

PRELIMINARY DRAFT

**THE CYCLE OF VIOLENCE? AN EMPIRICAL ANALYSIS OF
FATALITIES IN THE PALESTINIAN-ISRAELI CONFLICT**

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Abstract

This paper studies the dynamics of violence in the Palestinian-Israeli conflict since the outbreak of the Second (or “Al-Aqsa”) Intifada in September 2000, during which more than 3,200 Palestinians and 1,000 Israelis have been killed. The violence has followed an uneven pattern, with periods of high levels of violence and periods of relative calm. We document that deaths among Palestinians occur primarily among younger men while those among Israelis are somewhat more evenly distributed across ages and sexes. We also find that there has been a substantial shift towards suicide attacks as the primary means by which Israelis are killed, while Palestinians have been consistently most likely to be killed by gunfire throughout the Intifada. Using data on the number of deaths occurring each day between September 2000 and January 2005, we estimate reaction functions for both Israelis and Palestinians and find evidence of unidirectional Granger causality from Palestinian violence to Israeli violence, but not vice versa. This finding is consistent whether we look only at the incidence of fatalities or whether we look at the level of fatalities, and is robust to the specification of the lag structure and the level of time aggregation. We find little evidence that violence on either side has a direct deterrent or incapacitation effect. We also find that the construction of the separation barrier between Israel and the West Bank has had little impact on the incidence or level of violence, while the extended Israeli military presence in the Occupied Territories after “Operation Defensive Shield” (i.e., since mid-2002) has reduced the incidence of Palestinian violence against Israelis. The estimated parameters of the reaction functions changed somewhat over the period examined; however, unidirectional Granger causality holds before, during and after “Operation Defensive Shield.” We conclude that, despite the popular perception that Palestinians and Israelis are engaged in “tit-for-tat” violence, there is no evidence to support that notion. Rather, the Israelis reacted in a predictable and statistically significant way to Palestinian violence against them, while Palestinian actions were not related to Israeli violence, either through revenge, deterrence or incapacitation.

The most recent outburst of the Palestinian-Israeli conflict, commonly known as the Second, or al-Aqsa, Intifada,¹ has claimed the lives of more than 3,200 Palestinians and nearly 1,000 Israelis since its outbreak in September 2000. This eruption of violence has been accompanied by a severe economic crisis, both in Israel and in the Palestinian Authority-administered territories in the West Bank and Gaza.² Repeated attempts to broker a stable ceasefire have failed, and the conflict has often been characterized as a vicious cycle of violence, from which it is impossible to escape.³ This view suggests that the dynamics of the conflict are governed primarily by a vengeance motive, and that any act of violence will lead to a spiral of retaliation and counter-retaliation that cannot be broken. It is possible, however, that incapacitation and deterrence also play a role and that military operations conducted by the Israel Defense Forces (IDF) against suspected terrorists and militants might also lead to a reduction in violence, to the extent that they limit the operational capabilities of Palestinian groups to carry out attacks against Israeli targets. The question of whether military operations are effective and whether their timing is chosen appropriately has been at the center of the public debate in Israel, but no serious and convincing evidence has been provided to settle the issue.

¹ The term “intifada” literally means “shaking off” in Arabic, but it is most often and somewhat loosely translated as “uprising.” The first intifada took place between 1987 and 1993. By and large, Palestinians did not resort to the use of gunfire and explosives, drawing sympathy for their cause among international public opinion and in Israel. The first intifada ended in September 1993 with the Declaration of Principles, which marked the mutual recognition of Israel and the Palestine Liberation Organization, and the launch of the Oslo peace process.

² Israeli GDP per capita shrunk by about 6 percent in Israel between 2000 and 2002 in local currency terms, and by 19 percent in dollar terms (source: Bank of Israel). Palestinian Gross National Income per capita fell by 46 percent between 1999 and 2002 (World Bank, 2003).

³ For example, here are some reactions to the suicide bombing attack at the Dolphin disco in Tel Aviv on June 1, 2001. “U.N. Secretary-General Kofi Annan [...] condemns this indiscriminate terrorist attack [...]. This [...] event underlines the urgency of breaking the **cycle of violence**.” (UN Secretary-General press release, June 1, 2001). “The Presidency of the European Union [...] appeals to Israel not to take measures which result in a further escalation of the **cycle of violence**.” (European Union press release, June 2, 2001). The emphasis is ours.

In this paper we explicitly address these issues by testing whether violence against Israelis and Palestinians affects the incidence and intensity of each side's reaction. We estimate how Palestinians react to targeted killings and Israeli violence against Palestinians in general, as well as Israel's response to suicide bombings and other Palestinian violence against Israelis, and examine the incidence and intensity of each side's reaction. We test empirically whether the pattern of violence in the current conflict should indeed be characterized as a cycle, in which violence by one party causes violence by the other party and vice versa, or whether causality is unidirectional.

Recent years have seen a flurry of research on the various aspects of terrorism and armed conflict in general, as well as specific to the Palestinian-Israeli conflict. A number of theoretical papers analyze terrorism as a tool to achieve political goals. Pape (2003) argues that suicide terrorism is mainly used as a strategic device to coerce modern liberal democracies to make significant territorial concessions, while Kydd and Walter (2002) develop a model in which the main objective of terrorism is to prevent the implementation of a peace treaty. Berrebi and Klor (2004) set up a political economic model, in which they show that support for the right-wing party in Israel rises after periods with high levels of terrorism, and decreases after relatively calm periods, while the expected level of terrorism is higher during the left wing party's tenure in office. Using data on fatal Israeli terrorism casualties since 1991 and Israeli public opinion polls, they find generally strong support for their hypotheses. One empirical branch of the literature investigates the effects of terrorism on a number of different outcomes, such as macroeconomic aggregates (Eckstein and Tsiddon, 2004) or financial markets (Abadie and Gardeazabal, 2003; Berrebi and Klor, 2005).

A different set of studies has looked instead at the individual and aggregate determinants of terrorism. Berrebi (2003) studies the individual determinants of suicide terrorism, and finds that, contrary to conventional wisdom, most Palestinian suicide bombers come from relatively educated and wealthy backgrounds. Similarly, Krueger and Maleckova (2003) fail to find any significant connection between education, poverty and the propensity to participate in terrorism among Lebanese militant groups. Krueger and Laitin (2003) study the factors that affect the probability of a country to be either the source or the target of a terrorist event.

More closely related to our work is Enders and Sandler (1993), which examines the effectiveness of antiterrorism policies in the context of transnational terrorism. Brophy-Baermann and Conybeare (1994) build a theoretical model that describes the optimal level and modality of retaliation against terrorism. In a recent paper, Zussman and Zussman (2005) attempt to assess the effectiveness of Israel's policy of targeted killings of terrorist leaders in the current conflict by looking at the reaction of the Israeli stock market.

We directly examine the dynamic of violence between Palestinians and Israelis. Using data on the daily number of deaths on both sides of the conflict from September 2000 to January 2005, we find that there is little evidence to suggest that both sides of the conflict react in a regular and predictable way to violence against them. Rather, we find that the direction of causality (in a Granger, 1969, sense) runs only from violence committed by Palestinians to violence committed by Israelis and not vice versa, and that this causality generally holds throughout the different phases of the conflict. That is, we find that the incidence and levels of Palestinian fatalities can be predicted by the past

incidence and levels of Israeli fatalities, while there is little evidence that there is a direct relationship between fatal casualties suffered by the Palestinians and a lethal response. We do find indirect evidence that the extended Israeli military presence in the Occupied Territories after “Operation Defensive Shield” (mid-2002) has reduced the daily incidence of Israeli fatalities but not their level. This is due in part, we conclude, to a shift in fatalities resulting from a balance between gunfire and suicide attacks by the Palestinians to almost exclusively suicide attacks.

In the next section of the paper we present a brief chronology of the second Intifada, motivating the periods we use to divide our data. We then present a brief theoretical model in which violence by both sides affects future levels of violence through a combination of revenge, deterrence and incapacitation motives. In Section II we discuss the data used for our analysis as well as some descriptive statistics of the individuals who have been killed on both sides of the conflict. Section III presents our basic estimates of the Israeli and Palestinian reaction functions. These are examined more closely in the next two sections on the location and demographics of the fatalities and on the role of targeted killings and suicide bombings. In the last section we offer some conclusions.

I. Chronology

On Thursday, September 28, 2000, Ariel Sharon, then the Israeli opposition leader, made a heavily escorted visit to the Temple Mount in Jerusalem. Palestinians saw this visit as a political provocation. The following day, a large crowd of Palestinian demonstrators gathered on the Temple Mount at the end of the Friday prayers, and

confronted the Israeli police, throwing stones at policemen in the vicinity of the Western Wall. According to the U.S. Department of State (2000), “the Israeli police used rubber bullets and live ammunition to disperse the demonstrators, killing four people and injuring about 200.” According to the Israeli government, 14 policemen were injured during these incidents.⁴ Over the next following days, several similar demonstrations took place in the West Bank and the Gaza Strip. Thus began what has become known as the Second, or Al-Aqsa, Intifada, which has since claimed the lives of more than 3,500 Palestinians and 1,000 Israelis.⁵

To get a broad picture of the conflict, we identify seven distinct phases, from its inception in September 2000 until mid-January 2005, when Mahmoud Abbas assumed the Presidency of the Palestinian Authority after the death of Yasser Arafat. These phases are characterized by differences in the intensity and the character of the violence. Although this classification is somewhat arbitrary, we believe that it captures many important features of the conflict.

The first phase of the conflict ran from the outbreak of violence in September 2000 until the February 2001 Israeli elections, which saw the fall of the Labor-led coalition government headed by Ehud Barak and the installment of a national unity government led by Likud leader Ariel Sharon.⁶ The violence began as a series of confrontations between the Israeli security forces and Palestinian demonstrators, but it quickly evolved into a wider array of violent actions and responses (Mitchell et al., 2001). During this period,

⁴ Mitchell et al., (2001).

⁵ “Al-Aqsa” refers to the Al-Aqsa Mosque on the Temple Mount in Jerusalem.

⁶ In the Israeli political landscape, the left-of-center Labor Party is committed to a two-state solution to the Palestinian-Israeli conflict. The right-of-center Likud party puts more emphasis on security issues, and has always been vague with respect to the final status of the territories. In the 2003 elections, its campaign was based on the statement that Israel would be willing to make “painful concessions” in exchange for peace.

channels of communication between the Government of Israel and the Palestinian Authority remained open, and in early January 2001 final status talks were held in the Egyptian town of Taba. The gap between the two sides' positions reportedly narrowed relative to the July 2000 Camp David summit, but no final agreement was reached.

The second phase of the conflict coincided with the first several months of the Sharon government, from February to September 2001. This period saw the continuation of the diplomatic effort by the United States and other parties to broker a ceasefire and to resume final status talks. The report of the Sharm-el-Sheikh Fact Finding Committee led by United States Senator George Mitchell (2001), released in April, urged both sides to “immediately implement an unconditional cessation of violence,” to rebuild confidence between the sides, and to resume negotiations. Although both sides adopted the recommendations of the report in principle, violence on both sides did not end. A second attempt at a ceasefire, outlined in a plan by U.S. director of the Central Intelligence Agency, George Tenet and released in June 2001, also failed to curb the violence. After this second attempt, the international community progressively decreased its diplomatic involvement.

