Journal of Economic Perspectives—Volume 21, Number 3—Summer 2007—Pages 223–238

Human Capital and the Productivity of Suicide Bombers

Efraim Benmelech and Claude Berrebi

Suicide terrorism is rising around the world. From the onset of the Palestinian *intifada* in September 2000 through August 2005, 151 Palestinian suicide bombing attacks have been launched against Israeli targets, killing 515 people and injuring almost 3,500 more. From 1987 to 2001, the Tamil Tigers launched 76 suicide bombing attacks in Sri Lanka and India, killing a total of 901 people, including two prominent national leaders: India's former prime minister Rajiv Gandhi in 1991 and Sri Lanka's President Ranasinghe Premadasa in 1993 (Pape, 2005). In Iraq, suicide bombers have killed thousands of people, mostly Iraqi civilians, since 2003.

In this paper, we study the relation between human capital of suicide bombers and the outcomes of their suicide attacks. We will provide evidence that human capital is an important factor in the production of suicide terrorism, and that more able suicide bombers are more destructive when assigned to more important targets. Our paper is related to a growing body of literature on the relation between education, poverty, and terrorism. Previous studies have suggested that terrorism may in some cases offer greater benefits for those with more education (Krueger and Maleckova, 2003). We provide empirical evidence consistent with this prediction.

The intuition behind our analysis is straightforward. On the demand side, suicide attacks are complex tasks that require a considerable level of task-specific and general human capital. Suicide bombers must reach their targets and often

■ *Efraim Benmelech is Assistant Professor of Economics, Harvard University, and Faculty Research Fellow, National Bureau of Economic Research, both in Cambridge, Massachusetts. Claude Berrebi is Research Economist, RAND Corporation, Santa Monica, California. Their e-mail addresses are ⟨effi_benmelech@harvard.edu⟩ and ⟨berrebi@rand.org⟩, respectively.*

must disguise themselves to blend in with the local population. After reaching the target, suicide bombers must decide on the timing and the exact location of their attack. For example, when attempting to blow up a bus, a suicide bomber has to judge the trade-off between the expected number of passengers that will get on and off in the next stop against the likelihood that he will be captured if he waits before detonating his explosive device. The high cost of incompetent, unreliable, or untrustworthy suicide bombers predicts that suicide bombers will tend to be relatively well-educated and mentally stable, as in the models of Iannaccone (2006) and Bueno de Mesquita (2005). Since some targets are more important and thus more rewarding from the suicide bomber's perspective, terror organizations will have an incentive to assign suicide bombers to targets according to their abilities. In addition, Krueger and Maleckova (2003) argue along these lines that terror organizations may prefer to select those who have better education since a high level of education attainment is probably a signal of commitment, as well as ability to carry out an attack.

On the supply side, we follow Iannaccone's (2006) approach of "rational sacrifice," where suicide bombers obtain benefits from their suicide-related activities.[1] He writes: "[T]he benefits will start well before the sacrificial acts (as when the volunteer is honored by his comrades or rewarded by his leaders) and extend well beyond (and, perhaps into a life after death)." The benefits of suicide-related activities include: fame, honor, and recognition; moral status; value of accomplishment; beneficial consequences and rewards for significant others; beneficial consequences and rewards for self; and the magnitude of harm and humiliation imposed on enemies. These benefits are likely to be increasing in the expected impact of a suicide attack. Accordingly, if able suicide bombers are capable of launching more successful attacks, individuals with greater human capital will be willing to participate in larger-scale suicide attacks.

In an equilibrium model of attack assignments for terror organizations, human capital is an important factor in the production of suicide terrorism, and more able suicide bombers are assigned in equilibrium to targets that are associated with greater rewards (Benmelech and Berrebi, 2007). The profiles of the hijackers chosen for the 9/11 attacks are consistent with this notion. Two-thirds of the hijackers had pursued formal academic studies, and at least seven of the 19 hijackers had formal flight training.[2] Moreover, the average age of the 9/11 hijackers was 24.2 years, compared to a mean age of 21 years for Palestinian

[1] While empirical evidence exists on the relation between economic distress and unemployment, and suicide in general (for example, Krug et al., 1998; Aihara and Iki, 2002; Kposowa, 2001), and between income and suicide rates (Helliwell, 2004), the typical profile of suicide bombers is different than those who commit suicide in general (Berrebi, 2003; Krueger and Maleckova, 2003).

[2] Twelve hijackers were either graduates or were enrolled in academic institutions. While Ahmed Alghamdi entered the United States on a student visa, we do not know whether he was actually enrolled in an academic institution, and accordingly we do not classify him as a hijacker pursuing a higher education.

suicide bombers in roughly the same period. Thus, the characteristics of the 9/11 hijackers, although anecdotal evidence, tend to confirm that human capital is particularly important for the completion of complex suicide attacks.

