0.00181)
F.d. CERP			-0.000238	0.000115	0.0000220	-0.000238
			(0.00114)	(0.00641)	(0.00122)	(0.00146)
L.f.d CERP			-0.000162	0.00191	0.000364	-0.000162
			(0.00116)	(0.00545)	(0.00104)	(0.00136)
Constant	0.278**	0.276***	0.276***	1.520***		0.276***
	(0.0937)	(0.0115)	(0.0126)	(0.0545)		(0.0875)
Governorate FE	No	Yes	Yes	Yes	Yes	Yes
Controls	No	No	Yes	Yes	Yes	Yes
R-Squared	0.0255	0.199	0.208			0.208
N	60	60	60	60	60	60

$^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Columns (1)-(5) report robust standard errors clustered by governorate in parentheses. Column (5) reports marginal effects from the fractional logit regression calculated at the means of the covariates. Column (6) reports bootstrapped standard errors (10,000 bootstraps). The dependent variable is the Local Kill Proportion. Control variables are the present and lagged first-differences in the level of CERP spending and insurgent and coalition civilian causalities. All covariates are at the governorate-month level. I limit sample to dates February 1 2006 to August 31 2006 and to governorates where AQI operated.

4.2 Addressing a District-Month Level of Analysis

For the months in the analysis, the Iraq Body Count data includes monthly governorate-level morgue reports for Baghdad. Were it not for these reports, I would be able to use a finer-grain district-month level of analysis. In Table 2, as a robustness check, I re-estimate the results above dropping Baghdad and using a district-month level of analysis. In all identified models, I include district fixed effects and either cluster standard errors at the district level or estimate bootstrapped standard errors. Across specifications, excluding the average marginal effects from Model 4, the results remain positive and statistically significant (at the 5% level), suggesting the Zarqawi targeting led to increased level of subversion within AQI.

Table 2: Zarqawi Targeting and Changes in the Local Kill Proportion, District-Month Level, (Feb-Aug 2006)

	(1) OLS	(2) OLS	(3) OLS	(4) F.Logit	(5) ME F.Logit	(6) Boot
Zarqawi	0.0641***	0.0644***	0.0659***	0.692***	0.0120	0.0659***
	(0.0201)	(0.0200)	(0.0214)	(0.188)	(5.076)	(0.0207)
F.d. In Civcas			-0.00193	-0.0220	-0.000358	-0.00193
			(0.00183)	(0.0215)	(0.152)	(0.00208)
L.f.d. In Civcas			-0.00120	-0.0164	-0.000267	-0.00120
			(0.00189)	(0.0216)	(0.113)	(0.00239)
F.d. Co Civcas			0.00123	-0.00710	-0.000116	0.00123
			(0.00137)	(0.0104)	(0.0490)	(0.00225)
L.f.d. Co Civcas			0.000236	-0.00827	-0.000135	0.000236
			(0.00166)	(0.0119)	(0.0571)	(0.00284)
F.d. CERP			-0.00104	-0.00588	-0.0000956	-0.00104
			(0.00162)	(0.00913)	(0.0406)	(0.00225)
L.f.d CERP			-0.00156	-0.0134	-0.000218	-0.00156
			(0.00211)	(0.0125)	(0.0923)	(0.00248)
Constant	0.121***	0.121***	0.121***	-1.266		0.121***
	(0.0318)	(0.00856)	(0.00922)	(804.2)		(0.0317)
District FE	No	Yes	Yes	Yes	Yes	Yes
Controls	No	No	Yes	Yes	Yes	Yes
R-Squared	0.0215	0.0610	0.0705			0.0705
N	182	182	182	182	182	182

$^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Columns (1)-(5) report robust standard errors clustered by governorate in parentheses. Column (5) reports marginal effects from the fractional logit regression calculated at the means of the covariates. Column (6) reports bootstrapped standard errors (10,000 bootstraps). The dependent variable is the Local Kill Proportion. Control variables are the present and lagged first-differences in the level of CERP spending and insurgent and coalition civilian causalities. All covariates are at the district-month level. I limit sample to dates February 1 2006 to August 31 2006 and to governorates where AQI operated.