We mark the beginning of the third phase of the conflict on September 11, 2001. According to several observers, the attacks on New York City and Washington, DC gave the Israeli government a “green light” to pursue more proactive measures against militant and terrorist groups, including incursions deep into the Palestinian-administered Territories. Among the measures adopted by the Israeli government was the confinement of Palestinian Authority President Yasser Arafat to his Ramallah headquarters, in December 2001. Arafat was not allowed to leave his compound until October 2004,

when, suffering from terminal illness, he was transferred to Paris, where he died on November 11. This third phase saw an escalation of violence on both sides, which culminated in March 2002. In this month alone, Palestinians were able to carry out 8 deadly suicide bombings inside Israel, and the total death toll among Israelis climbed to over 100. At the same time, Israeli incursions inside Palestinian cities claimed the lives of close to 250 Palestinians. On March 27, 2002, a Palestinian suicide bomber entered the Park Hotel in the Israeli coastal city of Netanya, killing 28 Israelis who were gathered to celebrate the Jewish festivity of Passover. As a response to this attack and the escalating violence of the previous month, the Israeli government launched a large-scale military offensive against the Palestinian militant and terrorist infrastructure in the West Bank, named “Operation Defensive Shield” (ODS).

Operation Defensive Shield and its aftermath marks the fourth phase of the conflict, characterized by intense fighting in the West Bank between the IDF and the Palestinians. Following intense international pressure, Israel gradually withdrew its forces from major Palestinian population centers. The operation officially ended on May 10. However, the continuing suicide bombings inside Israel led the Israeli government to launch a second offensive in the West Bank, “Operation Determined Path”, on June 20, 2002. In this second operation, Israeli forces encountered little resistance from the Palestinians. With international public opinion relatively silent, Israel has maintained its presence in all the major West Bank cities up to February 2005, when, as a result of the Sharm-el-Sheikh summit between Ariel Sharon and Mahmoud Abbas, it agreed to gradually transfer security control of the cities to the Palestinian Authority.

It should also be noted that two other important events occurred around this time: a) the beginning of construction of Israel's separation barrier in the north of Israel and around Jerusalem, on June 15, 2002;⁷ b) President George W. Bush's Middle East speech on June 24, 2002, which called for a new Palestinian leadership and laid out Bush's vision for the long-term solution of the conflict. This speech marked the beginning of renewed U.S. diplomatic efforts to broker a ceasefire, and to move towards a negotiated settlement of the conflict. Later that year the United States was joined in its diplomatic efforts by the United Nations, the European Union, and Russia (the "Quartet"), who, on September 17, launched the "roadmap" for peace, a detailed three-phased plan for the implementation of Bush's vision. We take the Bush speech of June 24 as the beginning of the fifth phase of the conflict.

In early 2003, pressure was brought upon Palestinian Authority President Yasser Arafat to appoint the moderate Mahmoud Abbas as Prime Minister. Arafat initially attempted to cripple the post of Prime Minister, but eventually was forced to relinquish some degree of real power to Abbas. This paved the way for the United States to restart the long-stalled peace process. In June, Abbas and Israeli prime minister Ariel Sharon agreed to begin implementing the road map to peace. Abbas convinced the leaders of the Hamas and the Islamic Jihad to pledge to a ceasefire, which went into effect on June 29, 2003.

⁷ The barrier separating Israel and the West Bank was erected in order to prevent the uncontrolled entry of Palestinians into Israel. In most areas, the barrier is comprised of an electronic fence with dirt paths, barbed-wire fences, and trenches on both sides, at an average width of 60 meters. In some areas, a wall six to eight meters high has been erected in place of the barrier system. The total planned length of the barrier is 620 kilometers, of which 174 kilometers around large Israeli settlements in the West Bank are subject to further approval. As of May 2005, 213 kilometers had been completed, and 114 kilometers were under construction. A similar barrier surrounding Gaza was completed in 1994, prior to the beginning of the Second Intifada.

The summer 2003 ceasefire represents the sixth phase of the conflict. While violence did indeed drop dramatically, there were still isolated attacks against Israelis. The Israeli government, which did not see itself bound by the ceasefire, continued to target militants and terrorists planning attacks against Israel. The ceasefire was not comprehensive, as the Al-Aqsa Martyrs Brigades (the armed wing of the Fatah movement) and other smaller Palestinian groups did not agree to it. On August 19, 2003, Hamas claimed responsibility for a large suicide bombing on a Jerusalem bus, which claimed the lives of 23 people. This marked the end of the ceasefire, and the beginning of the seventh and final phase of the conflict. This phase has been similar in character to the fifth phase, with Israel maintaining its military pressure on the militant groups, and the Palestinians attempting to carry out attacks against military and civilian targets inside Israel and in the Territories. Among the notable events in this last period was a suicide attack in the port of Ashdod in March 2004, and the subsequent Israeli decision to target the political leadership of Hamas, which resulted in the targeted killings of Sheikh Ahmed Yassin, Hamas' spiritual leader, and Abdel-Aziz el-Rantisi, his successor, in April 2004. Our analysis ends on 15 January 2005, two months after the death of Yasser Arafat, when Mahmoud Abbas assumed the presidency of the Palestinian Authority.

II. A Sketch of a Model

We postulate that there are three key ingredients of each side's reaction to violence. First, violence by one side can have an *incapacitation* effect, if it limits the other side's capability to react. For example, Palestinian attacks against the IDF may

reduce its capacity to respond. More plausibly, perhaps, Israeli targeted killings of key Palestinian leaders might reduce Palestinians' ability to carry out further attacks against Israel; this is the stated Israeli rationale for such actions.⁸ Second, violence can have a *deterrent* effect, when one side refrains from using violence in fear of the other side's reaction. Finally, violence by one side can lead to a reaction by the other side through a *vengeance* effect, to the extent that one side wishes to dispense retribution in response to the fatal casualties it suffers.

Solving for a full dynamic and game-theoretic equilibrium of violent behavior based on these three motives is beyond the scope of this paper. Instead, we posit the existence of empirical *reaction functions* for both sides. Allowing for a time lag between action and reaction as well as other factors that may shift the reaction function yields, for the Israelis,

$$Pal_t = f_i(Isr_{t-1}, \dots, Isr_{t-p}, Pal_{t-1}, \dots, Pal_{t-p}, \mathbf{X}_t),$$

and for the Palestinians,

$$Isr_t = f_p(Pal_{t-1}, \dots, Pal_{t-p}, Isr_{t-1}, \dots, Isr_{t-p}, \mathbf{X}_t),$$

where Pal_t and Isr_t represent Palestinian and Israeli fatalities, respectively, at time t , p is the maximum number of lags that have a potentially non-zero effect, and \mathbf{X}_t is a vector of “structural” variables that may shift the reaction function up or down or (if we were to add interactions between these variables and the lagged fatalities) change the parameters of the reaction function. Note that the dependent variable is fatalities of the *opposite* group. That is, for the Israeli reaction function the dependent variable is Palestinian

⁸ Assassinations of undercover Israeli General Security Service agents can be a form of violence on the Palestinian side that has an incapacitation effect. There have been a small number of such incidents in the current conflict.

fatalities, and vice versa. Our primary interest is the effect of “own” fatalities on fatalities of the “opposite” group.

This is inherently a reduced-form approach. Which of the three effects (incapacitation, deterrence, and vengeance) is dominant is an empirical question. Moreover, we cannot empirically estimate the magnitude of each effect, but instead estimate the net effect of all three. If the coefficients on the “own” fatality variables are negative then the incapacitation and deterrence effects dominate while if they are positive then the vengeance effect is more important.

The long-run dynamics of violence depend on the relative magnitude of the response of each side. Consider a simplified model without “structural” variables in which the sides take turns in reacting to one another, so that one side will react in each odd-numbered period and one side will react in each even-numbered period. Conditional on the initial number of fatalities on one side in period 0 and holding the reaction parameters fixed, there are three possible dynamic paths. If $\frac{\partial f_i}{\partial Isr_{t-1}} \cdot \frac{\partial f_p}{\partial Pal_{t-1}} > 1$ then the

violence will follow an escalating spiral. This situation is shown in Figure 1a, with

$\frac{\partial f_i}{\partial Isr_{t-1}} = 1.5$ and $\frac{\partial f_p}{\partial Pal_{t-1}} = .75$. Palestinian fatalities (indicating the Israeli reaction) are

shown on the vertical axis and Israeli fatalities (indicating the Palestinian reaction) are

shown on the horizontal axis. Starting with 10 initial Israeli fatalities, the graph shows

that the level of violence will spiral outward (we have constrained the responses to be

integers). If $\frac{\partial f_i}{\partial Isr_{t-1}} \cdot \frac{\partial f_p}{\partial Pal_{t-1}} < 1$ then the level of violence will follow an inward spiral, as

shown in Figure 1b, where $\frac{\partial f_i}{\partial Isr_{t-1}} = .75$ and $\frac{\partial f_p}{\partial Pal_{t-1}} = .4$ and we have again rounded the

responses to integers. In such a situation, the eventual equilibrium would be a cessation of violence. The speed of such cessation is faster the closer $\frac{\partial f_i}{\partial Isr_{t-1}} \cdot \frac{\partial f_p}{\partial Pal_{t-1}}$ is to zero.

The last potential dynamic path in this simplified model is one where $\frac{\partial f_i}{\partial Isr_{t-1}} \cdot \frac{\partial f_p}{\partial Pal_{t-1}} = 1$, as illustrated in Figure 1c. Here, the dynamic path is a true “tit-for-tat” in which the level of violence cycles indefinitely without exploding or diminishing to zero.

The “structural” variables that may shift the reaction functions play a potentially important role in this model as they may (at least temporarily) disrupt the dynamic path of violence. And if these exogenous variables are interacted with the reaction parameters they may change the dynamic path from one that explodes to one that diminishes or one that follows a circular path.

Of course, the actual path that violence has taken in this conflict is not deterministic, as in our simplified model, but stochastic and so it is not surprising that the violence has neither spiraled out of control or diminished to zero. Moreover, our simplified model is self-contained in the sense that violence serves only two purposes: revenge for past violence or prevention of future violence (either through deterrence or incapacitation). In reality, it may be that violence, particularly on the part of Palestinians, is partially undertaken for other reasons that fall outside of the model.

III. Data and Descriptive Statistics

Data

To construct the data on the daily series of fatal casualties in the Palestinian-Israeli conflict since September 2000, we rely primarily on the web site of B’tselem

(www.btselem.org), an Israeli human rights organization. In its statistics section, the site records in detail every single fatal casualty (excluding suicide bombers) on both sides of the conflict during the second Intifada. The data includes information on the date and circumstances of the fatal wounding, the date of death, the age, gender and locality of residence of the victim, and whether the victim was a civilian or a member of the security forces.⁹ Among the advantages of this data set are its comprehensiveness and the symmetrical treatment of fatalities on both sides of the conflict, something that is unavailable in the official statistics compiled by the Israeli Ministry of Foreign Affairs or the Palestinian National Information Centre, nor in the unofficial statistics compiled by the Palestinian Red Crescent Society. The B'tselem data also have a number of limitations. For example, B'tselem does not keep daily statistics on non-fatal casualties, preventing us from assessing more accurately the intensity of violence on both sides. In addition, for the majority of the sample period B'tselem makes no effort to report the combatant status of Palestinian or Israeli fatalities: as a result, members of militant Palestinian groups are always classified as civilians, while uniformed Israeli soldiers not on duty are always classified as security forces, regardless of whether they were actively involved in combat at the time of their fatal wounding. Nevertheless, we feel that these data are the best comprehensive and consistent source measuring violence on both sides of the conflict.

⁹ For Palestinians, the distinction between civilians and members of the security forces is not very relevant, since armed members of militia groups are classified as civilians.

