Economica LSE

Economica (2010) **77**, 518–543
doi:10.1111/j.1468-0335.2008.00766.x

The Impact of Terrorism on the Defence Industry

By CLAUDE BERREBI† and ESTEBAN F. KLOR‡

†*Rand Corporation, Santa Monica, CA* ‡*The Hebrew University of Jerusalem*

Final version received 28 July 2008.

This paper analyses the impact of terrorism on Israeli companies related to the defence, security or anti-terrorism industries, relative to its impact on other companies. We match every Israeli company to the American company with the closest expected return among all the companies that belong to the same industry and trade in the same market, in order to isolate the effect of terrorism from other common industry shocks. The findings show that whereas terrorism had a significant negative impact of 5% on non-defence-related companies, it had a significantly positive overall effect of 7% on defence-related companies.

INTRODUCTION

Evidence suggests that politically motivated violence in general and terrorism in particular have a strong negative effect on economic prosperity. This is, at least, the main message we obtain from a rapidly growing literature that analyses the effects of terrorist acts on various aspects of the economy. Although there is no reason to believe that terror attacks have a homogeneous impact across all economic activities, the extant literature seldom probes terrorism in terms of its impact on different industries.

This paper marks the first attempt that we know of to systematically analyse the impact of terrorism on the defence sector in a specific country. The main purpose is to determine whether or not terrorism affects companies in the defence and security-related industries differently than it does companies in other economic sectors. Our hypothesis is intuitive: terror attacks dampen the activity of most economic sectors but, at the same time, may enhance expected business for companies in the defence and security industries.[1]

To test this hypothesis, we focus on Israeli companies that are traded in American markets and build, using matching score methods, a control group of American companies. The stock-market valuations of each Israeli company and its assigned American control allow us to differentiate between the effect of terrorism on companies involved in or with the defence, security or anti-terrorism industries and other companies.[2]

The main results of the paper show that terrorism has no significant impact on the average stock-market valuation of Israeli companies *vis-à-vis* the valuation of the control group's stocks. However, after controlling for companies that are significantly related to the defence or security industry, we observe that terrorism has a significant positive impact on these companies, and a significant negative impact on the rest of the companies. The results are robust to different samples of Israeli companies, different measures of terrorism, and different econometric specifications.

This paper contributes to the growing number of studies that, focusing on the Israeli–Palestinian conflict, attempt to quantify the economic costs of terrorism. Naturally, the empirical literature quantifying the effects of conflict on the Israeli economy has used time series analysis. Fishelson (1993) studied the impact of the first intifada (Palestinian uprising) on the levels and trends of various real economic activities in Israel in 1987–89. Fielding (2003a, b) investigated the impact of political instability on saving and investment, respectively, during 1987–99. Eckstein and Tsiddon (2004) conducted a similar analysis on consumption, investment, exports and per-capita GDP, and Eldor and Melnick (2004)

studied the impact of terrorism on the valuation of companies that are traded in the Tel Aviv Stock Exchange (TASE) and on the Israeli foreign exchange rate.

A fundamental problem that arises in any attempt to quantify the effect of terrorism on economic fluctuations is that the estimates obtained may be biased due to a plausible interaction between the two variables. The aforementioned studies use different approaches to differentiate between the effect of terrorism and politically motivated violence on the economic variable of interest and the effect of other macroeconomic distortions and shocks. Fishelson (1993) uses the years 1985–87 that immediately preceded the first Palestinian uprising as his source of identification. Fielding (2003a, b) isolates the effect of terrorism by relying on the relative stability of the Israeli economy after 1984 and including several control variables in his analysis. Eckstein and Tsiddon (2004) use a similar approach. Finally, Eldor and Melnick (2004) include in their analysis the S&P500 (Standard and Poor 500) index as a control to help them identify the effect of terrorism on the valuation of an index that includes the 100 largest companies traded on the TASE.

These efforts to identify the impact of terrorism may not be enough to overcome the intrinsic difficulty of the task. To surmount these problems, we construct a control group and conduct an event study analysis following the seminal study of Abadie and Gardeazabal (2003) on the Basque Country.

There are, however, several important differences between our approach and the one adopted by Abadie and Gardeazabal (2003). First, the approach we propose uses a matching method based on the most important characteristics of every stock to find the closest control stock for each Israeli stock, whereas Abadie and Gardeazabal (2003) use as their control variable the stocks of all Spanish companies not identified with the Basque Country. In particular, we match every Israeli company to the American company with the closest expected return among all the American companies that belong to the same industry and trade in the same market as the Israeli company. This allows us to isolate the effect of terrorism on Israeli companies from other common shocks, like industry-wide effects. Second, we exploit the high fluctuation on the number of fatalities of the Israeli–Palestinian conflict to assess the economic impact of terror attacks. The results of Abadie and Gardeazabal (2003) on the impact of conflict on the returns of Basque stocks relative to non-Basque stocks are based on two dummy variables that reflect whether or not the unilateral truce declared by ETA was credible. Their objective is therefore to measure the overall cost of the conflict since these variables neither quantify the marginal economic cost of an additional terror attack nor account for the impact of small changes on the credibility of the truce. Our paper uses the available detailed data on the daily number of terror attacks to estimate the economic cost of terror attacks when measured on a daily, weekly and monthly basis.

Additionally, we decompose the impact of terrorism to identify the different effects of terrorism on defence-related as against non-defence-related companies. Given the large size of Israel's defence sector, this decomposition is crucial for an accurate determination of the overall effect of terrorism on this particular country. In fact, a seemingly insignificant effect of terrorism on Israeli companies at large actually masks important differential effects across industries.

I. Data Description

Data on Israeli and American companies

For the purposes of this research, we identified all Israeli companies that were traded on the Amex, NYSE and Nasdaq exchanges as of November 2001. The classification used

was that of *Globes*, a leading financial Israeli newspaper that analyses and monitors Israeli companies.[3] This results in an original sample of 125 Israeli companies. Table 1 lists all the companies identified as Israeli.

For each Israeli company we built a set of potential controls comprised of American companies traded in the same market and from the same industry. Given the objectives of our study, we believe that these two conditions need to be satisfied to guarantee that the Israeli company and its American control are sufficiently similar. For all these companies (Israelis and their set of prospective controls) we collected daily end-of-the-day share prices for the sample period of 1 January 1998 to 10 September 2001.[4] Among all the companies identified as Israelis, only companies traded both before and after 28 September 2000 were included, even if complete data for the entire sample period were not available for some. Moreover, companies not traded before 1 January 1998 were also deleted from our sample. Among the 125 Israeli companies, 60 companies did not fulfil all these criteria, and were consequently omitted from the analysis below.

The procedure used to find an American company that best corresponds with each Israeli company based on the 1994–97 period is based on calculating a score for each company. The score summarizes in one simple number the main financial characteristics of the company, allowing us to compare different stocks in the same market and industry. Formally, we calculate each company's score according to the equation

$$\begin{aligned}(\text{score})_i =& (R^m - R^f) \times (\text{excess market return})_i + SMB \times (\text{size parameter})_i \\ &+ HML \times (\text{book-to-market parameter})_i,\end{aligned} \tag{1}$$

where R^m is the company's excess return on the market portfolio, R^f is the market's risk-free rate, SMB is the difference between the returns on portfolios composed of small and big size stocks, and HML is the difference between the returns on portfolios composed on high and low book-to-market stocks.

In practice, to obtain each company's score as specified in (1), we first calculated the size and book-to-market ratio (BE/ME) for each and every stock, as in Fama and French (1993). With these characteristics at hand we obtained the parameters on the size and book-to-market equity factors for every stock from Fama and French (1993). Each company's excess market return was obtained from *Security Risk Evaluation*, a quarterly publication of Merrill Lynch. We computed the excess return of companies that lacked this parameter in *Security Risk Evaluation* following the methodology employed by this publication.[5] The market's benchmark factors ($R^m - R^f$, SMB, HML) for the 1994–97 period were obtained from Fama and French's calculations.[6]

Given the scores of all the companies, for each Israeli company we chose as its American control the company in the set of potential controls that was traded before and after 28 September 2000 and had the closest score. The final sample of Israeli companies and their respective American controls—65 pairs of companies—appears in Table 2. In addition, this table depicts the industry and market of every pair of companies, the number of potential controls, and summary statistics on the companies' main characteristics.

Table 2 shows that the constraint that Israeli and American companies must belong to the same industry and be traded in the same market plays an important role in the analysis. Whereas these two constraints are not too binding for several companies, they significantly reduce the number of potential controls for others.[7] We insist on these requirements, however, to neutralize as much as possible industry-specific shocks that presumably have a similar effect on Israeli and American companies only if these companies belong to the same industry. In addition, we observe from this table that, on average, American companies are