4.3 Addressing Outliers

I address the possibility of outliers by illustrating no one governorate is driving the results in Table 6. Table 3 re-estimates the full empirical model with controls, but each column in Table 3 lists a governorate that is excluded from the sample (the first column's sample excludes Anbar, the second column's sample excludes Babylon, etc.). In all cases the effect remains positive and statistically significant at the 10% level, suggesting the Zarqawi targeting led to increased level of subversion within AQI.

Table 3: Zarqawi Targeting and Changes in the Local Kill Proportion, Dropping Governorates

	(1) Anbar	(2) Babylon	(3) Baghdad	(4) Diyala	(5) Erbil	(6) Ninewa	(7) Salah A.D.	(8) Tameem	(9) Wassit
Zarqawi	0.0996*	0.0889*	0.0906*	0.0851*	0.0762*	0.0897*	0.0915*	0.0739*	0.108**
	(0.0296)	(0.0326)	(0.0348)	(0.0348)	(0.0275)	(0.0327)	(0.0331)	(0.0271)	(0.0242)
F.d. In Civcas	0.000129	0.000207	-0.0000939	0.000117	0.000241	0.000463	0.000158	-0.00000974	0.0000861
	(0.000496)	(0.000380)	(0.000576)	(0.000502)	(0.000392)	(0.000301)	(0.000444)	(0.000403)	(0.000339)
Lag f.d. In Civcas	0.0000948	0.000461	0.000417	0.0000140	0.000396	0.000702	0.000340	0.0000660	0.000344
	(0.000857)	(0.000493)	(0.000706)	(0.000607)	(0.000535)	(0.000467)	(0.000615)	(0.000494)	(0.000521)
F.d. Co Civcas	0.000235	0.000223	0.00104	0.00119	0.000541	0.000734	0.00109	0.000558	0.000557
	(0.00107)	(0.000441)	(0.00119)	(0.00143)	(0.000657)	(0.000729)	(0.000804)	(0.000773)	(0.000725)
Lag f.d. Co Civcas	-0.000965	-0.000758	-0.0000713	0.000831	-0.000368	-0.000175	-0.000624	-0.000180	-0.000345
	(0.000871)	(0.000647)	(0.00130)	(0.00126)	(0.000890)	(0.000941)	(0.000997)	(0.00107)	(0.000971)
F.d. CERP	0.000222	-0.000449	0.000295	0.000268	-0.0000726	-0.000660	-0.0000704	-0.000304	-0.00103
	(0.00142)	(0.00113)	(0.00173)	(0.00128)	(0.00114)	(0.00141)	(0.00125)	(0.00115)	(0.000840)
Lag f.d CERP	0.000265	-0.000602	0.000398	0.000512	0.0000638	-0.000226	-0.000212	-0.000297	-0.000839
	(0.00139)	(0.00110)	(0.00202)	(0.00131)	(0.00124)	(0.00127)	(0.00119)	(0.00120)	(0.000825)
Constant	0.309***	0.260***	0.254***	0.271***	0.295***	0.299***	0.299***	0.296***	0.196***
	(0.0131)	(0.0141)	(0.0151)	(0.0152)	(0.0120)	(0.0144)	(0.0144)	(0.0119)	(0.0108)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Violence Controls									
R-Squared	0.230	0.230	0.200	0.186	0.219	0.209	0.206	0.143	0.313
N	53	53	53	53	56	53	53	53	53

$^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Robust standard errors clustered by governorate are in parentheses. The dependent variable is the Local Kill Proportion. Control variables are the present and lagged first-differences in the level of CERP spending and insurgent and coalition civilian causalities. All covariates are at the governorate-month level. I limit sample to dates February 1 2006 to August 31 2006 and to governorates where AQI operated.