Our argument fits within a growing body of literature that analyzes the rationality of terror organizations (for example, Berman, 2004; Berrebi and Klor, 2006; Iannaccone, 2006; Kydd and Walter, 2002). Similarly, Becker and Posner (2005) develop a model where suicide bombers derive utility from sacrificing their lives and killing members of a hated group. In their model, persons with high reservation wages would only accept suicide missions that have high expected payoffs. Likewise, Krueger and Maleckova (2003) suggest in this journal that on the supply side, terrorism may offer greater benefits for those with more education and that on the demand side, terrorist organizations may prefer to choose those who have better education.

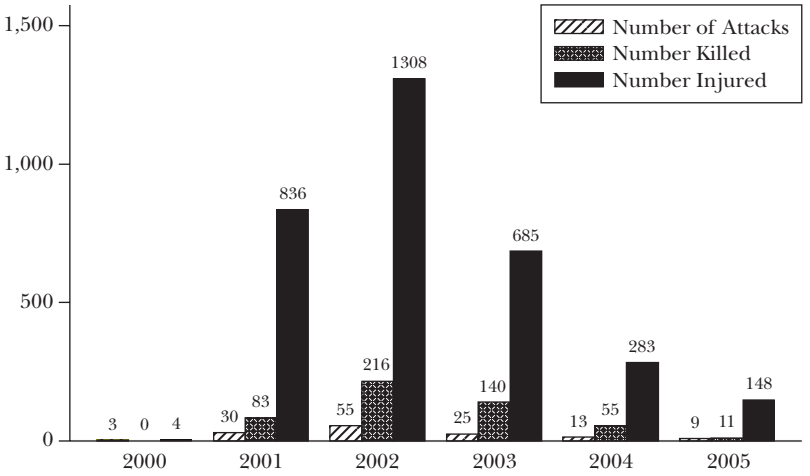
In this paper we offer evidence based on a unique database constructed from reports of the Israeli Security Agency (ISA). The data detail the biographies of Palestinian suicide bombers between the years 2000 and 2005, including detailed information about the targets they attacked, and number of people that they killed and injured. We find that the suicide bomber's age and education and the importance of the target are strongly correlated; older and more-educated suicide bombers are assigned to attack more important targets. Older and more-educated suicide bombers kill more people when they attack more important targets. We also find that more-educated and older Palestinian suicide bombers are less likely to fail or to be caught during their attacks, emphasizing the importance of human capital in the production of killing and terror.

Suicide Attacks, Characteristics of Bombers, and Importance of Targets

Suicide Attacks

Our dataset contains detailed information on all suicide attacks by Palestinians against Israeli targets in Israel, the West Bank, and the Gaza Strip between September 2000 and August 2005. The Israeli Security Agency reports cover 151 suicide bombing attacks carried out by 168 suicide bombers in Israel, the West Bank, and Gaza. In the 151 suicide attacks included in the dataset, 515 Israelis were killed and 3,428 were injured. According to the ISA, there were about 25,000 Palestinian attacks against Israeli citizens and residents between September 2000 and August 2005. In those attacks, more than 1,000 Israelis were killed. While suicide attacks account for only 0.6 percent of the total number of attacks, the number of Israelis who were killed in suicide attacks is more than half the number of all Israelis killed in Palestinian attacks during this period. We restrict our sample to attacks in which we have information about the age and education of suicide bombers. We also

Figure 1
Number of Suicide-Bombing Attacks and of People Killed and Injured in Suicide-Bombing Attacks September 2000–August 2005



Source: Authors' calculations based on Israeli Security Agency reports.

exclude suicide attacks that were launched by non-Palestinians or in which we could not identify the target. We thus end up with 135 suicide bombing attacks carried out by 148 suicide bombers. Our sample represents 89 percent of the total number of suicide attacks between September 2000 and August 2005, 88 percent of the suicide bombers, and 98 percent of the Israelis who were killed in suicide attacks.

Figure 1 displays the number of suicide attacks, number of people killed, and number of those who were injured in suicide attacks from September 2000 to August 2005. The al-Aqsa intifada began on September 29, 2000, and thus there were fewer suicide attacks in the year 2000. (Intifada is an Arabic word for uprising—literally translated as "shaking off.") There were 60 suicide attacks in 2002 (55 are included in our sample), almost twice as many as the number of attacks in 2001 and 2003. The number of suicide attacks gradually declined in the years 2004 and 2005.

There is a positive correlation between the number of suicide attacks and the number of people killed and injured in these attacks. For example, in 2000, our sample contained three suicide attacks in which there were no casualties. In contrast, in 2002 there are 55 suicide attacks in our sample that killed 216 and injured 1,308 people. The correlation between the number of suicide attacks and the number of people killed in these attacks within a year is 0.95. Likewise, the correlation between the number of suicide attacks and the number of people injured in these attacks within a year is 0.95. Finally, the correlation between the number of people killed and the number of those who were injured in suicide attacks within a year is 0.94. (All correlations are significant at the 1 percent level.)

