



## להרויח 25% בתיק השקעות ?

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## What can math tell us about the war in Gaza?

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There are two possible scenarios for the effect of collateral damage in guerrilla warfare.

After 29 days of intense fighting, 2,657 rocket attacks by the Hamas, 4,762 air attacks by Israel, 1,865 Palestinians and 68 Israelis dead, and thousands of houses leveled in the Gaza Strip it appears that neither side can claim victory. The mighty IDF, deploying over 100,000 soldiers, could not defeat a smaller, relatively ill-equipped and poorly trained terrorist/guerrilla organization. This should come as no surprise.

Mathematical models of armed conflicts have been around for almost 100 years.

They often provide insights about combat situations such as the recent war in Gaza. In a simple yet compelling model, an American mathematician named Deitchman showed, over 50 years ago, that guerrilla warfare is distinctly different than "regular" force-on-force wars such as WWII, the 1973 Israel-Arab war and the 1991 Gulf war. Unlike regular "symmetric" conflicts, guerrilla wars are asymmetric with respect to the targeting capabilities of each side. While the regular force (IDF) is fully exposed as targets to the guerrillas (Hamas), the latter are diffused and hiding among civilians and thus become more elusive and harder to target accurately.

The manifestation of this asymmetry in the Gaza war was that while the attrition of the IDF forces depended on the Hamas strength, the attrition of the Hamas also depended on their proportion, or their density, in the civilian population.

This observation has two important implications. First, as time passed and Hamas losses and casualties mounted, the density of active weapons and fighters in the area shrunk, and thus it became even harder for the IDF to find and effectively target its enemy. Secondly, and perhaps more importantly, a large portion of the IDF miss-targeted firepower generated collateral casualties among civilians, and this portion kept obviously increasing as the number of Hamas targets shrank.

There are two possible scenarios for the effect of collateral damage in guerrilla warfare. In the first scenario, the collateral damage amplifies resentment among civilians against the regular force (IDF) and thus enhances support and recruitments to the guerrillas (Hamas).

In the second scenario, people may put the blame for the collateral damage on the guerrillas, who instigated the conflict, and consequently will actively oppose them by supporting the regular force. Using an appropriate mathematical model that dynamically follows the evolution of the conflict, it has been shown that in the first

scenario the regular force cannot win; the best it could hope for is a stalemate with the guerrillas, which may be ultimately resolved by negotiations and agreement. In the second scenario, when the civilians turn against the guerrillas, the regular force may prevail as the victor – eradicating the guerrillas. This can happen if the regular force applies sufficiently effective firepower, and the support of the disenchanted civilians to the regular force is significant (mostly by supplying intelligence regarding the whereabouts of the guerrillas).

Which of these two scenarios applies in Gaza is yet to be seen. From scattered reports it appears that some criticism against Hamas, accompanied by outbursts of violence, has been expressed in Gaza during the war. However, it looks like heavy-handed coercion by Hamas would crush any such civilian rebellion and mitigate the effect. If most of the people in Gaza only blame Israel for the damage and fully support Hamas, which seems to be the case as of now, any future military engagement between the IDF and Hamas will end with a similar result – stalemate.

The author is a professor of Operations Research at the Naval Postgraduate School in Monterey, CA. His research on combat modeling has appeared in leading scientific journals including Science Magazine.



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