Descriptive Statistics

Table 1 presents the demographic distribution of fatalities on both sides of the conflict over the entire sample period, from September 29, 2000 to January 15, 2005. The number of Palestinian fatalities is more than three times as high as that of Israeli fatalities. Moreover, the demographic distribution of fatalities differs considerably between the two sides. Close to one third of total Israeli fatalities were women, while the share among Palestinians is less than 5 percent. The share of women killed rises to 40 percent among Israelis if we restrict attention to civilians, while it stays at around 5 percent among Palestinians. There are differences also in the age distribution of fatalities. Relatively to Israelis, a larger share of Palestinian fatalities were children below the age of 17 (19 percent versus 11 percent; 21 percent versus 16 percent among civilians). On the other hand, Israelis suffered a proportionally higher share of fatalities among the adults and elderly (45 percent versus 22 percent overall; 60 percent versus 22 percent among civilians). The difference in the age distribution of civilian fatal casualties can also be gleaned from Figures 2a and 2b: the vast majority of Palestinian fatal casualties are clustered between the ages of 15 and 30, while Israeli civilian fatal casualties are much more spread out over the age distribution. These figures reflect the different strategies adopted by the two sides: Israel's declared policy is to target only members of militant and terrorist groups, while Palestinian militant groups such as the Hamas, the Palestinian Islamic Jihad, and the Al-Aqsa Martyrs Brigades have never hidden their position that attacks against military and civilian targets are equally legitimate.

Figures 3a and 3b show the dynamics of violence on both sides over our sample period. The graphs show the total number of fatal casualties, at monthly and weekly

frequencies, respectively. The Israeli count includes all civilians and members of the security forces killed during this period, either in Israel (within the 1948 borders) or in the Territories, as well as foreign civilians killed by Palestinians.¹⁰ The Palestinian count includes all civilians and members of the security forces, as well as foreign civilians killed by Israeli security forces and civilians. The figures are consistent with the chronology of the events described in the previous section. We observe a large imbalance between the number of Palestinian and Israeli fatal casualties in the first phase of the conflict. The second phase, characterized by international efforts to broker a ceasefire saw a reduction in the level of violence on both sides. The level of violence rose sharply on both sides during the third phase of the conflict, after the failure of the international community's mediation efforts, and up to Operation Defensive Shield. During the fifth phase, with the reoccupation of the major centers by the Israeli army, the number of Palestinian fatalities remained at a high level. The number of Israeli fatalities during this period appears to exhibit a slight downward trend, with a few substantial spikes in coincidence with large suicide bombings. The level of violence on both sides dropped to nearly zero during the summer 2003 ceasefire. However, as the ceasefire broke down, the number of Palestinian fatalities returned to its pre-ceasefire levels, while the number of Israeli fatalities continued to fall.

Table 2 presents the statistics on the total number and the daily rate of fatal casualties in the seven phases of the conflict described above. Some interesting points are worth noting. On the Israeli side, there is a substantial difference between the first phase

¹⁰ The count does not include Israeli civilians killed in terrorist attacks outside of Israel's borders, such as the December 2002 attack at a hotel in Mumbasa, Kenya, for which Al Qaeda claimed responsibility. The count also does not include three Israeli civilians killed in a suicide bombing in Tel Aviv perpetrated by British nationals on April 30, 2003.

and subsequent phases, in terms of the location of the conflict. In the first phase of the conflict, 13 percent of civilian casualties occurred within Israel, while this share jumped to 57 percent in the second phase, and remained at or about 66 percent after September 11, 2001. Similarly, the overall share of Israeli casualties occurring within Israel was only 8 percent during the early phase and then hovered around 55 percent afterwards. These findings can be subject to one of two interpretations: on one hand, they may point to a shift in strategy by the Palestinians, away from roadside attacks inside the Territories, and more towards large and more deadly suicide bombings inside Israel (see also Table 3); on the other hand, it is also possible that the Palestinian strategy has not changed at all, and that shift in the balance of fatalities is due to an increased Israeli ability to thwart and defend itself against attacks inside the Territories. This may, in part, be reflected in the relative stability of the daily incidence of casualties between 23 and 36 percent until the announcement of the “road map” after which it fell substantially, particularly during and after the ceasefire period.

On the Palestinian side, we observe more variability in the number of casualties per day, with a peak of over 4 during Operation Defensive Shield and a low of .196 during the ceasefire. Unlike the Israeli casualty rate, the Palestinian casualty rate approaches its pre-Operation Defensive Shield level after the ceasefire. The daily casualty incidence also approaches its pre-Operation Defensive Shield average after the ceasefire. It is also worth noting that Palestinian security forces essentially ceased to be a part in the conflict after Operation Defensive Shield, with their share of fatalities falling to less than 5 percent.

Paralleling the shift from Israeli fatalities from the Occupied Territories to Israel, the circumstances of those fatalities has also changed during the different phases of the conflict. In Table 3, we present the distribution of fatality circumstances and, in line with the results in Table 2, we find a steady shift towards use of suicide bombings rather than gunfire attacks on the Palestinians' part, with around 60 percent of Israeli fatalities in the last period falling victim to suicide bombings. The daily rate of fatalities by suicide attacks also was higher in the post-ODS period relative to the early phases of the conflict. On the Israeli side, we also observe a shift in methods over time, with an increase in the use of sophisticated weaponry as the conflict progresses. Between 17 and 31 percent of Palestinian fatalities fell victim to helicopter, aircraft or tank shelling in the post-ODS periods, relative to between 4 and 10 percent in the pre-ODS periods. The daily casualty rate went up from about 0.10-0.14 in the pre-ODS period, versus 0.34-0.62 in the post-ODS periods (ceasefire excluded). Israel also resorted more often to targeted killings of militant and terrorist leaders: the daily rate of fatalities killed in these attempts roughly doubled between the pre-ODS period and the post-ODS period, going from about 0.11-0.14 to about 0.20-0.25.

IV. Estimated Reaction Functions

Empirical Framework

While the above descriptive statistics give the broad outlines of the conflict, our primary objective is to test whether Israeli violence causes Palestinian violence and/or vice versa. To do this, we use the daily data from B'tselem to estimate vector autoregressions of Palestinian and Israeli violence. Our basic specification is:

$$\begin{pmatrix} Pal_t \\ Isr_t \end{pmatrix} = \mathbf{A}_0 + \mathbf{A}_1 \begin{pmatrix} Pal_{t-1} \\ Isr_{t-1} \end{pmatrix} + \dots + \mathbf{A}_p \begin{pmatrix} Pal_{t-p} \\ Isr_{t-p} \end{pmatrix} + \mathbf{B}\mathbf{X}_t + \boldsymbol{\varepsilon}_t,$$

where the \mathbf{A}_j 's and \mathbf{B} are matrices of coefficients, \mathbf{X}_t is a vector of exogenous variable, and $\boldsymbol{\varepsilon}_t$ is the vector error term. We look at two different specifications of the VAR: in the first specification (the *incidence* specification), Pal_t and Isr_t are dummies for whether there were any Palestinian and Israeli fatalities on day t ; in the second (the *levels* specification) Pal_t and Isr_t are the total number of fatalities in day t . All models are estimated by ordinary least squares with heteroskedasticity-consistent standard errors reported; all statistical tests use the heteroskedasticity-consistent variance-covariance matrix.¹¹

While the point estimates from the above regressions are of some interest, we are primarily interested in testing whether fatalities on one side of the conflict cause fatalities on the other side, i.e. whether we can reasonably say that side A reacts to the actions of side B and, potentially, vice versa. Our main empirical tool for doing so is the Granger (1969) causality test, which amounts to testing the joint significance of the coefficients on the opposite side of the conflict, conditional on lagged values of the dependent variable, in the above regressions. The primary question is whether these coefficients (and therefore the Granger test) can be given a “true” causal interpretation. Granger causality has often been criticized on the grounds that it can be quite unrelated to the standard meaning of “causality” in economics and the social sciences. That is, it does not truly provide an answer to the thought experiment of what would have happened to the dependent variable (Y_t) if in the past the explanatory variable (X_{t-j}) had taken on,

¹¹ We have also estimated the models using a logit specification for the incidence regressions and zero-inflated Poisson specifications for the levels regressions reported below. This yielded little qualitative difference from the results presented here.

counterfactually, different values. Indeed, it is possible that Granger causation runs in the opposite direction of true causation, especially with time series that reflect forward-looking behavior.¹² In our context, such forward-looking behavior could occur if the expected future level of violence on one side affected the other side's level of violence in the present. For example, if extremist groups on side A engage in violence to block the implementation of a ceasefire, but the ceasefire is declared and maintained by both sides nonetheless, we would observe that violence by side A "Granger-reduces" the level of violence by side B, even if the direction of causation is really the opposite. Alternatively, if side B attacks side A preemptively in anticipation of side A's future violence, but this attack does not affect the level of violence by side A, we would incorrectly observe Granger causality running from B to A. We do not believe that either of these scenarios is particularly plausible in our context, especially given the asymmetry between the two sides and the observed results.¹³

Therefore, the question of causality boils down to a standard exogeneity question: is the disturbance in one's side fatalities correlated with past values of the opposite side's fatalities? Given the nature conflict, where many of the realized fatalities are due to random factors (was the bus boarded by the suicide bomber crowded? Did the intended target of an assassination attempt sit in the front or the back of his car?), we suspect that endogeneity bias is unlikely to be a substantial factor in our results.

¹² In the classic example of estimating the determination of stock prices on the basis of dividends, Granger's test would indicate that causality runs from stock prices to dividends and not vice versa, even though stock prices are determined by the expected future dividend process, and have no effect on it.

¹³ For example, if Israel engages in ineffective pre-emptive strikes, this would bias us toward finding spurious Granger causality running from Israeli violence to Palestinian reactions. This is in fact counterfactual to our findings.

Results

Figures 4a and 4b present the Israeli and Palestinian impulse response functions in the incidence version. The model includes seven lags of the dependent variables and no additional regressors are included. The Israeli response function shows that a day with Israeli fatalities leads to an increase in the probability of Palestinian fatalities in the next 20 days. The increase is statistically significant in most of the first 10 days, and is especially strong in days 1, 4 and 5. On the other hand, the Palestinian impulse-response function shows that there is a slight increase in the probability of Israeli fatalities in the first 8 days following a day with at least one Palestinian casualty, but the increase is never statistically significant.

Figures 5a and 5b present the corresponding impulse-response functions for the levels specification. A similar pattern emerges: the number of Palestinian fatalities rises significantly in the first 10 days following an Israeli death, with the strongest effect being at lags of 4, 6, 7, and 8 days. On the other hand, the number of Israeli fatalities rises on the second day following a Palestinian death, but otherwise the impulse response function is never statistically different from zero. It is worthwhile noting that in both specifications the impulse response function rarely falls below zero, indicating that violence on both sides has little deterrent or incapacitation effect.

In Table 4 we present the coefficients of the Israeli reaction function from the above model. The first column presents results using the incidence of any Palestinian deaths as the dependent variable, with seven lagged values of the incidence of any Israeli and Palestinian deaths as the independent variables. The results indicate that the Israelis react in a statistically significant and regular way on the first and fourth days after a fatal

Palestinian attack, with a 7.2 percent higher probability of any Palestinian fatalities on the first day and 8.5 percent higher probability on the fourth day after a fatal Palestinian attack. The lack of any negative and statistically significant coefficients again suggests that Palestinian attacks do not have a deterrent or incapacitation effect. While the pattern of reaction is of some interest, our primary focus is on the test of Granger (1969) causality, reported in the penultimate line of the table. We find clear evidence that the incidence of fatal Palestinian attacks Granger-causes an Israeli response leading to the death of Palestinians.

In the second column of Table 4 we add indicators for the days of the week and the seven periods described earlier (the initial period, that of Ehud Barak's government, is the reference period). We also add a variable indicating the cumulative length of the separation barrier dividing the West Bank from Israel.¹⁴ The patterns that emerge from these coefficients are (not surprisingly) consistent with those in Figure 3, in particular, the decline in the incidence of violence against Palestinians, relative to the first period, during the initial period of the first Sharon government as well as during the declared ceasefire in mid-2003. As in the model without these additional controls, we find higher probabilities of fatal Israel attacks in the Occupied Territories one and four days after an attack against Israelis. The inclusion of period dummy variables and the length of the separation barrier does not mitigate our finding of Granger causality from the incidence of fatal Palestinian attacks to the incidence of fatal Israeli attacks.