Table 1
Characteristics of Suicide Attacks

	Number killed				*Number injured*		
	Number of attacks	*Mean*	*Maximum*	*Standard deviation*	*Mean*	*Maximum*	*Standard deviation*
Full sample	135	3.7	29	6.1	24.2	170	32.6
2000	3	0.0	0	0.0	1.3	3	1.5
2001	30	2.8	22	5.5	27.9	170	40.4
2002	55	3.9	29	6.2	23.8	144	27.6
2003	25	5.6	23	7.8	27.4	115	36.7
2004	13	4.2	16	5.3	21.8	100	30.2
2005	9	1.2	5	2.2	16.4	88	31.8

Note: This table reports the number of attacks and summary statistics for the number of people killed and injured in suicide attacks for each of the years in the sample and for the full sample.

Table 1 reports detailed summary statistics for the number of people killed and injured in suicide attacks. The mean number of individuals killed in a suicide attack in the full sample is 3.7; the mean number injured is 24.2.

In our sample, 39.9 percent of the suicide attacks were carried out by Hamas; 25.7 percent by the Palestinian Islamic Jihad (PIJ); 26.4 percent by the Fatah; 5.4 percent by the Popular Front for the Liberation of Palestine (PFLP); and 2.7 percent by other organizations. Hamas and the PIJ, the two Islamic Palestinian terrorist organizations, together carried out 65.5 percent of the suicide attacks in our sample.

Suicide Bombers

The reports of the Israeli Security Agency (ISA) include a brief biography of the suicide bombers, a detailed description of the attack (including a description of the target and its location), and detailed information about the number of people killed and injured in the attack. We augment the biographical data (when possible) with information from the websites of Hamas and the Palestinian Islamic Jihad (PIJ).[3] Our sample includes 148 suicide bombers for whom we know their names, membership in terror organization, age, city of residence, marital status, and whether they had an academic degree or were enrolled in a higher-education institution. There are eight female and 140 male suicide bombers in the sample.

[3] See Berrebi (2003) for details on the Hamas and PIJ web sites. Since praising *Shahids* (martyrs) is a divine obligation in Islam, it is possible that terror organizations will exaggerate the qualities of suicide bombers as part of a religious obligation or for mere propaganda. However, since we have detailed information about the biographies of suicide bombers from the ISA, we were able to check the reliability of the information reported by the terror organizations. After translating the biographies from the web sites of the Hamas and PIJ, (which are in Arabic), and the data from the ISA, (which are in Hebrew) we find no disparities between the two sources in the biographies of the suicide bombers.

The youngest suicide bomber is 12 years old, and the oldest is 48. The mean age of the suicide bombers is 21.1, the median is 20.5 and the standard deviation is 4.7 years. These results are similar to previous findings regarding the age of Palestinian suicide bombers (for example, Berrebi, 2003). We measure education using a dummy variable that equals 1 for those who went beyond high school education. We treat students in academic institutions as if they have higher education even if they had not graduated at the time when they carried out a suicide attack. By this measure, 18 percent of the suicide bombers went beyond high school education, compared with only 8 percent in the Palestinian population as a whole (as reported by Berrebi, 2003).

Measuring Target Importance

To estimate the relation between targets, suicide bombers, and the outcomes of suicide attacks, we need a measure of target importance. One sensible proxy for the importance of a target is the size of a city in which the target is located. A target in a large city is potentially more important than a target in a smaller city. Likewise, a civilian target in an Israeli city is potentially more valuable as a weapon of terror than a military target in Israel or in the West Bank and Gaza. We construct two measures of target importance. Our first measure is a dummy variable that equals 1 for cities with a population of more than 50,000, and 0 otherwise.[4] We measure city size using population within the metro area of the city, using the Israeli Central Bureau of Statistics (CBS) population figures for the year 2003. Our second measure of target importance is a dummy variable that equals 1 for civilian targets, and equals 0 for military targets.

Table 2 displays the outcomes of suicide attacks stratified by the two measures of target importance. There is positive correlation between the number of people killed in attacks and the target's ranking. For example, the mean number of people killed per attack in targets in smaller cities is 1.4, and the mean number of people killed in targets in larger cities is 6.2. Furthermore, the mean number of people killed per attack in military targets is 0.3, and the mean number of people killed in civilian targets is 5.0. There is also a positive correlation between the number of people injured in attacks and the target's ranking. The mean number of people injured per attack in targets in smaller cities is 7.0, and the mean number of people injured per attack in targets in larger cities is 42.6. Similarly, the mean number of people injured in military targets is 2.4, and the mean number of people injured in civilian targets is 32.5. Obviously the number of casualties per attack is not the only way of measuring target importance: for example, attacks on military targets probably carry a symbolic value as well. For this reason we use city size as a measure of target importance through the rest of our analysis.