4.4 Addressing Concerns with the Sampling Window

I also address concerns over the assigned testing window of February 1, 2006 to August 31, 2006. As discussed earlier, this window was created to accommodate Assumption 2 by excluding months experiencing a meaningful shift in the trade-off between attacking coalition forces and attacking local actors. Natural concerns may arise over the specification of this sample. For example, regarding the September 2006 cutoff, there may be concerns that the Awakening had already begun in August and this month should be excluded. Alternatively, there may also be concerns that the September cutoff is too conservative and AQI's leadership would not have changed their preferences towards attacking local actors until October. Similar concerns may arise for using February 2006 as a start-date. I address these concerns and find across a wide range of sample windows, removing Zarqawi led to an increase in subversion.

Table 4: Shifting the Zarqawi Treatment Testing Window, Full Model

Start Date \ End Date	July 31, 2006	August 31, 2006	September 31, 2006
January 1, 2006	0.125** (0.0420)	0.0935*** (0.0267)	0.0751*** (0.0213)
February 1, 2006	0.120** (0.0440)	0.0890** (0.0287)	0.0703** (0.0234)
March 1, 2006	0.108* (0.0520)	0.0805* (0.0361)	0.0588 (0.032)

$^{*}\ p < 0.1$, $^{**}\ p < 0.05$, $^{***}p < 0.01$

Robust standard errors clustered by governorate are in parentheses. The dependent variable is the Local Kill Proportion. Control variables are the present and lagged first-differences in the level of CERP spending and insurgent and coalition civilian causalities. All covariates are at the governorate-month level. I limit sample to dates February 1 2006 to August 31 2006 and to governorates where AQI operated.

Table 4 reports the magnitudes and standard errors for each possible combination of a January, February, or March start date with a July, August, or September termination date. All coefficients are positive, and, excluding the (March, September) pairing that has a p-value of 0.103, are statistically significant at the 10% level. This provides further evidence that the Zarqawi targeting caused an increase in subversion.

4.5 Addressing the Uniqueness of Zarqawi Treatment

I also demonstrate that the killing of Zarqawi produced an average treatment effect that was atypical and unlikely to have arisen as part of a random walk. For the Zarqawi treatment to stand out as an important event that shifted AQI's profile of violence, it should be that the effect of the Zarqawi targeting is statistically atypical relative to the general patterns of violence in Iraq *outside of the seven month sample.* Figure 1 shows this to be true.

In the body of the paper, the estimation uses a seven-month sample window, with the first four months being the untreated sample (occurring before the Zarqawi targeting) and the last three months being the treated sample (including and after the Zarqawi targeting). In the paper, the actual treatment (the killing of Zarqawi) begins June 2006. This seven-month sample window with treatment occurring in the fifth through seventh month can be shifted to out-of-sample months to estimate counterfactual treatment effects. Figure 1 displays the results from these counterfactual estimations. Each x-value in Figure 1 identifies a month where a counterfactual treatment begins. For example, when the x-value is "2006 m10," the model is re-run utilizing a treatment variable (an indicator variable equal to "1" for October, November, and December 2006 and "0" for June, July, August and September 2006). All estimated counterfactual models have dependent variable Local Kill Proportion, governorate fixed effects, governorate clustered standard errors, and the controls mentioned in the body of the text. The top image in Figure 1 displays the average treatment effect magnitudes with confidence intervals, and the bottom displays t-statistics for each month, for twenty counterfactual months centered around the actual treatment (which is blue).