TABLE 1
LIST OF ISRAELI STOCKS TRADED AT AMERICAN MARKETS

Symbol	Name	Symbol	Name
ACSEF	ACS-Tech80 Ltd	KERX	Keryx Biopharmaceuticals Inc.
ALDN	Aladdin Knowledge Sys Ltd	KOR	Koor Industries Ltd
AIP	American Israeli Paper Mills	LANTF	Lannet Data Communications
ARLC	Arel Communications & Software	LNOP	Lanoptics Ltd
ATTU	Attunity Ltd	LVEL	Level 8 Sys Inc.
AUDC	Audiocodes Ltd	MAGS	Magal Security Sys Ltd
BWEB	Backweb Technologies Ltd	MGIC	Magic Software Enterprises
BTGC	Bio Technology General Corp.	MATV	Matav-Cable Sys Media
BSI	Blue Square Israel Ltd	MDSLF	MEDIS EL Ltd
BOSC	BOS Better Online Solutions	MEMCF	Memco Software Ltd
BRZE	Breezecom Ltd	MNTE	Mentergy Ltd
BVRT	BVR Technologies Ltd	MTSL	Mer Telemgmt Solutions Ltd
CAMT	Camtek Ltd	MTLK	Metalink Ltd
KML	Carmel Container Sys	MNDO	Mind CTI Ltd
CHKP	Check Point Software Techn	FLSH	M-Systems Flash Disk Pioneer
CIMT	Cimatron Ltd	NNDS	NDS Group PLC
CKSW	Clicksoftware Technologies Ltd	DDDDF	New Dimension Software Ltd
CTCH	Commtouch Software Ltd	NXUS	Nexus Telocation Sys Ltd
CGEN	Compugen Ltd	NICE	Nice Systems Ltd
CMVT	Comverse Technology Inc.	NOGAF	Noga Electro-Mechanical Inds
CREO	Creo Products Inc.	NVMI	Nova Measuring Instruments Ltd
CRYS	Crystal Systems Solutions Ltd	NURM	Nur Macroprinters Ltd
DSSI	Data Systems & Software Inc.	OBAS	Optibase Ltd
DELT	Delta Galil Inds Ltd	OPTL	Optisystems Solutions Ltd
DDDC	Deltathree Inc.	ORFR	Orbit/FR Inc.
DSPG	DSP Group Inc.	ORBK	Orbotech Ltd
ESIM	E Sim Ltd	ORCT	Orckit Communications Ltd
ECIL	Eci Telecommunications	PGEO	Paradigm Geophysical Ltd
ECTX	Ectel Ltd	PTNR	Partner Comm. Co. Ltd
EDNTF	Eduentics Ltd	PARS	Pharmos Corp.
EDUSF	Edusoft Ltd	PLCM	Polycom Inc.
ELOFC	El De Electro-Optic Dev Ltd	PRSE	Precise Software Solutions Ltd
ELBT	Elbit Ltd	RADIF	Rada Electronics Inds
EMITF	Elbit Medical Imaging Ltd	RDCM	Radcom Ltd
ESLT	Elbit Systems Ltd	RVSN	Radvision Ltd
EVSN	Elbit Vision Systems Ltd	RDWR	Radware Ltd
EFCX	Electric Fuel Corp.	RTLX	Retalix Ltd
EIL	Electrochemical Indus Frutar	RITT	RIT Technologies Ltd
EFII	Electronics for Imaging Inc.	ROBO	Robo Group Tek Ltd
ELRN	Elron Electronics Inds	3RBMXF	Robomatix Tech Ltd
ELT	Elscint Ltd	SPNS	Sapiens Intl Corp N V
ELTK	Eltek Ltd	SCIX	Scitex Corp. Ltd
ENGEF	Engel General Developers Ltd	SILCF	Silicom Limited
EQY	Equity One Inc.	3SMPL	Simplayer.com Ltd
ESCM	ESC Medical Systems Ltd	SAE	Super Sol Ltd
ETZ	ETZ Lavud Ltd	TAD	Tadiran Ltd
FLRE	Floware Wireless Systems Ltd	TTELF	Tadiran Telecommunications Ltd
FORTY	Formula Sys 1985 Ltd	TARO	Taro Pharmaceutical Inds Ltd

TABLE 1
CONTINUED

Symbol	Name	Symbol	Name
FORS	Forsoft Ltd	TATTF	TAT Technologies Ltd
FNDT	Fundtech Ltd	TCNO	Tecnomatix Technologies Ltd
WILCF	G Willi-Food Intl Ltd	TFR	Tefron Ltd
GALT	Galileo Technology Ltd	TLDCF	Teledata Communications Ltd
GILTF	Gilat Satellite Networks Ltd	TERM	Terayon Communications Systems Inc.
HCTL	Healthcare Technologies Ltd	TEVA	Teva Pharmaceutical Inds
HOMEF	Home Centers (DIY) Ltd	TIGA	Tioga Technologies Ltd
ICTS	ICTS International N V	TISA	Top Image Systems Ltd
IISL	IIS Intelligent Info	TSEM	Tower Semiconductor Ltd
INDG	Indigo NV	TTIL	TTI Team Telecom International Ltd
IGLD	Internet Gold-GLDN Lines Ltd	VRYA	Viryanet Ltd
IPLLF	Interpharm Labs Ltd	VOCL	Vocaltec Communications Ltd
ISRL	Isramco Inc.	3WIZTF	Wiztec Solutions
ISEFE	Istec Industries & Tech Ltd	ZRAN	Zoran Corp.
JCDA	Jacada Ltd		

larger, more overvalued and less volatile than Israeli companies. Of course, by construction, these differences are not as pronounced between the average Israeli company and its average American control.

A clarification is in order regarding our matching procedure. We also attempted to pair Israeli to American stocks using propensity score matching for the 35 companies with over 20 potential American controls.[8] We estimated the propensity score using a logistic regression where the dependent variable was an indicator for Israeli company and the independent variables were the company's excess market return, size and book-to-market ratio. For nine of the companies, the logit regressions do not produce a match for the treated observation among the available untreated observations.[9] These cases occur when the Israeli company (the only treated observation in each separate regression) has the highest or the lowest value for one of the independent variables relative to the rest of the sample, even if the difference is very small. For the rest of the estimations, the American control company matched according to equation (1) was also selected as one of the companies in the set of nearest neighbours matched to the Israeli company based on its propensity score.

That the two matching techniques are so similar is not surprising, since both techniques use the same explanatory variables. This similarity leads us to believe that the qualitative results of the paper are not affected by the chosen matching procedure. We show below the estimation based on the matching methodology described above because we believe that this is a more sensible choice given the available data. First, the methodology we propose takes into account not only the main characteristics of each stock, but also the difference return behaviour of small and big stocks and the difference return behaviour of high and low BE/ME firms. Note that these important market variables are constant across different stocks and therefore cannot be used as covariates in the set of variables included in the propensity score matching procedure. Second, given that a majority of the Israeli companies in the data have only a low number of prospective American controls, over half of the companies cannot be matched using

TABLE 2
FINAL LIST OF ISRAELI COMPANIES WITH THEIR RESPECTIVE AMERICAN CONTROLS

Israeli company	Symbol	Market	Industry	Number of potential controls	Chosen US control	Symbol
ACS-Tech80 Ltd	ACSEF	Nasdaq SC	CMP integrated system design	43	Softech Inc.	SOFT
Arel Communications & Software	ARLC	Nasdaq NM	CMP integrated system design	56	Intergraph Corp.	INGR
Attunity Ltd	ATTU	Nasdaq NM	Prepackaged software	161	Timberline Software Corp.	TMBS
BOS Better Online Solutions§	BOSC	Nasdaq NM	Computer communication equipment	24	Network Peripherals Inc.	NPIX
Blue Square Israel Ltd §	BSI	NYSE	Grocery stores	9	Weis Markets Inc.	WMK
Bio Technology General Corp.	BTGC	Nasdaq NM	Medicinal chemicals, botanical products	4	Cyanotech Corp.	CYAN
BVR Technologies Ltd	BVRT	Nasdaq SC	Misc. elec. machinery, equipment, supplies	8	Datakey Inc.	DKEY
Check Point Software Techn*	CHKP	Nasdaq NM	Prepackaged software	161	Take-Two Interactive Software	TTWO
Cimatron Ltd	CIMT	Nasdaq SC	Prepackaged software	60	Tangram Enterprise Solutions	TESI
Comverse Technology Inc.*	CMVT	Nasdaq NM	Tele & telegraph apparatus	23	Symmetricom Inc.	SYMM
DSP Group Inc.	DSPG	Nasdaq NM	Radio,TV broadcast, comm. equip	41	Adaptive Broadband Corp.	ADAP
Data Systems & Software Inc.	DSSI	Nasdaq NM	Computer programming service	5	Analysts International Corp.	ANLY
Eci Telecommunications*	ECIL	Nasdaq NM	Tele & telegraph apparatus	23	Aspect Communications Corp.	ASPT
Electric Fuel Corp.*	EFCX	Nasdaq NM	Misc. elec. machinery, equipment, supplies	9	Publicard Inc.	CARD
Electronics for Imaging Inc.	EFII	Nasdaq NM	Computer communication equipment	24	Entrada Networks Inc.	ESAN
Elscint Ltd	ELT	NYSE	Electro-medical apparatus	4	Varian Medical Sytems Inc.	VAR
Eltek Ltd*	ELTK	Nasdaq SC	Printed circuit boards	6	Sigmatron International Inc.	SGMA
Elbit Systems Ltd§*	ESLT	Nasdaq NM	CMP integrated system design	56	3com Corp	COMS
ETZ Lavud Ltd	ETZ	AMEX	Misc. plastics products	1	Intersystems Inc./De	II