[4] We have tried alternative cutoffs such as population of more than 100,000 and 150,000 and obtained similar results. We focus on the 50,000 cutoff since most of the major Israeli cities have a population of more than 50,000.

Table 2
Targets and Outcomes

	Number killed per attack					*Number injured per attack*			
	Number of attacks	*Mean*	*Median*	*Maximum*	*Standard deviation*	*Mean*	*Median*	*Maximum*	*Standard deviation*
Population ≥50,000	78	6.2	3.0	29.0	7.3	46.2	34.5	170.0	40.0
Population <50,000	70	1.4	0.0	17.0	3.4	7.0	2.0	52.0	13.1
Correlation between target ranking and number killed: 0.38***									
Correlation between target ranking and number injured: 0.51***									
	Number of attacks	*Mean*	*Median*	*Max*	*Std*	*Mean*	*Median*	*Max*	*Std*
Civil	115	5.0	2.0	29.0	6.8	32.5	20.0	170.0	37.2
Military	33	0.3	0.0	4.0	0.85	2.4	2.0	17.0	3.5
Correlation between civil target and number killed: 0.31***									
Correlation between civil target and number injured: 0.36***									

Note: This table reports summary statistics for the number of people killed and injured in suicide attacks, stratified by target importance and civil vs. military targets, as well as correlation coefficients between the number of people killed and injured on the one hand, and target importance and civil vs. military targets on the other.
*** denotes significance at the 1 percent level.

The results are consistent with the findings of Berrebi and Lakdawalla (2007) that city population is strongly and positively correlated with terror attack frequency in Israel.

The Human Capital of Suicide Bombers and the Outcome of Their Attacks

As a starting point for considering the connections between the human capital of suicide bombers and the outcomes of their attacks, we consider the top five stand-alone suicide bombers in our dataset based on the number of people killed in their attacks.[5] This anecdotal evidence suggests that the best performing suicide bombers tend to be older and more educated, and are also more likely to attack targets in major cities.

Table 3 reports the name, age, education, and terror organization affilia-

[5] The list includes "stand-alone" suicide bombers and excludes suicide attacks with more than one suicide bomber, such as the attack on January 5, 2003, in which two suicide bombers blew themselves up in the old central bus station in Tel Aviv resulting in 23 killed and 106 wounded people.

Table 3
Top Five Palestinian Suicide Bombers

Name	*Age*	*Education*	*Organization*	*Attack date and location*	*Number killed*	*Number injured*
'Abd al-Baasit 'Awdeh	25	High School	Hamas	3/27/2002 Netanya	29	144
Raa'id 'Abd al-Hamid 'Abd al-Razzaaq Misk	29	Masters' Candidate	Hamas	8/19/2003 Jerusalem	23	115
Sa'eed Hasan Husayn al-Hutari	22	High School	Hamas	6/1/2001 Tel-Aviv	21	83
Hanaadi Taysir 'Abd al-Malik Jaraadaat	29	Law School Graduate	PIJ	10/4/2003 Haifa	21	48
Muhammad Hazzaa' 'Abd al-Rahmaan al-Ghoul	22	Masters' Candidate	Hamas	7/18/2002 Jerusalem	19	50
Top-five mean	25.8	0.60			22.8	88.0
Rest-of-sample mean[a]	20.9	0.17			3.0	22.4
p-value (t-test on means)	0.02***	0.02**			0.00***	0.00***

Note: This table lists the top-five "stand-alone" suicide bombers ranked based on the number of people killed in their attacks. The table reports name, age, education, terror organization affiliation, attack date, attack location, number of people killed, and number of people injured. The *p*-value of t-tests on the means are reported for age, education, number of people killed, and number of people injured. "Education" is measured as a dummy variable that takes the value of one for higher education and zero otherwise.

[a] This truncated sample mean excludes the top-five suicide bombers.

** denotes significance at the 5 percent level.

*** denotes significance at the 1 percent level.

tion of the top five suicide bombers and provides detailed information about date, location, and number of people killed and injured in the attack. The average age of the top five suicide bombers is 25.8 years compared to an average age of 20.9 years in the rest of the sample. Three of the top five suicide bombers had academic degrees (two were masters' candidates and one had a degree in law), while only 17.0 percent of the suicide bombers in the rest of the sample had or were pursuing academic degrees. The top-five suicide bombers killed on average 22.8 people, compared with a rest-of-the-sample mean of 3.0, and injured on average 88 people, compared with a mean of 22.4. in the rest of the sample. These differences in age, education, death, and injury between the means for top five suicide bombers and the means for rest of the sample are all highly statistically significant. Furthermore, all the top-five suicide bombers attacked targets in large Israeli cities; while only about half of the suicide bombers in the full sample attacked in these cities.

