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*Reply to Golan et al.: Revisiting the Statistical Analysis of the Israeli-Palestinian Conflict Confirms That Both Sides Retaliate*

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## Reply to Golan and Rosenblatt: Revisiting the statistical analysis of the Israeli–Palestinian conflict confirms that both sides retaliate

We thank Golan and Rosenblatt (1) for their comments on our analysis (2), which we address in turn. First, Golan and Rosenblatt suggest that the time series may be nonstationary (that is, the distribution of the variables in the data may change over time). Our original paper addressed this concern in two ways. First, we tested for stationarity using the standard Dickey Fuller test. The results (table S2 in ref. 2) supported the stationarity hypothesis. Second, we included year dummy variables to control for structural breaks. We chose years rather than political events for these dummy variables to avoid the arbitrariness inherent in the latter approach. Thus, nonstationarity is not a concern for our conclusions. Nevertheless, Golan and Rosenblatt answer an interesting additional question by showing that the patterns of retaliation vary across subperiods.

Golan and Rosenblatt also suggest a modified model in which (i) the same lag is used for all time series, (ii) a square root-stabilizing transformation is applied to the data before analysis, and (iii) all three variables (Qassam firings and Israeli and Palestinian fatalities) are included in the equation. We find that this alternative model does not fit the data better than ours. The mean-squared prediction error of our model was  $7.894 \pm 1.564$  (mean  $\pm$  1 SE), and the mean-squared prediction error of the model by Golan and Rosenblatt (1) is  $7.717 \pm 1.466$ ; the difference in fit is insignificant ( $t = -0.95$ ,  $P = 0.34$ ). However, we are pleased that this model confirms our main result, which is that both sides retaliate. Table 1, which replicates our original analysis with the modifications suggested by Golan and Rosenblatt, confirms this claim. Note that the  $F$ -tests that we use are consistent by standard results from large-sample theory (3), despite the claims of Golan and Rosenblatt to the contrary. An interesting difference between our original model and the model

of Golan and Rosenblatt is that, in their analysis, Qassam attacks lead to Israeli retaliation, whereas in our model, they did not. Golan and Rosenblatt correctly say that it is more customary to fit vector autoregressions (VARs) using all predictor variables with the same number of lags, and although this does not lead to an improvement in model fit in this case, it lends weight to the view that Israel does indeed retaliate for Qassam firings.

Golan and Rosenblatt further argue that figures 2 and 3 in ref. 2 do not take the autocorrelation of the data into account. We fully agree that plots of the VAR impulse response functions are more informative. We merely showed the response functions used by Jaeger and Paserman (4) to allow comparison of our results with their results. Of course, all statistical results and conclusions of our paper were based purely on the VAR results, which control for autocorrelation.

Finally, Golan and Rosenblatt point out that, by computing the proportion of events that can be attributed to retaliation based on the first day rather than several days after an attack, our analysis provided a lower bound on the proportion of events that can be attributed to retaliation. This is correct; we chose this approach to be as conservative as possible and to avoid overstating our results. However, we are encouraged that less-conservative approaches confirm our findings.

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Table 1. Israeli and Palestinian retaliation for killings and Qassam attacks

Specification	Test statistic	Palestinian retaliation using Qassams		Palestinian retaliation using killings		Israeli retaliation for Qassams		Israeli retaliation for killings	
		Levels	Incidence	Levels	Incidence	Levels	Incidence	Levels	Incidence
Basic	<i>F</i>	4.5995*	1.7358*	2.9396*	3.6051*	2.0461*	1.8014*	4.8493*	5.7026*
	<i>P</i>	0.0000	0.0599	0.0007	0.0000	0.0210	0.0484	0.0000	0.0000
Control same-day events	<i>F</i>	3.5830*	1.4848	1.6405*	2.1028*	1.2342	0.9383	4.2495*	4.5359*
	<i>P</i>	0.0000	0.1299	0.0811	0.0172	0.2579	0.5019	0.0000	0.0000
Omit mutual events at $t - 1$	<i>F</i>	2.5316*	1.7358*	3.7769*	3.6051*	1.8577*	1.8014*	3.5251*	5.7026*
	<i>P</i>	0.0035	0.0599	0.0000	0.0000	0.0403	0.0484	0.0001	0.0000
Control variable for years	<i>F</i>	4.5617*	1.9226*	1.7645*	1.7912*	1.9333*	1.7990*	4.1343*	3.9416*
	<i>P</i>	0.0000	0.0323	0.0546	0.0501	0.0311	0.0488	0.0000	0.0000

The table reports the test statistics for the test of the null hypothesis that the lagged coefficients on the respective other variable are jointly equal to zero. The model was suggested by Golan and Rosenblatt (1) (i.e., a full 3D VAR with 11 lags of all dependent variables and a square root variance-stabilizing transformation). Significant statistics can be interpreted as retaliation by one party for previous violence from the other side. Palestinian retaliation after killings of Palestinians by Israel includes killings of Israelis by Palestinians or Qassam attacks by Palestinians on Israel. Israeli retaliation includes killings of Palestinians by Israel after either Qassam attacks by Palestinians on Israel or killings of Israelis by Palestinians.

\*Significant statistics.