TABLE 2
CONTINUED

Israeli company	Symbol	Market	Industry	Number of potential	Chosen US control	Symbol
Elbit Vision Systems Ltd	EVSN	Nasdaq SC	CMP integrated system design	43	Softech Inc.	SOFT
M-Systems Flash Disk Pioneer	FLSH	Nasdaq NM	Computer storage devices	11	Mti Technology Corp.	MTIC
Formula Sys 1985 Ltd §*	FORTY	Nasdaq NM	CMP integrated system design	56	Quality Systems Inc.	QSII
Galileo Technology Ltd	GALT	Nasdaq NM	Semiconductor, related device	62	Logic Devices Inc.	LOGC
Gilat Satellite Networks Ltd *	GILTF	Nasdaq NM	Radio, TV broadcast, comm. equipment	41	Telular Corp	WRLS
Healthcare Technologies Ltd	HCTL	Nasdaq SC	*In vitro*, *in vivo* diagnostics	20	Amer Biogenetic Sci—Cl A	MABA
Home Centers (DIY) Ltd §	HOMEF	Nasdaq NM	Building material, hardware, garden—retail	3	Fastenal Co.	FAST
ICTS International N V *	ICTS	Nasdaq NM	Business services, NEC	15	Teletech Holdings Inc.	TTEC
IIS Intelligent Info	IISL	Nasdaq SC	Computer terminals	5	Network Computing Devices	NCDI
Indigo N V	INDG	Nasdaq NM	Printing trades machinery, equipment	3	Check Technology Corp.	CTCQ
Isramco Inc.	ISRL	Nasdaq SC	Crude petroleum & natural gas	47	Credo Petroleum Corp.	CRED
Koor Industries Ltd §*	KOR	NYSE	Conglomerates	6	Standex International Corp.	SXI
Lanoptics Ltd	LNOP	Nasdaq NM	Computer communication equipment	24	Ciprico Inc.	CPCI
Level 8 Sys Inc.	LVEL	Nasdaq NM	Computer programming service	5	Covansys Corp.	CVNS
Magal Security Sys Ltd §*	MAGS	Nasdaq NM	Communications equipment, NEC	8	Numerex Corp.—Cl A	NMRX
Matav-Cable Sys Media	MATV	Nasdaq NM	Cable and other pay TV services	7	Comcast Corp.—Cl A Spl	CMCSK
Magic Software Enterprises*	MGIC	Nasdaq NM	Prepackaged software	161	Edgewater Technology Inc.	EDGW
Mentergy Ltd	MNTE	Nasdaq NM	Computer programming, data processing	42	Epresence Inc.	EPRE
Mer Telemgmt Solutions Ltd	MTSL	Nasdaq SC	Tele & telegraph apparatus	16	Science Dynamics Corp.	SIDY
Nice Systems Ltd*	NICE	Nasdaq NM	Tele & telegraph apparatus	23	Ciena Corp.	CIEN

Noga Electro-Mechanical Inds	NOGAF	Nasdaq SC	Electrical work	1	Able Telcom Holding Corp.	ABTE
Nur Macroprinters Ltd	NURM	Nasdaq NM	Printing trades machinery, equipment	3	Presstek Inc.	PRST
Nexus Telocation Sys Ltd*	NXUS	Nasdaq SC	Radio, TV broadcast, comm. equipment	16	Salient 3 Commun Inc.—Cl A	STCIA
Orbotech Ltd	ORBK	Nasdaq NM	Industrial measurement instruments	12	Cognex Corp.	CGNX
Orckit Communications Ltd §*	ORCT	Nasdaq NM	Tele & telegraph apparatus	23	Picturetel Corp.	PCTL
Orbit/FR Inc.*	ORFR	Nasdaq NM	Elec. measurement & test instruments	23	Tollgrade Communications Inc.	TLGD
Pharmos Corp. *	PARS	Nasdaq SC	Pharmaceutical preparations	17	Biospecifics Technologies Cp	BSTC
Polycom Inc.§*	PLCM	Nasdaq NM	Tele & telegraph apparatus	23	Advanced Fibre Comm Inc.	AFCI
Rada Electronic Inds*	RADIF	Nasdaq NM	Search, det., nav., guid., aero systems	5	Kvh Industries Inc.	KVHI
Radcom Ltd	RDCM	Nasdaq NM	Computer communication equipment	24	Ciprico Inc.	CPCI
RIT Technologies Ltd	RITT	Nasdaq NM	Computer communication equipment	24	Ciprico Inc.	CPCI
Robo Group Tek Ltd§	ROBO	Nasdaq SC	Misc. elec. machinery, equipment, supplies	8	Infinite Group Inc.	IMCI
Super Sol Ltd§	SAE	NYSE	Grocery stores	9	Smart & Final Inc.	SMF
Scitex Corp. Ltd§	SCIX	Nasdaq NM	Printing trades machinery, equipment	3	Presstek Inc.	PRST
Silicom Limited	SILCF	Nasdaq SC	Computer communication equipment	14	Advanced Electr Support Pds	AESP
Sapiens Intl Corp N V§	SPNS	Nasdaq NM	Prepackaged software	161	Phoenix Technologies Ltd	PTEC
Taro Pharmaceutical Inds Ltd	TARO	Nasdaq NM	Pharmaceutical preparations	77	Boston Life Sciences Inc.	BLSI
TAT Technologies Ltd*	TATTF	Nasdaq SC	Aircraft engine, engine parts	2	Kreisler Manufacturing Corp.	KRSL
Tecnomatix Technologies Ltd	TCNO	Nasdaq NM	Prepackaged software	161	Indusri-Matematik Intl Corp.	IMIC
Teva Pharmaceutical Inds§	TEVA	Nasdaq NM	Pharmaceutical preparations	77	Viropharma Inc.	VPHM
Top Image Systems Ltd*	TISA	Nasdaq SC	Prepackaged software	60	Quadramed Corp.	QMDC
Tower Semiconductor Ltd§*	TSEM	Nasdaq NM	Semiconductor, related device	62	Opti Inc.	OPTI
TTI Team Telecom Intl Ltd	TTIL	Nasdaq NM	Computer integrated system design	56	Dynamics Research Corp.	DRCO

TABLE 2
CONTINUED

Israeli company	Symbol	Market	Industry	Number of potential	Chosen US control	Symbol
Vocaltec Communications Ltd*	VOCL	Nasdaq NM	Prepackaged software	161	Eagle Point Software Corp.	EGPT
G Willi-Food Intl Ltd	WILCF	Nasdaq SC	Groceries & related products—WHSL	5	Pizza Inn Inc./Mo	PZZI
Zoran Corp	ZRAN	Nasdaq NM	Semiconductor, related device	62	Integrated Silicon Solution	ISSI
Average				37		
Standard deviation				44.97		

Notes
§Arbitrage stocks: companies dually listed prior to 1 January 1999.
*Companies involved in or with security/defence-related businesses.

	Size			Book to market ratio			Excess market return			Score		
Israeli company symbol	Israeli company	Average potential controls	Chosen American control	Israeli company	Average potential controls	Chosen American control	Israeli company	Average potential controls	Chosen American control	Israeli company	Average potential controls	Chosen American control
ACSEF	6.30	20.83	18.75	1.2030	− 2.5326	0.5164	1.01	0.81	1.20	0.0428	0.0311	0.0417
ARLC	30.48	476.10	279.69	0.2598	0.4099	1.2817	1.13	1.15	0.75	0.0344	0.0354	0.0338
ATTU	66.37	3139.06	129.53	0.2672	0.3784	0.1628	0.93	1.31	1.28	0.0295	0.0370	0.0293
BOSC	50.72	6262.36	55.31	0.2236	0.5764	0.5599	0.99	1.09	0.74	0.0310	0.0345	0.0307
BSI	382.84	8540.65	1623.27	0.6734	0.3806	0.5609	0.13	0.65	0.34	0.0090	0.0115	0.0119
BTGC	359.72	73.12	14.45	0.3419	0.5199	1.0658	1.68	0.84	0.93	0.0548	0.0258	0.0409
BVRT	23.49	17.21	9.14	0.3360	0.6900	0.2227	0.87	0.96	1.05	0.0282	0.0352	0.0325
CHKP	1661.99	3139.06	140.57	0.1057	0.3784	0.2518	1.20	1.31	1.04	0.0236	0.0370	0.0236
CIMT	13.42	37.08	63.12	1.7941	− 1.0221	0.0913	1.02	0.89	1.69	0.0479	0.0765	0.0479
CMVT	3145.58	1055.05	100.59	0.1213	0.5025	0.8583	1.59	1.11	0.59	0.0274	0.0684	0.0273
DSPG	196.35	251.74	138.57	0.3855	0.7186	0.6102	1.43	1.24	1.02	0.0329	0.0409	0.0335
DSSI	19.51	867.60	433.86	2.0202	0.1666	0.1913	1.30	0.88	0.96	0.0547	0.0225	0.0375
ECIL	2712.88	1055.05	850.58	0.2816	0.5025	0.3556	0.99	1.11	0.62	0.0131	0.0340	0.0098