Assignment of Suicide Bombers to Targets

For a more systematic analysis of the connections between human capital of suicide bombers and the outcome of their attacks, we begin with a regression

Table 4
Influence of Age and Education on Attack Assignments

	Dependent variable	
	Population ≥ 50,000	*Military target*
Age	0.04***	−0.01
	(0.00)	(0.32)
Education (1 = have or are pursuing academic degree)[a]	−0.02	−0.14***
	(−0.20)	(0.01)
Pseudo R^2	0.30	0.35
Observations	148	148

Note: Probit regression results of target index (column 1) and military target (column 2) on the suicide bomber's age and an academic degree dummy variable. Additional regressors (not shown on the table) include terror organization indicator variables, and a dummy variable for attacks with more than one suicide bomber. The regression for column 1 also includes a dummy variable for military targets. Robust standard errors are calculated assuming groupwise clustering at the attack location level. Marginal effects and their associated *p*-values (in parentheses) are reported along with pseudo R^2, and *N*, the number of observations.
[a] dy/dx is for discrete change of dummy variable from 0 to 1.
*** denotes significance at the 1 percent level.

investigating the connection from higher-ability suicide bombers to more important targets. In the first column of Table 4, we estimate a regression in which the dependent variable is a dummy variable for whether the attack occurred in a city with a population of greater than 50,000. The two key explanatory variables are the age and academic background of the suicide bomber. The regression also includes various control variables whose results are not reported in the table: variables for the terror organization to which the bomber belongs; a dummy variable for attacks with more than one suicide bomber; and a dummy variable for military targets. The coefficients on "Age" and "Education" should be positive and significant if older and educated suicide bombers are assigned to more important targets, as measured by city size. The coefficient on "Age" equals 0.04 and is statistically significant at the 1 percent level, while the coefficient on "Education" is not statistically different from zero. The marginal effect of one year of age is large and represents an increase of 4 percentage points in the probability that a suicide bomber will be assigned to a target in a large city. In terms of economic magnitude, this coefficient implies that a 25-year old suicide bomber has a 28 percentage points higher probability to be assigned to a target in a large city (representing an increase of 53.1 percent relative to the unconditional mean) than an 18-year old suicide bomber.

In the second column of Table 4, our dependent variable is whether a suicide bomber is assigned to a civil or military target. Again, we use "Age" and "Education" as explanatory variables. As before, the regression includes a number of control variables whose coefficients are not reported in the table: terror organization

indicator variables and a dummy variable for attacks with more than one suicide bomber. In this regression, a strong negative relationship emerges between the "Education" variable and the choice of a military target. Educated suicide bombers are 14 percentage points less likely to be assigned to military targets, representing a decrease of 62.8 percent relative to the unconditional mean. The coefficient on "Age" however is not statistically significant.

We also experimented with using the distance between the suicide bomber's hometown or terror cell headquarters and the location of the target as the dependent variable. We could imagine reasons why more able suicide bombers would be sent to more distant targets or saved for closer targets, depending on whether or not the risk of detection due to the target's distance is affected by the individual suicide bomber's own ability as opposed to other factors such as, for example, the skills of the dispatching driver. However, we do not find evidence in such regressions that Palestinian terror organizations assign older or more-educated suicide bombers either to targets that are further away, nor to those that are closer to the location of the suicide bomber or the headquarters of its terror cell.

In summary, we find that Palestinian terror organizations assign older suicide bombers to targets in larger cities and less-educated suicide bombers to military targets. However, age and education are not correlated with distance between the target and the bomber or the terror cell location.

The Productivity of Suicide Bombers

We now test whether older and more-educated suicide bombers are more effective in the production of terror when assigned to more important targets. Our strategy for examining this question uses regressions with the number of people killed or injured as the dependent variables. Again, two key explanatory variables are the "Age" and "Education" of the suicide bomber. However, since we want to know the extent to which these factors matter when holding the importance of the target constant, we also use a measure of the importance of the target and interaction terms. For the importance of the target, we used the dummy variable for whether the city size exceeds 50,000 (although our results hold if we use the civilian/military measure of the importance of the target as well). We then use interaction terms in the regression, which interact either "Age" or "Education" with the measure of target importance. The coefficients on these interaction terms should be positive if older and more-educated suicide bombers cause greater injury and death at more important targets. The regressions in Table 5 also use other control variables not reported in the table: terror organization indicator variables; a dummy variable for attacks with more than one suicide bomber; a dummy variable for military targets; and indicators for the type of suicide attack.[6]

The first two columns of Table 5 are based on all 148 suicide bombers in our

[6] There are nine types of suicide attacks in our sample: explosives-belt, bag, bus, car, bike, boat, diver, tanker, and wagon. The most common were explosives-belt, bag, car, and bus.