We also find that the separation barrier has little effect on the probability of Israeli attacks against Palestinians. We are cautious about interpreting this finding as conclusive

¹⁴ This variable was constructed using detailed data on the dates of completed construction and the length of each segment of the separation barrier, provided by the Israeli Ministry of Defense.

regarding its effectiveness, however. It is possible that it will be effective in reducing Palestinian violence within Israel only when it is complete. It is also possible that more detailed geographic data on the location of the barrier and on the geographic distribution of Israeli fatalities would affect our conclusions.

In the third and fourth columns of Table 4, we estimate the levels version of the VAR. Here we find that there is some variation in the magnitude of the Israeli response to Israeli fatalities, with the most violent response coming 7 days after a Palestinian attack, with each Israeli fatal casualty leading to .198 additional Palestinian fatalities. In Column 4 we find that there has been a substantial reduction in the magnitude of Israeli attacks since Operation Defensive shield. As with the incidence regressions, we find that the level of Palestinian attacks against Israelis Granger-causes an Israeli response.

We present estimates of the Palestinian reaction function for both incidence and levels in Table 5. While we find some degree of serial correlation in the Palestinians' attacks on Israelis, we find no support whatsoever for the hypothesis that Israel's actions Granger-cause a Palestinian response. Moreover, estimating no negative and statistically significant coefficients, we find no evidence that Israeli attacks against Palestinians have a short-term deterrent or incapacitation effect. It is interesting to note, however, that while the incidence of Palestinian attacks against Israelis has declined substantially since Operation Defensive Shield, the daily average number of Israelis killed has increased (although not statistically significantly) since then. As we will document below, we believe this is due to a change in tactics among the Palestinians from shooting to suicide bombings, likely due to the increased Israeli military presence in the Territories after Operation Defensive Shield.

Taking the results of Tables 4 and 5 together, we find there is strong evidence that the Israelis react in a significant and predictable way to Palestinian violence against them, but that there is no evidence that the Palestinians react to Israeli violence. This stands in contrast to the popular notion that the Israelis and Palestinians are engaged in a “tit-for-tat” cycle of violence.

Previous research (Stock and Watson, 1989) has shown that conclusions about Granger causality may be somewhat sensitive to the choice of the lag structure for the independent variables as well as the lagged values of the dependent variable. To examine this issue, we estimated the incidence and levels regressions that include the day-of-week and period indicators as well as the length of the separation barrier for a variety of combinations of 4, 7, 14, and 21-day lag structures. We present the χ^2 statistics from the tests of Granger causality for these models in Table 6. We find no evidence at all that our conclusion that Palestinian violence Granger-causes an Israeli response, but not vice versa, is sensitive to the choice of lag structure.

It *is* possible, however, that this result is sensitive to using daily fatalities as our regressors. It may be that using daily data masks some broader features of the data, particularly for the Palestinians. The decentralized and factional nature of the Palestinian side may dictate longer or less regular response times that may not be captured at a daily frequency. To explore this possibility, in Table 7 we present Granger causality statistics from the Israeli and Palestinian reaction functions estimated at weekly, bi-weekly, and monthly frequencies. Because there is very little variation in incidence at these frequencies, we present only results for regressions using levels. At any frequency, we do not find a significant response by the Palestinians, lending substantial weight to our

finding that Israeli violence does not Granger-cause a Palestinian response. Using weekly data, we continue to find that Palestinian violence Granger-causes an Israeli response using models with both two weeks and four weeks of lags. While not shown in the table, the coefficient on the first week's lag is always substantially larger than the coefficient on the other week(s). At bi-weekly and monthly frequencies we do not find a significant Israeli response at any conventional level, although the results using monthly data are marginally significant. It would appear, therefore, that any response to Israeli fatalities is likely to occur quickly.

To preserve the large number of observations available using daily data while also providing a parsimonious specification that captures the essential features of the data, we re-estimated the models from Tables 4 and 5 using information on the total number of fatalities in each of the previous two weeks as regressors, while continuing to use the daily incidence or levels of fatalities as the dependent variable. The results from these “smoothed” regressions are presented in the top panel of Table 8 for the models that include the period and day-of-week dummy variables as well as the length of the separation barrier.¹⁵ The results are extremely similar to those presented in Tables 4 and 5. We continue to find that Israel has a strong reaction to violence against Israelis in the first (and second) week after the occurrence of Israeli fatalities while there is no evidence that Palestinians react to violence against them. We will use this specification throughout the rest of the paper, although our results are not sensitive to using the “smoothed” specification or one that uses two weeks of lagged daily variables.

In Table 2 we showed that there is substantial variation over time in the level of violence committed by both sides, and the regression results in Tables 4 and 5 support

¹⁵ Results without these additional regressors are quite similar.

this. It is also possible that the parameters of the reaction function have changed over time. To explore this, we estimate versions of the “smoothed” regressions allowing the parameters of the reaction function to vary by period. Because Operation Defensive Shield signaled a change in IDF policy and ushered in continuous IDF presence in the Occupied Territories, we divide the data into three periods: before, during, and after Operation Defensive Shield. These results are presented in the bottom panel of Table 8. We estimate important differences in the parameters of the reaction function across the periods. We reject the null of no difference in the reaction function parameters across the three periods for the levels specification, but not for the incidence specification. However, our conclusion regarding Granger-causation of Palestinian violence to Israeli violence holds for all three periods, even though the Granger causality test is only marginally significant in the post-ODS period. Unlike the results in Table 5 and Table 7, we do find some evidence in column 4 that Israeli violence two weeks prior had a positive effect on the level of Palestinian violence prior to Operation Defensive Shield and a negative effect on the level of violence afterwards. Thus, there is some mixed evidence that Israeli violence did affect the magnitude of the Palestinian response, inducing a stronger response before Operation Defensive Shield and deterring the response after Operation Defensive Shield. We do not want to over-interpret these results, however, as the incidence and levels regressions tell a conflicting story. Overall, however, the pattern is consistent with the earlier regressions in that the effect of Palestinian violence on the Israelis is much greater than that of Israeli violence on the Palestinians.

V. Reactions to Fatalities of Different Groups or in Different Locations

Until now we have estimated reaction function in which we treat Israeli civilians and security force personnel equally.¹⁶ It is possible that Israel reacts differently to fatalities in these two groups. We explore this possibility in the top panel of Table 9 estimating the Israeli reaction function with separate variables for civilian and security forces fatalities. We find relatively small differences in the effects for civilians and security forces, with the effect for security forces being somewhat stronger, based on the size of the χ^2 statistic. For civilian fatalities, the reaction is stronger in the second week, while for security forces, the coefficient on the first week lag is larger. We are unable, however, to reject the joint hypothesis that the two coefficients on lagged civilian fatalities are equal to those on lagged security forces fatalities. While not shown in the table, this is also true individually of the coefficients on the first and second lags. Turning to the levels regressions we find that, for both civilians and security forces, the reaction is stronger at the first lag than at the second. Unlike the incidence results, however, we find using the χ^2 statistic as a metric that the reaction to civilian casualties is stronger. As with the levels regressions, we cannot reject the joint hypothesis that the coefficients are the same between civilians and security forces. Overall, there is little to suggest that Israel reacts differently to the deaths of civilians versus security forces.¹⁷

B'Tselem collected information on the location of the attack that caused the death of the individuals in the data, which we exploit to examine Israel's reactions to fatalities

¹⁶ The strategic difference for Palestinian security forces and non-security forces is less clear than that for the Israelis. Moreover, as shown in Table 2, the share of Palestinian fatalities that were security forces was never large and decreased substantially during ODS and afterwards. We therefore do not distinguish between Palestinian security forces and non-security forces.

¹⁷ We have also estimated these models the reaction to fatalities among women and children relative to others and find no differences in the estimated reactions.

in Israel and in the Occupied Territories in the bottom panel of Table 9. These results mirror those in the top panel, and we find that there is a significant relationship between fatalities in both Israel and the Occupied Territories and Palestinian fatalities. The coefficients on fatalities in Israel and in the Territories are fairly similar in the incidence regression, while there appears to be a stronger reaction to fatalities in the Territories than to those within Israel in the levels specification, with both a larger χ^2 statistic as well as a coefficient at the first lag that is more than twice as large as that for fatalities in the Occupied Territories. Despite these differences, we cannot reject the null hypothesis in either the incidence or levels regressions that the coefficients on fatalities in Israel are different from the coefficients on the coefficients in the Territories. It is clear, however, that Israel has a significant reaction to fatalities both within Israel and in the Territories and there is no evidence whatsoever of a deterrent effect.¹⁸

VI. Suicide Bombings

Perhaps the most well known feature of the Second Intifada has been the regular use of suicide bombings as a means of inflicting casualties within Israel. At the same time, Israel has undertaken a series of assassinations targeted at leaders of Palestinian groups such as Hamas, Islamic Jihad, and the Al-Aqsa Martyr Brigades. In this section we examine whether the two sides react to these specific events in a different way than to casualties inflicted by more conventional means. One of the advantages of this analysis is

¹⁸ We have also estimated whether Palestinians respond differently to the death of women and children, and whether Palestinian fatalities induce them to choose different targets (civilians versus security forces, inside Israel versus the territories). In no case did we find any evidence of a positive relationship between Palestinian fatalities and those in Israel, nor did we find any evidence of a deterrent effect. These results are available upon request.

that for both types of events we can identify in the data both successful and unsuccessful attempts: this allows us to glean some information onto how they react not only to *realized* levels of violence, but also to *intended* violence.

We first examine how Israel has reacted to suicide attempts by the Palestinians. We obtained from B'tselem a file recording all Palestinian suicide bombers from 1994 until February 2005. A suicide bomber is defined as the person who carried the explosive device that caused his or her death, or was present in a car when it exploded. Note that the data include information on all suicide bombers, regardless of whether they managed to inflict any fatalities on the Israeli side. We keep only the attempts since the beginning of the second Intifada, and define as a successful attempt a suicide attempt that resulted in at least one Israeli fatality. We then regress either the incidence of Palestinian fatalities or the number of Palestinian fatalities on the total number of successful and unsuccessful suicide attempts in the past two weeks, controlling for smoothed lags of other (non-suicide) Israeli and Palestinian casualties, the period dummies and the length of the separation barrier. The results are presented in Table 10. The incidence of Palestinian fatalities appears not to be affected by either successful or failed suicide attempts in the first week after the event, while there is some effect of successful attempts in the second week. On the other hand, the number of Palestinian fatalities increases significantly in the first week after a successful suicide attempt, while it is not affected by failed suicide attempts. These results suggest that Israel does not change its overall level of activity, but does increase the intensity of its military actions in response to successful suicide attempts.

We next move to the analysis of the Palestinians' reaction to Israeli assassination attempts. Since the beginning of the Second Intifada, Israel has carried out more than one hundred assassination attempts, directed at both military and political targets of all ranks. We obtained the data on assassination attempts used in Zussman and Zussman (2005). Using data from four different sources (both Israeli and Palestinian), these authors have compiled a list of all assassination attempts carried out by Israel from September 2000 to 30 April 2004. The data records the date and circumstances of each assassination attempt, the identity and the organizational affiliation of the target, whether the target was killed, and the total number of fatalities caused by the assassination attempt. We define an attempt as successful if the target is killed. As in the previous table we regress either the incidence or the number of Israeli fatalities on the total number of successful and failed assassination attempts in the past two weeks, controlling for smoothed lags of other Palestinian fatalities, smoothed lags of Israeli fatalities, the period dummies and the length of the separation barrier.