EFCX	38.63	181.17	232.97	0.2739	0.5727	0.0941	1.60	1.18	0.09	0.0457	0.0364	0.0459
EFII	2139.96	6262.36	20.73	0.1864	0.5764	0.8475	1.95	1.09	0.99	0.0417	0.0345	0.0396
ELT	199.76	10293.63	1132.80	1.1591	0.2601	0.4922	0.98	0.94	0.67	0.0392	0.0168	0.0199
ELTK	4.29	8.53	8.64	1.6166	1.3953	2.3669	0.89	0.77	0.71	0.0448	0.0348	0.0405
ESLT	296.36	476.10	16052.60	0.5379	0.4099	0.2027	0.88	1.15	1.57	0.0270	0.0354	0.0270
ETZ	29.88	7.83	7.83	0.7026	0.4958	0.4958	0.99	0.48	0.48	0.0370	0.0245	0.0245
EVSN	17.06	20.83	18.75	0.8743	− 2.5326	0.5164	1.01	0.81	1.20	0.0402	0.0311	0.0417
FLSH	41.97	619.85	128.45	0.3296	0.4586	0.4215	0.95	1.54	1.40	0.0302	0.0402	0.0322
FORTY	231.20	476.10	25.72	0.5894	0.4099	1.1532	1.48	1.15	1.08	0.0445	0.0354	0.0445
GALT	548.75	3959.72	10.36	0.1636	0.5103	1.4613	1.39	1.49	1.23	0.0479	0.0430	0.0481
GILTF	890.93	251.74	21.97	0.2473	0.7186	0.6358	1.00	1.24	0.27	0.0188	0.0409	0.0194
HCTL	4.03	25.08	28.92	1.7389	− 0.1769	0.1935	0.98	0.76	1.90	0.0470	0.0294	0.0529
HOMEF	52.22	628.56	1669.32	0.3545	0.6219	0.1320	0.76	1.04	1.28	0.0256	0.0325	0.0257
ICTS	32.20	276.60	622.89	0.9597	0.4881	0.2670	0.90	1.32	1.03	0.0375	0.0413	0.0391
IISL	2.77	25.95	112.34	1.4465	1.1469	0.4675	0.92	0.34	1.39	0.0407	0.0231	0.0320
INDG	832.97	87.50	18.02	0.0683	1.0172	1.0304	1.01	0.87	0.38	0.0191	0.0336	0.0250
ISRL	6.60	15.86	5.87	3.3430	0.6223	1.6170	0.36	0.56	0.40	0.0321	0.0288	0.0331
KOR	1438.93	62937.54	341.38	0.7081	0.2793	0.4632	1.08	0.70	0.56	0.0297	0.0121	0.0279
LNOP	10.33	6262.36	33.08	1.5573	0.5764	1.3699	0.94	1.09	1.13	0.0460	0.0345	0.0457
LVEL	84.36	867.60	1180.98	0.1054	0.1666	0.1204	0.52	0.88	1.01	0.0198	0.0225	0.0192
MAGS	17.97	97.65	29.74	1.5131	0.7480	1.0817	0.98	0.68	0.75	0.0469	0.0270	0.0365
MATV	263.81	4010.52	21700.58	0.3542	− 56.9515	0.2237	0.80	1.16	1.17	0.0178	0.0292	0.0174
MGIC	31.41	3139.06	650.73	0.5455	0.3784	0.4145	1.03	1.31	0.97	0.0376	0.0370	0.0378
MNTE	91.19	1167.86	168.37	0.3426	0.3481	0.0499	1.09	1.32	1.10	0.0248	0.0376	0.0250
MTSL	8.65	15.45	6.88	1.5036	0.4477	0.3171	1.11	1.06	2.02	0.0501	0.0369	0.0558
NICE	244.17	1055.05	1509.89	0.6438	0.5025	0.3372	1.61	1.11	2.18	0.0477	0.0340	0.0473
NOGAF	4.84	63.63	63.63	2.1465	0.5300	0.5300	1.08	1.79	1.79	0.0495	0.0559	0.0559
NURM	27.88	87.50	219.88	0.2665	1.0172	0.3977	0.97	0.87	1.11	0.0306	0.0336	0.0252
NXUS	34.14	16.24	55.87	0.0720	0.4748	1.3958	0.97	0.93	0.47	0.0305	0.0373	0.0298
ORBK	635.10	164.98	802.94	0.2667	0.6686	0.2776	0.99	0.54	1.69	0.0382	0.0231	0.0355
ORCT	272.40	1055.05	265.45	0.2103	0.5025	0.7167	0.99	1.11	0.63	0.0223	0.0340	0.0241
ORFR	15.08	95.64	111.86	1.0215	0.9042	0.4086	− 0.32	1.18	0.71	0.0082	0.0412	0.0156
PARS	63.43	15.19	18.48	− 0.0033	0.3266	0.5232	1.47	0.78	1.05	0.0426	0.0295	0.0382
PLCM	662.45	1055.05	828.14	0.0801	0.5025	0.3240	2.14	1.11	3.06	0.0658	0.0340	0.0684

TABLE 2
CONTINUED

Israeli company symbol	Size			Book to market ratio			Excess market return			Score		
	Israeli company	Average potential controls	Chosen American control	Israeli company	Average potential controls	Chosen American control	Israeli company	Average potential controls	Chosen American control	Israeli company	Average potential controls	Chosen American control
RADIF	19.90	74.22	8.78	− 0.0047	1.2521	1.9437	0.97	0.74	0.39	0.0306	0.0320	0.0328
RDCM	34.76	6262.36	33.08	0.8304	0.5764	1.3699	1.28	1.09	1.13	0.0466	0.0345	0.0457
RITT	17.29	6262.36	33.08	1.1651	0.5764	1.3699	1.20	1.09	1.13	0.0473	0.0345	0.0457
ROBO	3.96	17.21	5.01	1.9218	0.6900	0.6684	1.83	0.96	0.96	0.0674	0.0352	0.0361
SAE	512.66	8540.65	216.82	0.8642	0.3806	0.8730	0.75	0.65	0.80	0.0298	0.0115	0.0323
SCIX	505.71	87.50	219.88	0.7997	1.0172	0.3977	1.00	0.87	1.11	0.0359	0.0336	0.0252
SILCF	5.48	10.77	4.05	1.4493	− 0.8609	1.4210	1.00	0.93	0.94	0.0426	0.0336	0.0411
SPNS	367.37	3139.06	228.85	0.0758	0.3784	0.5591	0.88	1.31	1.11	0.0356	0.0370	0.0357
TARO	50.88	270.16	43.15	0.5835	0.3902	0.2441	0.99	1.23	1.21	0.0366	0.0367	0.0364
TATTF	7.27	14.22	20.51	2.1227	0.6421	0.5242	0.98	0.69	1.45	0.0470	0.0295	0.0477
TCNO	167.37	3139.06	160.05	0.4864	0.3784	0.5241	0.98	1.31	1.01	0.0326	0.0370	0.0333
TEVA	2533.90	270.16	107.25	0.2731	0.4347	0.1197	0.71	1.23	0.28	0.0063	0.0369	0.0053
TISA	11.54	37.08	409.43	0.5598	− 1.0221	0.1755	0.90	0.89	0.83	0.0344	0.0313	0.0344
TSEM	114.80	3959.72	50.00	1.2718	0.5103	1.3857	0.95	1.49	0.85	0.0387	0.0430	0.0389
TTIL	64.65	476.10	43.29	0.2801	0.7098	0.7298	1.19	1.15	0.95	0.0359	0.0356	0.0357
VOCL	128.40	3139.06	41.68	0.3962	0.3784	0.4876	0.99	1.31	0.39	0.0222	0.0370	0.0223
WILCF	6.22	32.00	51.03	1.6374	0.3680	0.2139	− 0.93	− 0.19	0.18	0.0012	0.0045	0.0117
ZRAN	178.73	3959.72	61.15	0.2025	0.5103	1.4869	3.06	1.49	2.04	0.0720	0.0430	0.0724
Average	348.87	2620.77	826.16	0.7516	− 0.5016	0.6549	1.05	1.01	1.02	0.0357	0.0338	0.0343
Standard deviation	676.60	7999.47	3303.79	0.6872	7.1420	0.5074	0.51	0.32	0.53	0.0139	0.0109	0.0128

propensity score. Due to the small number of companies in our sample, we would be forced to use an alternative methodology for companies without a matching based on the propensity score methodology. On the contrary, the proposed methodology provides a sensible matching for all the companies, including those that are not solvable using propensity score methods. Finally, the methodology we propose has a natural interpretation in the current context—different companies are matched according to their expected return for the 1994–97 period based on the Fama and French (1993) three factors model.

For the purposes of the empirical estimation, we further classified companies by main economic activities, differentiating between those that are substantially related to the defence, security or anti-terrorism industries and all the others.[10] The classification was primarily based on the companies' monthly profiles by market analysts at *Yahoo Finance*, retrieved between September 2001 and June 2002. In addition, we used information directly provided by the companies at their website and online Google newsfeeds for those companies not featured by *Yahoo Finance*. We found 23 Israeli companies in the sample that were involved in or with the defence, security or anti-terrorism industries. Table 2 identifies these companies from the others.

Data on terror attacks

To measure the level of terrorism, we use the daily number of terror attacks and non-combatant Israeli fatalities from these attacks. The particular definition of terror attacks that we use for the construction of our dataset is the one set forth by the US State Department, contained in Title 22 of the United States Code, Section 2656f(d). Accordingly,

> The term 'terrorism' means premeditated, politically motivated violence perpetrated against noncombatant targets by sub-national groups or clandestine agents, usually intended to influence an audience.

Specifically, our dataset on terror attacks contains daily information on each and every fatal terror attack against non-combatants that occurred on Israeli soil between 1 January 1998 and 10 September 2001.[11] Several explanations about the definition of terror attacks are in order.

1. Fatal: due to constraints on the collection procedure, only attacks that claimed the life of someone other than the terrorist were included.
2. Non-combatants: this term is construed as including, in addition to civilians, military personnel who were unarmed and/or not on duty at the time of the incident.
3. Israeli soil: this includes occupied territories when under Israeli control.

The main sources of the data are the Israeli Foreign Ministry, the National Insurance Institute, the Israeli Defence Forces and the archives of two newspapers (*Ma'ariv* and *Ha'aretz*). To the best of our knowledge, this is the most accurate and comprehensive unclassified dataset that exists on fatal terror attacks against non-combatants on Israeli soil. Figure 1, which depicts the data, and Table 3, which presents summary statistics, clearly reflect the impact of the second Palestinian uprising: on average, there was less than one monthly attack between 1 January 1998 and 28 September 2000, whereas from 29 September 2000 to 10 September 2001, the monthly average climbed to 7.25.

Several potential problems with the data are worth emphasizing. First, the data on terror attacks indicate only attacks in which someone other than the terrorist died. Thus

foiled attacks as well as 'unsuccessful' attacks in terms of producing fatalities are not included. Terror attacks not on Israeli soil were also excluded. Since such attacks may affect the stock-market valuation of Israeli companies *vis-à-vis* their American controls, we may be omitting relevant events.

Second, some of the stocks of the Israeli companies are dually listed, i.e. traded in an American market and on TASE.[12] Since short-term arbitrage opportunities are generally not available, it has been shown that for this type of stocks the domestic country usually emerges as the dominant market and the foreign market as the satellite (Lieberman *et al.* 1999). As a consequence, differences in returns between stocks that are dually-listed and their respective control may be attributed to differences in the general performance of the TASE relative to the corresponding American market and not necessarily to the effect of terrorism, which affects only Israeli companies. This could potentially cast doubt on the validity of the match with their American controls. We solved this problem by conducting the same analysis twice, first including all available companies and afterwards excluding arbitrage stocks.

A third potential concern about the data is that observed fluctuations on the returns on Israeli companies' shares may be caused by shocks to the Israeli economy that are unrelated to terrorism. If this is the case, we should observe an Israeli effect. According to our econometric specification, if such an effect exists it would be captured by the intercept. Similarly, every pair of companies may exhibit a specific permanent effect on the companies' abnormal returns due to particularities of the companies. For this reason, we repeat all our econometric estimations adding fixed effects for each set of companies.