Table 5

Age, Education, and the Productivity of Suicide Bombers

(dependent variable = number of people killed or injured in the attack)

	All suicide bombers		*Only successful suicide bombers*	
	# *Killed*	# *Injured*	# *Killed*	# *Injured*
Age	−0.25	−0.80	−0.11	−0.03
	(0.14)	(0.36)	(0.62)	(0.98)
Education (1 = have or are pursing academic degree)	−2.34*	−5.96	−4.68**	−15.15
	(0.10)	(0.60)	(0.03)	(0.30)
Target	−10.50**	−31.46	−13.50*	−40.21
	(0.05)	(0.31)	(0.09)	(0.36)
Age × Target	0.57**	2.62*	0.64*	2.91
	(0.02)	(0.06)	(0.07)	(0.16)
Education × Target	3.99**	1.28	5.83**	4.80
	(0.04)	(0.91)	(0.03)	(0.32)
Adjusted R^2	0.25	0.32	0.25	0.36
Observations	148	148	106	106

Note: This table reports regression results in which the dependent variable is the number of people that were killed or injured in suicide attacks (the output of the production of terror) and the independent variables are the suicide bomber's age; an academic degree dummy variable ("Education"); a target dummy variable; and interactions between "Age" and the target dummy variable, and "Education" and the target dummy variable. Additional regressors include terror organization indicator variables; a dummy variable for attacks with more than one suicide bomber; and a dummy variable for military targets. Regressions include fixed effects for suicide attack type. Coefficient estimates for the constant, additional regressors, and fixed effects are not reported for brevity. Regressions are run under ordinary least squares with robust standard errors that assume groupwise clustering at the attack location level. Coefficient estimates and their associated *p*-values (in parentheses) are reported along with adjusted *R*-squared, and the number of observations.

* denotes significance at the 10 percent level.

** denotes significance at the 5 percent level.

sample. In the last two columns of the table, we exclude from the analysis suicide bombers who were caught and stopped in order to focus on suicide bombers who actually reach their targets, and thus we have a sample of 106 suicide bombers. We separately analyze the determinants of caught suicide bombers in the next section. The results in the first column of Table 5 are consistent with our predictions. We find that both "Age × Target" and "Education × Target" are positive and significant for the number of people killed. Older and better educated suicide bombers, when assigned to more important targets, are more effective killers.

The coefficient of both "Age × Target" and "Education × Target" are indeed positive and significant. The coefficients on these variables are 0.57 and 3.99, and are statistically significant at the 2 and 4 percent level, respectively. To gauge the marginal effect of "Age", taking into account the interaction between "Age" and "Target", consider moving from a small city target to a large city target for a 25-year

old suicide bomber. The increase in the number of people killed when moving from a small city with a value of 0 to a larger city with a value of 1 for a 25 years old suicide bomber is

$$(-10.50 \times 1) + 0.57(25 \times 1) - ((-10.50 \times 0) + 0.57(25 \times 0)) = 3.75.$$

The marginal effect of targets on younger suicide bombers is close to zero. Indeed, moving from a small to a large city for an 18 year-old suicide bomber decreases the number of people killed by 0.2. Interestingly, the coefficient of "Age" is negative but not statistically significant, indicating that conditional on the target being a small city, we cannot reject the hypothesis that age has no additional impact on the number of people killed or injured. We obtain similar results when we exclude caught suicide bombers (columns 3 and 4). The positive and significant coefficient of "Education × Target" suggests that there are returns to education in the production of suicide attacks. An educated suicide bomber kills roughly four to six more people when he attacks a large city target compared to an uneducated suicide bomber.

Evidence from Caught Suicide Bombers

Some suicide bombers will fail in their missions and will be caught by security forces or civilians during the attack. To test the hypothesis that less-educated and younger suicide bombers are more likely to fail in their missions, we identify caught suicide bombers using the ISA reports. We classify suicide bombers as "caught" if they 1) failed to detonate their explosive devices, 2) looked suspicious and were apprehended or killed by civilians, policemen, or soldiers, 3) panicked and blew themselves up before they reached the target, or 4) chickened out. In this sample, 42 suicide bombers are classified as caught: 18 were caught alive and 24 were killed or died during capture.

Table 6 splits our sample of suicide bombers into two subsamples—caught and uncaught—and reports summary statistics for their age and education. Clearly, age and educational attainment differs between caught and uncaught suicide bombers in a statistically significant manner. In Panel A, the average age of a caught suicide bomber is 18.8, while uncaught suicide bombers are on average 3.2 years older. Likewise, the median caught suicide bomber is 19 years old, three years younger than the median uncaught suicide bomber.