Table 11 presents the results of these regressions when the dependent variable includes any type of Israeli fatality. We find that failed assassinations significantly raise the probability of Israeli fatalities in the first week after the attempt, while successful assassinations lower it (p-value of 0.078). The results are even more striking when we look at the levels specification: successful assassination attempts have a large and statistically significant negative effect on the number of Israeli fatalities in the first week after the attempt, and a smaller (and insignificant) positive effect in the second week. By contrast, there seems to be no effect of failed attempts on the level of Israeli fatalities. The results on the effect of successful attempts suggest that assassinations do have an

incapacitation effect and reduce the probability and magnitude of attacks against Israelis; however, one cannot rule out that the decreased number of Israeli fatalities is a result of preventive measures on the part of Israeli security forces, such as more frequent roadblocks, tighter restrictions on the movement of Palestinians within the Occupied Territories and from the Territories into Israel, and increased alertness. In contrast, the results on failed attempts suggest that these raise the Palestinians' motivation to carry out attacks against any type of Israeli targets, without much consideration for the scale of the attack.

In Table 12, we attempt to probe deeper into this issue by looking separately at the effect of assassination attempts on Israeli fatalities in suicide attempts and on all other fatalities. The results broadly confirm our previous conjecture. Successful assassination attempts have a large and statistically significant negative effect on the incidence and the levels of Israeli fatalities in suicide bombings, while they do not affect the level of violence against other Israeli targets. Failed assassination attempts have no effect on suicide bombings and increase the probability of attacks against other Israeli targets, but not their magnitude.

VII. Conclusion

Our results paint a consistent picture of the dynamics of violence between Israelis and Palestinians during the Second Intifada. We find strong evidence that Israel reacts in a predictable and significant way to fatal Palestinian attacks against Israelis, both in terms

of the incidence and magnitude of subsequent Palestinian fatalities. This result holds when we look at civilian versus security force casualties, within Israel versus within the Occupied Territories, or across different periods of the conflict. The result is also robust to the lag structure used. We also find that Israel does not react in a significant way to attempted violence, but only to realized violence.

There is little evidence to suggest that the Palestinians have a similar response to Israeli violence. With the exception of assassination attempts against leaders of Palestinian groups, we repeatedly found no significant relationship (either positive or negative) between Palestinian fatalities and the Palestinian response; this finding is not at all sensitive to the lag structure or frequency of data used. We did find that successful assassination attempts do reduce the level and (marginally) the probability of subsequent Israeli fatalities. These effects appear to affect the probability and magnitude of Israeli fatalities due to suicide bombings more than they affect other Israeli fatalities.

The command structure and methods of the two sides can perhaps explain the difference in the results between the Israeli and Palestinian sides. The Israeli Defense Force is highly organized and (most importantly) centrally commanded. The ability of Palestinians to respond in an organized, timely, and predictable way is mitigated by the decentralized nature of the various groups who engage in attacks against Israelis. Moreover, the nature of suicide attacks dictates, to some extent, that they not be predictable responses. It is also possible that Palestinians' efforts to carry out attacks do increase in response to Israeli violence, but these efforts do not lead to an increased number of fatal fatalities, as Israel can endogenously raise its level of alertness and implement measures to prevent Palestinian attacks.

We conclude that, despite the popular perception that Palestinians and Israelis are engaged in “tit-for-tat” violence, there is no evidence to support that notion. Rather, the Israelis react in a predictable and statistically significant way to Palestinian violence against them while Palestinian actions are not related to Israeli violence, either through revenge or deterrence. Our results suggest that a cessation of Palestinian violence against Israel may eventually lead to an overall cessation of violence.

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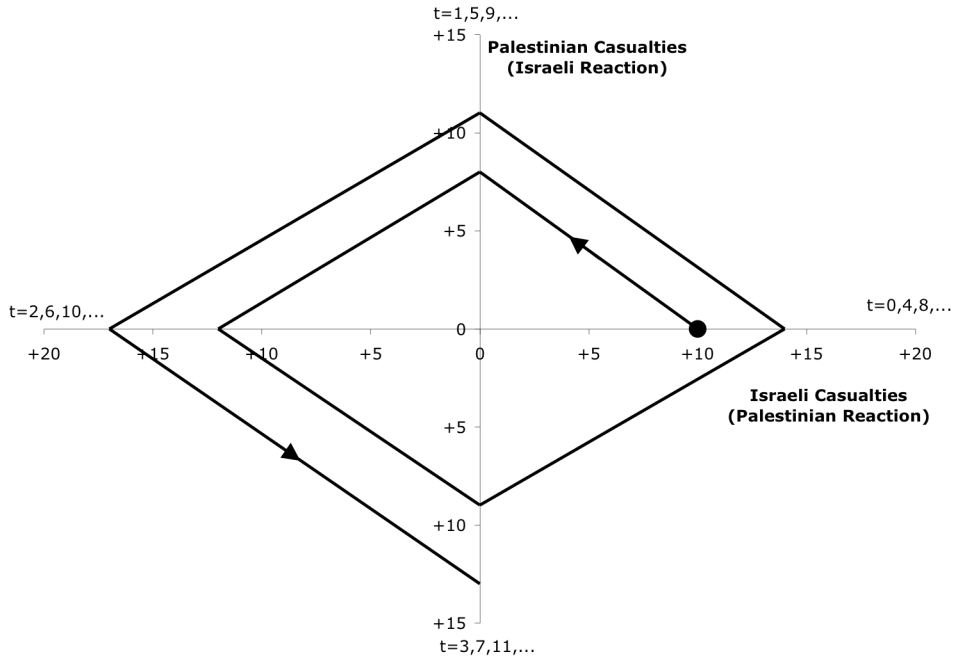


Figure 1a: Spiral of Violence with $\frac{\partial f_i}{\partial Isr_{t-1}} \cdot \frac{\partial f_p}{\partial Pal_{t-1}} > 1$

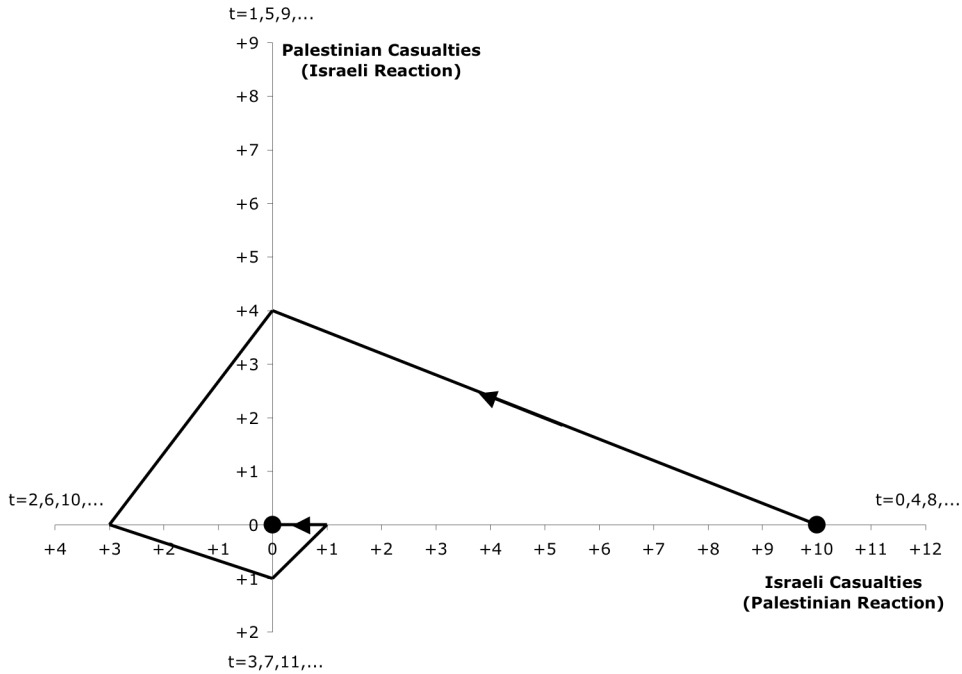


Figure 1b: Spiral of Violence with $\frac{\partial f_i}{\partial Isr_{t-1}} \cdot \frac{\partial f_p}{\partial Pal_{t-1}} < 1$

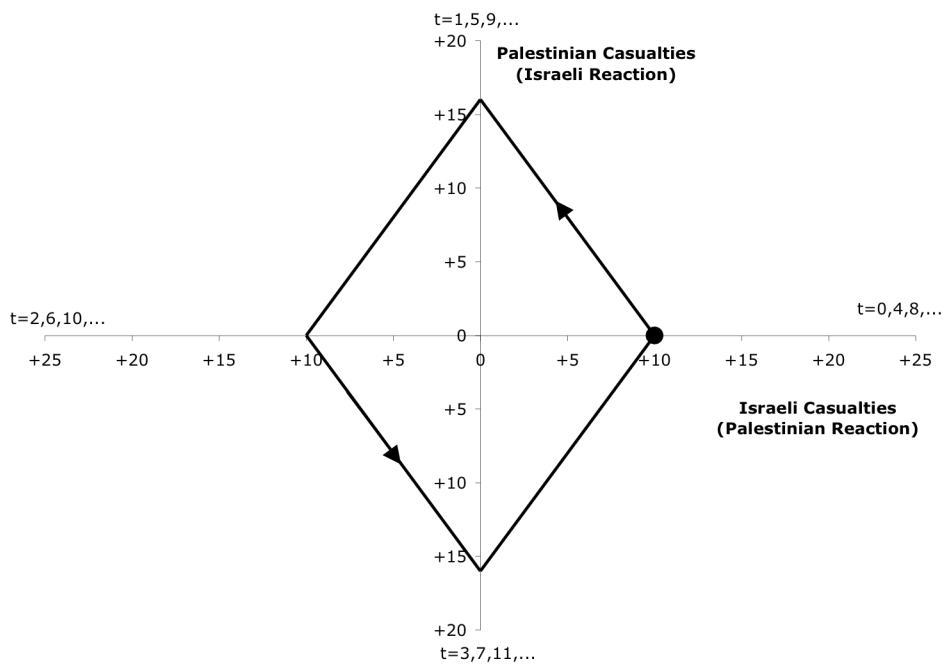


Figure 1c: Circle of Violence with $\frac{\partial f_i}{\partial Isr_{t-1}} \cdot \frac{\partial f_p}{\partial Pal_{t-1}} = 1$