II. Methodology

This section describes the empirical strategy used to test and quantify the impact of terrorism on stock returns. For this purpose, we employ event study methods, whereby we treat a given event that occurs at a predetermined point in time as exogenous, and study the impact of this event on the realizations of a variable of interest (Campbell *et al.* 1997). For the current analysis, we define terrorist attacks as the event of interest and measure their effect on the returns of Israeli companies' stocks relative to those of American companies.

The full econometric estimation proceeds in several steps. First, we compute the daily abnormal returns of every stock in the dataset during the analysed period. This step proceeds as follows. We obtain the expected returns of company i's stock at date t, $\hat{R}_t^i$, from the following equation based on the standard capital asset pricing model (CAPM) regression:

$$\hat{R}_t^i = R_t^f + \hat{\beta}_1^i R_t^m + \hat{\beta}_2^i SMB_t + \hat{\beta}_3^i HML_t, \tag{2}$$

where R_t^f, R_t^m, SMB_t, and HML_t, defined below equation (1), are all measured at time t. The parameters on SMB_t and HML_t, $\hat{\beta}_2^i$ and $\hat{\beta}_3^i$, were obtained for every stock from Fama and French (1993), whereas $\hat{\beta}_1^i$ was obtained from *Security Risk Evaluation* when available or calculated using that publication's methodology otherwise.

Thus the abnormal returns of stock i at time t, AR_t^i, are given by the difference between observed returns and expected returns:

$$AR_t^i = R_t^i - \hat{R}_t^i. \tag{3}$$

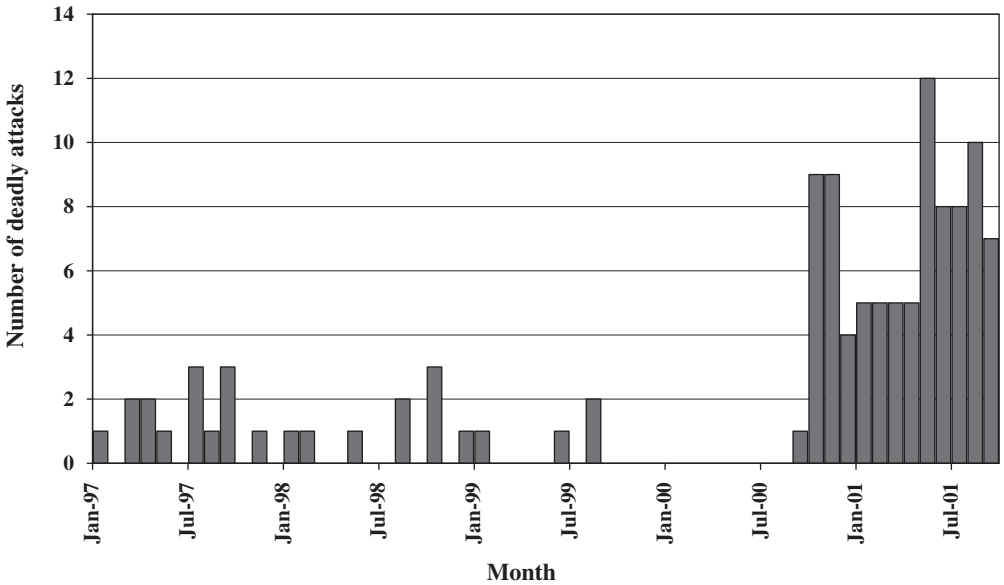

FIGURE 1. Deadly attacks on a monthly basis.

We then subtract from the abnormal returns of every Israeli stock the abnormal returns of its American control. This yields the difference in abnormal returns for every pair of stocks, DAR_t^i. Our first model of interest investigates the effects of terror attacks on the difference in the abnormal returns of Israeli companies and their respective American control. Formally, we estimate the model

$$DAR_t^i = \alpha_1 + \alpha_2(\text{terror attacks})_t + \upsilon_{i,t}, \tag{4}$$

where the coefficient α_2 reflects the economic impact of an increase in the level of terrorism on Israeli stocks relative to their American controls.

Conventional wisdom has it that the economic impact of terror should be significantly negative. This is indeed the consensus reached by the constantly growing body of related research. Several studies, using mostly cross-country panel datasets, show that political factors (such as the extent of civil rights or local politically motivated violence) have a negative effect on investment and savings (Venieris and Gupta 1986; Alesina and Perotti 1996), and on economic growth (Barro 1991; Mauro 1995; Alesina *et al.* 1996; Easterly and Levine 1997).[13] This consensus is supported by the available cross-country evidence on the economic consequences of terrorism. In this regard, Abadie and Gardeazabal (2008) show that terrorism has a substantial impact on a country's economy by affecting its net foreign direct investment positions (see Krueger (2007) for a recent review of this literature).

Studies using Israeli data reported similar findings. Fielding (2003a,b) investigated the impact of political instability on saving and investment, respectively, during 1987–99. His results show that the savings ratio in Israel would almost double and investment would rise on average by 20% if politically related deaths in Israel were to cease. Eckstein and Tsiddon (2004) conducted a similar analysis on consumption, investment, exports and GDP per capita. They concluded that had Israel not suffered from terrorism during 2000–03, its GDP per capita would have been 4% higher than its actual level.

TABLE 3
TERRORISM SUMMARY STATISTICS

	Terror attacks:		
	1 January 1998 to 10 September 2001	1 January 1998 to 28 September 2000	29 September 2000 to 10 September 2001
Daily attacks:			
Average	0.0719	0.014	0.2392
Standard deviation	0.3009	0.1174	0.5244
Maximum	2	1	2
Minimum	0	0	0
Number of days	1349	1002	347
Weekly attacks:			
Average	0.5026	0.0909	1.68
Standard deviation	1.0161	0.2885	1.3768
Maximum	5	1	5
Minimum	0	0	0
Number of weeks	193	143	50
Monthly attacks:			
Average	2.2444	0.4242	7.25
Standard deviation	3.3585	0.7513	2.4909
Maximum	12	3	12
Minimum	0	0	4
Number of months	45	33	12
Yearly attacks:			
Average	30.25	6.5	54
Standard deviation	37.3753	3.5355	43.8406
Maximum	85	9	85
Minimum	4	4	23
Number of years	4	2	2
Total	97	14	83

Notes
Weekly data ending in 2001 include the entire week of 9 September 2001.
The entire week of 24 September 2000 is included in the weekly statistics ending on 28 September 2000. (This week is omitted from the statistics beginning in 29 September 2000.)
Weeks start on Sunday and end on Saturday.
Monthly data ending in 2001 include the entire month of September 2001.
September 2000 is entirely omitted from the monthly statistics beginning on 29 September 2000. (September 2000 was included in the monthly statistics ending 28 September 2000.)
Yearly data ending in 2001 include the entire year 2001.
The entire year 2000 is included in the yearly statistics beginning on 29 September 2000. (2000 is omitted from the yearly statistics ending 28 September 2000.)

Perhaps more related to the variables of interest in the current paper, Eldor and Melnick (2004) studied the consequences of terrorism on stocks traded at the TASE and found that the Palestinian uprising caused a significant decrease of around 30% on a TASE market index.

Our analysis allows for the possibility that the effect of terror may be positive for some companies even if its overall effect is negative. That is, the expected impact of terror is not constrained to be uniform across companies but rather depends on the company's main economic activities. This possibility was already raised by Fishelson (1993), who performed an industry decomposition analysis to study the impact of the first Palestinian uprising on the levels and trends of various real economic activities in Israel in 1987–89,[14] and by Wolfers and Zitzewitz (2008), who estimated the effects of the war in Iraq on several S&P sector indices.[15]

To account for this effect, we add in the second part of the econometric analysis a dummy variable that indicates whether a company is associated with defence, security or anti-terrorism products, services or clients. That is, we estimate the model

$$(5) \qquad DAR_t^i = \gamma_1 + \gamma_2(\text{terror attacks})_t + \gamma_3(\text{defence})_i + \gamma_4(\text{terror attacks})_t * (\text{defence})_i + u_{i,t},$$

where γ_2 measures the effect of terrorism common to all companies, γ_3 is a defence effect that controls for possible differences in the abnormal returns of companies in the defence sector as against non-defence companies, and γ_4 is an interaction effect of terrorism on defence-related companies.

This specification allows us to explicitly test any systematic difference between the impact of terrorism on the returns of stocks of defence-related companies and that of all other companies. It also lets us address the question of whether or not terrorism increases the abnormal returns of Israeli defence-related companies compared with the abnormal returns in the control group.

If our hypothesis is correct, i.e. if the effect of terror is not evenly distributed across industries, we should expect γ_2 to be negative and γ_4 to be positive. Moreover, if terrorism has a positive effect on the stock prices of Israeli defence companies *vis-à-vis* their American controls, the sum of γ_2 and γ_4 should be greater than zero.

The next section presents the results of the estimation of models (4) and (5) presented above.

III. Results

We first proceed by presenting simple summary statistics and a graphical depiction that support the empirical evidence regarding the main results of the paper. Table 4 provides summary statistics of stocks' returns and abnormal returns, differentiating between defence-related and non-defence-related companies. Both types of Israeli companies experienced, on average, lower abnormal returns than their American controls during the analysed time period. The main difference across sectors is observed before the Palestinian uprising that started on 28 September 2000. For that period, the defence-related companies had lower average abnormal returns than those observed for their controls, whereas the average abnormal return of the rest of the Israeli companies was higher than that observed for their controls. All four groups of companies exhibit negative average abnormal returns between 1 January 1998 and 28 September 2000, and positive average abnormal returns for the remainder of the analysed period. This observation highlights the importance of the control group. Absent a proper control

group, a statistically significant positive effect of terrorism on the stock-market valuation of the Israeli companies would have been wrongfully obtained.

Figure 2 shows the evolution over time of the average cumulative difference in abnormal returns, *CDAR*, differentiating between companies associated with defence, security or anti-terrorism products and the rest.