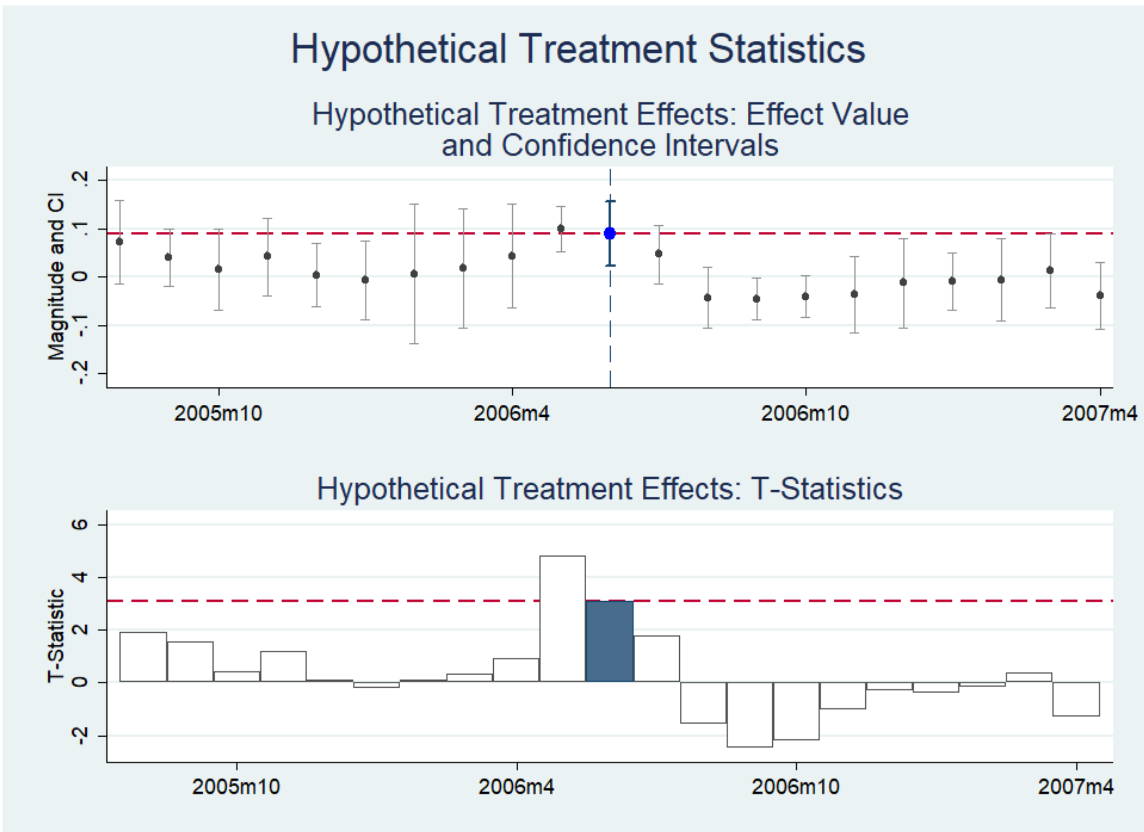

Figure 1. Uniqueness of the Zarqawi treatment, relative to out-of-sample counterfactual tests. All estimated models have dependent variable Local Kill Proportion, governorate fixed effects, governorate clustered standard errors, and the present and lagged first-differences in the level of CERP spending and insurgent and coalition civilian causalities as controls. All covariates are at the governorate-month level, and I limit the sample to governorates where AQI operated.

These results show that the killing of Zarqawi was, in fact, unique. Comparing the magnitudes of the treatment effects and t-statistics, only one hypothetical treatment (out of 21) exceed the Zarqawi magnitude and t-statistic. Thus, the Zarqawi treatment stands out as a tail-event. For this reason, it seems unlikely that the observed Zarqawi treatment arose as the result of a random walk.