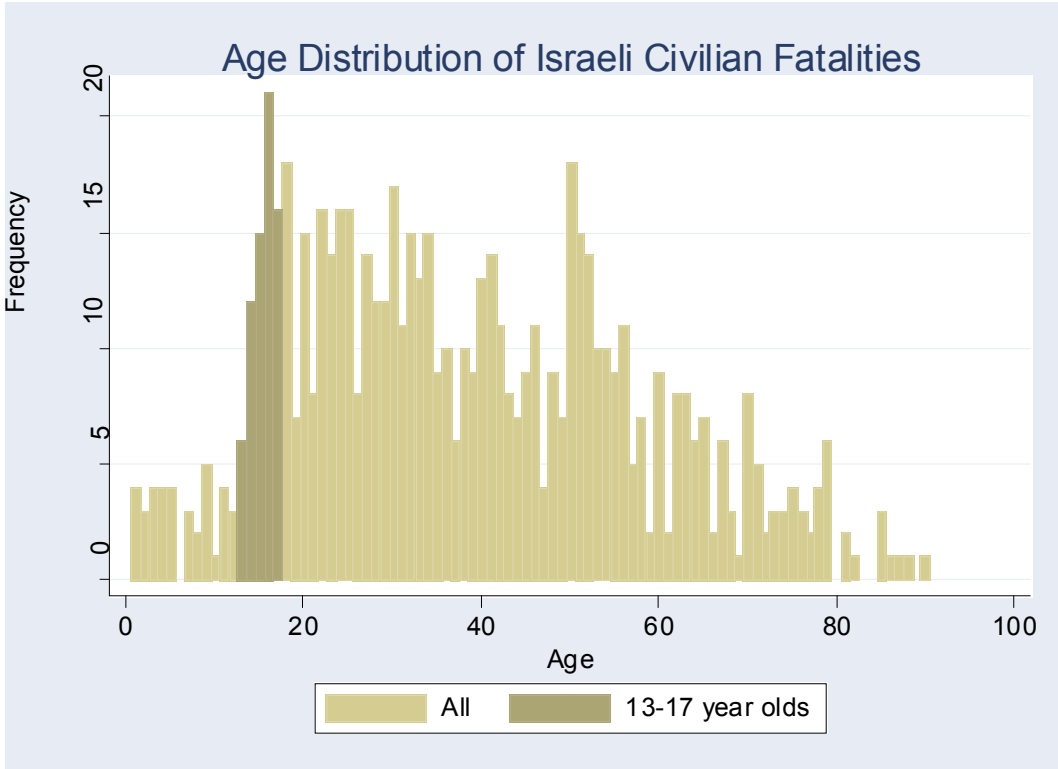


Figure 2a: Age distribution of Israeli Civilian Fatalities

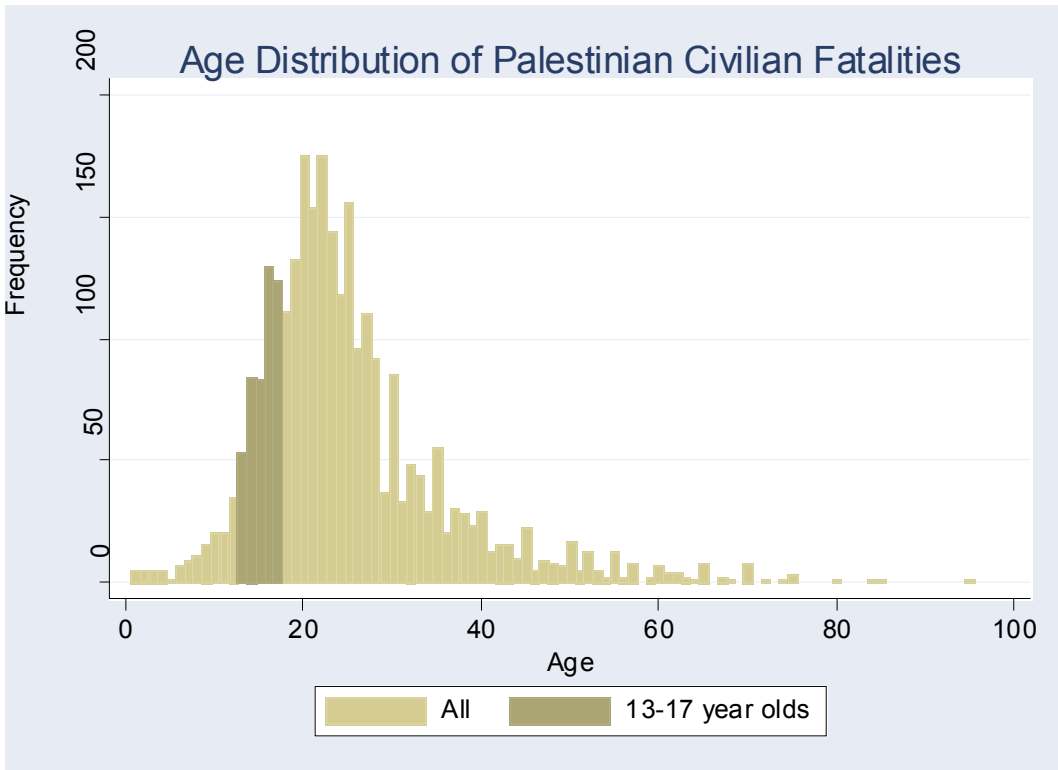


Figure 2b: Age Distribution of Palestinian Civilian Fatalities

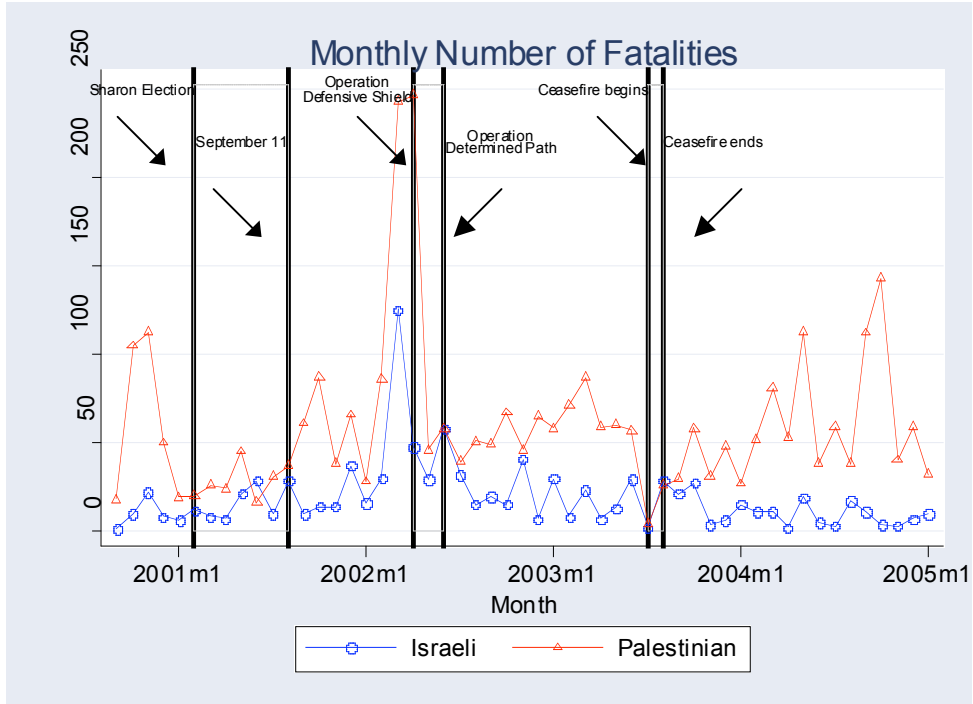


Figure 3a: Monthly Number of Fatalities

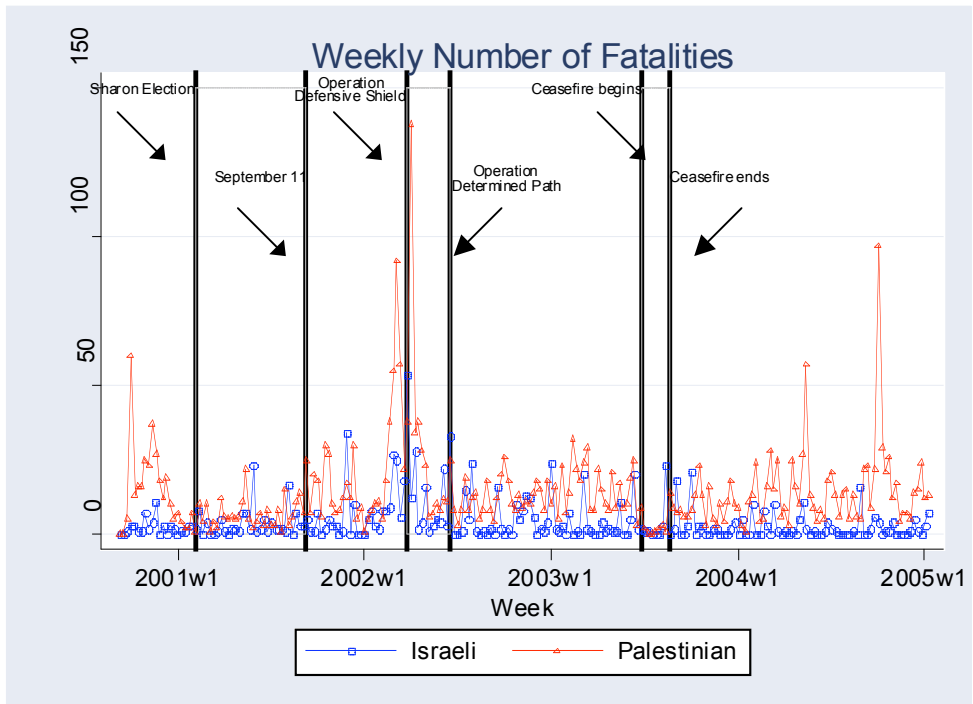


Figure 3b: Weekly Number of Fatalities

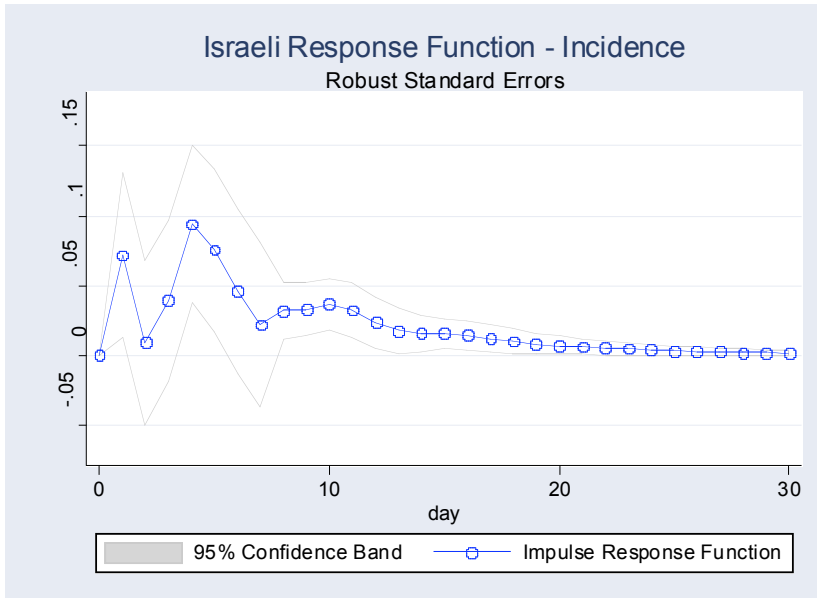


Figure 4a
Israeli Response Function – Incidence

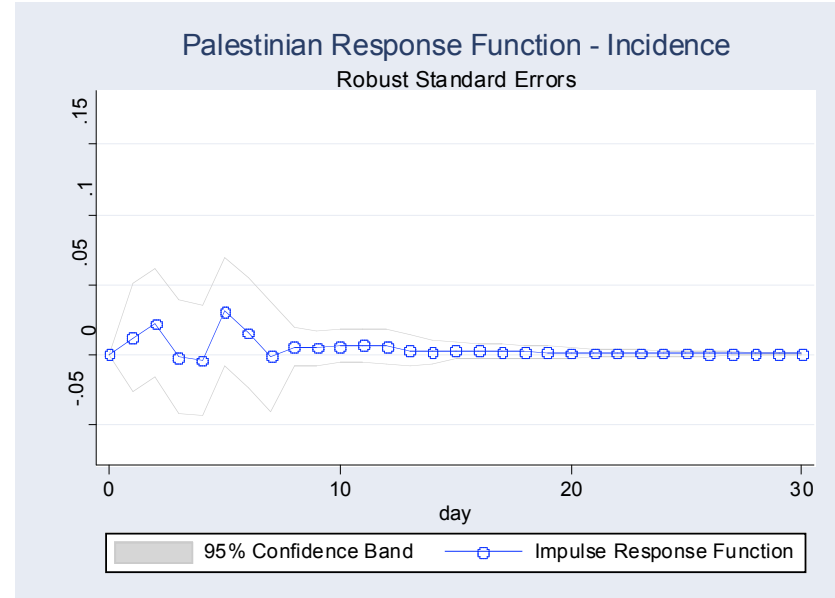


Figure 4b
Palestinian Response Function – Incidence

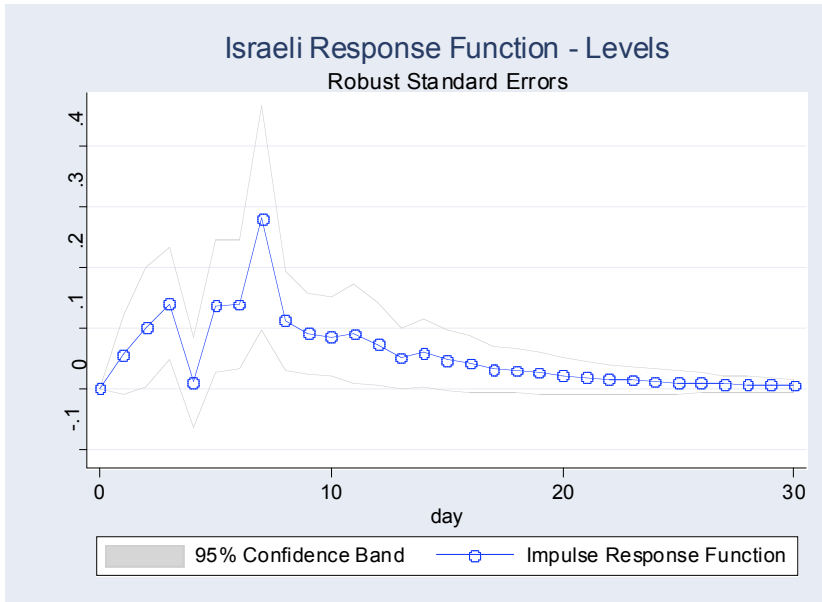


Figure 5a
Israeli Response Function – Levels

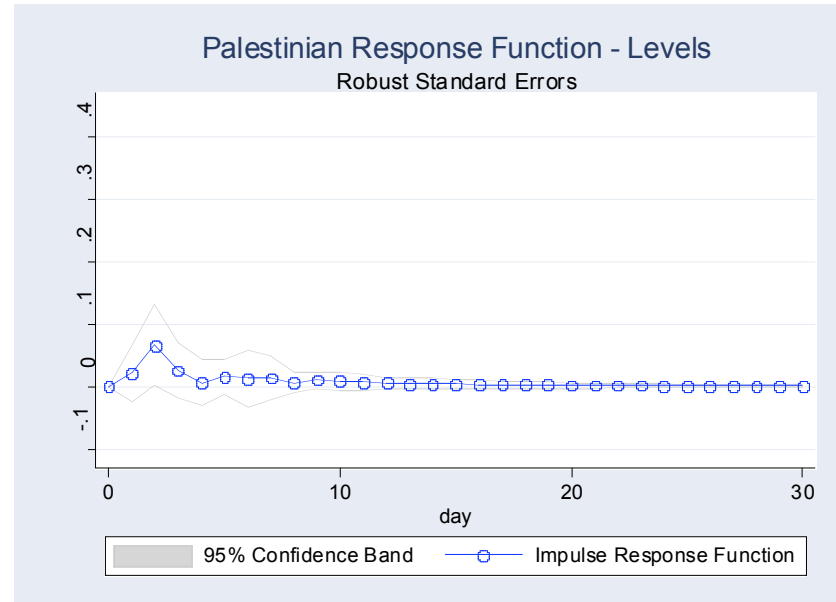


Figure 5b
Palestinian Response Function – Levels

Table 1
Demographic Distribution of Fatalities for Israelis and Palestinians

	Israelis		Palestinians	
	<i>N</i>	Share	<i>N</i>	Share
	<i>All</i>			
Total Number of Fatalities		988		3,212
Females	308	.312	147	.046
Age				
Children (0-17)	107	.108	614	.191
Young Adults (18-23)	301	.305	990	.308
Young Adults (24-29)	118	.119	711	.221
Adults (30-59)	346	.350	670	.209
Elderly (60 or older)	102	.103	49	.015
Age unknown	14	.014	178	.055
	<i>Civilians</i>			
Total Number of Fatalities		688		2,909
Females	276	.401	147	.051
Age				
Children (0-17)	107	.156	613	.211
Young Adults (18-23)	78	.113	892	.307
Young Adults (24-29)	78	.113	609	.209
Adults (30-59)	309	.449	596	.205
Elderly (60 or older)	102	.148	46	.016
Age unknown	14	.020	153	.053

Note: Entries in table are shares. Shares are based on observations with non-missing values for that variable.

Source: Authors' tabulations of data from B'Tselem from 29 September 2000 to 15 January 2005.

Table 2
Number and Daily Rate of Fatalities, Israelis and Palestinians, by Period

	Barak Government	Sharon Gov't pre-9/11/2001	9/12/2001- ODS	ODS- Roadmap	Roadmap- Ceasefire	Ceasefire	Post- Ceasefire	Total
	29.9.2000- 6.2.2001	7.02.2001- 11.09.2001	12.09.2001- 28.03.2002	29.03.2002- 24.06.2002	25.06.2002 28.06.2003	29.06.2003- 21.08.2003	22.08.2003- 15.01.2005	29.09.2000- 15.01.2005
	(131 days)	(217 days)	(198 days)	(88 days)	(369 days)	(51 days)	(513 days)	(1570 days)
<i>Israelis</i>								
Casualties	50	116	220	156	240	5	201	988
Fatalities/Day								
All	.382	.535	1.111	1.773	.650	.098	.390	.629
Civilians	.229	.419	.803	1.080	.469	.078	.264	.438
Security Forces	.153	.115	.308	.693	.182	.020	.126	.203
Daily Incidence of Fatalities	.229	.212	.318	.364	.190	.078	.105	
Civilian Share	.600	.784	.723	.609	.721	.800	.677	.707
Share within Israel	.080	.552	.568	.596	.558	.600	.597	.523
Share within Israel among Civilians	.133	.571	.667	.758	.688	.750	.779	
<i>Palestinians</i>								
Fatalities	308	207	567	374	717	10	1,034	3,217
Fatalities/Day								
All	2.351	.954	2.864	4.250	1.943	.196	2.004	2,049
Non-Security Forces	2.069	.742	2.167	3.795	1.856	.196	1.983	1,218
Security Forces	.282	.212	.697	.455	.087	.000	.021	.231
Daily Incidence of Fatalities	.672	.484	.662	.841	.661	.137	.607	
Non-Security Force Share	.878	.778	.756	.892	.955	1.000	.975	.882
Share within Gaza								

Source: Authors' tabulations of data from B'Tselem from 29 September 2000 to 15 January 2005.

Table 3