Quite strikingly, both sets of stocks exhibit a behaviour that corresponds with the intuition stated above. Namely, the average cumulative difference in abnormal returns for defence-related companies is downward sloping during the first part of the analysed time period, whereas the average *CDAR* of the rest of the companies exhibits an important increase. On the contrary, with the outbreak of the second Palestinian uprising and the significant increase in the number of terror attacks, the trend above is completely reversed; that is, we observe a sharp increase in the average *CDAR* of defence-related companies accompanied by a sharp decrease in the average *CDAR* of the rest of the companies. Although these trends start before September 2000 (maybe reflecting the investors' concerns associated with the failure of Israelis and Palestinians to reach a permanent peace agreement on the intense negotiations during the summer of 2000), the sharp differences between the two portfolios intensified between September 2000 and May 2001. During this particularly violent period, the defence-related portfolio gained over 70 percentage points whereas the portfolio with the rest of the companies lost over 60 percentage points, both relative to their American controls.

Tables 5 and 6 provide parameter estimates for the effects of terrorism on companies in the defence-related sector and the rest according to the two models shown above.[16] These tables use different time spans to account for the level of terrorism. The only difference between the tables is that Table 5 includes all the available stocks whereas Table 6 excludes the companies that are dually listed. The results of all specifications convey a similar message: terrorism has a positive effect on the stock returns of Israeli companies involved in or with defence, security or anti-terrorism products or clients, and a negative effect on the rest of the Israeli companies, irrespective of the time frame used to measure the level of terrorism.

Table 5 reports the results of our estimation of equations (4) and (5) by ordinary least squares (OLS) panel regression model. In columns (1) and (2), we measure terrorism using a dummy variable equal to one from 28 September 2000 onward. In columns (3) and (4), we measure terrorism using the number of monthly terrorist attacks. Columns (5) and (6) depict the results of the estimation when looking at the weekly number of attacks. Finally, columns (7) and (8) report the results obtained on the basis of daily attacks.[17]

According to all the estimations, the data show a consistent negative relationship between terrorism and abnormal returns of Israeli companies only when the estimation includes the defence indicator and the interaction of the defence indicator with the proxy for the level of terrorism. In other words, since terrorism has a negative effect on some sectors of the economy and a positive effect on other sectors, the overall effect of terrorism is misrepresented when the sectors are pooled together. Moreover, if the positive and negative effects cancel each other out, one may reach the wrong conclusion, i.e. that terrorism has no impact on the abnormal returns of Israeli companies relative to their controls.

Whereas by looking at column (1) of Table 5 one may be inclined to conclude that terrorism does not have a significant impact on the abnormal returns of Israeli companies, the results depicted in column (2) indicate that over 5% of the decrease in the valuation of an Israeli company not related to the defence industry may be explained by the Palestinian

TABLE 4
STOCKS' SUMMARY STATISTICS

	Firms involved in or with defence or security-related businesses, products or clients					Other firms				
	Israeli firms		Control group			Israeli firms		Control group		
	Returns	Abnormal returns	Returns	Abnormal returns	Difference in abnormal returns	Returns	Difference in Abnormal returns	Returns	Abnormal returns	Difference in abnormal returns
Entire period: 1.1.98 to 10.9.01										
Mean	0.0008	− 0.0537	0.0022	− 0.0517	− 0.0028	0.0015	− 0.0585	0.0017	− 0.0548	− 0.0017
Standard deviation	0.0627	1.741	0.0647	1.705	1.1270	0.0794	1.6795	0.0698	1.6915	1.0443
Maximum	1.7270	13.757	2.556	21.579	8.8940	7.7	22.464	2.175	12.958	10.5860
Minimum	− 0.6110	− 11.234	− 0.8000	− 18.408	− 8.3740	− 1	− 19.571	− 1	− 13.540	− 10.7670
Number of observations	16,813	16,813	16,569	16,569	16,569	30,316	30,316	29,761	29,761	29,418
Pre-uprising: 1.1.98 to 28.9.00										
Mean	0.0017	− 0.0807	0.0026	− 0.0695	− 0.0122	0.0026	− 0.0747	0.0023	− 0.0781	0.0049
Standard deviation	0.0607	1.621	0.0646	1.582	1.0420	0.0834	1.573	0.0676	1.563	0.9461
Maximum	1.727	13.757	2.556	21.579	7.6420	7.7	22.464	2.175	12.958	9.6140
Minimum	− 0.4957	− 11.107	− 0.7996	− 13.849	− 8.3740	− 0.5899	− 16.097	− 1	− 11.332	− 9.9460
Number of observations	12,512	12,512	12,319	12,319	12,319	22,835	22,835	22,435	22,435	22,422
Post-uprising: 29.9.00 to 10.9.01										
Mean	− 0.0021	0.0393	0.0008	0.0117	0.0272	− 0.0021	0.0045	− 0.0001	0.0325	− 0.0249
Standard deviation	0.0682	2.043	0.0651	2.012	1.3410	0.0656	1.962	0.0765	2.027	1.3080
Maximum	1.473	8.120	0.6022	12.666	8.8940	0.7619	13.676	1.25	9.567	10.5860
Minimum	− 0.6111	− 11.234	− 0.4135	− 18.408	− 7.8880	− 1	− 19.571	− 0.5	− 13.54	− 10.7670
Number of observations	4278	4278	4227	4227	4227	7439	7439	7284	7284	6954

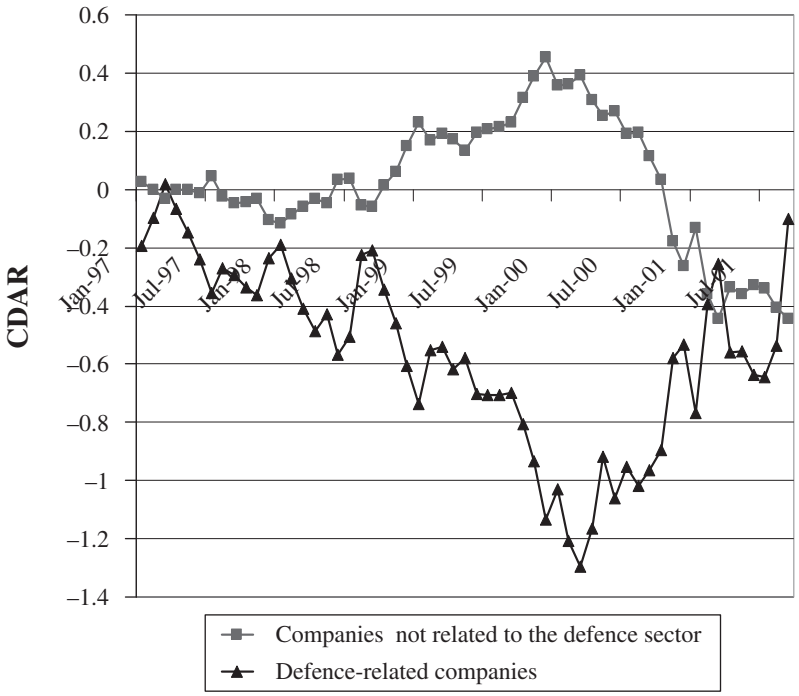

FIGURE 2. Cumulative difference in abnormal returns.

uprising that started in September 2000. Columns (4), (6) and (8) provide additional estimates of the impact of an increase in the level of attacks on the abnormal returns of a non-defence-related Israeli company compared to those of its American control. These effects vary from 0.7% to 2%, depending on whether attacks are measured on the basis of monthly, weekly or daily data. The effect of monthly attacks is significant at statistically accepted levels; that of weekly attacks is only marginally significant (at the 12% level).[18] The magnitude of the losses caused by terrorism is in the order of 84.6 million US dollars in market capitalization for the average Israeli company not related to the defence sector as measured in July 2007.

The defence effect, estimated in the even-numbered columns, is not consistently significant. This suggests that the behaviour of the relative abnormal returns of Israeli defence-related companies is not significantly different from that exhibited by the other companies. The fact that the intercept, too, is not statistically significant for any of the different specifications implies that there is no Israeli effect on the companies' abnormal returns.[19]

According to the results of our estimation, it is terrorism that influences the abnormal returns of companies in the defence sector differently from the rest of the companies. The overall effect of terrorism on Israeli companies in the defence-related sector is positive and highly statistically significant. As shown at the bottom of Table 5, the hypothesis that $\gamma_2 + \gamma_4$ equals zero is rejected at the 5% significance level for all specifications except that using daily terror attacks. The estimates indicate that the difference in the abnormal returns of Israeli defence-related companies increased by over 7% relative to the rest of the Israeli companies as a consequence of the Palestinian uprising. This coefficient implies that the average market capitalization of an Israeli company in the defence sector increased by an

TABLE 5
THE EFFECTS OF TERRORIST ATTACKS ON THE VALUE OF STOCKS (INCLUDES ALL THE AVAILABLE COMPANIES)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	− 0.0023	0.0098	− 0.0034	0.0117	− 0.0028	0.0054	− 0.0039	− 0.0025
	[0.0105]	[0.0126]	[0.0111]	[0.0133]	[0.0105]	[0.0127]	[0.0102]	[0.0124]
Defence		− 0.0343		− 0.0419*		− 0.0230		− 0.0040
		[0.0226]		[0.0237]		[0.0226]		[0.0218]
Uprising	− 0.0077	− 0.0556*						
	[0.0271]	[0.0338]						
Defence × Uprising		0.1288**						
		[0.0565]						
Monthly attacks			− 0.0004	− 0.0075**				
			[0.0032]	[0.0040]				
Defence × Monthly attacks				0.0189***				
				[0.0067]				
Weekly attacks					− 0.0030	− 0.0196		
					[0.0103]	[0.0129]		
Defence × Weekly attacks						0.0444**		
						[0.0215]		
Daily attacks							− 0.0045	− 0.0139
							[0.038]	[0.0478]
Defence × Daily attacks								0.0251
								[0.0789]
F-test: (Terror + Terror × Defence) *p*-value		5.34		12.96		5.88		0.02
		[0.0208]		[0.0003]		[0.0153]		[0.8847]
Number of observations	45,987	45,987	45,987	45,987	45,987	45,987	45,987	45,987

Notes
Each column reports the estimated coefficients of a separate ordinary least squares panel regression model in which the dependent variable is the difference between the abnormal return of every Israeli company and its respective control, DAR_t^i.
Heteroskedasticity-robust standard errors are in brackets.
Sample period: 1 January 1998 to 10 September 2001.
F-test is an *F*-test of the null hypothesis that the sum of the coefficients on the terror proxy and the terror proxy interacted with companies in the defence sector is equal to zero, with *p*-values reported in brackets.
*Indicates statistically significant at the 10% level.
**Indicates statistically significant at the 5% level.
***Indicates statistically significant at the 1% level.