Panel B of Table 6 compares educational attainment between caught and uncaught suicide bombers. While 23 percent of the uncaught suicide bombers went beyond high school education, only 7 percent of the caught suicide bombers had a higher education. The difference in educational attainment between caught and uncaught suicide bombers is sizeable (16 percentage points), and represents nearly an 89 percent decrease in the likelihood of being educated compared to the mean.

Regression analysis confirms this finding. In a probit regression using whether

Table 6
Characteristics of Caught vs. Uncaught Suicide Bombers

Panel A: Age

	Mean	*Median*	*Minimum*	*Maximum*	*Standard deviation*	*Number*
Caught	18.8	19	12	26	3.3	42
Uncaught	22.0	22	16	48	4.9	106
Full sample	**21.1**	**20.5**	**12**	**48**	**4.7**	**148**

p-value of a two-sample t-test for equal means: 0.00***

Panel B: Education (1 = have or are pursuing a higher education)

	Mean	*Median*	*Minimum*	*Maximum*	*Standard deviation*	*Number*
Caught	0.07	0	0	1	0.26	42
Uncaught	0.23	0	0	1	0.42	106
Full sample	**0.18**	**0**	**0**	**1**	**0.39**	**148**

p-value of a two-sample t-test for equal means: 0.03**

Note: This table compares age and education for suicide bombers that were caught with those that were not caught. Mean, median, minimum, maximum, standard deviation, and number of observations are reported along with *p*-value of t-tests on the means.
** denotes significance at the 5 percent level.
*** denotes significance at the 1 percent level.

a suicide bomber is caught as the dependent variable, and "Age" and "Education" as the explanatory variables, an additional year of age is associated with a decrease of 5 percentage points in the probability of being caught, a reduction of 17.6 percent relative to the sample mean. Likewise, suicide bombers who went beyond high school education are 16 percentage points less likely to be caught, which represents a 56.4 percent decrease from the 28.4 percent frequency of caught suicide bombers in the sample. These estimates are statistically significant at the 1 percent level. The coefficients are essentially the same if we use logit estimates or if we add a number of control variables, such as a dummy variables for the terrorist organization; a dummy variable that equals one if more than one bomber participated in an attack and zero otherwise; and a dummy variable for military targets. In short, these results confirm the importance of human capital in suicide bombing.

One competing hypothesis to our human capital–based explanation is that the probability of being caught is driven purely by attack assignment and that there is no causal impact of age or education on getting caught. For example, if terror organizations believe that older bombers are more trustworthy (even if there is in fact no difference), they might then assign older people to missions in which they

have a lower chance of getting caught. While we cannot reject this alternative explanation, we have controlled in our regression analysis for the target importance and the distance between the suicide bomber's locality and the target location and obtained similar results.

Conclusion and Discussion

This paper provides the first detailed empirical analysis of the relationship between suicide bombers characteristics and their performance in suicide bombing attacks. We find evidence that Palestinian terror organizations match older and more-educated suicide bombers to more important Israeli targets. We also find that older and more-educated suicide bombers kill more people in their suicide attacks when assigned to important targets. Furthermore, we also find that older and more-educated suicide bombers are less likely to fail or to be caught when they attack.

Our paper also contributes to the debate on the relation between education, poverty, and terrorism. While suicide bombers are on average more educated than the general Palestinian population, our estimate of higher education among suicide bombers is lower than the figures reported by Berrebi (2003) and Krueger and Maleckova (2003). Berrebi (2003) finds that 55 percent of the suicide bombers for whom he was able to find information on education had or were persuing higher education. Berrebi's figure is more than three times our estimate of 18 percent.[7] We suspect that selection bias may drive these differences in the estimates of education among suicide bombers. For example, Berrebi's (2003, footnote 36) data do not include suicide bombers who were caught or failed in their mission, or suicide bombers that did not succeed in killing others—who tend to be less educated than those who do not fail in their missions. Out of the 148 suicide bombers in our data, 42 (28.4 percent) were either caught or failed in their mission. Another potential explanation is that Berrebi (2003) uses data on suicide bombing attacks between 1993 and 2002, and it is possible that due to excess demand for suicide bombers during the al-Aqsa intifada, terror organizations were less selective in recruiting potential suicide bombers during this period (2001–2005). In either case, while we confirm earlier findings that Palestinian suicide bombers are more educated than average for Palestinian society, our estimates of the educational attainment of suicide bombers are lower than previous estimates.

[7] The evidence on the effects of education on suicide rates in general is mixed. Durkheim (1952) argues that education encourages inquiry and is likely to be associated with higher suicide rates. However, many modern empirical studies found that suicide rates of students were below those of demographically matched cohorts (Helliwell, 2004).