Circumstances of Fatalities for Palestinians and Israelis, by Period

	Barak Government	Sharon Gov't pre-9/11/2001	9/12/2001- ODS	ODS- Roadmap	Roadmap- Ceasefire	Ceasefire	Post- Ceasefire	Total
	29.9.2000- 6.2.2001	7.02.2001- 11.09.2001	12.09.2001- 28.03.2002	29.03.2002- 24.06.2002	25.06.2002 28.06.2003	29.06.2003- 21.08.2003	22.08.2003- 15.01.05	29.09.2000- 15.01.05
	(131 days)	(217 days)	(198 days)	(88 days)	(369 days)	(51 days)	(513 days)	(1570 days)
<i>Israelis</i>								
Share								
By Gunfire	.760	.388	.459	.276	.438	.200	.294	.400
By Suicide Attacks	.000	.422	.477	.603	.458	.600	.592	.486
Rate								
By Gunfire	.290	.207	.510	.489	.285	.020	.114	.252
By Suicide Attacks	.000	.226	.530	1.068	.298	.059	.231	.306
Other	.092	.101	.071	.216	.068	.020	.045	.072
<i>Palestinians</i>								
Share								
By Gunfire	.933	.870	.836	.882	.741	.900	.675	.746
By Helicopter, Aircraft or Tank Shelling	.042	.101	.051	.096	.176	.100	.308	.169
Targeted Killings	.046	.150	.048	.048	.130	.000	.102	.090
Rate								
Gunfire	2.206	.829	2.394	2.500	1.439	.176	1.353	1.529
Helicopter, Aircraft or Tank Shelling	.099	.097	.146	.409	.341	.020	.616	.346
Other	.046	.028	.323	1.341	.163	.000	.035	.173
Targeted Killings	.107	.143	.136	.205	.252	.000	.203	.183
Non-targeted Deaths	2.244	.811	2.727	4.045	1.691	.196	1.800	1.866

Source: Authors' tabulations of data from B'Tselem from 29 September 2000 to 15 January 2005.

Table 4
Daily Israeli Reaction Function, Incidence and Number of Fatalities

	Incidence of Palestinian Fatalities				Number of Palestinian Fatalities			
	Coef.	Std. Err	Coef.	Std. Err	Coef.	Std. Err	Coef.	Std. Err
Israeli Fatalities								
t-1	.072	.030	.064	.030	0.056	0.034	0.050	0.035
t-2	-.002	.031	.001	.031	0.083	0.049	0.085	0.048
t-3	.029	.030	.028	.030	0.103	0.047	0.109	0.047
t-4	.085	.030	.089	.030	-0.045	0.037	-0.038	0.038
t-5	.049	.030	.057	.031	0.108	0.049	0.109	0.051
t-6	.011	.031	.020	.031	0.070	0.048	0.076	0.049
t-7	-.010	.031	-.010	.031	0.198	0.086	0.199	0.084
Palestinian Fatalities								
t-1	.041	.026	.055	.026	0.235	0.048	0.222	0.048
t-2	.039	.026	.044	.026	0.111	0.039	0.107	0.039
t-3	-.035	.026	-.039	.026	0.005	0.036	0.001	0.036
t-4	.064	.026	.061	.026	0.151	0.058	0.146	0.059
t-5	.051	.026	.055	.026	0.032	0.036	0.028	0.036
t-6	.035	.026	.043	.026	-0.043	0.033	0.053	0.033
t-7	.000	.026	-.006	.026	0.057	0.034	0.042	0.033
Periods								
Barak-Sharon				ref.				ref.
Sharon-9/11			-.151	.054			-0.804	0.271
9/12-ODS			-.032	.052			-0.104	0.325
ODS-Roadmap			.091	.057			0.065	0.505
Roadmap-Ceasefire			-.007	.048			-0.503	0.273
Ceasefire			-.450	.100			-1.989	0.520
Post-Ceasefire			-.108	.148			-2.199	0.847
Length of Separation Barrier (100 km)			.049	.082			1.189	0.489
χ^2 for joint sig. of Israeli Fatalities (p-value)	25.88		23.05		22.51		22.70	
	(.001)		(.002)		(.002)		(.002)	
R^2	.062		.089		.234		.247	

Note: Dependent variable is an indicator for any Palestinians killed in columns 1 and 2 and number of Palestinians killed in columns 3 and 4. Columns 2 and 4 also include day-of-week indicator variables. All models estimated with ordinary least squares. Standard Source: Authors' tabulations of data from B'Tselem from 29 September 2000 to 15 January 2005.