TABLE 6

THE EFFECTS OF TERRORIST ATTACKS ON THE VALUE OF STOCKS (INCLUDES ONLY COMPANIES THAT ARE NOT DUALLY LISTED)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	− 0.0041	0.0106	− 0.0062	0.0119	− 0.0064	0.0024	− 0.0061	− 0.0053
	[0.0124]	[0.0146]	[0.0130]	[0.0154]	[0.0125]	[0.0148]	[0.0121]	[0.0145]
Defence		− 0.0458*		− 0.0555**		− 0.0271		− 0.0022
		[0.0273]		[0.0287]		[0.0273]		[0.0264]
Uprising	− 0.0080	− 0.0696*						
	[0.0324]	[0.0400]						
Defence × Uprising		0.1832***						
		[0.0683]						
Monthly attacks			− 0.0001	− 0.0089*				
			[0.0039]	[0.0048]				
Defence × Monthly attacks				0.0265***				
				[0.0081]				
Weekly attacks					0.0007	− 0.0188		
					[0.0124]	[0.0153]		
Defence × Weekly attacks						0.0575**		
						[0.0259]		
Daily attacks							0.0005	− 0.0102
							[0.0457]	[0.0569]
Defence × Daily attacks								0.0313
								[0.0956]
F-test: (Terror + Terror × Defence)		5.50		11.94		5.78		0.01
p-value		[0.0190]		[0.0005]		[0.0162]		[0.9761]
Number of observations	35,183	35,183	35,183	35,183	35,183	35,183	35,183	35,183

Notes

Each column reports the estimated coefficients of a separate ordinary least squares panel regression model in which the dependent variable is the difference between the abnormal return of every Israeli company and its respective control, DAR_t^i.

Heteroskedasticity-robust standard errors are in brackets.

Sample period: 1 January 1998 to 10 September 2001.

F-test is an *F*-test of the null hypothesis that the sum of the coefficients on the terror proxy and the terror proxy interacted with companies in the defence sector is equal to zero, with *p*-values reported in brackets.

*Indicates statistically significant at the 10% level.

**Indicates statistically significant at the 5% level.

***Indicates statistically significant at the 1% level.

average of 69.2 million US dollars (measured in July 2007) as a consequence of the second Palestinian uprising. The evidence regarding the overall effect of terrorism on defence-related Israeli companies in shorter time spans is also significantly positive: an effect of 1% or 2.5% was obtained using monthly and weekly data, respectively.[20]

The magnitude of our coefficients is in line with the magnitude of coefficients reported in related studies. On the one hand, our coefficient using weekly data is slightly lower than the one reported by Guidolin and La Ferrara (2007). According to their study, the end of the civil war in Angola caused a decline of 4 percentage points in the abnormal returns of mining firms holding concessions in that country, but had no effect on a control portfolio of otherwise similar companies. We believe that the difference in the magnitudes of the coefficients may be driven by the difference in the importance of the new information carried by the event study of interest. In particular, given the high levels of terrorism existent in Israel, the marginal effect of an individual attack is expected to be lower than the effect of the end of a civil war.

On the other hand, our coefficient is slightly larger than the one reported by Karolyi and Martell (2006). Karolyi and Martell study the impact of terror attacks against publicly traded firms on their stock prices. They report a significant negative reaction of stock prices on the day of the attack of -0.83%. This coefficient reflects the average decline for all types of attacks in all the countries analysed. Their findings regarding the effects of attacks that destroy human capital against firms incorporated in the US (the only cases analysed in the current paper) are strikingly similar to those observed in our study.[21]

As mentioned above, the fact that several of the Israeli companies are traded simultaneously at the Tel Aviv Stock Exchange and at one of the American markets could potentially bias the results. Table 6 addresses this issue by showing the results of the analysis with the sample restricted to Israeli companies that are traded only in American markets.

The findings using this subsample are essentially identical to those observed using the full sample. Namely, the observed effect of terrorism on abnormal stock returns is still insignificant when we do not differentiate across industries. Moreover, once we introduce the interaction variable for the defence sector, terror attacks show a significantly negative effect on Israeli companies overall, and a positive effect on defence-related companies. From the table it follows that the positive impact of terrorism on companies related to the defence sector is higher than that observed when the full sample is used. In particular, once we exclude dually-listed companies from the sample, the observed effect of terror on the defence sector is roughly one standard deviation higher than that obtained before, irrespective of the time frame used to proxy for terrorism. Furthermore, the overall effect of terrorism on the defence sector, as measured by $\gamma_2 + \gamma_4$, is also higher under this restricted sample and is significantly positive (at the 5% level) for all specifications except the one focusing on daily attacks.

Finally, Table 7 provides estimates for equations (4) and (5) including companies' fixed effects. The results are basically the same as those obtained without the inclusion of fixed effects. Moreover, an *F*-test of the null hypothesis that all pairs of matched companies' specific fixed effects are equal to zero cannot be rejected at the 99% level. This provides empirical support for the matching procedure used to build the control group, as the particular characteristics of each company seem to cancel out with the particular characteristics of its control. In other words, the results of the *F*-test corroborate our finding that the behaviour of the relative abnormal returns of every pair of matched companies is not significantly different from that observed among the rest of

TABLE 7
THE EFFECTS OF TERRORIST ATTACKS ON THE VALUE OF STOCKS (INCLUDES COMPANIES' FIXED EFFECTS)

	All stocks				Non-arbitrage stocks			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Defence	− 0.1161*	− 0.0622	− 0.0524	− 0.0436	− 0.0660	− 0.1371**	− 0.1136*	0.0441
	[0.0689]	[0.0970]	[0.0971]	[0.0972]	[0.0966]	[0.0696]	[0.0684]	[0.0973]
Uprising	− 0.0533				− 0.0664*			
	[0.0336]				[0.0398]			
Defence × Uprising	0.1276**				0.1816***			
	[0.0565]				[0.0684]			
Monthly attacks		− 0.0072*				− 0.0085*		
		[0.0040]				[0.0047]		
Defence × Monthly attacks		0.0188***				0.0262***		
		[0.0067]				[0.0081]		
Weekly attacks			− 0.0188				− 0.0176	
			[0.0128]				[0.0152]	
Defence × Weekly attacks			0.0438**				0.0566**	
			[0.0215]				[0.0259]	
Daily attacks				− 0.0122				0.0078
				[0.0479]				[0.0569]
Defence × Daily attacks				0.0236				0.0291
				[0.0790]				[0.0957]
F-test: (Terror + Terror × Defence) *p*-value	5.40	13.00	5.92	0.02	5.57	11.98	5.82	0.00
	[0.0201]	[0.0003]	[0.0150]	[0.8868]	[0.0183]	[0.0005]	[0.0158]	[0.9738]
Number of observations	45987	45987	45987	45987	35183	35183	35183	35183

Notes
Each column reports the estimated coefficients of a separate ordinary least squares panel regression model in which the dependent variable is the difference between the abnormal return of every Israeli company and its respective control, DAR_t^i.
Heteroskedasticity-robust standard errors are in brackets.
Sample period: 1 January 1998 to 10 September 2001.
F-test is an *F*-test of the null hypothesis that the sum of the coefficients on the terror proxy and the terror proxy interacted with companies in the defence sector is equal to zero, with *p*-values reported in brackets.
*Indicates statistically significant at the 10% level.
**Indicates statistically significant at the 5% level.
***Indicates statistically significant at the 1% level.

the pairs, once we control for the level of terrorism and whether or not these companies are related to the defence industry.

IV. Conclusions

This paper has empirically assessed the impact of terrorism on the stock-market valuation of Israeli companies that are traded in American markets. Its main contribution is to show that the impact of terrorism varies across companies in different industries. Overall, the evidence strongly suggests that terrorism has a positive effect on the stock-market valuation of companies involved with defence, security or anti-terrorism products or clients, and a significantly negative effect on that of other companies.

There are several plausible explanations for our results. It is well known that terrorism and political violence are detrimental for the general economy. The fact that companies in the defence sector thrive during the same period is not only driven by an increase in the local demand for their products. The constant risk of war and terrorism has placed Israeli companies under continuous pressure to create innovative defence products in order to thwart constantly evolving threats. As a consequence, these companies have become highly specialized in defence manufacturing. This specialization (highlighted constantly by continuous terror attacks) gives Israeli companies an advantage in global defence product and technology markets, thus allowing them to capture a bigger share of these markets.[22] At the same time, an increase in the level of terrorism puts pressure on the Israeli government to grant more aid to companies in the defence sector, allowing these companies to be more competitive in the international arena.

This paper marks the first step toward a better understanding of the differential impact of terrorism on the defence sector. We conjecture that the differing effects of terrorism across industries should lead to a reallocation of resources in countries that expect to suffer lengthy periods of violence in the future. Specializing in anti-terrorism products and technologies may not only be a natural way to cope with this threat but may also prove to be an efficient way to alleviate some of the economic costs of conflict. We hope to be able to assess our empirical conjecture in the near future.