■ *We thank Gary Becker, Lauren Cohen, Mark Garmaise, Ed Glaeser, James Hines, Caroline Hoxby, Esteban Klor, Emily Oster, Yona Rubinstein, Jesse Shapiro, Andrei Shleifer, Jeremy Stein, Timothy Taylor, Ivo Welch, Luigi Zingales, and seminar participants at Brown University, Harvard-MIT organizational economics seminar, MIT Sloan, NBER National Security Summer Institute, NBER Education Summer Institute, Northwestern, and the University of Chicago. Shadi Nasser provided excellent research assistance. All errors are our own. Benmelech thanks the Warburg fund at Harvard University for financial support. This document has not been subject to formal review by the RAND Corporation. The opinions and conclusions are solely those of the authors and do not necessarily represent the opinions or policy of the RAND Corporation or its research clients and sponsors.*

References

Aihara, H., and M. Iki. 2002. "Effects of Socio-Economic Factors on Suicide from 1980 Through 1999 in Osaka Prefecture, Japan." *Journal of Epidemiology,* 12(6): 439–49.

▶**Becker, Gary S.** 1968. "Crime and Punishment: An Economic Approach." *Journal of Political Economy,* 76(2): 169–217.

Becker, Gary S., and Richard A. Posner. 2005**.** "Suicide and Risk-Taking: An Economic Approach." Unpublished paper, University of Chicago.

Benmelech, Efraim, and Claude Berrebi. 2007. "Attack Assignments in Terror Organizations and the Productivity of Suicide Bombers." National Bureau of Economic Research Working Paper 12910.

Berman, Eli. 2004. "Hamas, Taliban and the Jewish Underground: An Economist's View of Radical Religious Militias." National Bureau of Economic Research Working Paper 10004.

Berman, Eli, and David D. Laitin. 2005. "Hard Targets: Theory and Evidence on Suicide Attacks." National Bureau of Economic Research Working Paper 11740.

Berman, Eli, and Ara Stepanyan. 2004. "How Many Radical Islamists? Indirect Evidence from Five Countries." http://www.econ.ucsd.edu/~elib/funfert.pdf.

Berrebi, Claude. 2003. "Evidence about the Link between Education, Poverty and Terrorism among Palestinians." Princeton University Industrial Relations Section Working Paper 477. Available at http://ssrn.com/abstract=487467. (Forthcoming in the Bepress journal *Peace Economics, Peace Science, and Public Policy.*)

▶**Berrebi, Claude, and Esteban F. Klor.** 2006. "On Terrorism and Electoral Outcomes: Theory and Evidence from the Israeli–Palestinian Conflict." *Journal of Conflict Resolution,* 50(6): 899–925.

▶**Berrebi, Claude, and Darius Lakdawalla.** 2007. "How Does Terrorism Risk Vary Across Space and Time?" *Defence and Peace Economics,* 18(2): 113–131.

Bueno de Mesquita, Ethan. 2005. "The Quality of Terror." *American Journal of Political Science,* 49(3): 515–30.

Durkheim, Emile. 1952. *Suicide: A Study in Sociology.* London: Routledge and Kegan Paul.

Glaeser, Edward L., 2005. "The Political Economy of Hatred." *Quarterly Journal of Economics,* 120(1): 45–86.

Helliwell, John F. 2004. "Well-Being and Social Capital: Does Suicide Pose a Puzzle?" National Bureau of Economic Research Working Paper 10896.

▶**Iannaccone, Laurence R.** 1992. "Sacrifice and Stigma: Reducing Free-Riding in Cults, Communes, and Other Collectives." *Journal of Political Economy,* 100(2): 271–92.

Iannaccone, Laurence R. 2006. "The Market for Martyrs." George Mason University, Mercatus Center, Global Prosperity Initiative Working Paper 35.

Kydd, Andrew, and Barbara F. Walter. 2002. "Sabotaging the Peace: The Politics of Extremist Violence." *International Organization,* 56(2): 263–96.

Kposowa, A. J. 2001. "Unemployment and Suicide: A Cohort Analysis of Social Factors Predicting Suicide in the US National Longitudinal Mortality Study." *Psychological Medicine,* 31(1): 127–38.

Krug, E. G., M. Kresnow, J. P. Peddicord, L. L. Dahlberg, K. E. Powell, A. E. Crosby, and J. L. Annest. 1998. "Suicide after Natural Disasters." *The New England Journal of Medicine,* 338(February 5): 373–8.

Krueger, Alan B., and Jitka Maleckova. 2003. "Education, Poverty and Terrorism: Is There a Casual Connection?" *Journal of Economic Perspectives,* 17(4): 119–44.

Pape, Robert A. 2005. *Dying to Win.* New York: Random House.

Sinnott, R. W. 1984**.** "Virtues of the Haversine." *Sky and Telescope* 68(2): 159.