Table 5
Daily Palestinian Reaction Function, Incidence and Number of Fatalities

	Incidence of Israeli Fatalities				Number of Israeli Fatalities			
	Coef.	Std. Err	Coef.	Std. Err	Coef.	Std. Err	Coef.	Std. Err
Palestinian Fatalities								
t-1	.012	.020	.011	.020	0.021	0.023	0.022	0.023
t-2	.020	.020	.020	.020	0.059	0.034	0.058	0.033
t-3	-.007	.020	-.009	.021	0.002	0.021	0.004	0.021
t-4	-.007	.020	-.013	.021	-0.008	0.020	-0.007	0.020
t-5	.030	.021	.026	.021	0.006	0.014	0.004	0.014
t-6	.007	.020	-.000	.020	-0.007	0.020	-0.013	0.020
t-7	-.012	.020	-.018	.021	0.001	0.018	-0.005	0.017
Israeli Fatalities								
t-1	.081	.027	.063	.028	0.086	0.036	0.068	0.034
t-2	.062	.027	.046	.027	-0.003	0.018	-0.020	0.018
t-3	.051	.027	.033	.026	0.023	0.021	0.006	0.021
t-4	.013	.026	-.003	.026	0.033	0.045	0.015	0.044
t-5	.073	.027	.057	.028	0.019	0.021	0.002	0.023
t-6	.065	.028	.048	.028	0.012	0.022	-0.005	0.024
t-7	.065	.027	.036	.028	0.013	0.027	-0.011	0.028
Periods								
Barak-Sharon				ref.				ref.
Sharon-9/11			-.012	.047			0.232	0.163
9/12-ODS			.064	.049			0.651	0.209
ODS-Roadmap			.086	.063			1.203	0.454
Roadmap-Ceasefire			-.033	.042			0.337	0.153
Ceasefire			-.139	.080			0.528	0.492
Post-Ceasefire			-.152	.111			1.352	1.013
Length of Separation Barrier (100 km)			.036	.061			-0.780	0.560
χ^2 for joint sig. of Palestinian Fatalities (p-value)		4.21		3.94		6.72		7.21
		(.755)		(.786)		(.458)		(.408)
R^2		.046		.075		.026		.052

Note: Dependent variable is an indicator for any Israelis killed in columns 1 and 2 and number of Israelis killed in columns 3 and 4. Columns 2 and 4 also include day-of-week indicator variables. All models estimated with ordinary least squares. Standard Source: Authors' tabulations of data from B'Tselem from 29 September 2000 to 15 January 2005.

Table 6
Granger Causality Tests for Different Lag Structures
(χ^2 statistics, p-values in parentheses)

Lag Structure (own, opposite)	Israeli Reaction Function		Palestinian Reaction Function	
	Incidence	Levels	Incidence	Levels
(4,4)	19.67 (.001)	11.96 (.018)	2.78 (.596)	4.75 (.314)
(7,4)	25.46 (.001)	23.21 (.002)	5.56 (.591)	7.03 (.425)
(14,4)	49.38 (<.001)	28.75 (.011)	9.65 (.788)	8.84 (.841)
(21,4)	69.12 (<.001)	43.39 (.003)	17.03 (.651)	19.52 (.552)
(7,7)	23.05 (.002)	22.70 (.002)	3.94 (.786)	7.21 (.408)
(14,7)	42.73 (<.001)	27.62 (.016)	7.83 (.898)	9.10 (.825)
(21,7)	60.68 (<.001)	41.53 (.005)	15.8 (.729)	19.62 (.546)
(14,14)	38.82 (<.001)	28.26 (.013)	6.86 (.940)	10.48 (.726)
(21,14)	53.10 (<.001)	41.61 (.005)	14.31 (.814)	21.25 (.444)
(21,21)	51.19 (<.001)	42.73 (.003)	14.59 (.800)	21.72 (.416)

Note: All models include period variables, length of separation barrier, and day-of-week variables.

Source: Authors' tabulations of data from B'Tselem from 29 September 2000 to 15 January 2005.

Table 7
Effect of Time Aggregation on Granger Causality Tests: Levels
(χ^2 statistics, p-values in parentheses)

Frequency of Data	Israeli Reaction Func.	Palestinian Reaction Func.
Weekly		
2 Lags	4.90 (.086)	1.36 (.507)
4 Lags	23.68 (.000)	1.92 (.751)
Bi-Weekly		
1 Lag	0.25 (.619)	0.98 (.323)
2 Lags	0.31 (.855)	1.98 (.371)
Monthly		
1 Lag	2.51 (.113)	0.06 (.810)

Note: All models include period variables and length of separation barrier.

Source: Authors' tabulations of data from B'Tselem from 29 September 2000 to 15 January 2005.

Table 8
"Smoothed" Reaction Functions: Before, During, and After Operation Defensive Shield

Own Casualties and Period	Israeli Reaction Function (Palestinian Fatalities)				Palestinian Reaction Function (Israeli Fatalities)			
	Incidence		Levels		Incidence		Levels	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
<i>Entire Period</i>								
t-1	.030	.010	0.096	0.022	-.002	.007	0.007	0.007
t-2	.035	.010	0.018	0.016	.003	.007	0.001	0.005
χ^2 for sig. of own fatalities (p-value)	27.78 ($<.001$)		18.44 ($<.001$)		0.22 (.894)		1.45 (.484)	
<i>Period-by-period Analysis</i>								
Before Operation Defensive Shield								
t-1	.038	.015	0.089	0.040	-.004	.013	-0.002	0.011
t-2	.031	.017	0.043	0.026	.007	.013	0.021	0.008
During Operation Defensive Shield								
t-1	-.006	.016	0.174	0.057	-.050	.043	0.004	0.028
t-2	.065	.025	0.078	0.049	.001	.040	-0.029	0.009
After Operation Defensive Shield								
t-1	.025	.017	0.048	0.020	.003	.008	-0.004	0.004
t-2	.032	.017	-0.012	0.013	-.000	.008	-0.002	0.004
χ^2 for sig. of own Fatalities: Pre-ODS (p-value)	12.89	(.002)	8.54	(.014)	0.33	(.846)	7.07	(.029)
χ^2 for sig. of own Fatalities: ODS (p-value)	11.42	(.003)	9.76	(.008)	1.46	(.482)	9.72	(.008)
χ^2 for sig. of own Fatalities: Post-ODS (p-value)	5.76	(.056)	6.50	(.039)	0.17	(.916)	2.09	(.351)
χ^2 for test of equality of coefficients in all periods	4.14	(.387)	9.57	(.048)	1.93	(.749)	17.70	(.001)
R^2	.647		.418		.257		.133	

Note: "Smoothed lags" are 7 day periods prior to date. Heteroskedasticity-consistent standard errors. All models estimated with ordinary least squares and include lagged "own" smoothed lags, period and day-of-week indicators as well as the length of the separation barrier as regressors.

Source: Authors' tabulations of data from B'Tselem from 29 September 2000 to 15 January 2005.

Table 9
"Smoothed" Israeli Reaction Functions:
Reaction to Israeli Civilian and Security Forces Fatalities and
Fatalities in Israel and in the Territories

	Palestinian Fatalities			
	Incidence		Levels	
	Coef.	Std. Err.	Coef.	Std. Err.
<i>Reaction to Israeli Civilian and Security Forces Fatalities</i>				
Civilians				
t-1	.020	.013	0.089	0.026
t-2	.033	.014	0.011	0.020
Security Forces				
t-1	.034	.013	0.128	0.052
t-2	.016	.013	0.056	0.039
χ^2 for sig. of civilian fatalities (p-value)	8.11	(.017)	12.01	(.002)
χ^2 for sig. of security force fatalities (p-value)	9.58	(.008)	7.88	(.019)
χ^2 for test of equality of civ. and security forces (p-value)	1.12	(.008)	1.25	(.537)
R^2		.096		.199
<i>Reaction to Fatalities in Israel and in the Territories</i>				
Within Israeli				
t-1	.019	.017	0.074	0.026
t-2	.053	.017	0.010	0.019
In the Territories				
t-1	.036	.012	0.171	0.056
t-2	.022	.013	0.047	0.044
χ^2 for sig. of fatalities in Israel (p-value)	10.41	(.005)	8.01	(.018)
χ^2 for sig. of fatalities in the Territories (p-value)	13.34	(.001)	10.54	(.005)
χ^2 for test of equality of Israel and Territories (p-value)	2.68	(.262)	2.56	(.277)
R^2		.090		.201

Note: "Smoothed lags" are 7 day periods prior to date. Heteroskedasticity-consistent standard errors. All models estimated with ordinary least squares and include "smoothed" lags of Palestinian Fatalities, period and day-of-week indicators as well as the length of the separation barrier as regressors.

Source: Authors' tabulations of data from B'Tselem from 29 September 2000 to 15 January 2005.

Table 10
"Smoothed" Israeli Reaction Functions:
Reaction to Successful and Unsuccessful Suicide Attempts

	Palestinian Fatalities			
	Incidence		Levels	
	Coef.	Std. Err.	Coef.	Std. Err.
Successful suicide attempts				
t-1	-.001	.022	0.628	0.234
t-2	.049	.021	0.099	0.183
Failed suicide attempts				
t-1	.002	.027	0.176	0.178
t-2	.020	.026	0.093	0.179
Other Israeli fatalities				
t-1	.036	.011	0.157	0.051
t-2	.021	.012	0.028	0.033
χ^2 for sig. of successful attempts (p-value)	5.73	(.057)	7.33	(.026)
χ^2 for sig. of failed attempts (p-value)	0.60	(.741)	1.12	(.571)
χ^2 for sig. of other fatalities (p-value)	16.40	(.000)	10.50	(.005)
R^2				

Note: "Smoothed lags" are 7 day periods prior to date. Heteroskedasticity-consistent standard errors. All models estimated with ordinary least squares and include "smoothed" lags of Palestinian Fatalities, period and day-of-week indicators as well as the length of the separation barrier as regressors.

Source: Authors' tabulations of data from B'Tselem from 29 September 2000 to 15 January 2005.

Table 11
"Smoothed" Palestinian Reaction Functions:
Reaction to Successful and Unsuccessful Assassination Attempts

	Israeli Fatalities			
	Incidence		Levels	
	Coef.	Std. Err.	Coef.	Std. Err.
Successful assassination attempts				
t-1	-.023	.013	-0.245	.070
t-2	.004	.014	0.123	.096
Failed assassination attempts				
t-1	.084	.036	0.056	.206
t-2	-.014	.029	-0.229	.157
Other Palestinian fatalities				
t-1	.001	.008	0.014	.009
t-2	-.000	.008	0.001	.007
χ^2 for sig. of successful attempts (p-value)	3.22	(.200)	12.34	(.002)
χ^2 for sig. of failed attempts (p-value)	5.93	(.052)	3.12	(.210)
χ^2 for sig. of other fatalities (p-value)	0.03	(.987)	3.22	(.200)
R^2		.077		.046

Note: "Smoothed lags" are 7 day periods prior to date. Heteroskedasticity-consistent standard errors. All models estimated with ordinary least squares and include "smoothed" lags of Israeli Fatalities, period and day-of-week indicators as well as the length of the separation barrier as regressors.

Source: Authors' tabulations of data from B'Tselem and Zussman and Zussman (2005) from 29 September 2000 to 30 April 2004.

Table 12
"Smoothed" Palestinian Reaction Functions:
Reaction to Successful and Unsuccessful Assassination Attempts

	Israeli Fatalities from Suicide Bombings				Israeli Fatalities from All Other Actions			
	Incidence		Levels		Incidence		Levels	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Successful assassination attempts								
t-1	-.021	.006	-0.205	0.063	-.007	.012	-0.040	0.032
t-2	.012	.007	0.133	0.088	-.007	.013	-0.010	0.037
Failed assassination attempts								
t-1	-.024	.014	-0.022	0.182	.112	.036	0.078	0.096
t-2	-.002	.016	-0.105	0.145	-.028	.026	-0.124	0.063
Other Palestinian fatalities								
t-1	-.001	.004	0.003	0.006	.004	.008	0.011	0.008
t-2	-.003	.004	0.004	0.006	.001	.007	-0.003	0.004
χ^2 for sig. of successful attempts (p-value)	11.14	(.004)	10.49	(.005)	0.67	(.716)	1.60	(.450)
χ^2 for sig. of failed attempts (p-value)	3.14	(.208)	0.60	(.740)	11.91	(.003)	5.15	(.076)
χ^2 for sig. of other fatalities (p-value)	0.50	(.777)	1.03	(.596)	0.29	(.865)	2.25	(.325)
R^2	.045		.028		.082		.064	

Note: "Smoothed lags" are 7 day periods prior to date. Heteroskedasticity-consistent standard errors. All models estimated with ordinary least squares and include "smoothed" lags of Israeli Fatalities, period and day-of-week indicators as well as the length of the separation barrier as regressors.

Source: Authors' tabulations of data from B'Tselem and Zussman and Zussman (2005) from 29 September 2000 to 30 April 2004.