ACKNOWLEDGMENTS

This paper was previously circulated as 'The impact of terrorism across industries: an empirical study' (Berrebi and Klor 2005). We are grateful to Eli Berman, Eric Gould, Alan Krueger, Saul Lach, Solomon Polachek and Cecilia Rouse for very helpful remarks. The paper also benefited from the comments of participants at the ASSA/AEA annual meeting in Philadelphia, NBER's Working Group in National Security and the 21st meeting of the Israeli Economic Association. Yaakov Garini and Hernan Meller provided invaluable help in the construction of the data sets. Esteban F. Klor thanks the Maurice Falk Institute for Economic Research in Israel and the Israeli Foundation Trustees for their financial support. We bear sole responsibility for the content of this article. 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.

NOTES

1. Zussman and Zussman (2006) suggest, independently, the same basic idea. The section of their article that deals with this hypothesis provides only an illustration, since it focuses on only two companies. That article focuses mainly on the effects of counter-terrorism on the expected level of terrorism in the future, and is not intended to identify and assess the differential effect of terrorism on the defence sector—the main objective of our study.

2. We defined companies as related to the defence, security or anti-terrorism industry if they fulfilled one or more of the following conditions: (i) they were directly owned or managed by the military, one of the security services or the department of defence; (ii) they conducted a sizeable part of their business or services with or for the military, one of the security services or the department of defence; (iii) they developed or manufactured products directly targeted for military, intelligence, security or anti-terrorism use.
3. This classification is not based solely on the companies' registered addresses. Rather, it identifies all companies that were perceived to conduct a significant part of their business in Israel.
4. The terrorist attacks on US soil on 11 September 2001 invalidate the use of American stocks as controls after this date.
5. In particular, we used the same specification for the regression, with up to five years of data on the monthly return of the security, and focused on the same time period as *Security Risk Evaluation*. We regressed these returns on the S&P500, following the methodology employed by this publication. All this was done especially to avoid introducing unnecessary noise in the measurement of the companies' abnormal returns. The necessary data to calculate these companies' excess return were obtained from the Center for Research in Security Prices (CRSP) dataset.
6. These calculations appear on French's website http://mba.tuck.dartmouth.edu/pages/faculty/ken.-french/data_library.html). The data were collected for the entire 1994–2001 period for later use in the computation of the expected returns of the companies.
7. The number of potential controls does not reflect the additional requirement that, to be used as a control, the company had to be traded before and after 28 September 2000. For 12 Israeli companies (BVRT, EVSN, HCTL, IISL, ISRL, MTSL, PARS, ROBO, TATTF, TCNO, TISA, WILCF), the American company with the closest score among all the potential controls does not fulfil this requirement.
8. We believe that for sample sizes below 20 the estimates are not reliable. That said, our qualitative results below do not depend on this arbitrary cut-off level.
9. These companies are BOSC, EFII, HCTL, ORFR, PLCM, TEVA, LNOP, RITT and ZRAN.
10. We merged the companies in these three different but related industries into only one group in order to avoid conclusions based on very small samples.
11. The available dataset on terror attacks extends from 1949 until 2004. See Berrebi (2007) and Berrebi and Klor (2006, 2008) for a detailed description of the dataset and its sources.
12. Fifteen of the resulting 65 Israeli companies in the sample were dually-listed by 1 January 1999. These companies are identified in Table 2.
13. Notwithstanding that conventional wisdom, the findings of Guidolin and La Ferrara (2007) on the effects of the civil war on the diamond industry in Angola raise the possibility that the negative effect of violence may be restricted only to developed countries.
14. Fishelson's (1993) main findings are that the uprising had a statistically significant effect on most economic activities, with the exception of some related to exports. He did not, however, study the specific effect of violence on defence-related industries.
15. Wolfers and Zitzewitz (2008) find that an increase in the probability of war had a negative effect for the transportation, consumer discretionary and investment sensitive sectors, and a positive effect (relative to the other sectors) for gold, energy and defence stocks.
16. All the tables in this paper employ terror attacks as the proxy to terrorism. Using terror fatalities as our explanatory variable delivers the same qualitative results. These estimations are available from the authors upon request.
17. The time difference between Israel and the US creates a problem when daily attacks are used. Attacks perpetrated before the closing of the stock markets may show an effect the same day, whereas the effects of attacks perpetrated after the closing of the stock market are captured the next trading day. Weekends and holidays create the same concern. To account for this possibility, we repeated the empirical analysis including lags of the daily attacks. The results, available from the authors upon request, are basically the same.
18. Daily attacks are not significant in any of the estimated models, even when we include lags of this variable. Given the aforementioned issues that arise when using daily data, we are reluctant to conclude that markets are not efficient.
19. The fact that the intercept is not significant does not mean that there may not be specific fixed effects for each company. Table 7 addresses this alternative specification using a model with company fixed effects.
20. Note that these results are based on OLS panel regression models with heteroskedasticity-robust standard errors. This approach does not allow for arbitrary serial correlation over time for each pair of companies. We tried two more conservative approaches to address this concern: clustering standard errors by company pairing, and using the Newey–West correction. The results for both alternatives do not qualitatively change the nature of our conclusions. There exists some quantitative differences. Although the Newey–West correction somewhat weakens the precision of our estimates, the overall effect of terrorism remains statistically significantly different from zero when attacks are measured using the uprising dummy, monthly or weekly attacks. On the contrary, when clustering standard errors at the company-pair, the overall effect of terrorism is not significantly different from zero using the uprising dummy or weekly terror attacks.

21. See Karolyi (2006) for a comparison of the results of several papers that study the effects of terrorism on financial markets.
22. In fact, Israel has more than doubled its defence exports over the last decade, elevating its share in global defence exports nowadays to nearly 8% (Enav 2003). In view of this significant increase, *Defense News*, a leading magazine specializing in military issues, ranked Israel as the world's number three exporter of defence products in 2002, behind only the US and Russia.

REFERENCES

ABADIE, A. and GARDEAZABAL, J. (2003). The economic costs of conflict: a case study of the Basque Country. *American Economic Review*, **93**(1), 113–32.

——— and ——— (2008). Terrorism and the world economy. *European Economic Review*, **52**(1), 1–27.

ALESINA, A. and PEROTTI, R. (1996). Income distribution, political instability and investment. *European Economic Review*, **40**(6), 1203–28.

———, ———, OZLER, S., ROUBINI, N. and SWAGEL, P. (1996). Political instability and economic growth. *Journal of Economic Growth*, **1**(2), 189–211.

BARRO, R. J. (1991). Economic growth in a cross section of countries. *Quarterly Journal of Economics*, **106**(2), 407–43.

BERREBI, C. (2007). Evidence about the link between education, poverty and terrorism among Palestinians. *Peace Economics, Peace Science and Public Policy*, **13**(1), article 2.

——— and KLOR, E. F. (2005). The impact of terrorism across industries: an empirical study. Discussion Paper 5360, Centre for Economic Policy Research (CEPR).

——— and ——— (2006). On terrorism and electoral outcomes: theory and evidence from the Israeli–Palestinian conflict. *Journal of Conflict Resolution*, **50**(6), 899–925.

——— and ——— (2008). Are voters sensitive to terrorism? Direct evidence from the Israeli electorate. *American Political Science Review*, **102**(3), 279–301.

CAMPBELL, J. Y., LO, A. W. and MACKINLAY, A. C. (1997). *The Econometrics of Financial Markets*. Princeton, NJ: Princeton University Press.

EASTERLY, W. and LEVINE, R. (1997). Africa's growth tragedy: policies and ethnic divisions. *Quarterly Journal of Economics*, **112**(4), 1203–50.

ECKSTEIN, Z. and TSIDDON, D. (2004). Macroeconomic consequences of terror: theory and the case of Israel. *Journal of Monetary Economics*, **51**(5), 971–1002.

ELDOR, R. and MELNICK, R. (2004). Financial markets and terrorism. *European Journal of Political Economy*, **20**(2), 367–86.

ENAV, P. (2003). Israel's weapons exports skyrocket, making it friends and money. SFGate.com, 18 November.

FAMA, E. F. and FRENCH, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, **33**, 3–56.

FIELDING, D. (2003a). Counting the costs of the intifada: consumption, saving and political instability in Israel. *Public Choice*, **116**(3–4), 297–312.

——— (2003b). Modeling political instability and economic performance: Israeli investment during the *Intifada*. *Economica*, **70**, 159–86.

FISHELSON, G. (1993). Political events and economic trends: the effects of the intifada on the Israeli economy. Working Paper 10–93, Foerder Institute for Economic Research, Tel Aviv University.

GUIDOLIN, M. and LA FERRARA, E. (2007). Diamonds are forever, wars are not. Is conflict bad for private firms? *American Economic Review*, **97**(5), 1978–93.

KAROLYI, G. A. (2006). The consequences of terrorism for financial markets: what do we know? *Canadian Investment Review*, 9–15.

——— and MARTELL, R. (2006). Terrorism and the stock market. SSRN library, working paper no. 823465.

KRUEGER, A. B. (2007). *What Makes a Terrorist: Economics and the Roots of Terrorism*. Princeton, NJ: Princeton University Press.

LIEBERMAN, O., BEN-ZION, U. and HAUSER, S. (1999). A characterization of the price behavior of international dual stocks: an error correction approach. *Journal of International Money and Finance*, **18**(2), 289–304.

MAURO, P. (1995). Corruption and growth. *Quarterly Journal of Economics*, **110**(3), 681–712.

VENIERIS, Y. P. and GUPTA, D. K. (1986). Income distribution and sociopolitical instability as determinants of savings: a cross-sectional model. *Journal of Political Economy*, **94**(4), 873–83.

WOLFERS, J. and ZITZEWITZ, E. (2008). Using markets to inform policy: the case of the Iraq war. *Economica*, in press.

ZUSSMAN, A. and ZUSSMAN, N. (2006). Assassinations: evaluating the effectiveness of a counterterrorism policy. *Journal of Economic Perspectives*, **20**(2), 193–206.