4.6 Addressing Concerns with the Governorate-Month Specification

I also address concerns regarding the use of governorate-months as the unit of analysis. Because the level of violence between governorates varied significantly, a natural concern would be that smaller governorates with large shifts in the Local Kill Proportion are driving the results. These issues are unwarranted for two reasons. First, similar results hold when comparing aggregated violence levels for all AQI governorates pre- and post-Zarqawi. After summing the total number of Local Killings and Coalition Attacks, the four months before Zarqawi's death had a Local Kill Proportion of 0.284 and the three months including and after the death of Zarqawi had a local killing proportion of 0.353. This implies that across governorates, the Zarqawi targeting created a shift consistent with more subversion. Second, Table 5, reports the local killing proportion differences pre- and post- Zarqawi by governorate. Excluding Wassit, all governorates experienced an increase in local killing proportion.

Table 5: Per-Governorate Local Killing Ratio Shift

Governorate	Difference in Local Killing Proprtion, Pre- and Post- Zarqawi
Erbil	0.25
Tameem	0.220
Babylon	0.138
Diyala	0.122
Ninewa	0.0821
Baghdad	0.0714
Salah al-Din	0.0675
Anbar	0.00551
Wassit	-0.0777

The Local Kill Proportion is at the governorate-month level. I limit sample to dates February 1 2006 to August 31 2006.

4.7 Addressing "Unknown" Incidents

"Unknown Killings" are killings of Iraqis that are identified but unattributed by the Iraq Body Count. In the sample, there were 448 Unknown Killings. As Condra and Shapiro (2012) describes, the unknown incidents can likely be ascribed to sectarian violence, which is a key component to this analysis. As a robustness check, I modify the Local Killing variable to be a combination of identified Local Killings and Unknown Killings, then re-estimate the model in 6.

In all cases the effect remains positive and statistically significant at the 5% level, suggesting the Zarqawi targeting led to increased level of subversion within AQI.

Table 6: Baseline Model, Treating Unknown Killings as Sectarian Volence (Feb-Aug 2006)

	(1) OLS	(2) OLS	(3) OLS	(4) F.Logit	(5) ME F.Logit	(6) Boot
Zarqawi	0.0851**	0.0891**	0.0898**	0.575***	0.115***	0.0898***
	(0.0264)	(0.0274)	(0.0292)	(0.164)	(0.0327)	(0.0278)
F.d. In Civcas			0.000237	0.000456	0.0000896	0.000237
			(0.000326)	(0.00218)	(0.000429)	(0.000759)
L.f.d. In Civcas			0.000379	-0.000458	-0.0000900	0.000379
			(0.000538)	(0.00464)	(0.000912)	(0.000805)
F.d. Co Civcas			0.000530	0.00383	0.000753	0.000530
			(0.000673)	(0.00375)	(0.000736)	(0.00265)
L.f.d. Co Civcas			-0.000478	-0.00292	-0.000573	-0.000478
			(0.000871)	(0.00410)	(0.000805)	(0.00200)
F.d. CERP			-0.000183	0.000303	0.0000595	-0.000183
			(0.00107)	(0.00583)	(0.00115)	(0.00142)
L.f.d CERP			-0.000362	0.000729	0.000143	-0.000362
			(0.00104)	(0.00466)	(0.000916)	(0.00122)
Constant	0.287**	0.285***	0.284***	1.663***		0.284***
	(0.0948)	(0.0119)	(0.0128)	(0.0530)		(0.0900)
Governorate FE	No	Yes	Yes	Yes	Yes	Yes
Controls	No	No	Yes	Yes	Yes	Yes
R-Squared	0.0254	0.215	0.228			0.228
N	60	60	60	60	60	60

$^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Columns (1)-(5) report robust standard errors clustered by governorate in parentheses. Column (5) reports marginal effects from the fractional logit regression calculated at the means of the covariates. Column (6) reports bootstrapped standard errors (10,000 bootstraps). The dependent variable is the Local Kill Proportion. Control variables are the present and lagged first-differences in the level of CERP spending and insurgent and coalition civilian causalities. All covariates are at the governorate-month level. I limit sample to dates February 1 2006 to August 31 2006 and to governorates where AQI operated.

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